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When your answers have been submitted successfully, you will be directed to an online survey about your examination experience. Your participation is critical to future planning so please answer all the questions.

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American Society of Plastic Surgeons In-Service Examination



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This In-Service Examination has been designed to enhance the participant's clinical knowledge base of plastic surgery and serve as a self-assessment tool. Each participant will become updated on the core curriculum of plastic surgery. Upon completion of questions and thoughtful review of individual scores, participants can establish a benchmark for areas of focus needing further concentrated educational efforts. It is expected that completion of this educational activity will assist participants in obtaining better outcomes in practice.

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for the

In-Service Examination



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Section 1: Comprehensive

1. A 54-year-old woman undergoes breast reconstruction using a deep inferior epigastric artery perforator (DIEP) flap. Arterial thrombosis is noted after performing the microanastomosis. Which of the following is more likely to occur with local administration of tissue plasminogen activator (tPA) as an adjunct to revision microanastomosis as compared with revision microanastomosis alone (without tPA)?
- A) Decreased flap salvage rate
 - B) Decreased incidence of fat necrosis
 - C) Increased flap salvage rate
 - D) Increased incidence of fat necrosis
 - E) Increased incidence of operative hematoma

The correct response is Option B.

Administration of tissue plasminogen activator (tPA) during revision of a microanastomosis has a decreased rate of subsequent fat necrosis. The suspected mechanism of action is thrombolysis of distant “shower” emboli in the microvasculature.

The administration of tPA as an adjunct to microanastomotic revision has no effect on flap salvage rates. In addition, there is no change in hematoma risk since the dose is low (2 mg) and is usually injected directly into the flap artery, which is maintained locally in the flap. Only if larger doses of tPA were given systemically would there be a risk of operative hematoma.

REFERENCES:

1. Chang EI, Mehrara BJ, Festekjian JH, et al. Vascular complications and microvascular free flap salvage: The role of thrombolytic agents. *Microsurgery*. 2011 Oct;31(7):505-9.
2. Macadam SA, Bovill ES, Buchel EW, et al. Evidence-Based Medicine: Autologous Breast Reconstruction. *Plast Reconstr Surg*. 2017 Jan;139(1):204e-229e.

2. An 18-year-old woman is evaluated for chest wall and breast asymmetry. She has a history of pectus excavatum and underwent surgery as a child for placement of a correction bar, which was subsequently removed 3 years after insertion. Since the removal of the bar, she has noticed progressive recurrence of her chest wall deformity with associated breast asymmetry. Physical examination shows a thin patient with a 4-cm deep concavity involving the lower end of the sternum and medial distortion of the right breast. The patient denies shortness of breath or chest pain. Which of the following treatment options is the most appropriate recommendation for contour improvement?
- A) Autologous transfer of fat tissue to the sternal defect and right breast
 - B) Implantation of a customized silicone elastomer device with concurrent augmentation mammoplasty
 - C) Injection transplantation of cultured autologous chondrocytes
 - D) Placement of bilateral silicone breast implants greater than 550 cc
 - E) Reinsertion of the correction bar with sternal wiring

The correct response is Option B.

When considering how best to treat pectus excavatum in the female patient, it is important to recognize that the majority of the contour deformity is due to the thoracic concavity with only a small portion of the deformity due to actual breast tissue hypoplasia. However, reinsertion of a correction bar is not always successful in correcting the thoracic deformity in post-adolescent patients whose bones have ossified, and is only done in extreme cases. Augmentation mammoplasty is also unsuccessful, regardless of implant volume, since, as stated above, only a small portion of the defect is actually caused by breast tissue asymmetry. Although some might consider autologous fat grafting a viable option for correcting both the chest wall defect and the hypoplastic breast, there have been reports that indicate that injecting between the tight adhesions of presternal skin and bone is technically challenging and rarely successful. Injection of cultured autologous chondrocytes, which is still in the early stages of research and development, would prove to be equally technically challenging, and at this time, de novo generation of cartilage or fat for injection into soft-tissue defects is still unproven. As a result, customized silicone elastomer implants are commonly used in conjunction with augmentation mammoplasty to provide consistent and reliable correction of pectus excavatum and breast asymmetry in the female patient. Studies have shown that placing a custom sternal prosthesis and bilateral breast implants during one surgery is both safe and effective in producing an improved aesthetic result.

REFERENCES:

1. Schwabegger AH. Pectus excavatum repair from a plastic surgeon's perspective. *Ann Cardiothorac Surg.* 2016;5(5):501-512.
2. Ma IT, Rebecca AM, Notrica DM, et al. Pectus excavatum in adult women: repair and the impact of prior or concurrent breast augmentation. *Plast Reconstr Surg.* 2015;135(2):303e-12e.

3. A 34-year-old T12 paraplegic man presents with a Stage IV sacral pressure sore. The ulcer has been persistent and chronic, with exposed structures down to bone. Serial bedside debridements have maintained a clean and healthy-appearing wound. On admission, the patient has an increased erythrocyte sedimentation rate (ESR). Prior to definitive coverage, which of the following is the most appropriate next step in management?

- A) Bone biopsy and culture
- B) CT scan with IV contrast
- C) Gadolinium-enhanced MRI
- D) Tagged white blood cell scan
- E) Triple phase bone scan

The correct response is Option A.

The preoperative management of pressure sores is vital to successful surgical outcomes and healing. When a patient presents, one of the first assessments must be whether that patient has evidence of osteomyelitis. For patients presenting with chronic exposed wounds at Stage III or Stage IV, the risk of pelvic osteomyelitis is very high. This will require intravenous antibiotic treatment and bony debridement prior to coverage. To establish this diagnosis, especially in a patient with an increased ESR, a bone biopsy is needed. This will help guide initiation and maintenance of treatment.

While a positive bone scan may indicate the presence of osteomyelitis, this test carries a high rate of false positives in patients with open wounds. Thus, the next line of workup for osteomyelitis would be a bone biopsy, with the tissue being sent for cultures and sensitivities. This should be done in such a way that some of the deeper pelvic bone is sampled, and not just the superficially exposed bone. This will allow for both diagnosis and a guide for directed antibiotic therapy.

In cases where bone biopsy is not available, a gadolinium-enhanced MRI or tagged white blood cell scan can be used to assess for the characteristic inflammation associated with osteomyelitis, and make a diagnosis indicating the need for antibiotic treatment. A CT scan with IV contrast is a last-line test used for this purpose, as it is less sensitive at showing localized inflammation, and is more helpful in assessing depth of invasion and defining exposed structures.

Thus, in this case, given the chronic nature of this open wound, and the fact that it is ready for closure based on clinical examination, a bone biopsy would be most helpful as the first step in ensuring there is no osteomyelitis prior to closure.

REFERENCES:

1. Lewis VL Jr, Bailey MH, Pulawski G, Kind G, Bashioum RW, Hendrix RW. The diagnosis of osteomyelitis in patients with pressure sores. *Plast Reconstr Surg*. 1988 Feb;81(2):229-32.
2. Bodavula P, Liang SY, Wu J, VanTassell P, Marschall J. Pressure Ulcer-Related Pelvic Osteomyelitis: A Neglected Disease? *Open Forum Infect Dis*. 2015 Sep; 2(3): ofv112.
3. Brunel AS, et al. Diagnosing pelvic osteomyelitis beneath pressure ulcers in spinal cord injured patients: a prospective study. *Clin Microbiol Infect*. 2016 Mar;22(3):267.e1-8.

4. A 35-year-old man is brought to the emergency department with a 15-cm open wound on the left hip and thigh after he was involved in an accident while using machinery at a construction site. Much of the skin of the lateral thigh is injured, and exposed bone is noted over the trochanter of the hip. Wound coverage using an anterolateral thigh flap from the right side is planned. When the flap is harvested, which of the following muscles must be identified in order to preserve perforators to the flap?

- A) Gracilis
- B) Inferior gluteal
- C) Sartorius
- D) Tensor fascia lata
- E) Vastus lateralis

The correct response is Option E.

The anterolateral thigh flap is a versatile coverage tool because of its wide skin island (up to 8 x 25 cm) and long, accessible pedicle (up to 7 cm). The blood supply originates from the lateral femoral circumflex artery descending branch, and sends perforating branches through the vastus lateralis and rectus femoris muscles, and occasionally through the intermuscular septum.

The inferior gluteal muscle, while a common muscle flap, is further posterior and proximal. The tensor fascia lata is more lateral to the anterolateral thigh flap zone, though it also has a blood supply from the lateral femoral circumflex system, as the vessel terminates in the tensor fascia lata. The sartorius is more medial and proximal and has a segmental circulation based on the femoral artery branches. The gracilis is more medially based, and is supplied by the medial femoral circumflex.

REFERENCES:

1. Buntic, Rudolf. The Anterolateral Thigh (ALT) Flap. Microsurgeon website. <https://www.microsurgeon.org/anterolateralthigh>. Accessed 12/21/2016.
2. Levine, JP. Muscle flaps and their blood supply. In: Thorne C, Gurtner G, eds. *Grabb and Smith's Plastic Surgery*, 7th ed. Lippincott, Williams, and Wilkins, 2013:413.

5. A 40-year-old man sustains burns to 35% of his total body surface area, including the neck, chest, axillae, and upper extremities. After subsequent skin grafting, a right anterior axillary dome scar contracture develops. The patient is scheduled to undergo revision of the scar using Z-plasty. Which of the following lateral limb angles will result in a theoretical 75% gain in central limb length?

- A) 30 degree
- B) 45 degree
- C) 60 degree
- D) 75 degree
- E) 90 degree

The correct response is Option C.



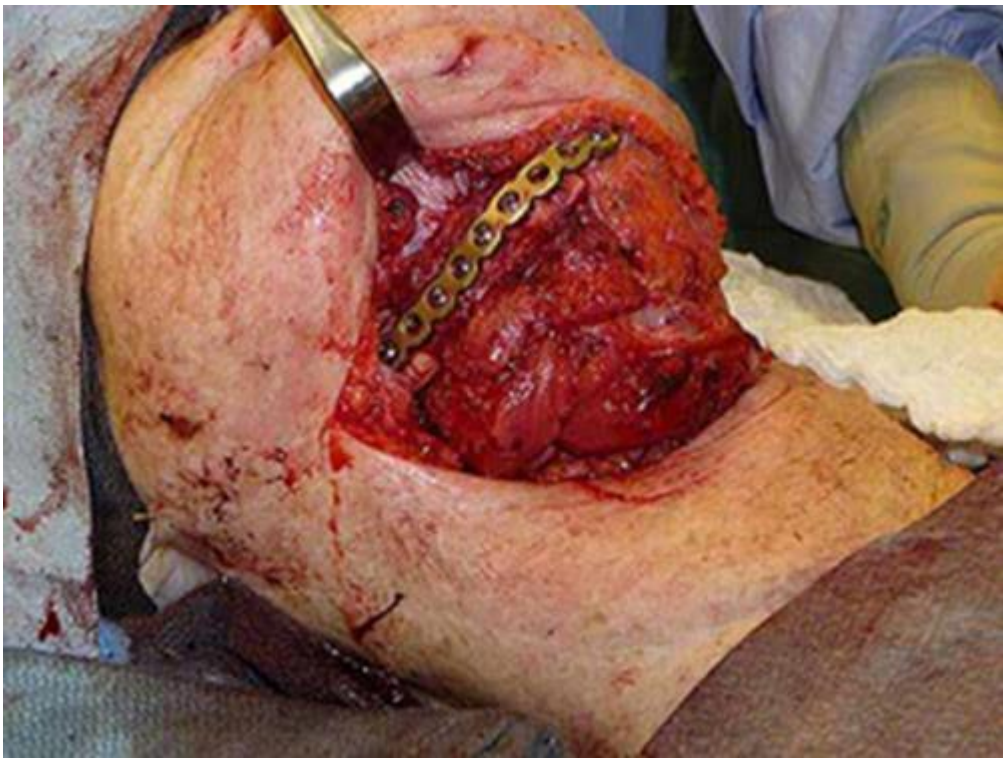
Angle	Gain in Length
30°	25%
45°	50%
60°	75%
75°	100%
90°	125%

The traditional standard Z-plasty consists of at least three incisions of equal length (two limbs and one central incision) and two angles of equal degree. Ideally, the central incision runs parallel to the long axis of the scar, or the scar itself may be completely excised with the fusiform defect acting as the central incision. The resultant subcutaneous triangular skin flaps are transposed with each other such that the new, central incision lies perpendicular to the original central incision.

After closure, the scar is reoriented along the limb incisions, and the new central incision lies within relaxed skin tension lines. The length of the original scar also increases after a Z-plasty, which is a useful characteristic when a surgeon desires release of a scar contracture, as in this specific example. In general, as the central incision lengthens (given a constant angle), so does the resultant scar. Additionally, as the angles between the limbs increase (given a constant limb length), so does the resultant scar.

REFERENCES:

1. Shockley WWW. Scar revision techniques: z-plasty, w-plasty, and geometric broken line closure. *Facial Plast Surg Clin North Am.* 2011 Aug;19(3):455-63.
2. Furnas DW, Fischer GW. The Z-plasty: biomechanics and mathematics. *Br J Plast Surg.* 1971;24:144-160.
3. Basci, D. and Gosman, A. Basics of Flaps. In: Janis JE, eds. *Essentials of Plastic Surgery*, 2nd edition. Taylor and Francis Group, 2014:24-44.



6. A 55-year-old woman undergoes composite resection of the right mandibular body and floor of the mouth. Closure with a fibular free flap is performed. A photograph is shown. Which of the following mechanisms best describes the healing process associated with vascularized bone transfers?
- A) Endochondral ossification
 - B) Osteochondrosis
 - C) Osteoconduction
 - D) Osteogenesis
 - E) Osteoinduction

The correct response is Option D.

Osteogenesis is the formation of new bone by cells in a flap/graft that survive the transfer. This is the primary mechanism by which a vascularized bone graft heals. The pedicle keeps the bone alive so that primary bone healing can occur between the graft and recipient site. Osteoblasts from both locations participate in the formation of new bone at the interface

between graft and native bone. Advantages of a vascularized bone graft include the ability to place the graft into a hostile environment such as an irradiated wound bed and immediate structural support with shortened time to bony union compared with nonvascularized cortical grafts.

Osteoinduction refers to the direct stimulation of mesenchymal cells at the recipient site by bone morphogenetic protein to differentiate into osteoprogenitor cells. This mechanism of action is associated with the healing of cancellous bone grafts and demineralized bone matrix.

Endochondral ossification is the process by which the cartilaginous soft callus covering a fracture is transformed into bone.

Osteochondrosis refers to a family of ossification disorders in children.

Osteoconduction (creeping substitution) is the primary method by which cortical bone grafts heal. During osteoconduction, cells and blood vessels from the recipient bed grow into the graft. The bone graft becomes a template for the deposition of new bone and the graft resorbs. Neovascularization is complete by 6 to 8 weeks, but ultimate strength of cortical grafts is not seen until 6 to 12 months, at which time the graft is comparable to a vascularized bone graft.

REFERENCES:

1. Gosain AK, McCarthy JG, Staffenberg D, et al. The histomorphologic changes in vascularized bone transfer and their interrelationship with the recipient sites: a 1-year study. *Plast Reconstr Surg*. 1996 Apr;97(5):1001-1013.
2. Mehrara BJ, McCarthy JG. Repair and Grafting of Bone. In: Mathes SJ, ed. *Plastic Surgery*. Vol 1. Philadelphia: Elsevier-Saunders; 2006:639-718.
3. Finkemeier CG. Bone-grafting and bone-graft substitutes. *J Bone Joint Surg Am*. 2002 Mar;84-A(3):454-464.



7. A 15-year-old girl is evaluated 2 months after a failed scalp replantation because of an avulsion injury. Skin grafting is planned, followed by staged tissue expansion. Photographs are shown. Between which of the following layers of the scalp is the most appropriate anatomic plane for tissue expander placement?

- A) Skin and galea
- B) Galea and temporalis muscle
- C) Temporalis muscle and pericranium
- D) Pericranium and cranium

The correct response is Option B.



Layers of the scalp can be easily remembered using the mnemonic SCALP: S (skin), C (subcutaneous), A (galea aponeurotica), L (loose areolar), and P (pericranium). The skin is quite thick and densely adherent to the subcutaneous layer, which contains the vessels and nerves that travel just above the galea. The galea aponeurotica is continuous with extensions of the superficial muscular aponeurotic system: the frontalis anteriorly, the occipitalis posteriorly, and the temporoparietal fascia (superficial temporal fascia) laterally. The loose areolar plane is quite mobile and dissects very easily. As a result, most avulsions occur within this plane. The pericranium is densely attached to the skull and is contiguous laterally with the deep temporal fascia. The temporalis muscle lies below this layer and attaches directly to the temporal bone.

Tissue expanders should be placed under the galea/superficial muscular aponeurotic system layer to provide maximal tissue coverage and to protect and optimize the blood supply to the expanded skin. Placement in the subcutaneous plane would require a difficult, tedious dissection and would result in a thin, poorly perfused flap. Conversely, placement of the expander under the pericranium is unnecessary and would result in a painful, difficult, and unpredictable expansion. There is no clinical indication to place a tissue expander under the temporalis muscle.

REFERENCES:

1. Leedy JE, Janis JE, Rohrich RJ. Reconstruction of Acquired Scalp Defects: An Algorithmic Approach. *Plast Reconstr Surg*. 2005;116(4):54e-72e.
2. Argenta LC, Marks MW. Principles of Tissue Expansion. In: Mathes SJ, ed. *Plastic Surgery*. 2nd Edition. Philadelphia, PA: Saunders/Elsevier; 2006;1:548-551.
3. Wei FC, Dayan JH. Scalp, Skull, Orbit, and Maxilla Reconstruction and Hair Transplantation. *Plast Reconstr Surg*. 2013;131(3):411e-424e.

8. An otherwise healthy 2-year-old male infant is evaluated because of a congenital melanocytic nevus on his flank. Physical examination shows a hairy, 10 × 5-cm nevus with areas of dark brown pigmentation that is growing proportionate to the infant's growth rate. He has another nevus, which measures less than 2 cm, on his arm. Which of the following is the primary indication for excision?

- A) Dark color
- B) Growth rate
- C) Presence of hair
- D) Presence of two lesions
- E) Size of lesion

The correct response is Option E.

The primary indication for excision in this case is the 10-cm measurement in greatest dimension. This makes this congenital nevus a giant nevus. The exact definition of a giant nevus has been debated, but one of the most constant definitions is a nevus that is 20 cm in greatest dimension in an adult or a nevus that will become 20 cm in greatest dimension once the child is fully grown. This latter measurement usually translates to approximately a 9-cm nevus on the head and neck, or approximately a 6-cm nevus on the body of an infant. Other definitions of giant nevi include a nevus that is about 1% of the body surface area in the head and neck region or 2% of the body surface area in the trunk region, a nevus that is greater than 100 cm² in area, or a nevus that cannot be excised in one stage. The main indication for excision in these giant congenital nevi is the malignant potential that they harbor. The rates of malignant degeneration are also a matter of great debate, with rates quoted anywhere from 0 to 40%. More recently, however, rates of less than 5% are quoted.

The other clinical features are not risk factors that indicate excision of the nevus. If a patient has more than three nevi, that potentially does increase the risk for malignant melanoma in the patient; however, this patient has only two.

REFERENCES:

1. Arneja JS, Gosain AK. Giant Congenital Melanocytic Nevi. *Plast Reconstr Surg*. 2007 Aug;120(2):26e-40e.
2. Bittencourt FV, Marghoob AA, Kopf AW, et al. Large congenital melanocytic nevi and the risk for development of malignant melanoma and neurocutaneous melanocytosis. *Pediatrics*. 2000;106:736.

3. Marghoob AA, Schoenbach SP, Kopf AW, et al. Large congenital melanocytic nevi and the risk for the development of malignant melanoma: A prospective study. *Arch Dermatol.* 1996;132:170.
4. Zaal LH, Wolter JM, Klip H, et al. Risk of malignant transformation of congenital melanocytic nevi: A retrospective nationwide study from the Netherlands. *Plast Reconstr Surg.* 2005;116:1902.

9. An 18-year-old man is brought to the emergency department for thumb replantation. After an uneventful microsurgical anastomosis of the digital arteries and veins, papaverine is applied to the vessels. This medication works as a vasodilator through which of the following mechanisms?

- A) Blocking calcium channels
- B) Decreasing platelet aggregation
- C) Inactivating thrombin and factor Xa
- D) Inhibiting glycoprotein IIb/IIIa
- E) Inhibiting phosphodiesterase

The correct response is Option E.

Papaverine is a phosphodiesterase inhibitor and is a commonly used vasodilating agent in microsurgery. It is administered as a liquid, directly to the adventitia of blood arteries, leading to vasodilation. The proposed mechanism of action of papaverine is by induced increase in cyclic adenosine monophosphate (AMP) levels, causing smooth muscle relaxation in the vessels. It is this mechanism of papaverine that has also led to its use for treatment of cardiac and neurovascular vasospasm.

Nifedipine is another common topical vasodilator, which is a calcium channel blocker. The remaining choices are all used to prevent clotting. Glycoprotein IIb/IIIa inhibitors are antiplatelet agents along with aspirin. Heparin inactivates thrombin and factor Xa through an antithrombin dependent mechanism.

REFERENCES:

1. Yu JT, Patel AJ, Malata CM. The use of topical vasodilators in microvascular surgery. *J Plast Reconstr Aesthet Surg*. 2011 Feb;64(2):226-228.
2. Vargas CR, Iorio ML, Lee BT. A Systematic Review of Topical Vasodilators for the Treatment of Intraoperative Vasospasm in Reconstructive Microsurgery. *Plast Reconstr Surg*. 2015 Aug;136(2):411-22.
3. Rinkinen J, Halvorson EG. Topical Vasodilators in Microsurgery: What Is the Evidence? *J Reconstr Microsurg*. 2016 Sep 16. [Epub ahead of print]

10. A 34-year-old man with schizophrenia is examined 1 hour after amputating his penis at the base of the shaft with a cleaver. The penis has been retrieved and a decision is made to attempt microvascular replantation. Repair of which of the following arteries is paramount to a successful outcome?

- A) Bulbourethral
- B) Deep cavernosal
- C) Dorsal penile
- D) Helicine
- E) Internal pudendal

The correct response is Option C.

The blood supply to the penis arises from the internal pudendal arteries, which continue into the penis as the bulbourethral artery (supplying the bulb of the penis and penile urethra), the deep corporal/cavernosal artery (responsible for erection and supply to the penile shaft), and the dorsal penile artery (supplying the penile skin). A meta-analysis has shown that repair of the dorsal penile artery predicted the best combined sexual function, urinary function, and sensation outcomes. Repair of the deep corporal/cavernosal artery did not correlate with improved outcomes. The helicine artery is one of the terminal branches of the dorsal penile artery, and is distal to the site of amputation. The internal pudendal artery supplies the penis, but more proximal than the site of amputation.

REFERENCES:

1. Morrison SD, Shakir A, Vyas KS, et al. Penile Replantation: A Retrospective Analysis of Outcomes and Complications. *J Reconstr Microsurg*. 2016 Dec 21.
2. Raheem OA, Mirheydar, HA, Patel ND, et al. Surgical Management of Traumatic Penile Amputation: A Case Report and Review of the World Literature. *Sex Med*. 2015 Mar;3(1):49-53.
3. Roche NA, Vermeulen BT, Blondeel PN, et al. Technical recommendations for penile replantation based on lessons learned from penile reconstruction. *J Reconstr Microsurg*. 2012 May;28(4):247-50.
4. Biswas G. Technical considerations and outcomes in penile replantation. *Semin Plast Surg*. 2013 Nov;27(4):205-10.

11. A 5-year-old boy is evaluated for a cerebrospinal fluid leak and a 3 × 3-cm area of wound dehiscence involving the posterior trunk following tethered cord repair. Which of the following is the most appropriate method for reconstructing the wound?

- A) Gluteal muscle flap and skin advancement flap
- B) Latissimus muscle flap and skin advancement flap
- C) Local fascial flap and skin advancement flap
- D) Skin advancement flap only
- E) Split-thickness skin graft

The correct response is Option C.

The most appropriate method to reconstruct the wound is a local fascial flap and skin advancement flap. The major principle of tethered cord and myelomeningocele repair is to obtain a well-vascularized layer of soft-tissue coverage between the dural and skin closures. The fascia overlying the paraspinal muscles can be turned over as flaps to cover the underlying dural repair. This vascularized soft-tissue layer will minimize the risk of cerebrospinal fluid leak by reinforcing the dural repair. In addition, the fascial flaps will prevent contact with cutaneous bacteria and subsequent meningitis if either the dural repair or skin repair breaks down.

A split-thickness skin graft over the dura would not adequately protect the spinal cord. Closing the skin directly over the dural repair using skin advancement flaps would place the child at risk for meningitis in the event of a cerebrospinal fluid leak or if wound breakdown occurred along the incision line of the widely undermined skin flaps.

The use of a regional gluteal or latissimus muscle flap to cover the dural repair is unnecessary because local tissue (paraspinal muscle fascia) is available. Harvesting the gluteal or latissimus muscles also may cause significant donor site morbidity in a child already at risk for ambulatory problems from a neurological deficit.

REFERENCES:

1. Fiala TG, Buchman SR, Muraszko KM. Use of lumbar periosteal turnover flaps in myelomeningocele closure. *Neurosurgery*. 1996; 39:522-526.
2. Lien SC, Maher CO, Garton H, et al. Local and regional flap closure in myelomeningocele repair: a 15 year review. *Childs Nerv Syst*. 2010; 26:1091-1095.

3. Patel KB, Taghinia AH, Proctor MR, et al. Extradural myelomeningocele reconstruction using local turnover fascial flaps and midline linear skin closure. *J Plast Reconstr Aesthet Surg*. 2012 Nov;65(11):1569-72.

12. A 55-year-old woman is scheduled to undergo autologous fat grafting to improve the upper inner quadrant aesthetic contour of the breasts. Six months ago, she underwent bilateral mastectomy and breast reconstruction with deep inferior epigastric perforator flap coverage. The patient does not have or desire breast implants. Which of the following percentage ranges most accurately describes the likelihood of fat graft survival in this patient?

- A) 10%
- B) 35%
- C) 60%
- D) 85%

The correct response is Option C.

Because of demonstration of the safety, efficacy, and improvements in the harvest and preparation of fat, autologous fat grafting or liposculpting is gaining popularity to adjust aesthetic breast contour irregularities after all forms of breast reconstruction. The most common complication of fat injection remains the resorption of the grafted fat.

Fat graft volume retention has been studied previously. Employing radiologic volumetric data analysis in fat grafting for cosmetic and reconstructive breast surgery demonstrates volume retention between 50 to 80% and this retention may be time and volume dependent.

Resorption of grafted fat may be attributable to apoptosis, a reduction in adipocyte volume after transplantation and survival, or a reduction in the fluid content of the grafted mixture.

REFERENCES:

1. Del Vecchio DA. "SIEF"-- simultaneous implant exchange with fat: a new option in revision breast implant surgery. *Plast Reconstr Surg*. 2012 Dec;130(6):1187-1196.
2. Del Vecchio DA, Bucky LP. Breast augmentation using preexpansion and autologous fat transplantation: a clinical radiographic study. *Plast Reconstr Surg*. 2011 Jun;127(6):2441-2450.
3. Choi M, Small K, Levovitz C, Lee C, Fadl A, Karp NS. The volumetric analysis of fat graft survival in breast reconstruction. *Plast Reconstr Surg*. 2013 Feb;131(2):185-91.

13. Use of negative pressure wound therapy with a sponge dressing is likely to result in an adverse outcome in which of the following clinical scenarios?

- A) A hand wound with exposed tendons
- B) A lower extremity wound with exposed femoral vessels
- C) A Stage IV sacral pressure sore
- D) As a bolster over a split thickness skin graft on the arm
- E) Over a closed surgical incision after hernia repair

The correct response is Option B.

Negative pressure wound therapy (NPWT) has dramatically improved our ability to manage complicated and complex wounds. Advantages of NPWT include decreased healing time, simplified wound care with less frequent dressing changes, and promotion of healthy granulation tissue. However, there are several contraindications to the use of NPWT. The presence of exposed vessels is an absolute contraindication to its use; arterial rupture has been reported with multiple fatalities. In addition to placement over exposed vessels, significant bleeding has also been noted with use of NPWT in groin and sternal wounds, in patients on blood-thinning medications, and during removal of well-integrated foam pieces. Other complications include infections due to retained pieces of foam.

In addition to exposed vessels, NPWT should not be used in the setting of active, uncontrolled infection, malignant wounds, wounds with unexplored and/or nonenteric fistulas, and poorly debrided wounds.

Although NPWT may not be the definitive wound management in the other scenarios listed, there is no contraindication for its use.

REFERENCES:

1. Janis J, Harrison B. Wound Healing: Part II. Clinical Applications. *Plast Reconstr Surg*. 2014;133(3):383e-392e.
2. Attinger C, Bulan EJ, Blume PA. Pharmacologic and Mechanical Management of Wounds. In: Mathes SJ, ed. *Plastic Surgery*. Philadelphia, PA: Saunders/Elsevier; 2006;1:886-888.
3. Food and Drug Administration. FDA Consumer Update: *Negative Pressure Wound Devices Draw FDA Notice, Advice*. December 2009. Washington, DC.

4. Anghel EL, Kim PJ. Negative-Pressure Wound Therapy: A Comprehensive Review of the Evidence. *Plast Reconstr Surg*. 2016;138(3S):129S-137S.

14. A 50-year-old man comes to the emergency department after sustaining amputation of the right long finger involving an avulsion mechanism. The patient is taken to surgery for replantation. During surgery, extensive vascular injury is seen, and an approximately 2-cm vascular gap of the digital arteries and veins results following excision of injured vessels. Which of the following interventions is most likely to increase the probability of functional digit replantation?

- A) Bone shortening
- B) Medicinal leech therapy
- C) Postoperative warming
- D) Systemic heparin
- E) Vein grafts

The correct response is Option E.

In patients who sustain digital amputation as a result of an avulsion mechanism, there is often an extensive zone of injury that precludes primary vascular anastomosis. Vein grafts permit vascular anastomosis outside of the zone of injury.

Bone shortening can sometimes allow excision of the injured vasculature and primary anastomosis. However, in this case, bone shortening is unlikely to make up for a 2-cm vascular gap.

Longer vascular gaps can be addressed with vein grafts. Despite the fact that vein grafts involve an additional anastomosis per vessel compared to primary anastomosis, they have been found to exhibit similar rates of thrombosis and replantation survival.

Medicinal leech therapy can help address venous congestion, but is typically considered when venous congestion occurs after attempt at surgical replantation, or if no suitable veins can be found for anastomosis.

While postoperative warming and systemic heparin are often used adjunctively in patients undergoing replantation, they have not been demonstrated to increase the likelihood of survival of the replanted part, and would most likely not have as significant an effect as restoring perfusion to the amputated part using vein grafts.

REFERENCES:

1. Hyza P, Vesely J, Drazan L, et al. Primary vein grafting in treatment of ring avulsion injuries: a 5-year prospective study. *Ann Plast Surg*. 2007 Aug;59(2):163-7.
2. Prucz RB, Friedrich JB. Upper extremity replantation: current concepts. *Plast Reconstr Surg*. 2014 Feb;133(2):333-42.
3. Yan H, Jackson WD, Songcharoen S, et al. Vein grafting in fingertip replantations. *Microsurgery*. 2009;29(4):275-81.

15. A 63-year-old man has a full-thickness scalp defect following resection of a melanoma. Final pathology has confirmed clear margins. Which of the following criteria is an indication for coverage of the defect with a flap instead of a skin graft?

- A) Alopecia of the surrounding skin
- B) Exposed calvarium
- C) Granulation tissue in the base of the wound
- D) Intact pericranium
- E) Posterior location

The correct response is Option B.

Exposed bone does not provide an adequately vascularized bed for skin graft take.

Pericranium, in contrast, can support a skin graft. The presence of granulation tissue is a good sign that the wound bed is adequately vascularized for a skin graft to take.

Surrounding alopecia decreases aesthetic concerns associated with reconstructive options that do not support hair growth. Defect location does not significantly affect the need for vascularized coverage.

REFERENCES:

1. Hallock GG, Morris SF. Skin grafts and local flaps. *Plast Reconstr Surg*. 2011 Jan;127(1):5e-22e.
2. Scherer-Pietramaggiori SS, Pietramaggiori G, Orgill DP Chapter 17 Skin Graft In: Neligan PC. *Plastic Surgery*, 3rd Edition. Elsevier Inc: 2013;319-338.

16. A 30-year-old woman is evaluated for a mass on the anterior abdominal wall that has been growing over the past several months. Imaging and examination of the specimen obtained on biopsy confirm a diagnosis of desmoid-type fibromatosis arising from the anterior abdominal musculature. Which of the following is the most accurate statement regarding this condition?

- A) It is associated with previous radiation exposure
- B) It is locally aggressive with remote risk of metastatic disease
- C) It usually arises from an untreated lipoma
- D) Primary treatment is combination chemotherapy/radiation
- E) There is an autosomal recessive genetic inheritance pattern

The correct response is Option B.

This patient has a desmoid tumor, a rare, locally infiltrative mesenchymal neoplasm that is most commonly found in adolescents and young adults. It does not metastasize but can have a very unpredictable and aggressive natural history. Treatment can range from close observation (as some tumors will self-involute) to radical excision with wide margins. Traditionally, surgical excision can be difficult because of the high risk of local recurrence.

Desmoid tumors are not associated with chemical or radiation exposures, or lipomas.

Metastatic disease is not a characteristic of desmoid tumors.

Although treatment modalities for desmoids are evolving, they are not treated with chemotherapy/radiation therapy as a primary modality. Primary treatment is frequently observation for small or slowly changing tumors. For rapidly growing tumors, radical excision is frequently performed.

There does not appear to be a genetically inherited component for desmoid tumors, although they are associated with random mutations of the β -catenin (CTNNB1) and adenomatous polyposis coli (APC) genes.

REFERENCES:

1. Otero S, Moskovic EC, Straus DC et al. Desmoid-Type Fibromatosis. *Clin Radiol*. 2015 Sep;70(9):1038-45.
2. Fiore M, MacNeill A, Gronchi A et al. Desmoid-Type Fibromatosis: Evolving Treatment Standards. *Surg Oncol Clin N Am*. 2016 Oct;25(4):803-26.

17. A 20-year-old woman is evaluated for facial asymmetry due to loss of volume on one side of the face. She has no history of trauma or infection to that side of her face. Physical examination shows normal dental occlusion with normal bony anatomy and no cranial nerve deficits. She has a mild-to-moderate deficiency of soft tissue along the cheek between the zygomatic and mandibular areas of the face. Which of the following is the most appropriate intervention for correction of this patient's hemifacial atrophy?

- A) Adipofascial free flap
- B) Autologous fat grafting
- C) Distraction osteogenesis
- D) Hyaluronic acid filler
- E) Silicone injection

The correct response is Option B.

Romberg disease, also known as progressive hemifacial atrophy (PHA), is an acquired disease causing severe deformity of the facial contour. The therapeutic goals of surgery for patients with PHA are to minimize psychosocial effects and to correct the appearance and function of involved facial structures. PHA usually presents in the first 20 years of life, after which it is slowly progressive but self-limited. The atrophy affects subcutaneous tissue, fat, muscle, and osteocartilaginous structures, creating a sunken hemiface appearance.

Epidermal cutaneous involvement is minimal, but the tongue, gingiva, teeth, and palate may also be involved. For cases with minimal-to-moderate soft-tissue defects, autologous fat grafting can provide correction of the contour deformities. For more severe soft-tissue deficits, additional or other modalities such as adipofascial free flaps can be used. In more severe cases with skeletal and/or dental abnormalities, interventions such as distraction osteogenesis and bone grafting may be necessary. The injection of free silicone is not recommended and has been replaced by the use of autologous fat and other injectable substances. Hyaluronic acid may provide a temporary solution, but it is costly.

REFERENCES:

1. Tolkachjov S, Patel N, Tollefson M. Progressive hemifacial atrophy: a review. *Orphanet J Rare Dis*. 2015; 10: 39.
2. Palmero ML, Uziel Y, Laxer RM, et al. En coup de sabre scleroderma and Parry-Romberg syndrome in adolescents: surgical options and patient-related outcomes. *J Rheumatol*. 2010;37(10):2174–9.

18. A 34-year-old man sustains deep second-degree burns to the forearm. He is brought to a local burn center. A skin graft is chosen as the coverage method. Which of the following management techniques offers the highest likelihood of skin graft survival in this patient?

- A) Complete fascial excision
- B) Early range of motion
- C) Keeping the graft uncovered postoperatively
- D) Placing a full-thickness graft
- E) Placing a meshed graft

The correct response is Option E.

The principles of burn wound skin grafting dictate that first, a clean wound must be obtained. This is achieved through operative debridement and washout, to remove all necrotic eschar, and eliminate any possible source of bacteria or infection.

In most cases of second-degree burns, a complete fascial excision is not necessary, as this proceeds much deeper than the affected tissue. Instead, a tangential excision is used to remove burn eschar, in layers, until the necrotic tissue has been excised, and viable tissue remains at the base of the wound.

Following this, a split-thickness skin graft allows for greatest potential of graft survival. The use of a full-thickness graft will result in lower graft survival rates.

Meshing the skin graft prior to placement will improve survival, as it prevents accumulation of fluid or blood under the skin graft. Any collection of seroma or hematoma under the graft will prevent successful outcomes.

Placement of either a bolster dressing or a negative pressure (vacuum-assisted closure) dressing on the skin graft, will prevent mechanical shear forces, and improve graft survival rates. Thus, for the first 5 days after graft placement, any early motion or lack of dressing will result in greater risk of shear forces, and lower graft survival rates.

REFERENCES:

1. Gallagher JJ, Wolf SE, Herndon DN: Burns. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL (eds). *Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practice*. 18th ed. Saunders, 2008;559-585.
2. Kantak NA, Mistry R, Halvorson EG. A review of negative-pressure wound therapy in the management of burn wounds. *Burns*. 2016 Dec;42(8):1623-1633.

19. A 54-year-old woman undergoes bilateral immediate tissue expander–based breast reconstruction. BMI is 36 kg/m². On postoperative day 10, examination shows bilateral breast erythema; empiric antibiotics are started. In addition to *Staphylococcus* species, which of the following bacteria should be treated as the next most likely pathogen?

- A) *Bacteroides fragilis*
- B) *Enterococcus faecalis*
- C) *Mycobacterium marinum*
- D) *Pasteurella multocida*
- E) *Pseudomonas aeruginosa*

The correct response is Option E.

After *Staphylococcus aureus* and *S. epidermidis*, *Pseudomonas aeruginosa* is among the the next most common sources of breast infections. It is common in hospitalized or immunocompromised patients, as well as patients with foreign body devices such as catheters or implants. It is a gram negative rod, and common antibiotic treatments include advanced β -lactams (piperacillin, ceftazidime), carbapenems, quinolones, and aminoglycosides. Dual coverage is often recommended in severe infections. In the case of breast implant infections, if there is not rapid improvement on antibiotic therapy, or if significant systemic symptoms develop (vital sign instability, high white blood cell count, fever, renal impairment), then surgical washout and device removal is mandatory. In patients without systemic symptoms, wash out and new implant placement can be an option in carefully selected and counseled patients. Other breast pathogens include *Escherichia coli*, *Propionibacterium*, and *Corynebacterium*.

More than 300,000 breast implant procedures are performed each year in the United States. In reconstructive cases, the infection rate averages 6% and the explantation rate 3% (range, 1.5 to 8%). Preventative measures include proper patient selection, preoperative MRSA management when carriers are suspected, routine presurgery chlorhexidine washes, proper antibiotic timing presurgery and continuation of antibiotics in implant reconstruction cases for at least 24 hours (though the optimal treatment duration has not yet been determined).

None of the other bacteria listed are common in breast infections, though all are common pathogens. *Bacteroides* are anaerobic gram-negative rods that are common in gut flora and feces.

Enterococcus faecalis is a frequent cause of nosocomial infection, with a high prevalence of multi-drug resistance. It is a gram-positive coccus, and is not commonly seen in breast surgery patients as it primarily colonizes the digestive tract.

Mycobacterium marinum is a rare pathogenic cause of hand infections from injuries that occur in aquatic environments.

Pasteurella multocida is a frequent cause of animal bite infections, particularly from cats and dogs.

REFERENCES:

1. Cohen J, Carroll C, Tenenbaum M, Myckatyn T. Breast Implant–Associated Infections: The Role of the National Surgical Quality Improvement Program and the Local Microbiome. *Plast Reconstr Surg*. 2015 Nov;136(5):921-9.
2. Friedrich, M. *Pseudomonas Aeruginosa* Infections. Medscape website. <http://emedicine.medscape.com/article/226748-overview>. Updated: Dec 05, 2016; Accessed January 2, 2017.
3. Khansa I, Hendrick R, Shore A, et al. Breast Reconstruction with Tissue Expanders: Implementation of a Standardized Best-Practices Protocol to Reduce Infection Rates. *Plast Reconstr Surg*. 2014 Jul;134(1):11-8.



20. A 62-year-old woman is evaluated because of a new 2 × 2-cm open area near her left axillary fold. Medical history is significant for left breast cancer previously treated with bilateral mastectomies, left axillary node dissection, and adjuvant chemoradiation 10 years ago. A photograph is shown. She has been compliant with postoperative oncologic surveillance and has had no recent trauma. Which of the following underlying conditions is most likely responsible for her current presentation?

- A) Empyema with spontaneous drainage
- B) Lymphedema drainage tract
- C) Osteoradionecrosis of the underlying rib(s)
- D) Recurrent breast cancer
- E) Skin ulceration from intertriginous shearing forces

The correct response is Option C.

The effects of ionizing radiation are permanent and may present either acutely or in delayed fashion, even years after the original radiation insult. The mechanism of injury from this

radiation is through free radical production which, in turn, directly damages the DNA. In the acute period, the effects of radiation may manifest themselves as erythema and edema of the skin, vasodilation with endothelial edema, and lymphatic obliteration. This eventually leads to capillary thrombosis and subsequent inadequate tissue oxygenation. Over time, nonhealing ulcers can spontaneously develop, sometimes years later.

Although recurrent cancer is always a concern in patients with a personal history of cancer, proper, regular, and thorough surveillance can often detect recurrences early, especially in compliant patients. Most recurrences occur within the first 5 years.

Abscesses usually present initially with pain, erythema, and localized fluctuance, and often with associated fever and/or malaise. Spontaneous necroslution to the skin would also result in purulent drainage.

Lymphedema can be a chronic condition after mastectomy and axillary node dissection, and is usually manifested as generalized edema of the ipsilateral upper extremity. Sinus tract formation is rare.

Intertriginous shearing would most often present as superficial epidermal loss with possible superinfection with yeast due to moisture.

REFERENCES:

1. Janis JE, Harrison B. Wound Healing Part I – Basic Science. *Plast Reconstr Surg*. 2014 Feb;133(2):199e-207e.
2. Tibbs MK. Wound healing following radiation therapy: A review. *Radiother Oncol*. 1997;42:99–106.
3. Drake DB, Oishi SN. Wound healing considerations in chemotherapy and radiation therapy. *Clin Plast Surg*. 1995 Jan;22(1):31-7.



21. An 18-year-old woman comes to the office to discuss her congenital breast asymmetry. Physical examination shows asymmetry in the size and shape of the right breast and nipple-areola complex compared with the left breast. Additionally, there is an absence of the right anterior axillary fold. A photograph is shown. Which of the following is the most likely origin of the absent muscle in this patient?

- A) Ectoderm
- B) Endoderm
- C) Mesoderm
- D) Neuroectoderm
- E) Notochord

The correct response is Option C.



The patient above has Poland syndrome. Poland syndrome represents a spectrum of congenital chest wall anomalies ranging from the simple form (depicted in the preoperative photograph) to complex. The pathognomonic feature is the absence of the sternocostal head of the pectoralis major muscle. A variety of other ipsilateral chest wall and upper extremity malformations may be present, including absence of ribs two through five, foreshortening of the limb, brachysyndactyly, hypoplasia/aplasia of the breast and nipple-areola complex, and absence/hypotrophy of various trunk muscles including the latissimus dorsi, serratus anterior and external oblique. Although a few familial cases have been reported, Poland syndrome is believed to be sporadic in nature with an incidence of 1:100,000. There is a male-to-female predilection of 3:1, with a right-sided predominance in boys of 2:1. The patient is shown two months after reconstruction with a right latissimus flap and bilateral silicone gel-filled implants.

The trunk develops from the fusion of the ectoderm/neural crest layer with the somatic mesoderm during the fourth week of gestation. Mesoderm gives rise to somites, which differentiate into the dorsolateral dermomyotome and the ventromedial sclerotome. The dermomyotome gives rise to the musculature of the trunk and extremities. The sclerotome surrounds the developing spinal cord and notochord and forms the vertebral bodies and spinal skeletal structure. The notochord acts as a pathway for the development of the spinal cord and vertebral bodies. The notochord degenerates as the vertebral bodies develop and becomes the nucleus pulposus of the intervertebral disks.

The exact pathophysiology of Poland syndrome has not been elucidated. One theory suggests a mechanical disruption of the embryonic blood supply in the subclavian/vertebral systems during the sixth to seventh week of gestation. Another theory suggests the etiology to be an injury or developmental failure of the mesodermal plate during the third to fourth week of gestation.

Endoderm is the primitive germ layer that gives rise to the epithelium of the respiratory and gastrointestinal tracts. Ectoderm is divided into surface ectoderm and neuroectoderm. Surface ectoderm gives rise to the epidermis, adnexal structures of the skin, and the

mammary glands. Neuroectoderm becomes the central nervous system, various neural ganglia, and the branchial arches.

REFERENCES:

1. Mathes SJ, Seyfer AE, Miranda EP. Congenital Anomalies of the Chest Wall. In: Mathes SJ, ed. *Plastic Surgery*. 2nd ed. Vol VI. Philadelphia, PA: Saunders/Elsevier; 2006:457-537.
2. Moore KL, Persaud TVN, eds. *The Developing Human: Clinically Oriented Embryology*. 5th ed. Philadelphia PA: WB Saunders Company; 1993:57-61, 74, 370-4.
3. Pryor LS, Lehman JA Jr, Workman MC. Disorders of the female breast in the pediatric age group. *Plast Reconstr Surg*. 2009 Jul;124(1 Suppl):50e-60e.
4. Seyfer AE, Fox JP, Hamilton CG. Poland syndrome: evaluation and treatment of the chest wall in 63 patients. *Plast Reconstr Surg*. 2010 Sep;126(3):902-11.
5. van Aalst JA, Phillips JD, Sadove AM. Pediatric chest wall and breast deformities. *Plast Reconstr Surg*. 2009 Jul;124(1 Suppl):38e-49e.

22. A 55-year-old woman comes to the office requesting treatment of fine rhytides due to smoking and photoaging. Topical retinoid therapy is planned. Which of the following effects is most likely to occur with topical retinoid treatment?

- A) Decreased collagen production
- B) Decreased hyaluronic acid production
- C) Thinning of the dermis
- D) Thinning of the epidermis
- E) Thinning of the stratum corneum

The correct response is Option E.

Tretinoin (all-trans-retinoic acid) is one of the best long-term topical therapies available for chronically photoaged skin. Long-term use of tretinoin is associated with improved skin texture, decreased sallowness, a reduction in fine rhytides and actinic keratoses, fading of pigmented macules, and an overall improvement in skin appearance. Histologic effects of tretinoin include the following: increased epidermal and dermal layer thickness, elimination of dysplasia, atypia, and microscopic actinic keratoses, uniform dispersion of melanin granules, increased collagen and glycosaminoglycan deposition in the papillary dermis, diminished dermal elastosis, angiogenesis, and compaction/thinning of the stratum corneum.

The mechanism of action of retinoids is regulated through specific nuclear receptors. Ultraviolet radiation activates a series of phosphokinases that stimulate c-Fos and c-Jun proto-oncogenes, and thereby activate activator protein 1 (AP-1) transcription factor. AP-1 causes activation of metalloproteases, such as collagenase, gelatinase, and stromelysin which then break down collagen. Tretinoin results in a 70% inhibition of AP-1 transcription factor binding to DNA and a significant reduction in protease activity.

Tretinoin side effects include erythema, photosensitivity, and desquamation. Patients are initially started on a low dose with nightly application until tolerance is achieved. Because tretinoin is a photosensitizer, sunscreen use is absolutely imperative. Topical retinoids should be used for a minimum of 3 to 4 months, with the greatest improvement after 1 year of use. Patients who use alpha-hydroxy acids concomitantly with topical retinoids will see a synergistic effect and this combination is tolerated well in most patients.

REFERENCES:

1. Hubbard BA, Unger JG, Rohrich RJ. Reversal of Skin Aging with Topical Retinoids. *Plast Reconstr Surg*. 2014;133(4):481e-490e.
2. Saltz R, Borba T. Skin Care and Dermatologic Treatments. In: Nahai F, ed. *The Art of Aesthetic Surgery*. St. Louis, Missouri: Quality Medical Publishing; 2005;1:170-193.
3. Bhawan J, Olsen E, Lufrano L, et al. Histologic evaluation of the long term effects of tretinoin on photodamaged skin. *J Dermatol Sci*. 1996;11:177-182.
4. Clark CP. Office-Based Skin Care and Superficial Peels: The Scientific Rationale. *Plast Reconstr Surg*. 1999;104(3):854-864.
5. Leyden JJ. Treatment of Photodamaged Skin with Topical Tretinoin: An Update. *Plast Reconstr Surg*. 1998;102(5):1667-1671.

23. A 42-year-old woman presents with a Gustilo Type IIIB open tibial fracture with a large area of soft-tissue loss. Rectus abdominis free flap reconstruction is planned. CT angiography shows a patent posterior tibial artery; however, the peroneal and anterior tibial vessels are not suitable for use because they do not traverse past the level of the fracture. Compared with end-to-end anastomosis, which of the following is the main advantage to using end-to-side arterial anastomosis in this scenario?

- A) Allows anastomosis in zone of injury
- B) Decreases ischemia time
- C) Facilitates visualization
- D) Minimizes kinking of vessels
- E) Preserves distal blood supply

The correct response is Option E.

In this clinical scenario, the patient has a one-vessel runoff in the lower extremity. Preservation of the distal blood supply is critical and that is the main advantage of an end-to-side anastomosis.

In general, an end-to-side anastomosis is more technically difficult with longer ischemia time. Kinking of the vessels is still possible with end-to-side anastomosis and therefore is not a major advantage to this technique. There is no added benefit in visualizing the vessel and it is generally more difficult to see the entire vessel compared to an end-to-end anastomosis. This technique does not preferentially allow for an anastomosis in the zone of injury.

Finally, it is controversial whether or not the flap survival rate is different between end-to-side and end-to-end anastomosis. An early paper by Godina shows an advantage for end-to-side; however, many subsequent papers have contradicted these results.

REFERENCES:

1. Fan KL, Patel KM, Mardini S, et al. Evidence to support controversy in microsurgery. *Plast Reconstr Surg*. 2015 Mar;135(3):595e-608e.
2. Godina M. Preferential use of end-to-side arterial anastomoses in free flap transfers. *Plast Reconstr Surg* 1979; 64(5):673-82.

3. Cho EH, Garcia RM, Blau J, et al. Microvascular Anastomoses Using End-to-End versus End-to-Side Technique in Lower Extremity Free Tissue Transfer. *J Reconstr Microsurg*. 2016 Feb;32(2):114-20.
4. Apostolides JG, Magarakis M, Rosson GD. Preserving the internal mammary artery: End-to-side microvascular arterial anastomosis for DIEP and SIEA flap breast reconstruction. *Plast Reconstr Surg*. 2011;128:225e–232e.

24. An otherwise healthy, 2-month-old female infant is brought to the outpatient clinic for evaluation of an enlarging hemangioma of the face. The parents are concerned about its rapid growth and beginning ulceration. Which of the following interventions would provide the most efficacious treatment with the lowest risk of adverse events?

- A) Embolization
- B) Oral propranolol therapy
- C) Pulsed-dye laser treatment
- D) Surgical excision
- E) Triamcinolone injection

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option B.

A recent randomized controlled trial has shown that oral propranolol is better tolerated with fewer adverse effects than prednisolone. Based on this and other studies that have been published, oral propranolol has assumed the status of effective first-line treatment of infantile hemangiomas if there is no contraindication to its use.

Intralesional corticosteroids can arrest growth but generally do not cause regression. In large dosages, they can also have systematic adverse effects.

Surgical excision is typically reserved for urgent/emergent circumstances where a rapidly proliferating hemangioma threatens important structures or function, such as visual, nasopharyngeal, or auditory canal obstruction. Otherwise, on an elective basis, it is usually deferred until later in life (i.e. school-age) when psychosocial concerns present more prominently.

Pulsed-dye laser can be used, but requires multiple treatments or anesthesia, and carries generally more risk than oral propranolol, which is the correct choice in this situation.

REFERENCES:

1. Bauman NM, McCarter RJ, Guzzetta PC, et al. Propranolol vs prednisolone for symptomatic proliferating infantile hemangiomas: a randomized clinical trial. *JAMA Otolaryngol Head Neck Surg*. 2014 Apr;140(4):323-30.

2. Greene AK. Current concepts of vascular anomalies. *J Craniofac Surg*. 2012;23:220–224.
3. Investigators: Chinnadurai S, Snyder K, Sathe N, et al. *Diagnosis and Management of Infantile Hemangioma. Comparative Effectiveness Review No. 168*. (Prepared by the Vanderbilt University Evidence-based Practice Center under Contract No. 290-2010-0009-I.) Rockville (MD): Agency for Healthcare Research and Quality (US); 2016 Jan.

25. During a ventral hernia repair and abdominal wall reconstruction, a surgeon wishes to achieve full primary fascial closure over an intraperitoneal mesh. However, the fascia is under tension and requires a component separation to achieve full closure with minimal tension. Component separation technique involves which of the following?

- A) Incision of the anterior rectus sheath
- B) Internal oblique aponeurotomy
- C) Ligation of periumbilical perforators
- D) Plication of the linea semilunaris
- E) Preservation of intercostal nerves

The correct response is Option E.

Preservation of segmental intercostal nerves is a critical aspect of component separation.

Component separation is a powerful technique used during abdominal wall reconstruction to advance the abdominal fascia towards the midline and allow for primary closure with reduced tension.

A component separation is performed by making an incision longitudinally in the external oblique aponeurosis, just lateral to the linea semilunaris. Only the fascia is cut, not the external oblique muscle. This allows for advancement of a myofascial complex consisting of the rectus abdominus muscle, internal oblique muscle and fascia, and transversalis muscle and fascia.

The segmental intercostal nerves that supply the anterior abdominal wall run between the internal oblique and the transversalis muscle. They are deeper than the incision and dissection plane with component separation, and are thus protected from injury. This maintains abdominal wall tone in patients undergoing this procedure.

External oblique aponeurotomy, not internal oblique aponeurotomy, is involved in component separation. Incision of the anterior rectus sheath is not part of component separation, although some modifications include incision of the posterior rectus sheath to release more fascia available for primary closure. Plication of the linea semilunaris is not a part of component separation. Ligation of periumbilical perforators is commonly performed in the standard, open approach to component separation, but it is not considered a critical component of the procedure, as it is possible to perform a perforator-sparing component separation.

REFERENCES:

1. Ramirez OM, Ruas E, Dellon AL. "Components separation" method for closure of abdominal-wall defects: an anatomic and clinical study. *Plast Reconstr Surg*. 1990 Sep;86(3):519-26.
2. Pauli EM, Rosen MJ. Open ventral hernia repair with component separation. *Surg Clin North Am*. 2013 Oct;93(5):1111-33.

26. A 52-year-old woman undergoes fat grafting of the upper right breast area to correct a contour indentation after implant reconstruction. Which of the following factors will most likely increase the success of fat grafting?

- A) Abdominal donor site
- B) Grafting soon after harvest
- C) Rinsing the fat with Ringer's lactate
- D) Ultrasonic liposuction aspiration
- E) Use of centrifuged fat

The correct response is Option B.

There is evidence that the longer fat is exposed at room temperature, the lower the adipocyte viability. There may be complete loss of stem cell viability by 4 hours at room temperature and 24 hours at 4°C (39°F).

There is no high-level evidence suggesting that centrifuging or rinsing fat increases viability. There is also no evidence for enhanced fat survival based on donor site, such as the abdomen, thigh, or arm. Use of local anesthesia does not appear to hinder graft survival.

It does appear that less mechanical trauma with low-shear harvesting instruments is helpful. Ultrasonic liposuction is designed to rupture fat cells and would likely hinder graft survival.

Fat grafting is an increasingly common tool, although results appear to be operator-dependent based on wide ranges of success in published reports. There is no absolute agreed-upon method of measuring fat survival. Most studies use volumetric analysis with imaging. More future long-term studies are needed. At this time it appears that the commonality of successful results is delicate handling of the fat.

REFERENCES:

1. Sinno, Wilson S, Bownstone N, Levine S. Current Thoughts on Fat Grafting: Using the Evidence to Determine Fact or Fiction. *Plast Reconstr Surg*. 2016 Mar;137(3):818-24.

2. Kaufman MR, Bradley JP, Dickinson B, et al. Autologous fat transfer national consensus survey: Trends in techniques for harvest, preparation, and application, and perception of short- and long-term results. *Plast Reconstr Surg*. 2007 Jan;119(1):323-31.
3. Gir P, Brown SA, Oni G, et al. Fat grafting: Evidence-based review on autologous fat harvesting, processing, reinjection, and storage. *Plast Reconstr Surg*. 2012 Jul;130(1):249-58.

27. An otherwise healthy, nonsmoking 30-year-old mechanic has the long, ring, and little fingers amputated sharply through Zone II of the right hand. The amputated digits are stored appropriately, and he is rushed to surgery within 2 hours of the accident. Which of the following sequences is the best method of replantation?

- A) Digit by digit: bone, tendons, arteries, nerves, veins
- B) Digit by digit: bone, tendons, arteries, veins, nerves
- C) Structure by structure: bone, nerves, tendons, arteries, veins
- D) Structure by structure: bone, tendons, arteries, nerves, veins
- E) Structure by structure: tendons, bones, veins, arteries, nerves

The correct response is Option D.

The most efficient sequence to perform the replantation is structure by structure: bone, tendons, arteries, nerves, and then veins. It has been shown that the time to complete the procedure is significantly shorter if the same anatomic structure on each severed digit is fixed before repairing the next structures, as opposed to completing all aspects of the replantation one digit at a time. With respect to the sequence of repair of the severed structures, the general thought is to have a stable construct prior to starting the delicate microscopic repairs. However, the technical sequence used by microsurgeons varies greatly.

The only consistent agreement is starting with bony shortening and fixation. The traditional sequence that follows is extensor and flexor tendon repair, and then vessel/nerve repair. However, individual surgeon preference and patient circumstances dictate the usual sequence thereafter. Some surgeons like to start dorsally and complete the extensor tendon, venous, and skin repair first, and then complete the volar structures next. On the volar side, some surgeons repair the tendon first, followed by the artery and nerve, while others fix the artery and nerve first, followed by the tendon. There are those who believe that the nerve is better repaired in a bloodless field, so that should be done first. Others feel that repairing the vein first reduces blood loss and keeps a bloodless field more reliably for better vision. In patients who present with long ischemia time, it may be beneficial to anastomose the artery first, because this provides the advantages of earlier revascularization and allows easier detection of the most functional veins by their spurting backflow. In short, any of these sequences is fine, as long as it follows the bony fixation.

The other options are incorrect sequences for the above reasons.

REFERENCES:

1. Maricevich M, Carlsen B, Mardini S, Moran S. Upper extremity and digital replantation. *Hand (NY)*. 2011; Dec; 6(4):356–363.
2. Prucz RB, Friedrich JB. Upper Extremity Replantation: Current Concepts. *Plast Recon Surg*. 2014;133(2):333-342.
3. Walaszek I, Zyluk A. Long term follow-up after finger replantation. *J Hand Surg Eur Vol*. 2008;33(1):59–64.



28. An obese 47-year-old man comes to the office for pain and drainage in the perineal region. A photograph is shown. Medical history includes hypertension, hypercholesterolemia, and diabetes. Which of the following is the most important factor in reducing the risk of recurrence after surgery?

- A) Adjuvant radiation
- B) Antibiotic therapy
- C) Extent of resection
- D) Intralesional corticosteroid injection
- E) Method of closure

The correct response is Option C.

This patient has hidradenitis suppurative (HS). There are various surgical treatments available to these patients with varying risk of recurrence. Surgical options include incision and drainage, surgical deroofing, local excision, and radical resection of all involved tissue. Reconstructive and closure techniques include secondary healing, primary closure, skin

grafting and locoregional pedicled flaps. Numerous studies have looked at the outcomes with various closure techniques and they show that risk of recurrence is likely influenced more by the extent of disease rather than the method of definitive closure. Because of the recurrent nature of this disease, surgery has been considered as the only effective curative therapy for HS. Inadvertent compromise in the margin of resection may diminish the probability of successful healing. Radical resection of all hair-bearing skin with a 1- to 2-cm clear margin of normal tissue is the gold standard and the most important factor in reducing risk of recurrence. Recurrence rates tend to be higher after excision in regions where functional and aesthetic outcomes take priority, and often limit the extent of resection and compromise the ability to obtain clear margins (ie, axilla, perineum, breast). Historically, low-voltage radiation was used as a treatment modality for HS and it is thought to cause complete follicular destruction. Current studies on radiotherapy as treatment for HS are very limited because of concern regarding malignancies arising in radiation fields. Radiation should be reserved for individuals with severely recalcitrant disease and used with extreme caution in younger individuals. Bacterial burden may also diminish the probability of successful wound healing. Topical and systemic antibiotics are still the mainstay treatment for mild HS. Despite their widespread use, few studies have shown their efficacy. In addition, antibiotics do offer relief by reducing the burden of abscesses and pustules in some individuals, but recurrence in these people is frequent. Standard practice of managing acute flares with intra-lesional steroid injections lacks clinical evidence. It has been shown in a series of patients to reduce erythema, edema, size and pain, but no effect on recurrence of disease has been shown.

REFERENCES:

1. Falola RA, DeFazio MV, Anghel EL, et al. What Heals Hidradenitis Suppurativa: Surgery, Immunosuppression, or Both? *Plast Reconstr Surg*. 2016 Sep;138(3 Suppl):219S-29S.
2. Ellis, LZ. Hidradenitis Suppurativa: Surgical and Other Management Techniques. *Dermatol Surg* 38:517-536, 2012.
3. Riis, PT et al. Intralesional triamcinolone for flares of hidradenitis suppurative: A case series. *Journal of Amer Acad of Dermatol* 75(6): 1151-1155, 2016 Dec.

29. A 48-year-old woman is evaluated for bilateral microsurgical breast reconstruction. Compared with the deep inferior epigastric perforator (DIEP) flap, the superficial inferior epigastric artery (SIEA) flap places the patient at a greater risk for which of the following complications?

- A) Abdominal bulge
- B) Donor site dehiscence
- C) Fat necrosis
- D) Flap failure
- E) Umbilical necrosis

The correct response is Option D.

Several comparative studies have reported a higher incidence of anastomotic thrombosis and failure with the superficial inferior epigastric artery (SIEA) flap than with flaps based on the deep inferior epigastric artery (DIEA). These failure rates range from 7.35 to 14%. Most of these failures were arterial in nature. Since SIEA flaps do not require an incision into the anterior rectus sheath or rectus muscle, bulges do not occur. Reported fat necrosis rates are similar between SIEA and DIEA flaps. There is no evidence for a difference in donor site dehiscence or umbilical necrosis rates.

REFERENCES:

1. Coroneos CJ, Heller AM, Voineskos SH, Avram R. SIEA versus DIEP Arterial Complications: A Cohort Study. *Plast Reconstr Surg*. 2015 May;135(5):802e-807e.
2. Masoomi H, Clark EG, Paydar KZ, et al. Predictive risk factors of free flap thrombosis in breast reconstruction surgery. *Microsurgery*. 2014 Nov;34(8):589-94.
3. Vanschoonbeek A, Fabre G, Nanhekhyan L, Vandevoort M. Outcome after urgent microvascular revision of free DIEP, SIEA and SGAP flaps for autologous breast reconstruction. *J Plast Reconstr Aesthet Surg*. 2016 Dec;69(12):1598-1608.

30. A 50-year-old woman is evaluated for multiple firm, nodular, pink-colored lesions of the scalp, ranging in size from 2 to 4 mm. Examination of a specimen obtained on biopsy shows benign cylindroma. Which of the following is the most appropriate management of these lesions?

- A) Cryotherapy
- B) Electrodesiccation and curettage
- C) Imiquimod therapy
- D) Radiotherapy
- E) Surgical excision

The correct response is Option E.

Cylindromas are benign adnexal tumors showing an eccrine and an apocrine differentiation. They are found most commonly on the scalp and face, and are more common in women. Solitary cylindromas are generally sporadic in nature. Multiple cylindromas can be seen in patients with Brooke-Spiegler syndrome as an autosomal dominant trait with variable penetrance.

Cylindromas may undergo malignant transformation, and therefore surgical excision is typically recommended, with close postoperative follow-up given high recurrence rates.

Cryotherapy, electrodesiccation and curettage, and imiquimod are not treatments for cylindromas.

Radiotherapy has been used to treat malignant cylindromas (also known as cylindrocarcinoma or adenoid cystic carcinoma), but not benign cylindromas.

REFERENCES:

1. Jordão C, de Magalhães TC, Cuzzi T, Ramos-e-Silva M. Cylindroma: an update. *Int J Dermatol*. 2015 Mar;54(3):275-8.
2. Singh DD, Naujoks C, Depprich R, et al. Cylindroma of head and neck: review of the literature and report of two rare cases. *J Craniomaxillofac Surg*. 2013 Sep;41(6):516-21.

31. Which of the following technical factors has the greatest favorable impact on the final appearance of a surgical scar?

- A) Closing the wound in a single layer
- B) Use of an absorbable suture
- C) Use of topical cyanoacrylate
- D) Retention suture
- E) Wound-edge eversion

The correct response is Option E.

The two technical factors that increase the likelihood of a “good” scar are placement of sutures that will not leave permanent suture marks and wound-edge eversion. In wounds where the skin is brought precisely together, there is a tendency for the scar to widen. In wounds where the edges are everted or hypereverted in an exaggerated fashion, this tendency is minimized possibly by reducing the tension on the closure. While the most common method of closing a wound is with sutures, there is nothing necessarily superior about sutures or a specific type of suture. Staples, skin tapes, or wound adhesives are also useful in certain situations. Regardless of the method of closure or type of suture used, precise approximation of skin edges without tension is essential to ensure healing with minimal scarring. Simple interrupted suture is the gold standard for suturing wounds closed and everting the skin edges. Retention sutures tend to leave the most obvious and unsightly cross-hatching if they are not removed early. Wounds deeper than the skin are closed in layers. The key is to eliminate the dead space and provide a strong closure to prevent dehiscence and reduce tension. However, not all layers necessarily require separate closure.

REFERENCES:

1. Janis JE. A Practical Guide to Wound Healing. *Plast Reconstr Surg.* 2010 Jun;125(6):230e-44e.
2. Thorne CH, Chung KC, Gosain AK, et al. *Grabb & Smith's Plastic Surgery*, 7th Edition. Philadelphia: Lippincott Williams & Wilkins, 2013.

32. A 23-year-old woman comes to the office because of a hypertrophic scar after undergoing abdominoplasty 3 months ago. A multimodal approach to improving the appearance of the scar is planned. Which of the following therapies is supported by the highest quality evidence in this patient?

A) Allium cepa extract

B) Fat injection

C) Microneedling

D) Silicone gel

E) Vitamin E

The correct response is Option D.

Silicone gel has demonstrated efficacy in improving hypertrophic scars in a number of studies and is supported by level I evidence. Vitamin E, fat injection, allium cepa extract and microneedling are supported by lesser quality studies in a recent comprehensive review of the literature.

REFERENCES:

1. Kafka M, Collins V, Kamolz LP, Rappl T, Branski LK, Wurzner P. Evidence of invasive and noninvasive treatment modalities for hypertrophic scars: A systematic review. *Wound Repair Regen.* 2017 Jan;25(1):139-144.
2. Khansa I, Harrison B, Janis JE. Evidence-Based Scar Management: How to Improve Results with Technique and Technology. *Plast Reconstr Surg.* 2016 Sep;138(3 Suppl):165S-78S.
3. Saulis AS, Mogford JH, Mustoe TA. Effect of Mederma on hypertrophic scarring in the rabbit ear model. *Plast Reconstr Surg.* 2002 Jul;110(1):177-83; discussion 184-6.

33. A 24-year-old woman comes to the office to discuss augmentation mammoplasty. She is interested in subglandular implant placement and would like to discuss the risks of augmentation. Which of the following risks is more likely with smooth round silicone implants compared with textured anatomic silicone implants?

- A) Anaplastic large cell lymphoma
- B) Capsular contracture
- C) Double capsule
- D) Late seroma
- E) Malrotation

The correct response is Option B.

Capsular contracture is more common in smooth round silicone implants than in textured implants. It is believed that the texturing of the implant is protective against significant capsule formation.

On the other hand, there are several increased risks associated with textured anatomic implants. These include increased risks of late seroma and breast implant-associated anaplastic large cell lymphoma (BIA-ALCL), although this is very rare. Double capsule is a complication more recently noted with the introduction of textured anatomic implants. Malrotation can only be seen in an anatomic textured implant, because smooth round implants are symmetric in shape. In addition, it can be difficult to differentiate between anatomic shaped and smooth round implants, with several studies showing their similar cosmetic outcomes.

REFERENCES:

1. Lista F, Ahmad J. Evidence-Based Medicine: Augmentation Mammoplasty. *Plast Reconstr Surg*. 2013 Dec;132(6):1684-96.
2. Hall-Findlay EJ. Breast implant complication review: Double capsules and late seromas. *Plast Reconstr Surg*. 2011 Jan;127(1):56-66.
3. Brody GS, Deapen D, Taylor CR, et al. Anaplastic large cell lymphoma occurring in women with breast implants: Analysis of 173 cases. *Plast Reconstr Surg*. 2015;135:695–705.
4. Rubi CG, Lozano JA, Perez-Espadero, et al. Comparing Round and Anatomically Shaped Implants in Augmentation Mammoplasty: The Experts' Ability to Differentiate the Type of Implant. *Plast Reconstr Surg*. 2017 Jan;139(1):60-64.

5. Lista, F. Discussion. Comparing Round and Anatomically Shaped Implants in Augmentation Mammoplasty: The Experts' Ability to Differentiate the Type of Implant. *Plast Reconstr Surg*. 2017 139(1):65-66.

34. A 48-year-old woman undergoes immediate unilateral breast reconstruction with a free deep inferior epigastric artery perforator (DIEP) flap. At the conclusion of the procedure, the flap skin paddle is noted to have venous congestion. Upon reexploration, the venous anastomosis appears patent with venous outflow detected by handheld pencil Doppler evaluation, but the flap continues to have venous congestion with brisk capillary refill. Which of the following is the most appropriate next step in management?

- A) Apply leeches postoperatively
- B) Loosely re-inset the flap and monitor closely
- C) Perform a second venous anastomosis using the superficial inferior epigastric vein
- D) Perform a second venous anastomosis using the vena comitans
- E) Revise the venous anastomosis using a hand-sewn technique

The correct response is Option C.

Preservation of the superficial inferior epigastric veins (SIEV) during flap harvest is a useful preventive measure in microsurgical free tissue transfer operations. These veins can serve as important lifeboats to augment venous outflow in the setting of venous congestion. Typically, if a free flap demonstrates venous congestion, the inset should be taken down and the pedicle, recipient vessels, and anastomoses should be interrogated. Simple issues, such as mechanical compression or twisting of the vein, should be ruled out. Next, the SIEV should be inspected. If engorged, the flap is likely reliant on superficial outflow, and this vein should be connected to a recipient vessel to augment the venous outflow of the flap. Options for recipient veins include an anterograde branch on the pedicle vena comitans, or in a retrograde fashion to the vena comitans that was not used in the initial set of anastomoses.

In this case scenario, the flap continued to demonstrate venous congestion intraoperatively. This makes it unlikely that tension or pressure from the inset of the flap was causing the venous outflow obstruction. Furthermore, leech therapy is not indicated for a free flap with global venous congestion.

The venous coupling device is safe and effective for the anastomosis of veins in DIEP flap surgery. It has not been associated with patency rates that are different from hand-sewn anastomoses. The coupling device, however, has been shown to reduce the microsurgery time.

The use of one or two veins in microsurgical free tissue transfer is a topic that has been debated for several years. While some studies indicate that the use of two venous connections may reduce the velocity of blood flow across the anastomosis, there is not sufficient data to support differences in flap outcomes or thrombotic events. Therefore, the routine use of a second vein is largely up to surgeon preference.

REFERENCES:

1. Bui DT, Cordeiro PG, Hu QY, et al. Free Flap Reexploration: Indications, Treatment, and Outcomes in 1193 Free Flaps. *Plast Reconstr Surg*. 2007 Jun;119(7):2092-100.
2. Galanis C, Nguyen P, Koh J, et al. Microvascular Lifeboats: A Stepwise Approach to Intraoperative Venous Congestion in DIEP Flap Breast Reconstruction. *Plast Reconstr Surg*. 2014 Jul;134(1):20-7.

35. A 32-year-old man is brought to the emergency department with a full-thickness thermal burn injury to the left ear. Which of the following therapeutic agents allows for the most effective preservation of involved cartilage?
- A) Acetic acid
 - B) Honey
 - C) Mafenide acetate
 - D) Nanocrystalline silver dressings
 - E) Silver sulfadiazine

The correct response is Option C.

Mafenide acetate effectively penetrates burn eschar as well as cartilage and decreases the risk of suppurative chondritis in the setting of burns of the auricle. Twice-daily application is recommended. Care must be taken to monitor for metabolic acidosis, as mafenide acetate is metabolized to sulfamoylbenzoic acid, a carbonic anhydrase inhibitor. Silver sulfadiazine, nanocrystalline silver dressings, honey, and acetic acid have not demonstrated similar efficacy in preventing burn-associated chondritis.

REFERENCES:

1. Hashemi B, Bayat A, Kazemei T, Azarpira N. Comparison between topical honey and mafenide acetate in treatment of auricular burn. *Am J Otolaryngol*. 2011 Jan-Feb;32(1):28-31.
2. Mills DC, Roberts LW, Mason AD Jr, et al. Suppurative chondritis: its incidence, prevention, and treatment in burn patients. *Plast Reconstr Surg*. 1988 Aug;82(2):267-76.
3. Purdue GF, Hunt JL. Chondritis of the burned ear: a preventable complication. *Am J Surg*. 1986 Sep;152(3):257-9.

36. A 50-year-old woman undergoes reconstruction of a postburn neck contracture with a free anterolateral thigh flap. On postoperative day 2, the flap is explored for vascular compromise and is successfully salvaged. On postoperative day 3, the flap suffers vascular compromise and is explored again. During the operation, the anastomoses are revised using vein grafts. Which of the following factors is most strongly associated with unsuccessful flap salvage in this patient?

- A) Anatomic site
- B) Multiple reexplorations
- C) No use of anticoagulants
- D) No use of thrombolytic agents
- E) Postoperative day of initial reexploration

The correct response is Option B.

The need for multiple reexplorations has been found to be a predictor for unsuccessful free flap salvage.

Free flap reconstruction of the breast has been associated with higher flap survival rates than other anatomic areas, such as the head and neck and extremities.

Higher free flap survival rates have been observed when vascular compromise occurs earlier in the postoperative period (postoperative days 0 to 2) compared with later.

Anticoagulants, such as heparin, are sometimes used during free flap salvage attempts. However, their use has not been found to impact flap survivability. The same has been found with regard to thrombolytic agents, such as tissue plasminogen activator.

REFERENCES:

1. Askari M, Fisher C, Weniger FG, et al. Anticoagulation therapy in microsurgery: a review. *J Hand Surg Am.* 2006 May-Jun;31(5):836-46.
2. Chang EI, Carlsen BT, Festekjian JH, et al. Salvage rates of compromised free flap breast reconstruction after recurrent thrombosis. *Ann Plast Surg.* 2013 Jul;71(1):68-71.
3. Chen KT, Mardini S, Chuang DC, et al. Timing of presentation of the first signs of vascular compromise dictates the salvage outcome of free flap transfers. *Plast Reconstr Surg.* 2007 Jul;120(1):187-95.

4. Hanasono MM, Butler CE. Prevention and treatment of thrombosis in microvascular surgery. *J Reconstr Microsurg*. 2008 Jul;24(5):305-14.
5. Selber JC, Angel Soto-Miranda M, Liu J, Robb G. The survival curve: factors impacting the outcome of free flap take-backs. *Plast Reconstr Surg*. 2012 Jul;130(1):105-13.

37. A 30-year-old man is brought to the emergency department after a rollover motor vehicle collision. Physical examination shows significant soft-tissue loss and a median nerve injury. At the time of surgical repair, there is a 5-cm gap in the nerve. Which of the following treatment options is most likely to provide the best long-term functional outcome for this patient?

- A) Acellular autograft
- B) Autologous vein graft
- C) Collagen conduit
- D) Peripheral nerve autograft
- E) Polyglycolic acid conduit

The correct response is Option D.

For bridging long nerve gaps not amenable to primary repair (greater than 3 cm), peripheral nerve autografts are the most reliable choice. Their use is limited by supply and donor site morbidity from additional incisions, loss of sensation, and possible neuromas. Common donor sites include sural nerve, medial antebrachial cutaneous nerve, lateral antebrachial cutaneous nerve, dorsal cutaneous branch of the ulnar nerve, superficial peroneal nerve, and posterior and lateral cutaneous nerves of the thigh.

Nerve conduits, such as silicone tubes, synthetic biodegradable tubes (such as polyglycolic acid conduit or collagen conduit), and biologic tubes (such as autologous vein grafts) are limited to use in short gaps (less than 3 cm). Beyond 3 cm, there is no clinically meaningful regeneration. Acellular autografts have recently been used with good success in short nerve gaps (less than 3 cm). The advantage of these products is that they provide the extracellular matrix molecules, which may enhance nerve regeneration.

REFERENCES:

1. Sachanandani NF, Pothula A, Tung TH. Nerve gaps. *Plast Reconstr Surg*. 2014 Feb;133(2):313-9.
2. Fowler JR, Lavasani M, Huard J, Goitz RJ. Biologic strategies to improve nerve regeneration after peripheral nerve repair. *J Reconstr Microsurg*. 2015 May;31(4):243-8.
3. Konofaos P, Ver Halen JP. Nerve repair by means of tubulization: past, present, future. *J Reconstr Microsurg*. 2013 Mar;29(3):149-64.

38. A 43-year-old woman undergoes the second stage of tissue expander–based breast reconstruction. Exchange of the tissue expander for a smooth round silicone implant is planned along with a superior capsulotomy and fat grafting to the upper pole for contour improvement. Which of the following is an increased risk associated with fat grafting to the breast in this patient?

- A) Anaplastic large cell lymphoma
- B) Benign lesions
- C) Hypopigmentation
- D) Infection
- E) Recurrent breast cancer

The correct response is Option B.

Autologous fat grafting is a widely accepted technique in breast reconstruction. A large systematic review recently confirmed the oncologic safety of this technique but did report a significant incidence of benign lesions including cysts and calcifications. Fat grafting is not associated with an increased risk of recurrent breast cancer, infection or hypopigmentation.

REFERENCES:

1. De Decker M, De Schrijver L, Thiessen F, et al. Breast cancer and fat grafting: efficacy, safety and complications-a systematic review. *Eur J Obstet Gynecol Reprod Biol.* 2016 Dec;207:100-108.
2. Hivernaud V, Lefourn B, Robard M, et al. Autologous fat grafting: A comparative study of four current commercial protocols. *J Plast Reconstr Aesthet Surg.* 2016 Dec 14.
3. Streit L, Jaros J, Sedlakova V, et al. A Comprehensive In Vitro Comparison of Preparation Techniques for Fat Grafting. *Plast Reconstr Surg.* 2016 Nov 21.

39. An otherwise healthy 32-year-old woman is considering liposuction. Assuming that the patient maintains her current weight, which of the following most accurately describes the anticipated changes in her body fat distribution after surgery?
- A) Long-term reduction in the abdomen but eventual reaccumulation in the hips
 - B) Long-term reduction in the hips but eventual reaccumulation in the abdomen
 - C) Long-term reduction in treated areas but compensatory increase in fat in untreated areas
 - D) Long-term reduction in treated areas without reaccumulation in treated or untreated areas of the body
 - E) Short-term reduction in treated areas but eventual long-term fat reaccumulation in these areas

The correct response is Option D.

Available recent Level III evidence using prospectively collected standardized photographic measurements in patients who have undergone liposuction and/or abdominoplasty versus retrospective controls demonstrated that removal of excess fat through these methods provided long-term reduction in treated areas without fat reaccumulation in either treated or untreated areas of the body. This evidence contradicts the commonly held notion (mostly by the lay public) that removal of fat in one location leads to "return" of fat in another.

Short-term reductions of fat with reaccumulation in treated and/or untreated areas can occur if the patient does not remain calorically neutral after surgery. However, in this clinical scenario, it is mentioned that this patient has had no postoperative increase in caloric intake.

REFERENCES:

1. Swanson E. Photographic measurements in 301 cases of liposuction and abdominoplasty reveal fat reduction without redistribution. *Plast Reconstr Surg*. 2012 Aug;130(2):311e-322e.
2. Swanson E. Assessment of reduction in subcutaneous fat thickness after liposuction using magnetic resonance imaging. *J Plast Reconstr Aesthet Surg*. 2012 Jan;65(1):128-130. Epub 2011 Jul 29.
3. Kral JG. Surgical reduction of adipose tissue hypercellularity in man. *Scand J Plast Reconstr Surg*. 1975;9(2):140-143.

4. Swanson E. Prospective outcome study of 360 patients treated with liposuction, lipoabdominoplasty, and abdominoplasty. *Plast Reconstr Surg*. 2012 Apr;129(4):965-978.

40. A 25-year-old woman seeks permanent, nonsurgical treatment of acne scars. Which of the following is the most appropriate treatment option?

- A) Glycolic acid peel
- B) Hyaluronic acid filler
- C) Intense pulsed-light therapy
- D) Poly-L-lactic acid filler
- E) Polymethylmethacrylate filler

The correct response is Option E.

Polymethylmethacrylate (PMMA) fillers are indicated for treatment of moderate-to-severe, atrophic, distensible facial scars on the cheeks in patients over the age of 21.

Polymethylmethacrylate microspheres (30–50 μm) are suspended in a water-based gel containing 3.5% bovine collagen gel and 0.3% lidocaine. The collagen carrier is resorbed over 1 to 3 months post injection, first replaced by granulation tissue and then later by fibrous tissue. The PMMA microspheres act as a stimulus for tissue regeneration and deposition of autologous connective tissue. Because of the permanent nature of this filler material, care must be taken to place the filler in the appropriate plane (very deep dermis or subcutis). Also, the presence of bovine collagen requires skin testing one month prior to treatment to rule out hypersensitivity.

Prior first- and second-generation PMMA fillers were composed of smaller microspheres (

Hyaluronic acid fillers are an off-label option for treatment of scars, but in this case, the patient requested a permanent filler. Depending on the formulation, hyaluronic acid fillers resorb over 8 to 24 months.

Intense pulsed-light therapy may help with skin blemishes, improve redness, and smooth fine wrinkles, but it is not effective for the treatment of acne scars.

Poly-L-lactic acid filler is very useful for providing volume in the cheeks but is considered “semi-permanent.” It is recommended for placement in a deep plane to avoid skin irregularities, so correction of scars may be difficult. Additionally, use for scars would also be considered off-label.

Glycolic acid peels are useful for fine rhytids, but because their effect is confined to the epidermis, these peels will not improve the appearance of deep scars.

REFERENCES:

1. Lemperle G, Gauthier-Hazan N, Wolters M, et al. Foreign Body Granulomas after All Injectable Dermal Fillers: Part 1. Possible Causes. *Plast Reconstr Surg*. 2009;123(6):1842-1863.
2. Joseph JH, Eaton LL, Cohen SR. Current Concepts in the Use of Bellafill. *Plast Reconstr Surg*. 2015;136(5S):171S-179S.
3. Mills DC, Camp S, Mosser S, et al. Malar Augmentation With a Polymethylmethacrylate-Enhanced Filler: Assessment of a 12-Month Open-Label Pilot Study. *Aesthet Surg J*. 2013;33(3):421-430.

41. A 56-year-old woman presents with a 1-cm primary superficial basal cell carcinoma on the left volar mid-forearm. Medical history includes renal transplantation, carcinoma of the right breast managed with lumpectomy and radiation, and treatment for a gunshot wound to the left forearm. The basal cell carcinoma is located within the previous traumatic scar. Which of the following clinical features is an indication for Mohs micrographic surgery in this patient?

- A) Basal cell carcinoma arising in traumatic scar
- B) History of radiation
- C) Immunocompromised status of patient
- D) Size of basal cell carcinoma
- E) Superficial basal cell carcinoma

The correct response is Option A.

The clinical feature in this particular patient that fulfills the criteria to get Mohs micrographic surgery is that the basal cell carcinoma is arising in a traumatic scar. There are many clear indications for Mohs micrographic surgery for basal cell carcinoma: certain size, histology, and anatomic location, all recurrent basal cell carcinomas, and the occurrence of basal cell carcinoma in irradiated skin, traumatic scars, areas with osteomyelitis/chronic ulceration/inflammation, and/or patients with genetic syndromes. Almost all primary basal cell carcinomas in the H and M zones, regardless of pathology (i.e. superficial, nodular, or aggressive), size, or health status of the patient, are candidates for Mohs micrographic surgery. In the L zone, most basal cell carcinomas are also candidates for Mohs micrographic surgery (except all superficial subtypes [irrespective of health of patient], or those less than 1 cm size in immunocompromised patients or nodular subtypes).

Area H: 'Mask areas' of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermilion], chin, ear and periauricular skin /sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.

Area M: Cheeks, forehead, scalp, neck, jawline, and pretibial surface.

Area L: Trunk and extremities (excluding pretibial surface, hands, feet, nail units and ankles).

In this clinical case, the patient has a basal cell carcinoma that has a favorable pathology (i.e. superficial subtype) in the L zone, not an indication for Mohs micrographic surgery,

irrespective of tumor size. Additionally, with a 1-cm tumor of this pathology subtype, her immunocompromised state is not an indication for Mohs micrographic surgery, either. The radiation was remote from the area she developed her basal cell carcinoma, so it is not an indication, either.

REFERENCES:

1. Connolly SM, Baker DR, Coldiron BM, et al. AAD/ACMS/ASDSA/ASMS 2012 appropriate use criteria for Mohs micrographic surgery: a report of the American Academy of Dermatology, American College of Mohs Surgery, American Society for Dermatologic Surgery Association, and the American Society for Mohs Surgery. *J Am Acad Dermatol*. 2012. Oct;67(4):531-50.
2. Connolly SM, Baker DR, Coldiron BM, et al. AAD/ACMS/ASDSA/ASMS 2012 appropriate use criteria for Mohs micrographic surgery: a report of the American Academy of Dermatology, American College of Mohs Surgery, American Society for Dermatologic Surgery Association, and the American Society for Mohs Surgery. *Dermatol Surg*. 2012. Oct;38(10):1582-603.

42. A 43-year-old woman comes to the emergency department 2 hours after sustaining deep second-degree burns to the right elbow from a campfire. The wound measures 8 × 20 cm. After surgical excision, placement of autografts, and coverage with petrolatum gauze, which of the following dressings is most likely to promote graft survival?

A) Cotton balls and tie-over bolster dressing

B) Dry gauze and compressive wrap

C) Negative pressure wound therapy

D) Occlusive dressing

E) No additional dressing

The correct response is Option C.

In the patient described, the most effective way to fixate autografts is negative pressure wound therapy (NPWT). Several studies in burn patients have demonstrated the superiority of NPWT over the other conventional dressings listed. Whether staples or sutures are used has little effect on graft survival, although sutures may offer more precise graft placement. Most dressings for graft fixation use petrolatum gauze of some form, followed by some type of dressing that offers compression to fixate grafts. Dry gauze and a compressive wrap is the simplest option. Cotton balls with a tie-over bolster dressing are also effective, especially for small grafts. Larger surface areas are more difficult to secure with this method. A simple occlusive dressing, while acceptable for a donor site, will not effectively fixate autografts. NPWT offers good graft fixation, exudate removal, and promotion of local perfusion, which may explain the improved graft survival observed.

REFERENCES:

1. Llanos S, Danilla S, Barraza C, et al. Effectiveness of negative pressure closure in the integration of split thickness skin grafts: a randomized, double-masked, controlled trial. *Annals of Surgery* 2006;244(5), 700–705.
2. Petkar KS, Dhanraj P, Kingsly PM, et al. A prospective randomized controlled trial comparing negative pressure dressing and conventional dressing methods on split-thickness skin grafts in burned patients. *Burns* 2011;37(6), 925–929.

43. A 56-year-old woman with a history of systemic sclerosis (scleroderma) is evaluated for intractable pain and progressive ulceration to the right index and middle fingers despite medical management. Duplex ultrasonography shows no identifiable vascular occlusion in the affected digits. Which of the following is the most appropriate surgical management?

A) Interposition bypass grafting

B) Intra-arterial TPA

C) Sympathectomy

D) Thrombectomy

E) Venous arterialization

The correct response is Option C.

For patients who have patent arterial inflow on imaging, spasm is likely to be responsible for their ischemia. Spasm is most common in those with autoimmune disease. Digital sympathectomy involves stripping the adventitia from the radial, ulnar, and digital arteries in an effort to decrease sympathetic input that is the presumed cause of pathologic vasoconstriction. Vascular occlusion with a satisfactory distal target may require an interposition bypass. Occlusion without a distal target for bypass may require venous arterialization. In the absence of evidence of occlusion, there is no indication for thrombolytic therapy.

REFERENCES:

1. Thibaudeau S, Serebrakian AT, Gerety PA, Levin LS. An Algorithmic Approach to the Surgical Treatment of Chronic Ischemia of the Hand: A Systematic Review of the Literature. *Plast Reconstr Surg*. 2016 May;137(5):818e-28e.
2. Cappelli L, Wigley FM. Management of Raynaud Phenomenon and Digital Ulcers in Scleroderma. *Rheum Dis Clin North Am*. 2015 Aug;41(3):419-38.
3. Flatt AE. Digital artery sympathectomy. *J Hand Surg Am*. 1980 Nov;5(6):550-6.

44. A 60-year-old man presents with a 6-mm lesion of the forehead. The patient states that it has enlarged over a period of 2 years. Examination of a biopsy specimen shows squamous cell carcinoma (adenoid subtype) with a 1.5-mm depth of involvement. Which of the following is the most likely risk factor for recurrence of this patient's lesion after surgical excision?

- A) Anatomic location
- B) Depth of involvement
- C) Growth rate
- D) Histologic subtype
- E) Size

The correct response is Option D.

A number of risk factors for recurrence have been identified for squamous cell carcinomas.

Histologic subtype is one such factor. Adenoid, adenosquamous, and desmoplastic subtypes are considered high risk for recurrence.

Anatomic location is another such factor and is typically considered in combination with the size of the lesion. High-risk areas include the "mask" areas of the face (eyelids, eyebrows, periorbital, nose, lips, chin, temple, ear), as well as genitalia, hands, and feet. Lesions greater than 6 mm in these areas indicate a high risk for recurrence. Mid-risk areas include the cheeks, forehead, scalp, and neck, with lesions greater than 10 mm indicating a high risk for recurrence. Low-risk areas include the trunk and extremities, with lesions greater than 20 mm indicating a high risk for recurrence. Based on this, this patient with a 6-mm forehead lesion would not be considered at high risk for recurrence.

Rapid growth is a risk factor for recurrence. However, this patient's lesion grew gradually over a period of 2 years and not rapidly.

Depth of involvement greater than 2 mm indicates a high risk for recurrence.

Other risk factors for recurrence include poorly defined borders, immunosuppression, prior irradiation, site of inflammatory process, neurologic symptoms, moderate/poor differentiation, and perineural/vascular involvement.

REFERENCES:

1. Connolly KL, Nehal KS, Disa JJ. Evidence-Based Medicine: Cutaneous Facial Malignancies: Nonmelanoma Skin Cancer. *Plast Reconstr Surg.* 2017;139:181e-190e.
2. Burton KA, Ashack KA, Khachemoune A. Cutaneous Squamous Cell Carcinoma: A Review of High-Risk and Metastatic Disease. *Am J Clin Dermatol.* 2016 Oct;17(5):491-508.

45. The use of routine systemic antibiotic prophylaxis is indicated in which of the following procedures?

- A) Abdominoplasty
- B) Carpal tunnel release
- C) Excision of squamous cell carcinoma of the skin
- D) Reduction mammoplasty
- E) Rhytidectomy

The correct response is Option D.

Systemic antibiotic prophylaxis is recommended in clean breast surgery. Studies have shown that the use of antibiotic prophylaxis in patients undergoing breast surgery (with or without implant) significantly reduces the risk of surgical site infections. The benefit from routine antibiotic prophylaxis is greater in individuals receiving tissue expanders or breast implants for reconstruction, but patients undergoing breast augmentation or reduction mammoplasty also benefit from antibiotic prophylaxis. With the exception of cosmetic breast surgery, clean operations have not been shown to benefit from routine antibiotic prophylaxis. Therefore, the use of routine antibiotic prophylaxis is not indicated in clean surgical cases of the hand (carpal tunnel release), skin (squamous cell carcinoma of the skin), head and neck, or abdominoplasty. It is indicated in contaminated surgery of the hand or face.

REFERENCES:

1. Ariyan S, Martin J, Lal A, et al. Antibiotic Prophylaxis for Preventing Surgical-Site Infection in Plastic Surgery: An Evidence-Based Consensus Conference Statement from the American Association of Plastic Surgeons. *Plast Reconstr Surg*. 2015 Jun;135(6):1723-39.
2. Bratzler DW, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm*. 2013 Feb 1;70(3):195-283.

46. A 43-year-old man undergoes wound closure with a split-thickness skin graft harvested from the left thigh. Which of the following skin appendages are the primary source of multipotent stem cells responsible for reepithelialization of the donor site?

- A) Apocrine glands
- B) Arrector pili
- C) Eccrine glands
- D) Hair follicles
- E) Sebaceous glands

The correct response is Option D.

Hair follicles contain multipotent stem cells that are activated upon the start of a new hair cycle and upon wounding to provide cells for hair follicle and epidermal regeneration. In the hair follicle, stem cells reside in the bulge area. Bulge cells are relatively quiescent compared with other cells within the follicle but can be recruited during wound healing to support reepithelialization. Sebaceous, apocrine, and eccrine glands secrete fluids that are involved in lubricating, coating, or cooling the skin. Arrector pili are responsible for motility of cutaneous hair in response to tactile stimulation or low temperatures.

REFERENCES:

1. Zakine G, Mimoun M, Pham J, Chaouat M. Reepithelialization from stem cells of hair follicles of dermal graft of the scalp in acute treatment of third-degree burns: first clinical and histologic study. *Plast Reconstr Surg*. 2012 Jul;130(1):42e-50e.
2. Scherer-Pietramaggiori SS, Pietramaggiori G, Orgill DP. Chapter 17 Skin Graft In: Neligan, P. *Plastic Surgery*, 3rd Edition. Elsevier Inc: 2013;17;319-338.e2

47. An otherwise healthy 55-year-old woman is evaluated for reconstruction of the left breast using a pedicled transverse rectus abdominis musculocutaneous (TRAM) flap. In addition to ligating the ipsilateral deep inferior epigastric pedicle, ligation of which of the following will maximize perfusion across the midline?

- A) Contralateral deep inferior epigastric vessels
- B) Contralateral periumbilical perforators
- C) Contralateral superior epigastric vessels
- D) Ipsilateral periumbilical perforators
- E) Ipsilateral superior epigastric vessels

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option B.

The contralateral periumbilical perforators are the vessels that need to be ligated during the delay procedure for a pedicled transverse rectus abdominis muscle (TRAM) flap. This intermediary procedure is effective in increasing the reliability of the TRAM flap in high-risk patients by augmenting blood flow to the areas rendered ischemic by the ligation through the opening of choke vessels. Traditionally in the TRAM delay procedure, the deep inferior and the superficial inferior epigastric vessels are ligated. There is some debate whether the contralateral deep and superficial systems need to be sacrificed during the delay procedure. Some authors feel that these vessels should be left uninjured so that they can be used in salvage situations for congested flaps. More recent studies show that ligating the ipsilateral deep epigastric vessels and the contralateral periumbilical perforators enhances the reliability of Zone III in TRAM flaps more effectively. This staged procedure is indicated in patients who require large tissue flaps, have been irradiated, are smokers, are obese, or have low midline incisions on the abdomen. This procedure should be done about 2 to 3 weeks prior to the scheduled TRAM flap.

The other options listed are incorrect because they would either interfere with the blood flow to the TRAM flap being used or have no effect on the enhancement of blood flow to the desired TRAM flap. Ligation of the contralateral deep inferior epigastric vessels is not as effective as ligation of the contralateral periumbilical perforators due to maintenance of perfusion via the superior epigastric vessels.

REFERENCES:

1. O'Shaughnessy K, Mustoe TA. The Surgical TRAM Flap Delay: Reliability of Zone III Using a Simplified Technique under Local Anesthesia. *Plast Reconstr Surg.* 2008;122(6):1627-1630.
2. Atisha, D, Alderman AK, Janiga T, et al. The Efficacy of the Surgical Delay Procedure in Pedicle TRAM Breast Reconstruction. *Ann Plast Surg.* 2009;63(4):383-388.
3. Hartrampf CR, Schefflan M, and Black PW. Breast reconstruction with a transverse abdominal island flap. *Plast Reconstr Surg.* 1982; 69:216.

48. Which of the following is the most appropriate surgical treatment recommendation for a 4-cm round sebaceous nevus of the scalp in a child?

- A) Excision, skin grafting, and delayed tissue expansion
- B) Serial excision without tissue expansion
- C) Serial monitoring and selective excision
- D) Tissue expansion and excision
- E) Tissue expansion, excision, and rotational flaps

The correct response is Option C.

Historically, there has been a 10 to 15% reported malignant degeneration in nevus sebaceous in children and the recommendation had been for all lesions to be removed before puberty. More recent studies have shown malignant transformation of these lesions to be less than 1%. Therefore, the decrease in malignant change prompted a more conservative approach to nevus sebaceous based on serial monitoring and excision of lesions that are a source of irritation, difficult to monitor clinically, or aesthetically displeasing. Tissue expansion is an option in patients with giant nevus sebaceous and usually requires one to two rounds of expansion and serial excisions. However, this is not a first line treatment for a small 4-cm lesion. Although serial excision is an alternative reconstructive option, it is recommended only for larger lesions that can be excised in three stages or less. If that is not possible, then tissue expansion is the preferred procedure. Reconstruction with rotational flaps should be planned in consideration of natural facial aesthetic units and an effort should be made to maintain natural brow and hairline position and symmetry and avoid creating tension in the perioral, periorbital, and periauricular regions.

REFERENCES:

1. Chela KJ, Gosain AK. Giant Nevus Sebaceous: Definition, Surgical Techniques, and Rationale for Treatment. *Plast Reconstr Surg*. 2012 Aug;130(2):296e-304e.
2. Arena JS, Gosain AK. Giant Congenital Melanocytic Nevi. *Plast Reconstr Surg*. 2007 Aug;120(2):26e-40e.

49. A 54-year-old woman with breast cancer undergoes a skin-sparing mastectomy with tissue expander reconstruction. Adjuvant chemotherapy and subsequent radiation therapy have been recommended. Chemotherapy proceeds during tissue expansion. Radiation may be performed either before or after the implant exchange procedure. When compared with radiating the permanent implant, radiating the tissue expander is most likely to increase the risk of which of the following?

- A) Cancer recurrence
- B) Capsular contracture
- C) Device rupture
- D) Explantation
- E) Radiation dermatitis

The correct response is Option D.

Cordeiro et al. updated the largest series of women undergoing two-stage implant breast reconstruction who require postmastectomy radiation. The authors found that radiating the tissue expander, as opposed to the permanent implant, increased the rate of reconstructive failure by 46%. However, aesthetic results were better and capsular contracture was less frequent. There were no differences in patient-reported outcomes. This study confirmed the earlier findings of Nava et al. regarding reconstruction failure (explantation). There are no known differences in cancer recurrence between the two approaches discussed.

REFERENCES:

1. Cordeiro PG, Alborno CR, McCormick B, et al. What Is the Optimum Timing of Postmastectomy Radiotherapy in Two-Stage Prosthetic Reconstruction: Radiation to the Tissue Expander or Permanent Implant? *Plast Reconstr Surg*. 2015 Jun;135(6):1509-17.
2. Nava MB, Pennati AE, Lozza L, et al. Outcome of different timings of radiotherapy in implant-based breast reconstructions. *Plast Reconstr Surg*. 2011 Aug;128(2):353-9.



50. An otherwise healthy 23-year-old man is brought to the emergency department following traumatic avulsion of 65% of his scalp. The avulsed tissue is not replantable due to multilevel injury. A photograph is shown. After complete debridement, there is healthy remaining soft tissue and no contamination, but exposed bone without periosteum. The patient is adamant that he does not want sacrifice of muscle. Which of the following provides durable soft tissue coverage while minimizing donor site morbidity?

- A) Bilaminate neodermal reconstruction
- B) Free anterolateral thigh flap
- C) Full-thickness skin grafting
- D) Scalp rotation flap after tissue expansion
- E) Split-thickness skin grafting

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option A.



Bilaminar neodermal reconstruction of large scalp defects has been described as a successful, low-morbidity, durable reconstructive technique. A recent systematic review of the literature regarding this technique confirmed substantial evidence that this technique can be used to achieve predictable, durable results in patients with large scalp defects. The bilaminar neodermal matrix consists of an outer silicone sheet and an inner layer of bovine collagen and glycosaminoglycan (derived from shark cartilage), which acts as a scaffold for regeneration. Specifically, there is migration of host fibroblasts into the matrix, which subsequently proliferate and form collagen. Additionally, there is migration of endothelial cells that form a vascular network within the neodermis that can subsequently act as a foundation to support staged split-thickness skin grafting, at which time the silicone outer layer is removed and a thin (usually 6 to 8/1000”) split-thickness autograft is applied. The success, or “take,” of the skin graft depends on whether the neodermis is vascularized sufficiently to maintain the graft viability. A 2001 study by Moiemmen et al, demonstrated clinically and histologically that this process takes 4 weeks on average, without the use of topical negative pressure.

Split- and full-thickness skin grafting on exposed bone without periosteum would not result in a successful reconstruction.

Scalp rotation flaps alone would not be sufficient to reconstruct a 65% defect, as there is not enough residual tissue. Furthermore, tissue expansion of scalp flaps is possible, but only for defects that are 50% or less of remaining scalp.

A free anterolateral thigh flap is an option that would likely result in a successful reconstruction if there is sufficient donor tissue of the thigh to reconstruct this large defect, and would abide by the patient’s request to avoid muscle harvest. However, given the size of the defect, it is likely that there would be a donor site defect that requires skin grafting, a longer index operation, and the risks of microvascular free tissue transfer that would outweigh the risks of a bilaminar neodermal matrix reconstruction.

REFERENCES:

1. Moiemmen NS, Staiano JJ, Ojeh NO, et al. Reconstructive surgery with a dermal regeneration template: clinical and histological study. *Plast Reconstr Surg*. 2001 Jul;108(1):93-103.
2. Momoh AO, Lypka MA, Echo A, et al. Reconstruction of full-thickness calvarial defect: a role for artificial dermis. *Ann Plast Surg*. 2009;62:656–659.
3. Johnson MB, Wong AK. Integra-based Reconstruction of Large Scalp Wounds: A Case Report and Systematic Review of the Literature. *Plast Reconstr Surg Glob Open*. 2016 Oct 24;4(10):e1074.
4. Schiavon M, Francescon M, Drigo D, et al. The Use of Integra Dermal Regeneration Template Versus Flaps for Reconstruction of Full-Thickness Scalp Defects Involving the Calvaria: A Cost–Benefit Analysis. *Aesthetic Plast Surg*. 2016 Dec;40(6):901-907.
5. Leedy JE, Janis JE, Rohrich RJ. Reconstruction of acquired scalp defects: an Algorithmic approach. *Plast Reconstr Surg*. 2005;116:54e–72e.

Section 2: Hand and Lower Extremity

51. A 50-year-old male construction worker is evaluated for weakness of grip and pinch with inability to touch index finger to thumb. The patient is referred from a neurologist with a diagnosis of anterior interosseous nerve syndrome. Which of the following muscles is most likely to be spared?
- A) Flexor digitorum profundus to index
 - B) Flexor digitorum profundus to middle
 - C) Flexor pollicis longus
 - D) Pronator quadratus
 - E) Pronator teres

The correct response is Option E.

The pronator teres is innervated by the median nerve prior to its take off of the anterior interosseous nerve (AIN), which is why it cannot be affected by AIN syndrome. Pronation generated by the pronator teres or the pronator quadratus would be indistinguishable clinically. The AIN is a terminal branch off the median nerve that innervates the flexor digitorum profundus to the index and middle fingers, flexor pollicis longus (FPL) and pronator quadratus. The AIN arises from the median nerve approximately 4 to 6 cm distal to the medial epicondyle. It travels between the flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) initially, and then between the FPL and FDP. Then it lies on the volar surface of the interosseous membrane and travels with the anterior interosseous artery, terminating in the pronator quadratus and then the wrist joint capsule and the intercarpal, radiocarpal, and radioulnar joints. The nerve originates from C5-T12, becoming the medial and lateral cords of the brachial plexus and then becoming the median nerve.

REFERENCES:

1. Maldonado AA, Amrami KK, Mauermann ML, Spinner RJ. Reinterpretation of Electrodiagnostic Studies and Magnetic Resonance Imaging Scans in Patients with Nontraumatic “Isolated” Anterior Interosseous Nerve Palsy. *Plast Reconstr Surg*. 2016 Nov;138(5):1033-1039.
2. Chi Y, Harness NG. Anterior interosseous nerve syndrome. *J Hand Surg Am*. 2010;35:2078–2080.

3. Rodner, Tinsley, O'Malley. Pronator syndrome and anterior interosseous nerve syndrome. *J Am Acad Orthop Surg*. 2013;21:268-75.
4. Aljawder A, Alkalifa M. Anterior interosseous nerve syndrome and intraoperative findings: a case report. *Int J Surg Case Rep*. 2016; 21:44–47.

52. A 25-year-old man sustained traumatic amputation of the nondominant index finger 3 hours ago and requests replantation. Which of the following factors has the greatest influence on survival of the injured digit after replantation?

- A) Mechanism of injury
- B) Number of vessels repaired
- C) Patient's smoking status
- D) Time from injury to replantation
- E) Use of anticoagulation

The correct response is Option A.

The mechanism of injury has the greatest influence on survival of replanted digits. Injuries from sharp devices that leave a clean cut with little or no crush component are the most amenable to replantation. The more the tissue is crushed or avulsed, resulting in greater vessel injury, the less likely the digit will survive. No studies have shown that the use of anticoagulants changes survival rates. Smoking decreases blood flow in digits, but has not been widely studied in replantation. Fingers have no muscle, which is the tissue most susceptible to ischemia, so digits can tolerate long delays as long as they are treated correctly. At least two veins per artery have been shown to help prevent venous congestion.

REFERENCES:

1. Prucz RB, Friedrich JB. Upper extremity replantation: current concepts. *Plast Reconstr Surg*. 2014 Feb;133(2):333-42.
2. Sears ED and Chung KC. Replantation of Finger Avulsion Injuries: A Systematic Review of Survival and Functional Outcomes. *J Hand Surg Am*. 2011;36A:686–694.

53. A 40-year-old man comes to the physician because of a 3-month history of pain and swelling over the proximal phalanx of the right index finger. He has no history of trauma. X-ray studies and MRI of the finger show an expansile osteolytic lesion of the proximal phalanx. Examination of a specimen obtained on biopsy confirms the diagnosis of giant cell tumor of the bone. Which of the following is the most appropriate staging test for this patient?

- A) CT scan of the cervical spine
- B) CT scan of the chest
- C) MR arthrography of the wrist
- D) MRI of the brain
- E) Pulmonary function testing

The correct response is Option B.

This patient is presenting with a primary giant cell tumor of the proximal phalanx bone. Giant cell tumors of the bone are considered benign but locally aggressive tumors. Only 2 to 5% of giant cell tumors arise from the bones of the hand. These lesions have a 1 to 5% incidence of pulmonary metastases. The distal radius is the third most common site of giant cell bone tumor origin. Hand and distal radius tumors have higher rates of recurrence and metastasis. The lungs are the most common site of metastatic lesions and a CT scan of the chest is recommended as part of the diagnostic work-up.

The tumors are graded radiographically according to the Campanacci grading system. Grade I lesions are well-demarcated with an intact bony cortex. Grade II lesions show cortical expansion, and Grade III lesions show cortical destruction with soft-tissue extension. Grade I and II lesions can be treated with curettage and bone grafting. Adjuvant treatments such as phenol and liquid nitrogen have been recommended, but their efficacy has not been proven. Recurrence rates have been reported between 30 and 80% with this approach. Later stage tumors are treated with en bloc excision or amputation and reconstruction with vascularized or nonvascularized bone grafts. High rates of tumor recurrence are thought to be due to incomplete resection or late presentation at the time of diagnosis.

There is no specific added benefit for an arthrogram of the wrist in a tumor arising from the proximal phalanx as in this case. MR arthrography of the wrist, CT scan of the cervical spine, MRI of the brain, and pulmonary function testing are not typically used for staging giant cell tumor of the bone.

REFERENCES:

1. Henderson M, Neumeister M, Bueno Jr R. Hand tumors: II. Benign and malignant bone tumors of the hand. *Plast Reconstr Surg*. 2014 Jun;133(6):814e-821e.
2. Ropars M, Kaila R, Cannon SR, Briggs TW. Primary Giant Cell Tumours of the Bones of the Hand. *J Hand Surg Eur Vol*. 2007 Apr;32(2):160-4.

54. A 30-year-old woman comes to the office because of pain and swelling of the right radial/distal forearm. The pain worsens with ulnar deviation of the wrist over a clasped thumb. Immobilization and a corticosteroid injection have failed, and surgical release is planned. Which of the following anatomic findings is most likely to have contributed to this patient's condition?

- A) Absent extensor pollicis brevis
- B) Combined first and second compartments
- C) Distal muscle belly on extensor pollicis brevis tendon
- D) Multiple slips of abductor pollicis longus
- E) Septum between abductor pollicis longus and extensor pollicis brevis

The correct response is Option E.

There is considerable variability in the anatomy of the first dorsal compartment of the wrist; this is particularly true when considering the presence or absence of a septum in the compartment. The significance of these variations is that they may predict failure of steroid injections to resolve de Quervain disease and must be considered when releasing the compartment surgically to ensure that a complete release of all tendons is performed.

While studies vary, based on methodology of imaging, cadaveric dissection, or surgical findings, there is consistency that septa are more common in patients presenting with de Quervain disease than in the general population.

Studies have shown no association between the number of APL slips and de Quervain disease.

REFERENCES:

1. Lee ZH, Stranix JT, Anzai L, Sharma S. Surgical anatomy of the first extensor compartment: A systematic review and comparison of normal cadavers vs. de Quervain syndrome patients. *J Plast Reconstr Aesthet Surg*. 2017 Jan;70(1):127-131.
2. Jackson WT, Viegas SF, Coon TM, et al. Anatomical variations in the first extensor compartment of the wrist. A clinical and anatomical study. *J Bone Joint Surg Am*. 1986 Jul;68(6):923-6.

3. De Keating-Hart E, Touchais S, Kerjean Y, et al. Presence of an intracompartmental septum detected by ultrasound is associated with the failure of ultrasound-guided steroid injection in de Quervain's syndrome. *J Hand Surg Eur* Vol. 2016 Feb;41(2):212-9.

55. A 58-year-old man is to undergo excision of a painful ulnar artery aneurysm of the palm, which has been causing ulnar nerve compression. Preoperative examination shows a digital/brachial index (DBI) of 0.5 in the small finger. After excision of the diseased segment, which of the following is the most appropriate next step in management?

- A) Arterial reconstruction
- B) Botulinum toxin type A injection
- C) Extended periarterial sympathectomy
- D) Periarterial injection of 2% lidocaine
- E) Postoperative anticoagulation

The correct response is Option A.

Ulnar artery aneurysms may cause symptoms because of local mass effect, distal embolization, and/or episodic vasospasm. Ligation of the ulnar artery to exclude the aneurysm from hand circulation can effectively eliminate risk for embolism, but may rob the digits of necessary blood flow if there is not enough collateral circulation from the deep arch or other sources. Measuring the digital-brachial index (DBI) is an effective way to assess whether or not there is sufficient blood flow to the digits. A normal DBI is between 0.75 and 0.97. Values equal to or less than 0.7 indicate inadequate perfusion. Below a DBI of 0.5, tissue loss is inevitable. Following ulnar artery ligation, if the DBI is below 0.7, then reconstruction of the ulnar artery is recommended rather than simple aneurysm excision or ligation. This is typically accomplished with a reversed vein graft or an arterial graft (e.g., from the lateral femoral circumflex system).

Anticoagulation alone, or anti-vasospastic drugs, such as botulinum toxin type A or lidocaine, are not sufficient in this clinical situation, where blood flow is limited because of blockage of flow. While sympathectomy could improve circulation in cases of vasospasm, this patient had no history of this, and sympathectomy alone would not be a substitute for arterial reconstruction.

REFERENCES:

1. McClinton MA. Reconstruction for ulnar artery aneurysm at the wrist. *J Hand Surg Am.* 2011;36(2):328-32.
2. Berger AC, Kleinert JM. Noninvasive vascular studies: a comparison with arteriography and surgical findings in the upper extremity. *J Hand Surg Am.* 1992;17(2):206-10.

3. Zimmerman NB. Occlusive vascular disorders of the upper extremity. *Hand Clin.* 1993 Feb;9(1):139-50.
4. Hui-Chou HG, McClinton MA. Current options for treatment of hypothenar hammer syndrome. *Hand Clin.* 2015 Feb;31(1):53-62

56. Which of the following is the type of axon fiber (neuron) that is primarily involved with the autonomic changes that occur with complex regional pain syndrome (CRPS) type 1?

- A) A delta sensory
- B) Alpha motor
- C) C sensory
- D) Gamma motor
- E) Ia sensory

The correct response is Option C.

C sensory fibers are responsible for a deeper, more non-localizable pain. C fibers can react to various stimuli, including thermal, mechanical, or chemical. C fibers respond to physiologic changes in the body, such as hypoxia, hypoglycemia, hypo-osmolarity, the presence of muscle metabolic products, and light or sensitive touch.

Paul Sudeck noticed that CRPS demonstrates classic inflammatory signs such as pain, swelling, erythema, hyperthermia, and impaired function. However, clinical chemistry markers of inflammation are not elevated. These findings imply a neurogenic inflammation. C fibers have an afferent function in the mediation of pain (and itch), but also an efferent neurosecretory function. They release neuropeptides such as substance P and calcitonin-gene-related peptide (CGRP). The presence of these neuropeptides might explain trophic and autonomic symptoms such as swelling, erythema, and hyperhidrosis. Elevated CGRP levels are also associated with autonomic disturbances, mainly with hyperhidrosis. Also, a role for CGRP in hair growth is suggested, and substance P seems to be involved in the regulation of osteoclastic activity.

Alpha motoneurons innervate muscle fibers of skeletal muscle and are directly responsible for initiating their contraction. When the central nervous system sends out signals to alpha neurons to fire, signals are also sent to gamma motoneurons to do the same. This process maintains the tautness of muscle spindles and is called alpha gamma co-activation. Without gamma motoneurons, muscle spindles would be very loose as the muscle contracts. Unrestricted alpha activity would not allow for muscle spindles to detect a precise amount of stretch and would not allow for optimization of muscle function.

Ia sensory fibers are a type of proprioceptor that is found inside the muscle itself. They lie parallel to the contractile fibers, and give them the ability to precisely monitor muscle length.

A delta fiber is a type of sensory nerve fiber. A delta fibers carry cold, pressure and some pain signals. Because A delta fibers have a higher conduction velocity, and are responsible for quick, shallow pain to a specific area. They are activated by a stimulus of weaker intensity, and are not responsible for the autonomic changes seen with CRPS.

REFERENCES:

1. van der Laan L, ter Laak HJ, Gabreëls-Festen A, et al. Complex regional pain syndrome type I (RSD): pathology of skeletal muscle and peripheral nerve. *Neurology*. 1998 Jul;51(1):20-5.
2. Maihöfner C, Seifert F, Markovic K. Complex regional pain syndromes: new pathophysiological concepts and therapies. *Eur J Neurol*. 2010 May;17(5):649-60.
3. Tajerian M, Clark JD. New Concepts in Complex Regional Pain Syndrome. *Hand Clin*. 2016 Feb;32(1):41-9.

57. A 53-year-old man comes to the emergency department because of an avulsion degloving injury to the left nondominant thumb sustained 3 hours ago. The amputated part is not retrievable. Physical examination shows loss of skin from the interphalangeal joint distally on both volar and dorsal surfaces. The distal phalanx and flexor pollicis longus and extensor pollicis longus tendons are intact. He has no other associated injuries. Which of the following is the most appropriate method of reconstruction of the thumb?

- A) Amputation revision at the mid-proximal phalanx
- B) Great toe wraparound flap
- C) Radial forearm osteocutaneous flap
- D) Second toe-to-thumb transfer
- E) Volar neurovascular advancement flap

The correct response is Option B.

Thumb reconstruction remains a difficult challenge for hand surgeons. Amputations of the skin distally may be covered with palmar advancement flaps; however, this technique is only limited to wounds less than 50% of the palmar surface of the thumb distal to the interphalangeal joint. In order to preserve length and function in more proximal amputations, either a regional or distant flap is required. The toe-to-thumb wraparound flap requires a microvascular anastomosis of digital vessels and nerves, providing excellent sensation and cosmetic results. The toe donor site can be covered with a skin graft in order to preserve length.

The volar neurovascular advancement flap would not adequately cover a defect this size. Amputation at the mid-proximal phalanx would result in a very short thumb with loss of function. The radial forearm flap may be utilized to cover the above defect; however, it would lack adequate sensation. Any osteocutaneous radial forearm flap would not be indicated since there is preservation of the bone. Similarly, a second toe-to-thumb transfer would not be indicated since there is preservation of bone in this patient.

REFERENCES:

1. Graham DJ, Venkatramani H, Sabapathy SR. Current Reconstruction Options for Traumatic Thumb Loss. *J Hand Surg Am.* 2016 Dec;41(12):1159-1169.

2. Del Piñal F, Pennazzato D, Urrutia E. Primary Thumb Reconstruction in a Mutilated Hand. *Hand Clin.* 2016 Nov;32(4):519-531.

58. In patients with basilar joint arthritis of the thumb, treatment with trapeziectomy alone compared with trapeziectomy with ligament reconstruction and tendon interposition is most likely to result in which of the following?

- A) Decreased complication rate
- B) Increased risk for recurrent pain
- C) Longer recovery time
- D) Worse functional outcomes

The correct response is Option A.

Simple trapeziectomy was first described in 1947 and though it is only utilized by a small minority of hand surgeons in the United States as solitary treatment for basilar thumb arthritis, its efficacy has not been demonstrated to be inferior to the more commonly employed trapeziectomy with ligament reconstruction and tendon interposition. Meta-analysis has demonstrated that simple trapeziectomy is equally beneficial in terms of pain relief and function as trapeziectomy with ligament reconstruction and tendon interposition, but results in fewer complications.

A variety of reconstructive techniques have been employed in management of basilar thumb arthritis. Most commonly employed in the United States is the trapeziectomy with ligament reconstruction and tendon interposition utilizing the flexor carpi radialis tendon. Other described techniques include CMC joint implant arthroplasty, partial trapeziectomy with interposition arthroplasty, and thumb metacarpal extension osteotomy for early-stage arthritis. None of these techniques have demonstrated superiority over simple trapeziectomy, and synthetic implants have been associated with significant complications.

REFERENCES:

1. Gervis WH. Osteo-arthritis of the Trapezio-metacarpal Joint treated by Excision of the Trapezium. *Proc R Soc Med.* 1947 Jul;40(9):492.
2. Aliu O, Davis MM, DeMonner S, Chung KC. The influence of evidence in the surgical treatment of thumb basilar joint arthritis. *Plast Reconstr Surg.* 2013(13):1816–828.
3. Wajon A, Carr E, Edmunds I, Ada L. Surgery for thumb (trapeziometacarpal joint) osteoarthritis. *Cochrane Database Syst Rev.* 2015 Feb 23;(2):CD004631.

59. A 53-year-old man comes to the office because of a 2-year history of increasing pain of the radial aspect of the right wrist. X-ray studies show scapholunate disruption and arthritis. Which of the following joints is most likely to be affected first by the arthritic degeneration in this patient?

- A) Capitulum
- B) Radiolunate
- C) Radioscaphoid
- D) Radioulnar
- E) Scaphotrapezoid

The correct response is Option C.

This patient has early-stage scapholunate advanced collapse (SLAC) wrist. SLAC wrist is generally categorized by the Watson classification, which is a descriptive classification but also helps determine management options.

The Watson classification is as follows:

Stage I: Arthritis between scaphoid and radial styloid

Stage II: Arthritis between scaphoid and entire scaphoid facet of the radius

Stage III: Arthritis between capitate and lunate

While original Watson classification describes preservation of radiolunate joint in all stages of SLAC wrist, subsequent description by other surgeons of pancarpal arthritis (stage IV) observed rare cases in which the radiolunate joint is affected. The radioulnar joint is not affected by SLAC wrist.

REFERENCES:

1. Shah CM, Stern PJ. Scapholunate advanced collapse (SLAC) and scaphoid nonunion advanced collapse (SNAC) wrist arthritis. *Curr Rev Musculoskelet Med*. 2013 Mar; 6(1): 9–17.
2. Strauch RJ. Scapholunate advanced collapse and scaphoid nonunion advanced collapse arthritis--update on evaluation and treatment. *J Hand Surg Am*. 2011 Apr;36(4):729-35.

3. Watson HK, Ballet FL. The SLAC wrist: scapholunate advanced collapse pattern of degenerative arthritis. *J Hand Surg Am.* 1984 May;9(3):358-65.



60. Which of the following conditions is a relative CONTRAINDICATION for use of the flap in the image shown for reconstruction of an 8 × 10-cm anterior ankle wound?

- A) Diabetes mellitus
- B) Hypertension
- C) Joint exposure with loss of the joint capsule
- D) Occlusion of the peroneal artery
- E) Underlying osteomyelitis

The correct response is Option D.

Hypertension does not preclude the use of any fasciocutaneous flaps in the lower extremity.

Diabetes mellitus can be associated with peripheral vascular disease, but by itself, would not prevent successful use of the reverse sural artery flap for foot or ankle reconstruction. Appropriate preoperative workup would include noninvasive ultrasound study of the lower extremity vasculature to prove the peroneal artery was patent.

Vascularized flaps, including the reverse sural artery flap, provide excellent coverage for foot/ankle wounds, including those with underlying osteomyelitis. Effective treatment

would necessitate adequate debridement and antibiotic therapy as part of the reconstructive paradigm.

The distally based sural artery flap receives its blood supply from a few sources, the most robust of which are perforators from the peroneal artery. The most distal of these perforators arise between 4 and 7 cm proximal to the lateral malleolus. Additional perfusion arises from neurocutaneous perforators from the sural nerve and venocutaneous perforators from the lesser saphenous vein.

REFERENCES:

1. Yan H, Yang M, Lineaweaver W, et al. Flap Reconstruction of Distal Lower Extremity Wounds in Diabetic Patients. *Ann Plast Surg.* 2011 Oct;67(4):426-8.
2. Follmar K, Baccarani A, Baumeister S, et al. The Distally Based Sural Flap. *Plast Reconstr Surg.* 2007 May;119(6):138e-148e.
3. Fodor L, Horesh Z, Lerner A, Ramon Y, Peled IJ, Ullmann Y. The distally based sural musculoneurocutaneous flap for treatment of distal tibial osteomyelitis. *Plast Reconstr Surg.* 2007 Jun;119(7):2127-36.

61. A 20-year-old woman comes to the office for evaluation of chronic pain of the right wrist, which is alleviated by nonsteroidal anti-inflammatory drugs (NSAIDs). Osteoid osteoma is suspected on x-ray. Which of the following imaging studies is most likely to confirm the suspected diagnosis?

A) Bone scan

B) CT scan

C) Laser fluorescence angiography

D) Magnetic resonance arthrography

E) Ultrasonography

The correct response is Option B.

Osteoid osteoma is a benign bone tumor that arises from osteoblasts; the principal symptom is focal pain at the site of the lesion.

Multiple studies suggest that CT is the best imaging technique for detection of this tumor. Specifically, CT is best at depicting the nidus, the radiolucent area typical of this tumor type. Within the radiolucent nidus, a central area of high attenuation is often seen, representing mineralized osteoid.

As ultrasound waves do not adequately penetrate bone, this intracortical lesion would not easily be detected by this technique.

Although magnetic resonance (MR) has been used to detect these lesions, it is not as sensitive at detecting the nidus as CT scanning. This is because the nidus, especially if it is small, will have signal similar to cortical bone on MR. Although an arthrogram may detect an intra-articular osteoid osteoma, this is a more unusual entity.

A bone scan may show the lesion, but it is nonspecific and will not confirm the diagnosis.

Laser fluorescence angiography has gained popularity for assessing the perfusion of soft tissues (skin, flaps, etc.), but this technique will not help assess bone or tissues of significant depth, nor can it reliably distinguish tumor from other tissue.

REFERENCES:

1. Assoun J, Richardi G, Railhac JJ, et al. Osteoid osteoma: MR imaging versus CT. *Radiology*. 1994 Apr;191(1):217-23.
2. Chai JW, Hong SH, Choi J-Y, et al. Radiologic Diagnosis of Osteoid Osteoma: From Simple to Challenging Findings. *Radiographics*. 2010 May;30(3):737-49.
3. Neligan P. *Plastic Surgery*, Volume 6, 3rd edition. Elsevier: 2012; 81.

62. A 46-year-old woman comes to the office for initial evaluation and management of the right upper extremity because of swelling and discomfort. Medical history includes right modified radical mastectomy for T3 N2 breast cancer 2 years ago. The patient reports that the swelling started 9 months after her procedure, and that she has had two episodes of cellulitis of the right upper extremity that required treatment with oral antibiotics. Physical examination shows marked non-pitting edema of the right upper extremity and a well-healed surgical incision along the right chest wall. There is currently no evidence of recurrent breast cancer. BMI is 27 kg/m². Which of the following is the most appropriate initial management for this patient?

- A) Complete decongestive therapy
- B) Magnetic resonance lymphangiography
- C) Pentoxifylline therapy
- D) Vascularized lymph node transfer
- E) Weight loss

The correct response is Option A.

This patient has post-mastectomy lymphedema. Incidence of lymphedema after axillary node dissection has been reported to be up to 14%. It very often presents after a period of latency after surgical intervention. The mainstay of initial treatment for this condition is complete decongestive therapy (CDT). CDT is a therapist-driven modality that incorporates a multimodality approach including manual lymphatic drainage, daily bandaging, exercise, and skin care. After a period of initial intensive therapy, patients are transitioned to self-directed care under the supervision of a therapist with compression garments and adjunctive modalities. The relative value and benefit of each of the components of CDT are the source of active investigation. Initial management of lymphedema with some form of compression and therapy is the currently accepted approach.

Significant advances have been made in understanding the pathophysiology of lymphedema. There is a complex interplay between the lymphatic, venous, and interstitial systems with venous insufficiency and obesity contributing to the incidence and severity of lymphedema. These conditions should be investigated and treated in conjunction with CDT. The patient in this question is not obese and weight loss would not be an initial appropriate step in management of her lymphedema.

Various pharmacotherapies have been investigated in the treatment of lymphedema. These include diuretics, coumarin, vitamin E, pentoxifylline, and nonsteroidal anti-inflammatory

drugs (NSAIDs). None have been demonstrated to provide efficacy in the treatment of lymphedema.

In patients who have persistent infections or symptomatic lymphedema after conservative management, there may be a role for treatment with physiologic surgical therapies such as vascularized lymph node transfer or lymphaticovenular anastomosis. Imaging modalities such as magnetic resonance lymphangiography may provide high-resolution visualization of the lymphatic system and assist in procedure selection, but should not be employed as a portion of the initial treatment of a patient with lymphedema.

REFERENCES:

1. Rao R, Euhus D, Mayo HG, Balch C. Axillary node interventions in breast cancer: a systematic review. *JAMA*. 2013 Oct 2;310(13):1385-94.
2. Chang DW, Masia J, Garza R 3rd, et al. Lymphedema: Surgical and Medical Therapy. *Plast Reconstr Surg*. 2016 Sep;138(3 Suppl):209S-18S.

63. Which of the following peripheral nerve tumors is most commonly associated with von Recklinghausen disease?

- A) Astrocytoma
- B) Glioblastoma
- C) Neurilemoma
- D) Neurofibroma
- E) Schwannoma

The correct response is Option D.

A neurofibroma is a lesion of the peripheral nervous system, which is derived from Schwann cells, other perineural cell lines, and fibroblasts. Neurofibromas may arise sporadically, or in association with von Recklinghausen disease (neurofibromatosis 1 or NF1). A neurofibroma may arise at any point along a peripheral nerve, and comes in two varieties.

The plexiform neurofibromas are larger tumors that develop inside the body and tend to intimately involve the nerves, blood vessels, and other structures in the body. They can reside deep inside the body or closer to the skin. Plexiform neurofibromas can cause pain, numbness, weakness, and disfigurement. These tumors do have a small chance of becoming cancerous. Plexiform neurofibromas may also be asymptomatic.

Dermal (subcutaneous) neurofibromas are small, nodule-like tumors that grow on or just under the surface of the skin. They can be painful, itchy, disfiguring, or tender when touched, but they have no known potential to become cancerous. Dermal neurofibromas may also be asymptomatic.

Schwannomas are peripheral nerve sheath tumors that can be seen with NF1, but are more commonly associated with neurofibromatosis 2. The major distinction between a schwannoma and a solitary neurofibroma is that a schwannoma can be resected while sparing the underlying nerve, whereas resection of a neurofibroma requires the sacrifice of the underlying nerve. A neurilemoma is another name for a schwannoma.

Astrocytomas and glioblastomas are tumors of the central nervous system. Astrocytomas and optic gliomas can be seen in association with NF1.

REFERENCES:

1. Amirian ES, Goodman JC, New P, Scheurer ME. Pediatric and adult malignant peripheral nerve sheath tumors: an analysis of data from the surveillance, epidemiology, and end results program. *J Neurooncol.* 2014; 116:609
2. Kolberg M, Høland M, Agesen TH, et al. Survival meta-analyses for >1800 malignant peripheral nerve sheath tumor patients with and without neurofibromatosis type 1. *Neuro Oncol.* 2013; 15:135.
3. Tucker T, Wolkenstein P, Revuz J, et al. Association between benign and malignant peripheral nerve sheath tumors in NF1. *Neurology.* 2005; 65:205.

64. A 19-year-old man comes to the office because of persistent left wrist pain after an ATV accident 4 months ago. Medical history includes cast treatment of a wrist fracture. X-ray study shows a proximal pole scaphoid fracture without arthritic changes or collapse. Which of the following is the most appropriate imaging for assessing the vascularity of the bone fragment in this patient?

- A) Angiography
- B) CT scan
- C) MRI
- D) Triple phase bone scan
- E) Ultrasonography

The correct response is Option C.

The most appropriate imaging modality is MRI.

This patient has presented with a delayed proximal pole scaphoid fracture/nonunion, which was previously untreated. The primary blood supply to the scaphoid enters distally and travels proximally. As a result, perfusion to the proximal portion of the scaphoid occurs in a retrograde fashion. Fractures of the proximal pole of the scaphoid are located at the furthest distance from the blood supply, and these fragments are at risk for nonunion and avascular necrosis.

MRI (particularly with gadolinium enhancement) would be the best imaging study for evaluating the blood supply to the scaphoid fragment and looking for the presence of avascular necrosis. MRI can also provide anatomical information regarding the fracture. Direct intraoperative visualization of bleeding of the fragment has also been advocated in assessing vascularity.

Angiography can show blood flow patterns, but would not provide anatomic information.

CT scan is useful for detailed anatomic analysis of fractures and assessment of healing, but would be less helpful than MRI in determining avascular necrosis.

Bone scan shows the presence of inflammatory activity and can be used in identifying the presence of occult fractures (high sensitivity, albeit with low specificity), but has low resolution and would not be helpful in determining avascular necrosis.

Ultrasonography has been used in the diagnosis of acute fractures, but would not determine vascularity.

REFERENCES:

1. Fox MG, Wang DT, Chhabra AB. Accuracy of enhanced and unenhanced MRI in diagnosing scaphoid proximal pole avascular necrosis and predicting surgical outcome. *Skeletal Radiol*. 2015 Nov;44(11):1671-8.
2. Geissler WB and Slade JF. Fractures of the Carpal Bones. In: Wolfe SW, Hotchkiss RN, Pedersen WC, et al. *Green's Operative Hand Surgery*, 6th ed. Philadelphia, PA: Elsevier Churchill Livingstone; 2010;18:639-707.
3. Smith M, Bain GI, Turner PC, Watts AC. Review of imaging of scaphoid fractures. *ANZ J Surg*. 2010 Jan;80(1-2):82-90.

65. A 25-year-old man sustains a high-voltage electrical injury of the right upper extremity with an entrance wound over the volar aspect of the wrist. If increased compartment pressures are not adequately relieved in time, which of the following muscles is most likely to develop an ischemic contracture?

- A) Brachioradialis
- B) Extensor carpi radialis brevis
- C) Flexor carpi radialis
- D) Flexor digitorum profundus
- E) Palmaris longus

The correct response is Option D.



The above patient did not undergo forearm compartment release and has flexion contractures of the interphalangeal joints of the fingers and thumb due to ischemic necrosis of the flexor digitorum profundus (FDP) and flexor pollicis longus (FPL).

Volkmann ischemic contracture is the end result of untreated compartment syndrome. The deeper muscles in the forearm sustain higher pressure sooner and for longer, causing them to be the most affected by compartment syndrome. The FDP to the middle and ring fingers lies against the ulnar and interosseous membrane in the deep compartment of the forearm. These two muscle segments, in addition to the remaining segments of the FDP to the index and small fingers and the FPL, are the most likely to develop contracture. All other muscles listed are more superficial. While brachioradialis, palmaris longus, extensor carpi radialis

brevis, and flexor carpi radialis can all become necrotic in untreated compartment syndrome, FDP and FPL are the most likely to do so due to their depth in the forearm.

REFERENCES:

1. Gulgonen A, Ozer K. “Compartment Syndrome” In: Wolfe SW, Hotchkiss RN, Pederson WC, Kozin SH, eds. *Green’s Operative Hand Surgery*, 6th ed. Philadelphia, Elsevier 2011:1929-48.
2. Stevanovic M, Sharpe F. Management of established Volkmann's contracture of the forearm in children. *Hand Clin.* 2006 Feb;22(1):99-111.

66. A 30-year-old Florida fisherman comes to the emergency department 24 hours after cutting his palm with a fish-scaling knife. Blood pressure is 90/50 mmHg and heart rate is 120 bpm. Physical examination shows severe swelling of the hand, hemorrhagic bullae of the hand, and erythema to the mid forearm. X-ray study shows no gas within the soft tissues. A Gram stain of drainage from a bulla reveals gram-negative bacilli. Which of the following infectious agents is the most likely cause of the patient's symptoms?

- A) *Clostridium perfringens*
- B) *Mycobacterium marinum*
- C) *Pseudomonas aeruginosa*
- D) *Staphylococcus aureus*
- E) *Vibrio vulnificus*

The correct response is Option E.

The patient described has necrotizing fasciitis and sepsis. *Vibrio vulnificus* is a gram-negative bacillus, a cause of necrotizing fasciitis, and is commonly associated with warm saltwater environments (Florida). It also tends to present with hemorrhagic bullae. *Staphylococcus aureus* is a gram-positive coccus, is not associated with watery environments, and is more commonly associated with pustules rather than hemorrhagic bullae. *Clostridium perfringens* is a gas-forming, gram-positive bacillus, and is associated with marine sediment. *Pseudomonas aeruginosa*, also a gram-negative bacillus, although associated with moist environments, is more typically associated with less aggressive soft-tissue infections. *Mycobacterium marinum* is also associated with watery environments, but tends to affect aquarium owners with an indolent granulomatous process.

REFERENCES:

1. Torok ME, Conlon CP. Skin and soft tissue infections. *Medicine*. 2009 Nov;37(11):603-609.
2. Horseman MA, Surani S. A comprehensive review of *Vibrio vulnificus*: an important cause of severe sepsis and skin and soft-tissue infection. *Int J Infect Dis*. 2011 Mar;15(3):e157-166. Epub 2010 Dec 21.

67. A neonate is born with unilateral edema of the arm. During the ensuing day, there is worsening edema and bullae formation. Which of the following is the most appropriate next step in management of this patient?

- A) Administration of intravenous antibiotics and elevation of the arm
- B) Compartment release
- C) Continued observation and dressing change
- D) Debridement and skin grafting
- E) Treatment in a hyperbaric chamber

The correct response is Option B.

Compartment release should be performed early and urgently. The other treatments above may play a role in secondary treatment. Volkmann's ischemia is not rare and awareness of the diagnosis is important. The sentinel lesion of neonatal compartment syndrome is bullous formation on the dorsum of the hand or arm. Etiology is often in utero and can be amniotic bands, umbilical cord loops, forceps extraction, oligohydramnios, preeclampsia, and excessive maternal weight. Diastolic pressures in neonates are usually 40 mmHg or less. Small increases in compartment pressure are therefore not tolerated well. The six P's of compartment syndrome, which include pain, paresthesias, pulselessness, pallor, paralysis, and pressure, will not be seen in the neonate. The three A's, which precede the six P's in children, are agitation, anxiety, and increasing analgesic requirements; and will not be seen in the neonate.

REFERENCES:

1. Ragland R, Moukoko D, Ezaki M, et al. Forearm compartment syndrome in the newborn: report of 24 cases. *J Hand Surg Am.* 2005 Sep;30(5):997-1003.
2. Stevanovic M, Sharpe F. Compartment Syndrome and Volkmann Ischemic Contracture. In: *Green's Operative Hand Surgery*, 7th Ed., Eslevier, 2016:1763-87.
3. Plancq MC, Buisson P, Deroussen F, et al. Successful early surgical treatment in neonatal compartment syndrome: case report. *J Hand Surg Am.* 2013;38(6):1185-8.

68. A 60-year-old woman with a history of rheumatoid arthritis presents with a boutonnière deformity of the long finger. Which of the following is the most likely cause of the deformity?

- A) Destruction of the cartilage of the proximal interphalangeal joint
- B) Dorsal subluxation of the lateral bands at the proximal interphalangeal joint
- C) Metacarpophalangeal joint subluxation
- D) Rupture of the distal extensor tendon
- E) Synovitis at the proximal interphalangeal joint

The correct response is Option E.

The posture of a boutonnière is flexion of the proximal interphalangeal (PIP) joint and hyperextension of the distal interphalangeal joint. The common injury for non-rheumatoid patients that suffer traumatic injuries that lead to the deformity is a rupture of the central slip that means no active extension at the PIP joint. Over time, the lateral bands slip volarly and cause hyperextension of the distal joint. Synovitis of the PIP joint leads to subsequent attenuation of the central slip, which leads to the same deformity.

REFERENCES:

1. Williams K and Terrono AL. Treatment of boutonnière finger deformity in rheumatoid arthritis. *J Hand Surg Am.* 2011 Aug;36(8):1388–93.
2. Chung KC and Pushman AG. Current Concepts in the Management of the Rheumatoid Hand. *J Hand Surg Am.* 2011;36A:736–747.



69. A 54-year-old woman is evaluated for an injury to the proximal interphalangeal (PIP) joint of the long finger of the left hand that she sustained during a motor vehicle collision. X-ray study is shown. Which of the following methods is the most appropriate surgical management of this patient's fracture?

- A) Dynamic external fixation
- B) Hemihamate arthroplasty
- C) Lag screw fixation
- D) PIP joint arthrodesis
- E) Volar plate arthroplasty

The correct response is Option A.



This patient presents with an intra-articular, or pilon, fracture of the middle phalanx base. Typically, pilon fractures are axial load injuries to the finger resulting in impaction, comminution, central depression, and splaying of the middle phalanx fracture fragments both volarly and dorsally.

Fractures involving the proximal interphalangeal (PIP) joint are generally divided into three categories: volar rim fractures, dorsal rim fractures, and pilon fractures (volar and dorsal rim) with or without joint dislocation. Joint dislocation occurs secondary to ligamentous injury and correlates to the amount of articular surface involved in the fracture.

Management of these injuries depends on the fracture type, severity, degree of articular surface involvement, extent of dislocation, and associated soft-tissue injuries. Pilon fractures due to the comminution and crush component of the middle phalanx base can be very difficult to treat. Post-traumatic osteoarthritis causing stiffness, impaired function, and pain is a known complication.

Multiple different types of dynamic external fixation devices have been described in the literature. These are mostly fabricated from K-wires with or without a rubber band traction system. The devices work by the principles of a lever and ligamentotaxis to maintain fracture reduction and joint congruency and to allow early motion for joint surface remodeling. The devices are inexpensive and relatively easy to place with experience, and can be placed using local anesthesia. Dynamic distraction external fixation has been indicated for use in pilon fractures and unstable PIP joint fracture dislocations. The constructs are usually removed 4 to 6 weeks after fracture consolidation and clinical healing is present. Most studies report 60 to 88 degrees of PIP motion with good patient satisfaction and return of function. The presence of arthritic changes on x-ray studies is common after these injuries. Pin tract infections up to 40% have been reported in retrospective studies; however, these seem to be treated with oral antibiotics alone and do not require pin removal. They do not progress to osteomyelitis.

PIP joint arthrodesis is an option for treatment in very severe pilon fractures or crush injuries with severe soft-tissue involvement; however, this sacrifices motion and should be reserved for cases where there are no other viable treatment options.

Hemi-hamate arthroplasty and volar plate arthroplasty are operations described to treat PIP joint fracture dislocations with isolated volar rim involvement. These procedures require an intact dorsal cortex of the middle phalanx base to achieve stable fixation. Both procedures are indicated for comminuted fractures involving 30 to 50% of the articular surface of the middle phalanx base.

Open reduction and internal fixation of pilon fracture with locking plates has been described, but is technically challenging and requires significant soft-tissue dissection compared with percutaneous dynamic external fixation. Lag screws are inadequate fixation in general for pilon fractures. Isolated volar rim fractures with a larger fracture fragment can be treated successfully with lag screws.

REFERENCES:

1. Badia A, Riano F, Ravikoff J, et al. Dynamic Intradigital External Fixation for Proximal Interphalangeal Joint Fracture Dislocations. *J Hand Surg Am.* 2005 Jan;30(1):154-60.
2. Ruland R, Hogan CJ, Cannon DL, Slade JF. Use of Dynamic Distraction External Fixation for Unstable Fracture-Dislocations of the Proximal Interphalangeal Joint. *J Hand Surg Am.* 2008 Jan;33(1):19-25.
3. Abou Elatta MM, Assal F, Basheer HM, et al. The Use of Dynamic External Fixation in the Treatment of Dorsal Fracture Subluxations and Pilon Fractures of Finger Proximal Interphalangeal Joints. *J Hand Surg Eur Vol.* 2017 Feb;42(2):182-187.17.

70. A 24-year-old man who works as a laborer comes to the office because of a 2-cm mass on the dorsum of each hand. MRI shows an anomalous muscle. Which of the following is the most likely structure?

- A) Extensor digitorum brevis
- B) Extensor digitorum longus
- C) Extensor digitorum brevis manus
- D) Extensor indicis proprius
- E) Extensor medii proprius

The correct response is Option C.

The extensor digitorum brevis manus is an anomalous muscle of the hand, which typically presents as a tender dorsal wrist mass. Incidence in the general population is estimated to be 2 to 3%. Anatomically, this muscle classically originates from the proximal dorsal radiocarpal ligament and inserts into the index finger extensor mechanism. Diagnosis is characteristic on ultrasonography or MRI. Treatment should be directed to symptoms and may include rest, activity modification, fourth dorsal compartment release, and/or muscle excision.

REFERENCES:

1. Shuck J, Rogers GF, Oh AK. The Extensor Digitorum Brevis Manus: Ganglion Surgeon Beware! *Plast Reconstr Surg*. 2015 Dec;136(6):860e-1e.
2. Capo JT, Shamian B, Li Y. Extensor digitorum brevis manus muscle in association with a metacarpal boss. *J Plast Surg Hand Surg*. 2014 Apr;48(2):152-4.
3. Froelich JM, Bidgoli-Moghaddam M, Moran SL. Bilateral extensor digitorum brevis manus. *Orthopedics*. 2012 Sep;35(9):e1431-3.
4. Tan ST1, Smith PJ. Anomalous extensor muscles of the hand: a review. *J Hand Surg Am*. 1999 May;24(3):449-55.

71. A 21-year-old man sustains traumatic amputation of the right thumb at the level of the metacarpal base. Pollicization should include osteosynthesis of which of the following?

- A) Index metacarpal base to trapezium
- B) Index metacarpal to thumb metacarpal
- C) Index middle phalanx to thumb metacarpal
- D) Index proximal phalanx to thumb metacarpal
- E) Index proximal phalanx to trapezium

The correct response is Option D.

Transfer of the index finger to the thumb position on the hand (pollicization) typically transfers the proximal phalanx to the thumb metacarpal, as long as the base of the thumb metacarpal is preserved. Transfer of the middle phalanx or metacarpal of the index would create a neo-thumb that is too short or too large, respectively. Obliterating an intact carpometacarpal joint by transferring the index metacarpal to the trapezium would eliminate palmar and ulnar abduction of the thumb and compromise global hand function.

REFERENCES:

1. Neligan P. *Plastic Surgery*, Volume 6, 3rd edition. Philadelphia: Elsevier: 2012;292.
2. Bravo CJ, Horton T, Moran SL, Shin AY. Traumatized index finger pollicization for thumb reconstruction. *J Hand Surg Am.* 2008;33(2):257-62.
3. Taghinia AH, Upton J. Index finger pollicization. *J Hand Surg Am.* 2011;36(2):333-9.

72. A 64-year-old woman with rheumatoid arthritis is evaluated for abrupt onset of inability to extend the ring and little fingers of the left hand. Surgical exploration confirms attritional tendon rupture and caput ulnae syndrome. In addition to tendon reconstruction, which of the following interventions is most likely to prevent recurrence of this condition?

- A) Distal ulna resection
- B) Proximal row carpectomy
- C) Radiocarpal arthrodesis
- D) Scaphoid excision and four-corner fusion
- E) Trapeziectomy and ligament reconstruction

The correct response is Option A.

Darrach procedure, or distal ulna resection, is a well-established procedure to treat distal radioulnar joint (DRUJ) arthritis and distal ulnar instability such as in caput ulnae syndrome. A dorsal approach is used to gain access to the DRUJ via dorsal fifth extensor compartment approach. The triangular fibrocartilage complex (TFCC) and extensor carpi ulnaris (ECU) sheath are preserved. Excision of the distal ulnar head is performed proximal to the radial sigmoid notch.

DRUJ arthritis and instability may result in attritional rupture of the extensor tendons due to tendons abrading against the dislocated, eroded ulna head as well as restriction of forearm rotation. Thus, the aims of treatment for DRUJ arthritis are pain relief, prevention of attritional tendon rupture if the patient presents prior to tendon rupture, and improvement of forearm rotation.

These aims are commonly achieved using a Darrach procedure or Sauvé-Kapandji procedure and less commonly by ulnar head replacement arthroplasty. The Sauvé-Kapandji procedure was introduced amid concerns over ulnar translocation of the carpus following resection of the distal ulnar head as done in the Darrach procedure, yet both procedures have shown good outcomes in the treatment of DRUJ arthritis. In fact, a recent systematic review found no significant difference in outcomes between the two procedures in rheumatoid arthritis patients.

Proximal row carpectomy and scaphoid resection and four-corner fusion are both used to treat wrist arthritis, but are usually for osteoarthritis such as with SLAC and scaphoid nonunion advanced collapse (SNAC) wrist, and are not generally used in rheumatoid arthritis patients. Trapeziectomy and ligament reconstruction are procedures used to treat

carpometacarpal arthritis of the thumb, not DRUJ arthritis. Radiocarpal arthrodesis is a treatment for radiocarpal arthritis, and not DRUJ arthritis with caput ulnae.

REFERENCES:

1. Nikkhah D, Rodrigues J, Dejager L. Do patients really do better after the Sauve-Kapandji procedure when compared to the Darrach procedure? A systematic review. *J Hand Surg Eur* Vol. 2011 Sep;36(7):615.
2. Rehim SA, Chung KC. Applying Evidence In The Care Of Patients With Rheumatoid Hand And Wrist Deformities. *Plast Reconstr Surg*. 2013 Oct;132(4):885-97.

73. Which of the following vessels runs within the pedicle of the reverse sural artery flap and serves as primary venous drainage?

- A) Femoral
- B) Greater saphenous
- C) Lesser saphenous
- D) Popliteal
- E) Posterior tibial

The correct response is Option C.

The reverse superficial sural artery flap (RSSAF) is a distally based fasciocutaneous or adipofascial flap that is increasingly being used for coverage of defects that involve the distal third of the leg, ankle, and foot. First described by Donski and Fogdestam and later championed by Masquelet et al, RSSAF has become a popular option for these difficult wounds. The description of the RSSAF (Masquelet flap) has revolutionized the osteoplastic armamentarium of surgeons not conversant with microvascular free flaps. The reliability of septocutaneous perforators has been well documented. Hence, raising a flap based on this reliable anastomosis of peroneal artery and median sural artery, along with the sural nerve and lesser (short) saphenous vein has been described to be successful.

A significant advantage of this flap is that it does not require sacrifice of a major artery to the lower limb. Touted for its ease of dissection, the RSSAF is often reputed to have a favorable complication profile as evidenced by a recent meta-analysis that found 82% of flaps heal without any flap-related complications. The main complications include venous congestion of the flap requiring delay or leech therapy in some higher-risk patients.

The greater saphenous vein runs proximal and medial to the lesser saphenous vein, and it drains the medial and anteromedial portion of the lower leg.

The popliteal vein drains the lesser (short) saphenous vein, and it is therefore not the primary drainage of the reverse sural flap.

The anterior and posterior tibial veins are the deep venous drainage of the lower leg and do not drain the RSSAF.

The femoral vein is the deep venous drainage system in the upper leg.

REFERENCES:

1. Sugg KB, Schaub TA, Concannon MJ, et al. The Reverse Superficial Sural Artery Flap Revisited for Complex Lower Extremity and Foot Reconstruction. *Plast Reconstr Surg Glob Open*. 2015 Sep 22;3(9):e519.
2. Akhtar S, Hameed A. Versatility of the sural fasciocutaneous flap in the coverage of lower third leg and hind foot defects. *J Plast Reconstr Aesthet Surg*. 2006;59(8):839-45.
3. Dhamangaonkar AC, Patankar HS. Reverse sural fasciocutaneous flap with a cutaneous pedicle to cover distal lower limb soft tissue defects: experience of 109 clinical cases. *J Orthop Traumatol*. 2014 Sep; 15(3): 225–229.



74. A 1-year-old boy is brought to the office by his parents for evaluation and correction of the findings shown in the photograph. The patient is otherwise healthy. Which of the following techniques is most appropriate to reconstruct the apex of the web space in this patient?
- A) Bilobed flap from the dorsal hand
 - B) Cross-finger flap
 - C) Full-thickness skin grafting
 - D) Proximally based dorsal rectangular flap
 - E) Split-thickness skin grafting

The correct response is Option D.

Full-thickness skin grafts are usually used to close the resultant defects of the fingers after release of congenital syndactyly. Several local dorsal flaps have been described to reconstruct the web space with differing shapes to avoid the use of skin grafts, including rectangular, a V-Y island, a dorsal flap interdigitated with a small palmar V and a dorsal V-shape. A bilobed flap has been described for treating web creep in adults, but would not routinely be used.

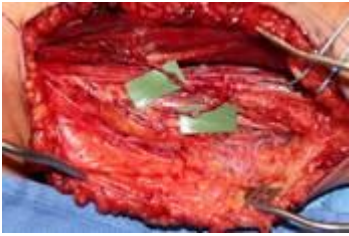
REFERENCES:

1. Hsu VM, Smartt JM, Chang B. The modified V-Y dorsal metacarpal flap for repair of syndactyly without skin graft. *Plast Reconstr Surg*. 2010 Jan;125(1):225–32.
2. Matsumine H, Yoshinaga Y, Fujiwara O, et al. Improved "bell-bottom" flap surgical technique for syndactyly without skin graft. *Plast Reconstr Surg*. 2011 Nov;128(5):504e–509e.
3. Miyamoto J, Nagasao T and Miyamoto S. Biomechanical analysis of surgical correction of syndactyly. *Plast Reconstr Surg*. 2010 Mar;125(3):963–8.
4. Sahin C, Ergun O, Kulahci Y, et al. Bilobe flap for web reconstruction in adult syndactyly release: a new technique which can avoid the use of skin graft. *J Plast Reconstr Aesthet Surg*. 2014 Jun;67(6):815–21.

75. A 24-year-old man comes to the office because of a brachial plexus injury sustained in a motorcycle accident. Nerve transfer to the biceps for restoration of elbow flexion is planned. Which of the following fascicles or nerves is the most appropriate donor for the transfer?

- A) Distal spinal accessory nerve
- B) Flexor carpi ulnaris fascicle of the ulnar nerve
- C) Medial pectoral nerve
- D) Palmaris longus fascicle of the median nerve
- E) Thoracodorsal nerve

The correct response is Option B.



Adult upper trunk brachial plexus injuries result in significant disability. Several surgical treatment strategies exist, including nerve grafting, nerve transfers, and a combination of both approaches.

The flexor carpi ulnaris (FCU) fascicle of the ulnar nerve to biceps transfer was first described by Oberlin et al in 1994. Generally, the donor nerve with the largest caliber and the greatest number of motor axons should be used for elbow flexion. The other suggested nerve transfer options are also possibilities, but are not as preferable as the FCU fascicle transfer. MacKinnon has advocated transfer of the FCU fascicle of the ulnar nerve to the biceps and FCR fascicle of the median nerve to the brachialis to maximize recovery of elbow flexion.

REFERENCES:

1. Ray WZ, Pet MA, Yee A, Mackinnon SE. Double fascicular nerve transfer to the biceps and brachialis muscles after brachial plexus injury: clinical outcomes in a series of 29 cases. *J Neurosurg*. 2011 Jun;114(6):1520-8.

2. Rohde RS, Wolfe SW. Nerve Transfers for Adult Traumatic Brachial Plexus Palsy (Brachial Plexus Nerve Transfer). *HSS Journal*. 2007;3(1):77-82.
3. Oberlin C, Béal D, Leechavengvongs S, et al. Nerve transfer to biceps muscle using a part of ulnar nerve for C5-C6 avulsion of the brachial plexus: anatomical study and report of four cases. *J Hand Surg Am*. 1994. Mar;19(2):232-7.

76. A 22-year-old man comes to the emergency department after sustaining a laceration to the dorsal thumb by punching a glass door. Radial nerve block is planned during surgical repair. Which of the following is the approximate distance proximal to the radial styloid in which the superficial branch of the radial nerve pierces the deep fascia?

- A) 0 to 4 cm
- B) 5 to 9 cm
- C) 10 to 14 cm
- D) 15 to 19 cm

The correct response is Option B.

The superficial branch of the radial nerve runs below the brachioradialis muscle in the mid-forearm, later becoming sub-fascial between the brachioradialis and extensor carpi radialis longus (ECRL) muscles. Approximately 8 to 9 cm proximal to the radial styloid, the superficial branch of the radial nerve (SBRN) becomes subcutaneous, piercing the fascia. The ideal location of infiltration for a radial nerve block is at the sub-fascial location just before the nerve becomes subcutaneous.

REFERENCES:

1. Poublon AR, Walbeehm ET, Duraku LS, et al. The anatomical relationship of the superficial radial nerve and the lateral antebrachial cutaneous nerve: A possible factor in persistent neuropathic pain. *J Plast Reconstr Aesthet Surg*. 2015 Feb;68(2):237-42.
2. Knutsen EJ, Calfee RP. Uncommon upper extremity compression neuropathies. *Hand Clin*. 2013 Aug;29(3):443-53.
3. Meng S, Tinhofer I, Weninger WJ, Grisold W. Anatomical and ultrasound correlation of the superficial branch of the radial nerve. *Muscle Nerve*. 2014 Dec;50(6):939-42.

77. A 53-year-old woman is evaluated for a 1-year history of numbness and tingling of the thumb and the index and long fingers of the right hand. She has been unresponsive to conservative treatment. An increase in which of the following is most likely suggestive of carpal tunnel syndrome in this patient?

- A) Abductor digiti minimi fibrillations
- B) Adductor pollicis fibrillations
- C) Motor nerve conduction velocity
- D) Sensory distal latency
- E) Sensory nerve conduction velocity

The correct response is Option D.

The diagnosis of carpal tunnel syndrome is primarily a clinical diagnosis; however, electrodiagnostic studies (EDX) may be helpful in confirming the diagnosis. While these EDX studies are commonly referred to as "EMGs," they are actually two separate studies: the nerve conduction studies (NCS) and the electromyography (EMG). NCS examine both the sensory and the motor nerve fibers. Sensory nerve conduction studies measure sensory nerve action potential, and the motor nerve conduction studies evaluate a compound muscle action potential. The NCS also measures the amplitude of both the compound muscle action potential and sensory nerve action potential. Nerve conduction velocity (NCV), the velocity of the nerve's action potential between two points, is also measured by the nerve conduction studies.

The EMG tests the muscle itself. The needle electrode examination can measure motor unit potential (MUP). MUP is measured in regards to its amplitude, duration, wave shape, and firing pattern. In the diagnosis of carpal tunnel syndrome, particular attention is given to the MUP of the abductor pollicis brevis muscle, which is uniquely innervated by the median nerve after it passes through the carpal tunnel.

In the diagnosis of carpal tunnel syndrome, changes in the sensory nerve are detected earlier in the carpal tunnel process than motor changes. Early NCS changes (as compared to standardized normal values) include prolonged or increased sensory distal latencies. Prolonged motor latencies (also abnormal) are detected less frequently than the sensory latency changes, and detected in only 35 to 50% of patients with carpal tunnel syndrome. Motor amplitude change, found in carpal tunnel syndrome, is detected even less commonly. A conduction block, or slowing of the nerve's action potential velocity (NCV) between two points, can be seen with carpal tunnel syndrome.

The needle electrode examination (EMG) is normal in more than 60% of patients with the diagnosis of carpal tunnel syndrome. Fibrillations in the abductor pollicis brevis occurs in generally less than 20% of patients with carpal tunnel syndrome. The adductor pollicis brevis and abductor digiti minimi muscles are innervated by the ulnar nerve, and would not show any electrodiagnostic evidence of muscle instability in isolated carpal tunnel syndrome.

REFERENCES:

1. Duckworth AD, Jenkins PJ, McEachan JE. Diagnosing carpal tunnel syndrome. *J Hand Surg Am.* 2014 Jul;39(7):1403-7.
2. Robinson LR. Electrodiagnosis of carpal tunnel syndrome. *Phys Med Rehabil Clin North Am.* 2007 Nov;18(4):733-46, vi.
3. Basiri K, Katirji B. Practical approach to electrodiagnosis of the carpal tunnel syndrome: A review. *Adv Biomed Res.* 2015;4:50.



78. A 27-year-old man is brought to emergency department because of a thumb avulsion injury measuring 3×3 cm. A photograph is shown. Which of the following is the best option for sensate, soft-tissue coverage?

- A) Cross-finger flap
- B) First dorsal metacarpal artery flap
- C) Moberg flap
- D) Pedicled groin flap
- E) Skin grafting

The correct response is Option B.

There are several sensate options for thumb pulp deformities. These include neurovascular island flaps, Moberg flaps, free toe pulp flaps, and the first dorsal metacarpal artery flap (FDMA). Cross finger flaps, skin grafts, and pedicle groin flaps do not have innate innervation. The defect in the question involves the entire pulp of the thumb overlying the distal phalanx and is too large for a Moberg advancement flap.

The FDMA flap is supplied by its eponymous artery, which travels in the fascia overlying the index metacarpal and supplies the skin overlying the dorsum of the proximal phalanx. The vessel is accompanied superficially by a branch of the radial nerve that provides neural activation to the skin overlying the proximal phalanx of the index finger. The flap can be transposed to provide sensate coverage of the tip of the thumb, and can provide sufficient size to resurface relatively large defects.

Cortical reorientation is the fact that the brain recognizes a stimulus from the flap area as a stimulus from the thumb, and not from the index finger. This process takes some time, but is usually complete after 2 years. Average static two-point discrimination in these flaps utilized for thumb resurfacing is 10 to 11 mm.

Use of the FDMA flap for resurfacing of the thumb pulp has been compared to heterodigital island flaps in several studies. Both remain options to be considered, but the ease of elevation, limited dissection, and acceptable donor site morbidity make the FDMA flap a common primary option for thumb tip resurfacing.

REFERENCES:

1. Tränkle M, Sauerbier M, Heitmann C, Germann G. Restoration of thumb sensibility with the innervated first dorsal metacarpal artery island flap. *J Hand Surg Am.* 2003; 28(5):758–766.
2. Muyldermans T, Hierner R. First dorsal metacarpal artery flap for thumb reconstruction: a retrospective clinical study. *Strat Traum Limb Recon.* 2009; 4:27.
3. Delikonstantinou IP, Gravvanis AI, Dimitriou V, Zogogiannis I, Douma A, Tsoutsos DA. Foucher first dorsal metacarpal artery flap versus Littler heterodigital neurovascular flap in resurfacing thumb pulp loss defects. *Ann Plast Surg.* 2011 Aug;67(2):119-22.

79. A 61-year-old man comes to the office for evaluation of a 3 × 3-cm calcaneal defect with exposed bone. Medial plantar flap reconstruction is planned. The principal blood supply to this flap arises from which of the following arteries?

- A) Arcuate
- B) Dorsalis pedis
- C) Peroneal
- D) Plantar arch
- E) Posterior tibial

The correct response is Option E.

The primary blood supply to the medial plantar flap is the medial plantar artery, a terminal branch of the posterior tibial artery. The dorsalis pedis is the continuation of the anterior tibial artery and does not contribute to this flap. The peroneal artery is a proximal branch of the posterior tibial artery and descends in the deep posterior compartment posterior to the tibialis posterior and anterior to the flexor hallucis longus; it does not contribute to this flap. The arcuate artery is the terminal branch of the anterior tibial artery. The plantar arch runs on the plantar aspect of the foot at the level of the metatarsals; it is formed from a confluence of the lateral plantar artery and the deep plantar artery from the dorsalis pedis.

REFERENCES:

1. Zeiken JA, Lin CH. An algorithm for forefoot reconstruction with the innervated free medial plantar flap. *Ann Plast Surg.* 2016; 76:221-226.
2. Oh SJ, Moon M, Cha J, Chung CH. Weight-bearing plantar reconstruction using versatile medial plantar sensate flap. *J Plast Reconstr Aesthet Surg.* 2011 Feb;64(2):248-54.
3. Duman H, Er E, Isik S, et al. Versatility of the medial plantar flap: our clinical experience. *Plast Reconstr Surg.* 2002 Mar;109(3):1007-12.

80. A 4-month-old infant is brought to the office for evaluation of a unilateral, seven-fingered hand with a central index finger flanked on each side by long, ring, and little fingers, with no thumb present. Abnormal expression of which of the following controlling substances is most likely responsible for this developmental anomaly?

- A) Bone morphogenetic protein
- B) Fibroblast growth factor
- C) Sonic hedgehog protein
- D) Wingless protein

The correct response is Option C.

The infant's described anomaly is that of a mirror hand, which is an abnormality of the anteroposterior (radioulnar) axis of limb development. Sonic hedgehog protein (SHH) is expressed in the zone of polarizing activity (ZPA) on the posterior (ulnar) surface of the developing limb bud and is the main controlling substance for this axis of development. Direct expression of SHH results in development of the ulna, the ulnar two columns of the carpus, the little finger, the ring finger, and the ulnar half of the long finger. Diffusion of SHH, or long range signaling, results in development of the radial half of the long finger and the index finger. Absence of SHH results in the development of the radius, the radial column of the carpus, and the thumb. Ectopic expression of SHH, such as with duplication of the ZPA at the anterior (radial) margin of the limb bud, results in duplication of the ulnar-sided structures found in a mirror hand.

Fibroblast growth factors (FGF) are the main controlling substances in the apical ectodermal ridge (AER) and are responsible for the proximodistal axis of limb bud development. Bone morphogenetic proteins (BMP) are expressed in the AER and are also thought to be involved in digital separation, the lack of which leads to syndactyly. Wingless proteins (WNT) are also expressed in the AER, but it is the WNT signaling pathway from the dorsal surface of the limb bud that controls the dorsoventral axis of limb development. Dorsal ectodermal WNT also maintains SHH in the ZPA such that lack of WNT leads to lack of ulnar ray development. This is contrary to the ectopic expression of SHH leading to duplication of the ulnar rays in mirror hand. Fibroblast growth factors, bone morphogenetic proteins, and wingless proteins are not principal controlling substances for the anteroposterior (radioulnar) axis of development of the limb.

REFERENCES:

1. Al-Qattan MM, Kozin SH. Update on embryology of the upper limb. *J Hand Surg Am.* 2013 Sep;38(9):1835-1844.
2. Al-Qattan MM, Yang Y, Kozin SH. Embryology of the upper limb. *J Hand Surg Am.* 2009 Sep;34(7):1340-1350.
3. Kozin S. Embryology of the upper extremity. In: Wolfe SW, Pedersen WC, Hotchkiss RN, Kozin SH, eds. *Green's Operative Hand Surgery*. 6th ed. Philadelphia, PA: Churchill Livingstone; 2011:1295-1301.



81. A 20-year-old rugby player is evaluated for an acute thumb injury 4 hours after falling onto his outstretched hand while being tackled. X-ray study is shown. Surgical intervention is planned. Which of the following is the most appropriate force to apply to the thumb metacarpal during reduction?

- A) Abduction
- B) Axial compression
- C) Flexion
- D) Supination

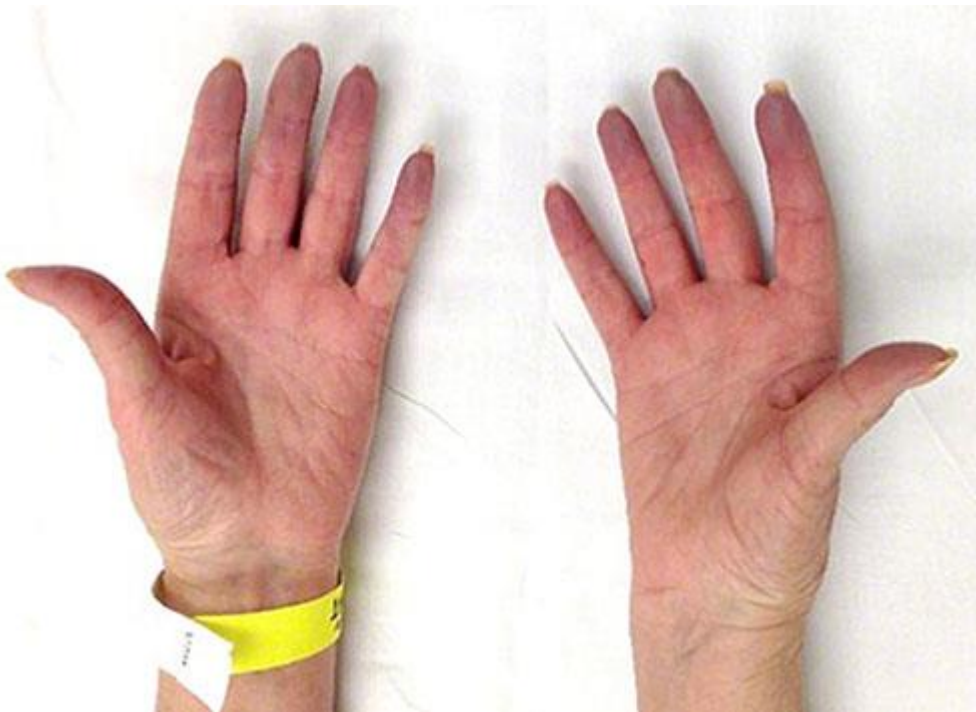
The correct response is Option A.

In a Bennett fracture, the smaller volar-ulnar fragment is retained by the anterior oblique (beak) ligament, while the abductor pollicis longus, thumb extensor tendons, and the adductor pollicis combine to distract the base of the larger shaft fragment radially, dorsally, and proximally. These distracting forces create joint incongruity, which is a relative indication for fracture reduction. These forces must be countered to reduce the fracture, thus, requiring axial distraction, pronation, and abduction of the metacarpal shaft, while simultaneously applying external pressure at the radial base of the metacarpal.

Axial compression will worsen proximal migration of the metacarpal shaft. Extension will worsen dorsal displacement, and supination will further distract the volar surfaces of the fracture fragments. Application of these forces will not promote fracture reduction.

REFERENCES:

1. Carlsen BT, Moran SL. Thumb trauma: Bennett fractures, Rolando fractures, and ulnar collateral ligament injuries. *J Hand Surg Am.* 2009;34(5):945-952.
2. Day CS, Stern PJ. Fractures of the metacarpals and phalanges. In: Wolfe SW, Pedersen WC, Hotchkiss RN, Kozin SH, eds. *Green's Operative Hand Surgery*. 6th ed. Philadelphia, PA: Churchill Livingstone; 2011:239-290.



82. A 45-year-old woman with systemic sclerosis (scleroderma) has severe Raynaud phenomenon. A photograph is shown. Periarterial injection of botulinum toxin type A is being considered for treatment in this patient. This treatment is believed to relieve vasospasm in Raynaud phenomenon by which of the following mechanisms?

- A) Blocking fast sodium channels in axonal gap junctions
- B) Increasing the activity of chronically down-regulated group C nerve fiber nociceptors
- C) Inhibiting Rho/Rho kinase activity
- D) Obstructing myofibroblast contractile activity in vascular smooth muscle
- E) Promoting substance P secretion/receptor sensitivity

The correct response is Option C.

Several mechanisms have been proposed to explain the effect of botulinum toxin type A (Botox) to inhibit Raynaud phenomenon in patients with scleroderma. Studies have demonstrated inhibition of Rho/Rho kinase activity, inhibition of substance P secretion and receptor sensitivity, and decreasing the activity of chronically up-regulated C-fiber

nociceptors all to occur in models of Raynaud phenomenon that responded to Botox treatment. Fast sodium channels conduct axonal signals AT in gap junctions, but have not been shown to be affected by Botox. Myofibroblasts may be involved in late fibrosis of scleroderma patients but do not exist within the vascular smooth muscle.

REFERENCES:

1. Fonseca C, Abraham D, Ponticos M. Neuronal regulators and vascular dysfunction in Raynaud's phenomenon and systemic sclerosis. *Curr Vasc Pharmacol*. 2009;7(1):34–39.
2. Iorio ML, Masden DL, Higgins JP. Botulinum toxin A treatment of Raynaud's phenomenon: a review. *Semin Arthritis Rheum*. 2012 Feb;41(4):599-603.
3. Neumeister MW. The role of botulinum toxin in vasospastic disorders of the hand. *Hand Clin*. 2015 Feb;31(1):23-37.
4. Uppal L, Dhaliwal K, Butler PE. A prospective study of the use of botulinum toxin injections in the treatment of Raynaud's syndrome associated with scleroderma. *J Hand Surg Eur Vol*. 2014 Oct;39(8):876-80.

83. A 60-year-old man sustains a Gustilo type IIIB open fracture of the distal left tibia during a boating accident. There is severe contamination of the wound, and the patient undergoes multiple formal washouts in the operating room. There is no neurovascular compromise of the extremity. He undergoes external fixation to stabilize the limb. Which of the following is the most appropriate next step in treatment?

- A) Coverage with a free tissue transfer
- B) Negative pressure wound therapy until secondary healing is achieved
- C) Pedicled gastrocnemius muscle and skin grafting
- D) Primary bone allografting
- E) Split-thickness skin grafting

The correct response is Option A.

The Gustilo classification describes open fractures of the tibia by the severity of the soft tissue injury overlying the fracture. In patients with IIIB injuries, there is extensive soft-tissue loss and periosteal stripping, but no vascular compromise requiring repair.

Gustilo classification:

Type I: The wound is less than 1 cm long. There is little soft-tissue damage and no sign of crush injury. There is no or minimal comminution of the fracture.

Type II: The laceration is more than 1 cm long but there is no extensive soft tissue damage, flap, or avulsion. There is slight to moderate crushing injury, moderate comminution of the fracture.

Type III: Extensive damage to the soft tissues, including muscle, skin, and neurovascular structures, and a high degree of contamination.

Type IIIA: Soft tissue coverage of the bone is adequate.

Type IIIB: Extensive injury to or loss of soft tissue, with periosteal stripping and exposure of bone, massive contamination, and severe comminution of the fracture from high-velocity trauma

Type IIIC: Any open fracture with a vascular injury requiring repair.

Free tissue transfer will bring healthy, nontraumatized tissue into the area to cover the exposed broken bone. Multiple recent studies have shown equivalence of muscle versus skin/fat/fascia flaps for coverage of the open fracture even in patients with osteomyelitis. Negative pressure wound therapy has proven to be an excellent adjunct in the management of patients with these injuries. Between washouts, negative pressure devices can help decrease edema and isolate the wound and bone from the outside world. In a patient with a

IIIB injury, there is insufficient tissue available to cover the wound. Therefore, secondary intention would not close the wound.

Split-thickness skin grafting provides an epithelial barrier to help seal off a wound from outside contamination. Grafts require a viable wound bed to survive. There must be a pliable bed to help grafts resist minor trauma in the future. With the periosteal stripping in this type of injury, a graft would not survive. In addition, graft placed directly on bone with periosteum would be very vulnerable to breakdown from minor trauma.

Bone allografting can be used to bridge defects in many circumstances. In the patient described, the severe contamination of the initial injury would make bone allografting much less appealing than autografting. Because of contamination, any type of bone grafting may need to be delayed until after achieving stable soft tissue coverage of the fracture.

A pedicled gastrocnemius muscle flap provides excellent coverage for defects about the knee, including the proximal tibia. Although the free gastrocnemius muscle flap could be transferred to any location, the pedicled flap would not be able to reach the distal tibia.

REFERENCES:

1. Chan JK, Harry L, Williams G, et al. Soft-tissue reconstruction of open fractures of the lower limb: muscle versus fasciocutaneous flaps. *Plast Reconstr Surg*. 2012 Aug;130(2):284e-295e.
2. D'Alleyrand JC, Manson TT, Dancy L, et al. Is time to flap coverage of open tibial fractures an independent predictor of flap-related complications? *J Orthop Trauma*. 2014 May;28(5):288-293.
3. Gustilo RB, Merkow RL, Templeman D. The management of open fractures. *J Bone Joint Surg Am*. 1990 Feb;72(2):299-304.
4. Kasabian AK, Karp NS. Lower-Extremity Reconstruction. In: Thorne, C., & Grabb, W. C. *Grabb and Smith's Plastic Surgery*, 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2007: Chapter 70. Online edition accessed November 28, 2014:676-678.

84. A 30-year-old man is evaluated for a hand injury after punching a wall. X-ray study shows a fracture of the fifth metacarpal neck. Which of the following findings is most likely to require surgical intervention?

- A) Angulation
- B) Callus formation
- C) Impaction
- D) Malrotation
- E) Shortening

The correct response is Option D.

Malrotation causes scissoring of the affected digit, which will adversely affect neighboring digits. This will affect activities of daily living and is an indication for operative intervention. Other indications for operative intervention include displaced intra-articular fractures, severe soft-tissue injury, unstable open fractures, segmental bone loss, and multiple fractures. Angulation is usually dorsal tip-oriented because of intrinsic and extrinsic muscle pull. A good rule of thumb is the 10, 20, 30, 40 for digits two, three, four, and five. The fourth and fifth digits have carpometacarpal joint mobility and can tolerate larger angulation. The fifth digit metacarpal may even tolerate up to 70 degrees of angulation as long as there is no extensor lag. Impaction can lead to shortening and/or angulation, which is tolerated more than rotational deformities. Similarly, shortening is well tolerated as long as there is no extensor lag. Nonoperative complications include aesthetic with loss of knuckle and possible pain in the palm from the metacarpal head. Callus formation is indicative of an old, healed fracture.

REFERENCES:

1. Bloom JM, Hammert WC. Evidence-Based Medicine: Metacarpal Fractures. *Plast Reconstr Surg*. 2014 May;133(5):1252-60.
2. Friedrich JB, Vedder NB. An Evidence-Based Approach to Metacarpal Fractures. *Plast Reconstr Surg*. 2010 Dec;126(6):2205-9.
3. Ben-Amotz O, Sammer DM. Practical Management of Metacarpal Fractures. *Plast Reconstr Surg*. 2015 Sep;136(3):370e-379e.
4. Kollitz, Hammert, Vedder, Huang. Metacarpal fractures: treatment and complications. *Hand (N Y)*. 2014 Mar; 9(1): 16–23.

85. A 23-year-old woodworker sustains an injury to the dominant left thumb that involves the loss of less than 2 cm of the distal pulp with exposed bone from a planing machine. Which of the following reconstruction methods is most likely to provide normal sensation to the volar pulp of this patient's thumb?

- A) Cross-finger flap from the long finger
- B) Islandized Moberg flap
- C) Flag flap
- D) Thenar flap
- E) Venous flow-through flap

The correct response is Option B.

The venous flow-through flap was described for small defects of the dorsum of a digit or hand where end-to-end anastomoses of the included veins on the proximal and distal edges of the flap can provide venous outflow for the digit and supply the flap. A defect from the distal, volar surface of the thumb would not have any veins large enough to use. A cross-finger flap is a classical solution to cover the volar aspect of a digit. The other mentioned flaps are also excellent options for volar thumb coverage, except for the thenar flap. The thenar flap is used for distal pulp defects of the fingers in children. The only flap that maintains the normal sensation of the thumb pulp is the Moberg flap, which advances the volar aspect of the thumb on its neurovascular pedicles. The islandized (O'Brien) modification was to make a transverse incision at the base of the thumb and dissect the neurovascular bundles to allow the flap to travel further distally, and then placing a skin graft over the proximal defect.

REFERENCES:

1. Graham DJ, Venkatramani H, Sabapathy SR. Current Reconstructive options for traumatic thumb loss. *J Hand Surg Am.* 2016 Dec;41(12):1159–1169.
2. Germann G, Sauerbier M, Rudolf KD, Hrabowski M. Management of thumb tip injuries. *J Hand Surg Am.* 2015 Mar;40(3):614–22; quiz 623.

86. A 6-month-old boy is brought to the office with a Blauth type IV (pouce flottant) thumb deficiency. Reconstruction with pollicization is planned. Which of the following is the most appropriate new function of the first palmar interosseous muscle?

- A) Abductor pollicis brevis
- B) Abductor pollicis longus
- C) Adductor pollicis
- D) Extensor pollicis longus
- E) Flexor pollicis brevis

The correct response is Option C.

The most appropriate new function of the first palmar interosseous muscle is the adductor pollicis.

Thumb deficiencies can be categorized according to the Blauth classification, ranging from hypoplasia (type I) to complete absence (type V). In deficiencies of type IIIB and greater, pollicization of the index finger is the recommended treatment.

In pollicization, the index finger is transferred on its neurovascular bundle and a new thumb carpometacarpal (CMC) joint is created using the metacarpophalangeal joint of the index finger. The tendons and muscles of the index finger are used to recreate functions of the new thumb. The extensor digitorum communis is used for the abductor pollicis longus, the dorsal interosseus becomes the abductor pollicis brevis, and the palmar/volar interosseous becomes the adductor pollicis. The extensor indicis proprius is used for the extensor pollicis longus. The flexor tendon is not typically disturbed.

REFERENCES:

1. Bates SJ, Hansen SL, Jones NF. Reconstruction of congenital differences of the hand. *Plast Reconstr Surg*. 2009 Jul;124(1 Suppl):128e-143e.
2. Light TR, Gaffey JL. Reconstruction of the hypoplastic thumb. *J Hand Surg Am*. 2010 Mar;35(3):474-479. Epub 2010 Feb 6.
3. Netscher DT, Baumholtz MA. Treatment of congenital upper extremity problems. *Plast Reconstr Surg*. 2007 Apr 15;119(5):101e-129e.
4. Soldado F, Zlotolow DA, Kozin SH. Thumb hypoplasia. *J Hand Surg Am*. 2013 Jul;38(7):1435-1444. Epub 2013 May 21.

5. Taghinia AH, Littler JW, Upton J. Refinements in pollicization: a 30-year experience. *Plast Reconstr Surg*. 2012 Sep;130(3):423d-433e.xc

87. A 53-year-old woman comes to the office after undergoing fixation of a humerus fracture 17 months ago. Physical examination shows inability to extend the wrist, fingers, and thumb. This has been present since the time of injury, without any recovery of function. Tendon transfers are planned. Transfer of which of the following muscles is most appropriate for restoration of wrist extension?

- A) Brachioradialis
- B) Flexor carpi ulnaris
- C) Flexor digitorum profundus
- D) Palmaris longus
- E) Pronator teres

The correct response is Option E.

The most appropriate muscle to transfer for restoration of wrist extension is the pronator teres.

The radial nerve can be injured as a result of humerus fracture and/or surgery as it crosses the spiral groove of the humerus. The resultant radial nerve palsy will cause inability to extend the wrist, fingers, and thumb.

Reinnervation of the muscle ideally should be completed within 12 to 18 months after injury to allow for recovery. In this patient, who has high radial nerve palsy after humerus fracture, the time following injury has been too long, so nerve repairs or nerve transfers are not a viable option, and tendon transfer is the procedure of choice.

Tendon transfer involves the use of a noncritical or expendable donor tendon to provide a missing function. The tendon to be transferred should have adequate strength and range of motion to provide the desired function. Ideally the tendon used should have synergistic action and allow for tenodesis to facilitate reeducation.

The pronator teres is a median nerve–innervated muscle that has adequate power and excursion to provide wrist extension. It is typically transferred to the extensor carpi radialis brevis (as opposed to the extensor carpi radialis longus) in these cases to provide for more centrally oriented wrist extension.

The brachioradialis is a radial nerve–innervated muscle and will not be functioning in this patient who has a high radial nerve palsy. In low radial nerve palsies, it can be used to

restore thumb extension. The brachioradialis can also be used to restore finger or wrist extension, as well as finger or thumb flexion in the appropriate patient.

The flexor carpi ulnaris would have adequate power and excursion, but it is not synergistic and it would be difficult to learn to use a wrist flexor to power wrist extension, as it provides an opposite function. This is typically used to restore finger extension, as it would take advantage of the tenodesis effect.

The flexor digitorum profundus would be synergistic with wrist extension, but it does not have independent muscle bellies and its use would require sacrifice of important finger flexor activity.

The palmaris longus does not have sufficient power to provide for wrist extension. It can be used as a transfer for thumb extension.

REFERENCES:

1. Chen A. Tendon Transfers – Radial Nerve. In: *Crucial Elements of Hand Surgery*, 2nd ed. Beredjiklian P. Chicago: American Society for Surgery of the Hand, 2008;15.
2. Ingari JV and Green DP. Radial Nerve Palsy. In: Wolfe SW, Hotchkiss RN, Pedersen WC, et al. *Green's Operative Hand Surgery*, 6th ed. Philadelphia, PA: Elsevier Churchill Livingstone; 2010;33:1075-1092.
3. Rockwell WB and Stern CA. Tendon Transfers. In: Guyuron B, Eriksson E, Persing JA, eds. *Plastic Surgery*. Philadelphia, PA: Saunders Elsevier; 2009;87:1139-1150.
4. Sammer DM, Chung KC. Tendon transfers: part I. Principles of transfer and transfers for radial nerve palsy. *Plast Reconstr Surg*. 2009;123(5):169e-177e.



88. A 30-year-old man is scheduled to undergo transhumeral amputation after unsalvageable brachial artery occlusion. A photograph is shown. Use of targeted muscle reinnervation may allow improved functional recovery by which of the following means?

- A) Better bulk and durability by preventing denervation atrophy of muscles at the amputation stump
- B) Better prosthesis control by input from median and ulnar nerve signals
- C) Better sensory detection in the prosthesis by positioning amputated nerve stumps closer to the skin closure
- D) More precise control of an osseointegrated body-powered prosthesis
- E) Preservation of greater bony length in the amputation stump

The correct response is Option B.

A body-powered prosthesis uses motion of remaining joints, such as the gleno-humeral and scapulo-thoracic joints, to control an upper extremity prosthesis. Targeted muscle reinnervation (TMR) would not affect function of a body-powered prosthesis.

TMR positions amputated nerve stumps well within the remaining muscle and far from the cutaneous closure. Current prosthetics are not yet able to detect sensation and transmit this to the patient. Having nerve stumps near the amputation closure site increases the risk for neuroma pain.

TMR has not been shown to decrease denervation atrophy of residual upper extremity muscles.

TMR has gained increasing acceptance in the treatment of patients who have undergone or will undergo upper extremity amputation. Resected nerves, such as the median and ulnar

nerves, can be coapted to nerve branches to remaining muscles, such as the pectoralis and deltoid. Transcutaneous EMG detectors are positioned over these reinnervation sites to detect nerve signal, which a myoelectric prosthesis can then use to better control distal joints.

TMR does not affect the amount of bony length that can be preserved in an amputation.

REFERENCES:

1. Dumanian GA, Ko JH, O'Shaughnessy KD, et al. Targeted reinnervation for transhumeral amputees: current surgical technique and update on results. *Plast Reconstr Surg*. 2009 Sep;124(3):863-9.
2. Souza JM, Cheesborough JE, Ko JH, et al. Targeted muscle reinnervation: a novel approach to postamputation neuroma pain. *Clin Orthop Relat Res*. 2014 Oct;472(10):2984-90.
3. Hijjawi JB, Kuiken TA, Lipschutz RD, et al. Improved myoelectric prosthesis control accomplished using multiple nerve transfers. *Plast Reconstr Surg*. 2006 Dec;118(7):1573-8.
4. Solarz MK, Thoder JJ, Rehman S. Management of Major Traumatic Upper Extremity Amputations. *Orthop Clin of North Am*. 2016; 47(1):127–36.

89. A 50-year-old man comes for evaluation 8 weeks after dislocating the right knee when he tripped on a railroad tie at work. Physical examination shows a right footdrop and dysesthesia along the lateral lower leg and dorsolateral foot. Electromyography and nerve conduction studies are most likely to confirm injury to which of the following nerves?

- A) Femoral
- B) Peroneal
- C) Plantar
- D) Sural
- E) Tibial

The correct response is Option B.

The peroneal nerve innervates the tibialis anterior and extrinsic extensors of the toes, thereby extending the ankle. Paralysis of these muscles leads to footdrop. The sural nerve is a cutaneous nerve about the lateral ankle. The tibial nerve innervates the ankle and toe flexors, and paralysis of this nerve would not lead to a footdrop. The femoral nerve runs in the anterior thigh and is not likely to be affected by a knee dislocation; it innervates the extensors of the leg at the knee. The plantar nerves are the terminal branches of the tibial nerve and provide intrinsic innervation to the foot and sensation to the medial and lateral plantar foot.

REFERENCES:

1. Nath RK, Lyons AB, Paizi M. Successful management of foot drop by nerve transfers to the deep peroneal nerve. *J Reconstr Microsurg*. 2008 Aug;24(6):419-427. Epub 2008 Aug 4.
2. Stewart JD. Foot drop: where, why and what to do? *Pract Neurol*. 2008 Jun;8(3):158-169.

90. A 47-year-old man is brought to the emergency department after sustaining a stab wound injury to the left shoulder. Physical examination shows isolated loss of deltoid function. The injured nerve is supplied by which of the following nerve roots?

- A) C5 through C6
- B) C6 through C7
- C) C7 only
- D) C7 through T1
- E) T1 only

The correct response is Option A.

The deltoid muscle receives motor innervation from the axillary nerve. The axillary nerve receives its contributions from C5 and C6 roots. These roots come together to form the superior trunk, which splits into anterior and posterior divisions. The axons heading to the axillary nerve travel in the posterior division, which joins the other posterior divisions from middle and inferior trunks to form the posterior cord. The axillary nerve arises from the posterior cord and travels laterally to innervate the deltoid muscle.

C7 is the primary innervation to the latissimus dorsi and triceps, and contributes to digital extension as well. C8 and T1 primarily serve the hand, providing intrinsic muscle innervation.

REFERENCES:

1. Neligan P. *Plastic Surgery*, Volume 6, 3rd edition. Philadelphia: Elsevier: 2012;695.
2. Petrucci FS, Morelli A, Raimondi PL. Axillary nerve injuries--21 cases treated by nerve graft and neurolysis. *J Hand Surg Am.* 1982 May;7(3):271-8.
3. Leinberry CF, Wehbe MA. Brachial plexus anatomy. *Hand Clinics.* 2004 Feb;20(1):1-5.
4. Baltzer HL, Spinner RJ, Bishop AT, Shin AY. Axillary Nerve Reconstruction: Anterior-Posterior Exposure With Sural Nerve Cable Graft Pull-Through Technique. *Tech Hand Up Extrem Surg.* 2015 Dec;19(4):168-75.

91. A 2-year-old boy is treated for congenital constriction band of the left upper extremity with distal edema. The child undergoes excision of 50% of the circumferential constriction band with direct closure. This intervention is most likely to have which of the following effects on the edema of the distal limb?

- A) Gradual improvement during childhood development
- B) Gradual worsening during childhood development
- C) Significant improvement within a few weeks of surgery
- D) Significant worsening during childhood development
- E) No effect

The correct response is Option C.

Congenital constriction band syndrome is a sporadic condition with an incidence varying from 1:1200 to 1:15,000 live births. There is a significant predilection for the upper extremities and distal limbs. The two main objectives for the treatment of congenital constriction band syndrome are improvement of function and improvement of cosmetic appearance. Different surgical techniques, such as Z-plasty, have been described and used for decades; however, direct closure after the excision of the constricting band is a simple yet effective treatment.

With complete circumferential constriction bands, it is recommended that a two-stage correction approach be used. At the first operation, one-half of the circumference is excised; the other half can be excised after 3 to 6 months. This will avoid any problems to the distal circulation in the limb, which may already be compromised. Edema, when present, will significantly improve within a few weeks of the first surgery.

REFERENCES:

1. Choulakian MY, Williams HB. Surgical correction of congenital constriction band syndrome in children: Replacing Z-plasty with direct closure. *Can J Plast Surg*. 2008;16(4):221-3.
2. Hung NN. Congenital constriction ring in children: sine plasty combined with removal of fibrous groove and fasciotomy. *J Child Orthop*. 2012 Jul; 6(3): 189–197.

92. Which of the following Zone II four-strand flexor tendon repair configurations demonstrates the greatest overall fatigue strength and gap resistance in biomechanical testing?

	Suture size	Suture placement within tendon	Type of stitch
A.	3-0	Dorsal	Locking
B.	4-0	Volar	Grasping
C.	3-0	Volar	Locking
D.	4-0	Dorsal	Locking
E.	3-0	Dorsal	Grasping

- A) A
- B) B
- C) C
- D) D
- E) E

The correct response is Option A.

Increasing the suture caliber has shown to increase the force in static testing and fatigue strength in dynamic testing. The use of 3-0 polyethylene terephthlate fiber suture increased the fatigue strength compared with 4-0 sutures by two to three times.

The placement of the suture dorsally has been shown to increase the strength of the repair by two to four times, and is more environmentally favored because of a decreased risk for interference with the synovial fluid.

It has been shown that locking loops improve force and gap resistance compared with grasping loops in flexor tendon repair. Statistically significant improvement was observed with the locking loop technique for ultimate and gap strength values using 2-0 core suture and ultimate strength values using 3-0 core suture.

REFERENCES:

1. Griffin M, Hindocha S, Jordan D, et al. An Overview of the Management of Flexor Tendon Injuries. *Open Orthop J.* 2012;6:28-35.

2. Starr HM, Snoddy M, Hammond KE, Seiler JG. Flexor Tendon Repair Rehabilitation Protocols: A Systematic Review. *J Hand Surg Am.* 2013 Sep;38(9):1712-7.e1-14.
3. Hatanaka H, Manske PR. Effect of suture size on locking and grasping flexor tendon repair techniques. *Clin Orthop Relat Res.* 2000 Jun;(375):267-74.
4. Soejima O, Diao E, Lotz JC, Hariharan JS. Comparative mechanical analysis of dorsal versus palmar placement of core suture for flexor tendon repairs. *J Hand Surg Am.* 1995 Sep;20(5):801-7.

93. A 54-year-old man comes to the office because of an injury to the long finger of the dominant right hand sustained when it was pinched in a machine at work. Physical examination shows a 1.3-cm loss of pulp tissue with no exposed bone. To preserve function and sensation in the digit, which of the following is the most appropriate intervention?

- A) Amputation at the distal interphalangeal joint
- B) Cross-finger flap
- C) Moist dressings
- D) Thenar flap
- E) Volar V-to-Y advancement flap

The correct response is Option C.

Fingertip injuries are one of the most common problems encountered in hand surgery. The long finger is the most common finger involved. The patient's age, occupation, and compliance with treatment should be considered when determining treatment. When possible, if the patient has no exposed bone or only a small area of exposed bone, treatment with dressing changes offers excellent results. There is no donor site morbidity, scarring is often minimal, and return of sensation is generally excellent. Patients, however, need to be cautioned that a prolonged period of dressing changes is required, often lasting 3 to 6 weeks.

Amputation at the distal interphalangeal joint would result in loss of function of the profundus tendon and grip weakness. Neurovascular island flaps and V-to-Y advancement flaps offer excellent closure options when digital length needs to be preserved and there is significant exposure of bone. However, with these flaps there is a donor defect and decreased sensation. Care must be taken when using a cross-finger flap or thenar flap in older patients to avoid contractures and stiffness of the digits.

REFERENCES:

1. Panattoni JB, De Ona IR, Ahmed MM. Reconstruction of fingertip injuries: surgical tips and avoiding complications. *J Hand Surg Am*. 2015 May;40(5):1016-24.
2. Krauss EM, Lalonde DH. Secondary healing of fingertip amputations: a review. *Hand (N Y)*. 2014 Sep;9(3):282-8

94. A 56-year-old woman is evaluated for the sudden, painless inability to flex the interphalangeal joint of the right thumb. Medical history includes rheumatoid arthritis. There is no history of antecedent trauma to the hand. Physical examination shows that flexor pollicis longus tenodesis is absent. X-ray studies show an osteophyte along the volar aspect of the scaphoid. Which of the following is the most appropriate next step in management?

- A) Anterior interosseous nerve decompression
- B) Extensor indicis proprius (EIP) tendon transfer
- C) Palmaris longus tendon grafting with osteophyte resection
- D) Primary tendon repair
- E) Observation

The correct response is Option C.

This patient has an atretic flexor pollicis longus (FPL) tendon rupture due to a scaphoid osteophyte. This is termed a Mannerfelt lesion. FPL ruptures are the most common flexor tendon ruptures in patients with rheumatoid arthritis. The underlying pathophysiology is secondary to osteophyte formation along the volar aspect of the scaphoid. Surgical treatment can include tendon transfer, tendon grafting, or interphalangeal joint fusion to correct the deformity. Treatment should include exploration of the carpal tunnel with resection of the underlying osteophyte to avoid additional attritional tendon ruptures. Due to the fraying of the tendon caused by the osteophyte, primary repair of the FPL tendon is not typically feasible. Treatment options include FDS tendon transfer and palmaris longus tendon graft. EIP tendon transfer is typically employed for extensor tendon ruptures in rheumatoid patients.

An incomplete anterior interosseous nerve (AIN) palsy can mimic FPL rupture. Physical examination allows differentiation between AIN palsy and FPL rupture. In the setting of AIN palsy, tenodesis of the IP joint will still be present with MCP hyperextension of the thumb. Initial management of AIN neuropathy consists of observation and splinting. Nerve conduction studies can be of diagnostic as well as prognostic value. Surgical exploration and decompression of the anterior interosseous nerve is a consideration after failure of nonoperative management of a compression neuropathy.

REFERENCES:

1. Mannerfelt L and Norman O. Attrition ruptures of flexor tendons in rheumatoid arthritis caused by bony spurs in the carpal tunnel. A clinical and radiological study. *J Bone Joint Surg Br* 1969; 51: pp. 270-277
2. O'Sullivan MB, Singh H, Wolf JM. Tendon Transfers in the Rheumatoid Hand for Reconstruction. *Hand Clin.* 2016 Aug;32(3):407-16.
3. Simmen BR, Kolling C, and Herren DB. The management of the rheumatoid wrist. *Curr Orthop.* 2007;21:344-357.



95. An 18-year-old female gymnast comes to the office because of the sudden onset of pain, swelling, and ecchymosis of the right ring finger that began 3 days ago while she was practicing hand-only climbing on a rock-wall. Physical examination shows tenderness over the palmar aspect of the finger at the proximal phalanx. Isolated flexion at the distal interphalangeal joint and flexion of the digit at the proximal interphalangeal joint while the remaining digits are held in hyperextension are intact. The patient can fully flex and extend the finger, and the proximal interphalangeal joint is stable to stress. X-ray study is shown. Which of the following is the most likely cause of the findings in this patient?

- A) Avulsion of the flexor profundus tendon insertion
- B) Dislocation of the proximal interphalangeal joint
- C) Rupture of the A2 pulley
- D) Stenosing tenosynovitis
- E) Volar plate avulsion fracture

The correct response is Option C.

Stenosing tenosynovitis (trigger finger) typically results in pain over the metacarpophalangeal (MCP) joint associated with crepitation, clicking, or locking of the digit with altered motion during the flexion-extension arc.

Dislocation of the proximal interphalangeal (PIP) joint could account for the symptoms; however the imaging shows the joint to be congruent and the exam did not reveal any instability.

An injury originally identified in rock climbers, rupture of the A2 pulley has been increasingly recognized in other sports and activities. The forceful flexion of the flexor profundus and superficialis tendons with the PIP joint flexed 90 degrees and the distal interphalangeal (DIP) joint extended (the “crimp” position) placed loads exceeding the tolerance of the A2 across the palmar PIP joint, resulting in rupture of the underlying pulley. Treatment for an isolated pulley injury includes rest, ice, anti-inflammatory drugs, and external support through use of a ring splint.

Avulsion of the profundus tendon (jersey finger) typically presents with loss of flexion of the DIP joint. Pain may be present both at the avulsion site and over the retracted end of the tendon. This patient’s examination shows the profundus function to be intact.

Volar (palmar) plate avulsion injuries present with pain and swelling at the PIP joint, but the joint will often be painful to stress in hyperextension and potentially, if the injury extends dorsally into the collateral ligaments, it may exhibit instability. X-ray imaging often demonstrates a small bony avulsion fragment (absent in this patient) along the palmar PIP joint.

REFERENCES:

1. Zafonte B, Rendulic D, Szabo R. Flexor Pulley System: Anatomy, Injury, and Management. *J Hand Surg Am.* 2014 Dec;39(12):2525-32; quiz 2533.
2. Lowrie AG, Lees VS. Considerations in the surgical use of the flexor sheath and pulley system. *J Hand Surg Eur Vol.* 2014 Jan;39(1):54-9.
3. Yamaguchi T, Ikuta Y. Climber's Finger. *Hand Surg.* 2007;12(2):59-65.

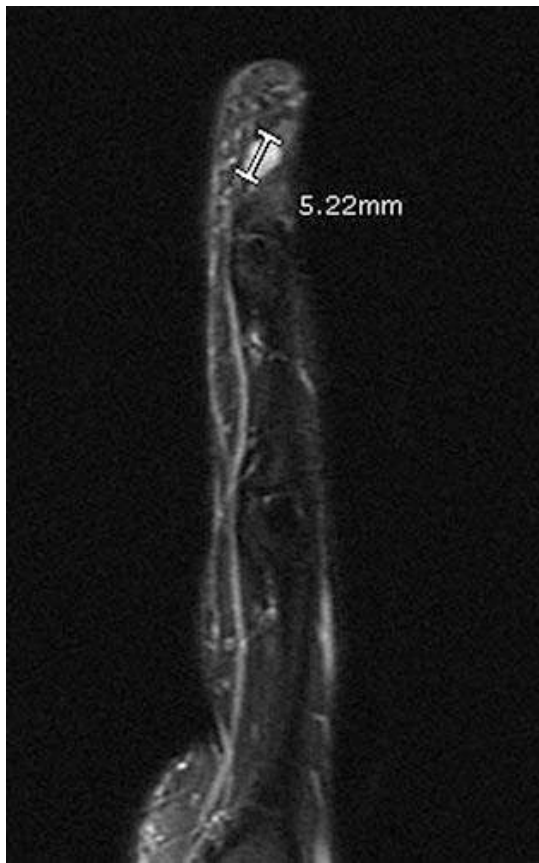
96. A 40-year-old man sustains an avulsion of the weight-bearing portion of the medial heel. Coverage with an instep flap is planned. Sensation to this flap is provided by which of the following?
- A) Lateral plantar nerve from the deep peroneal nerve
 - B) Lateral plantar nerve from the superficial peroneal nerve
 - C) Lateral plantar nerve from the sural nerve
 - D) Medial plantar nerve from the deep peroneal nerve
 - E) Medial plantar nerve from the tibial nerve

The correct response is Option E.

The medial plantar artery flap, or instep flap, provides sensate, full-thickness glabrous skin and subcutaneous tissue that can be transferred as a pedicled or free flap. The tissue is well suited for weight-bearing areas of the foot but has also been used as a free tissue transfer for palmar defects. Because the instep donor site is non-weight-bearing, the donor site can be covered with a skin graft. The innervation of the medial instep flap comes from the medial plantar nerve, a branch of the tibial nerve.

REFERENCES:

1. Mourougayan V. Medial plantar artery (instep flap) flap. *Ann Plast Surg.* 2006 Feb;56(2):160-3.
2. Scheufler O, Kalbermatten D, Pierer G. Instep free flap for plantar soft tissue reconstruction: indications and options. *Microsurgery.* 2007;27(3):174-80.
3. Wan DC, Gabbay J, Levi B, Boyd JB, Granzow JW. Quality of innervation in sensate medial plantar flaps for heel reconstruction. *Plast Reconstr Surg.* 2011 Feb;127(2):723-30.



97. A 13-year-old girl is brought for evaluation because of a 4-month history of severe pain of the tip of the right index finger. There is no history of trauma. On examination, the finger appears normal with no visible swelling or discoloration. The pain is exacerbated by local pressure when the patient writes and during her weekly swimming lessons. MRI (T2-weighted) image is shown. Which of the following is the most likely diagnosis?

- A) Digital fibroma
- B) Giant cell tumor
- C) Glomus tumor
- D) Neuroma
- E) Venous malformation

The correct response is Option C.

This lesion is a glomus tumor. Glomus tumors are benign hamartomas originating from the glomus body, a structure comprised of vascular and neural elements that is responsible for thermoregulation in the skin. These often inconspicuous tumors present with pain, point tenderness, and sensitivity to cold. X-ray studies may show cortical erosion of the bone adjacent to the lesion, and ultrasonography can provide confirmation. MRI is the most accurate imaging modality and the tumor appears as a bright, discrete mass on T2-weighted images.

Digital fibroma is a cutaneous fibroblastic proliferation and would be visible. It rarely causes pain and would not enhance on T2-weighted MRI imaging. Neuroma can cause focal pain as described in the vignette, but the enhancing focal lesion on the T2-weighted MRI effectively rules out solid masses such as neuroma or giant cell tumor (which is common but rarely causes pain or cold intolerance). Venous malformation would enhance on T2-weighted MRI, but would typically present with swelling and would not be as well circumscribed as the lesion shown here.

REFERENCES:

1. Hazani R, Houle JM, Kasdan ML, Wilhelmi BJ. Glomus tumors of the hand. *Eplasty* 2008; 8:e48.
2. McDermott EM, Weiss AP. Glomus tumors. *J Hand Surg Am.* 2006; 3:1397-1400.
3. Tang CY, Tipoe T, Fung B. Where is the lesion? Glomus tumors of the hand. *Arch Plast Surg* 2013; 40:492-495.

98. A patient with severe traumatic brachial plexus root avulsion injury is scheduled to undergo functioning free muscle transfer for simultaneous restoration of both elbow flexion and finger flexion, in addition to other reconstructive procedures. Use of which of the following muscles is most appropriate for this purpose?

- A) Gracilis
- B) Pectoralis major
- C) Rectus abdominus
- D) Serratus anterior
- E) Trapezius

The correct response is Option A.

The gracilis muscle is the most commonly described muscle for use as a free functioning muscle in reconstruction of upper extremity function following brachial plexus injury. Common options for use in these reconstructions include the gracilis, latissimus dorsi, rectus femoris, and vastus lateralis. The gracilis muscle has good excursion, size, and length, but does lack strength compared with some other muscle options.

The rectus abdominis, serratus anterior, and trapezius muscles have not been described for free functioning muscle transfer in the upper extremity. Though the pectoralis major muscle was described as a free functioning muscle transfer by Manktelow and McKee in 1978, it has not been a commonly used muscle.

REFERENCES:

1. Fischer JP, Elliott RM, Kozin SH, Levin LS. Free function muscle transfers for upper extremity reconstruction: a review of indications, techniques, and outcomes. *J Hand Surg Am.* 2013;38(12):2485-2490.
2. Doi K, Sakai K, Kuwata N, Ihara K, Kawai S. Double free-muscle transfer to restore prehension following complete brachial plexus avulsion. *J Hand Surg Am.* 1995;20:408-414.
3. Spinner RJ, Shin AY, Hebert-Blouin M-N, et al. Traumatic brachial plexus injury. In: Wolfe SW, Pedersen WC, Hotchkiss RN, Kozin SH, eds. *Green's Operative Hand Surgery*. 6th ed. Philadelphia: Churchill Livingstone; 2011:1236-1294.



99. A 14-month-old girl is evaluated for surgical management of the condition shown in the photograph. Which of the following is the most appropriate classification of this congenital difference?

- A) Duplication
- B) Failure of differentiation
- C) Failure of formation
- D) Overgrowth
- E) Undergrowth

The correct response is Option C.

The image shown is a patient with a typical cleft hand, or ectrodactyly. This is classified as a Swanson type I (failure of formation) congenital difference of the upper extremity. This deformity is caused by a longitudinal growth deficiency of one or more central digits. This condition may have a genetic underpinning and is most commonly inherited in autosomal dominant fashion with approximately 70% penetrance.

Ectrodactyly presents with significant heterogeneity. Many patients with cleft hand do not require any type of surgical management. The most important determinants of surgical management are establishment of an appropriate thumb to index webspace for gripping and grasping and release of syndactyly. Surgical management includes elevation of skin flaps, transposition of the index finger to the ulnar side of the cleft, and creation of a web space between the thumb and index finger.

Cleft hand is classified with the Thumb-Index Classification of Central Deficiency proposed by Manske. This generally guides the treatment approach in conjunction with management of syndactyly. A myriad of techniques have been employed based upon the severity of the webspace contraction and the presence of syndactyly adjacent to the cleft.

Type	Web Description	Characteristics
I	Normal	
IIA	Mild narrowing	Thumb web mild narrowing
IIB	Severe narrowing	Thumb web severe narrowing
III	Syndactyly	Thumb and index rays are syndactylized
IV	Merged	Index ray is suppressed, thumb web space is merged with the cleft
V	Absent	Thumb elements suppressed, ulnar rays remain, and thumb web space not present

REFERENCES:

1. Manske PR, Halikis MN. Surgical classification of central deficiency according to the thumb web. *J Hand Surg Am.* 1995;20: 687–697.

2. Kozin SH, Zlotolow DA. Common Pediatric Congenital Conditions of the Hand. *Plast Reconstr Surg*. 2015 Aug;136(2):241e-257e.
3. Upton J, Taghinia AH. Correction of the typical cleft hand. *J Hand Surg Am*. 2010 Mar;35(3):480-5

100. A 62-year-old woman is evaluated for acute rupture of an extensor tendon after undergoing closed treatment of a nondisplaced distal radius fracture 6 months ago. The tendon most likely to be involved is located in which of the following extensor compartments?

- A) First
- B) Second
- C) Third
- D) Fourth
- E) Fifth

The correct response is Option C.

Spontaneous rupture of the extensor pollicis longus (EPL) tendon is reported to occur in approximately 0.3 to 5% of nondisplaced or minimally displaced distal radius fractures, but it can also occur without trauma or in patients with inflammatory conditions such as rheumatoid arthritis. This is thought to arise from a loss of vascularity and atrophic changes in the compartment, and, because the tendon substance is usually degenerated, primary repair of the tendon is usually not possible. Tendon transfer using the extensor indicis proprius is the standard of care. Spontaneous rupture of other extensor tendons can occur in association with other conditions (e.g., rheumatoid arthritis), but would be exceedingly uncommon in the clinical scenario presented. The EPL passes through the third extensor compartment. Extensor tendon-compartment relationships include the following:

First - abductor pollicis longus, extensor pollicis brevis

Second - extensor carpi radialis longus, extensor carpi radialis brevis

Third - extensor pollicis longus

Fourth - extensor digitorum communis, extensor indicis proprius

Fifth - extensor digiti minimi

Sixth - extensor carpi ulnaris

REFERENCES:

1. Roth KM, Blazar PE, Earp BE, et al. Incidence of extensor pollicis longus tendon rupture after nondisplaced distal radius fractures. *J Hand Surg Am.* 2012; 37:942-947.
2. Kim CH. Spontaneous rupture of the extensor pollicis longus tendon. *Arch Plast Surg.* 2012; 39:680-682.

Section 3: Craniomaxillofacial



101. A 72-year-old man comes to the office for evaluation of a 2-cm growth over the lower half of his nose that has been growing slowly during the past 15 years. A photograph is shown. Medical history includes acne rosacea. Physical examination shows a broad, exophytic mass. Which of the following is the most appropriate management?

- A) Application of 5-fluorouracil
- B) Direct excision and coverage with a forehead flap
- C) Direct excision and coverage with a skin graft
- D) Direct excision and healing by secondary intention
- E) Observation only

The correct response is Option D.



Rhinophyma occurs on the far end of progressive acne rosacea involving the sebaceous glandular overgrowth of the skin. It most commonly occurs on the nose but phymas can occur elsewhere on the face.

In early stages, rhinophyma can be treated with isotretinoin and antibiotics; however, in advanced states it needs to be resected. Ablation modalities include dermabrasion, carbon dioxide laser excision, scalpel excision, or a combination of techniques. Since the procedure resects the skin to mid-dermis, skin grafting or other coverage is unnecessary and can lead to unsatisfactory aesthetic results. The best option is excision with secondary epithelialization.

REFERENCES:

1. Ferneini EM, Banki M, Paletta F, Ferneini CM. Surgical Management of Rhinophyma: A case report and review of literature. *Conn Med.* 2014 Mar;78(3):159-60.
2. Madan V, Ferguson JE, August PJ. Carbon dioxide laser treatment of rhinophyma: A review of 124 patients. *Br J Derm.* 2009 161: 814-818.
3. Bogetti P, Boltri M, Spagnoli G, Dolcet M. Surgical treatment of rhinophyma: a comparison of techniques. *Aesthetic Plast Surg.* 2002 Jan-Feb;26(1):57-60.



102. The patient shown in the photograph is most likely to have which of the following comorbidities?

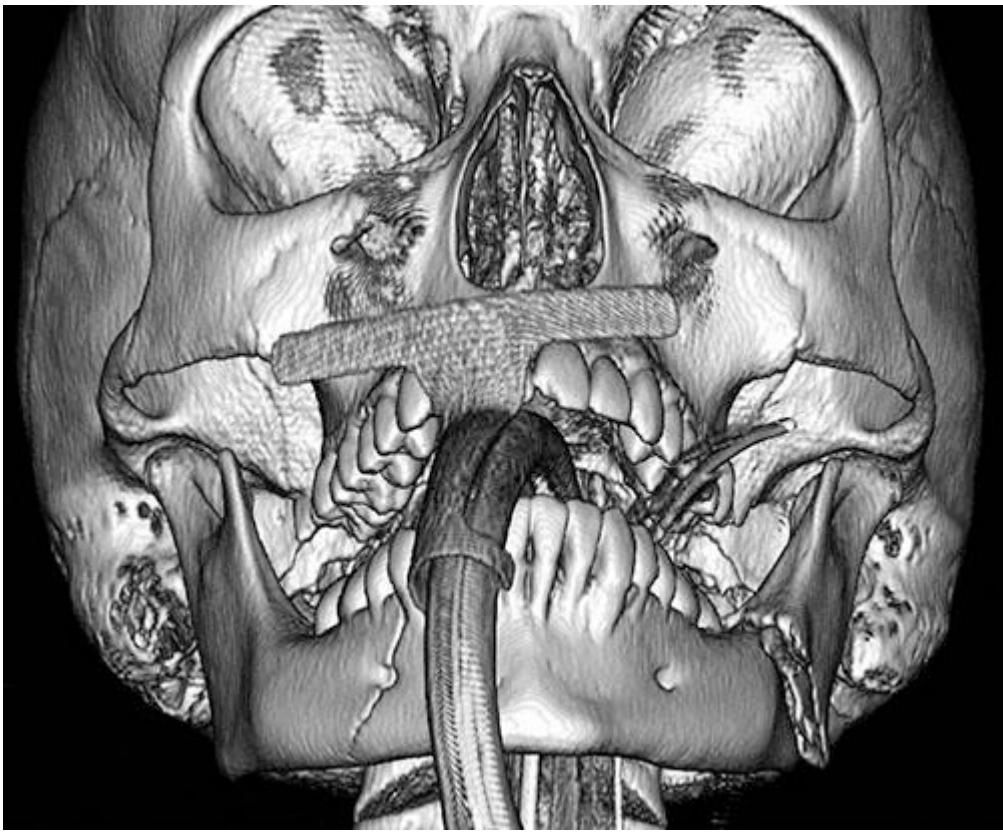
- A) Anosmia
- B) Craniosynostosis
- C) Epiphora
- D) Sensorineural hearing loss
- E) Velopharyngeal dysfunction

The correct response is Option C.

The patient pictured has a rare craniofacial (Tessier No. 4) cleft. Rare craniofacial clefts are characterized by variable soft-tissue and bony involvement. This patient has a cleft lip that begins lateral to the philtral column and courses laterally to the alar margin. Additionally, this patient has soft-tissue deficiency of the left medial malar region, as well as medial lower lid malposition and medial canthal dystopia. Of all of the options given, these findings suggest an increased risk for nasolacrimal duct abnormalities or inferior canalicular system malposition. Velopharyngeal dysfunction is common in patients with cleft lip and palate. Anosmia can be present in midline craniofacial anomalies, such as craniofrontonasal dysplasia. Rare craniofacial (Tessier No. 4) clefts are not associated with sensorineural hearing loss or craniosynostosis.

REFERENCES:

1. Horoz U, Kuroki T, Sato N, et al. A New Surgical Approach for Tessier No. 4 Facial Cleft Reconstruction: Lip-Rescue Flap. *J Craniofac Surg*. 2016 Nov;27(8):2138-2140.
2. Longaker MT, Lipshutz GS, Kawamoto HK Jr. Reconstruction of Tessier no. 4 clefts revisited. *Plast Reconstr Surg*. 1997 May;99(6):1501-7.



103. A 16-year-old girl is brought to the emergency department after sustaining fractures to the mandible in a rollover motor vehicle collision. She is intubated during the primary survey because of her critical airway. A CT scan is shown. Which of the following is the most appropriate treatment of this fracture pattern?

- A) Maxillomandibular fixation only
- B) Observation and soft diet
- C) Open reduction and internal fixation of both the right body and the left angle fractures
- D) Open reduction and internal fixation of the right body fracture only
- E) Secondary mandible reconstruction after 6 weeks

The correct response is Option C.

This CT scan shows right–body and left–angle fractures, both with clinically significant displacement. Modern facial fracture management dictates early primary reduction and repair; therefore observation and soft diet without surgery is incorrect, as is avoiding disturbance of the mandible and allowing 6 weeks of bone healing. Since she has reached the age of skeletal maturity permanent titanium hardware is an accepted modality of treatment; therefore it is incorrect to avoid hardware and rely on non-reduced maxillomandibular fixation. In addition, an angle fracture cannot typically be treated with maxillomandibular fixation alone, but requires a Champy plate or more rigid fixation. Open reduction and internal fixation of the right–body fracture, without repairing the left angle is incorrect, as Champy lines do not preclude the need for fixation. Open reduction and internal fixation of both the right body and the left angle fractures is correct, as both fractures need to be reduced, and then fixated, for the best chance of restoring occlusion.

REFERENCES:

1. Ellis E, Miles BA. Fractures of the mandible: a technical perspective. *Plast Reconstr Surg.* 2007 Dec;120(7 Suppl 2):76S-89S.
2. Ellis E, Walker LR. Treatment of mandibular angle fractures using one noncompression miniplate. *J Oral Maxillofac Surg.* 1996 Jul;54(7):864-71; discussion 871-2.
3. Sharabi SE, Koshy JC, Thornton JF, Hollier LH Jr. Facial fractures. *Plast Reconstr Surg.* 2011 Feb;127(2):25e-34e.
4. Stacey DH, Doyle JF, Mount DL. Management of mandible fractures. *Plast Reconstr Surg.* 2006 Mar;117(3):48e-60e.



104. A full-term baby is born via cesarean delivery because of a prenatally diagnosed mass in the posterior neck. An MRI is shown. After birth, there is no airway compromise. Which of the following is the most appropriate next step in management?

- A) Administration of propranolol
- B) Incisional biopsy
- C) Sclerotherapy
- D) Surgical resection
- E) Observation only

The correct response is Option C.

This is a macrocystic lymphatic malformation (LM) that was prenatally diagnosed. Former terms for this malformation include *cystic hygroma*. The most important management issue is control of the airway, and sometimes these children have to be delivered by EXIT procedures. After delivery, the airway should be evaluated and secured before making management decisions.

While some macrocystic LMs can be resected, this is a risky procedure in a neonate, and this LM extends toward midline structures. Sclerotherapy can be performed in neonates and is now the first choice of treatment.

Infantile fibrosarcoma appears different from LM on MRI. Infantile fibrosarcomas appear as heterogeneous vascular masses and not as a cystic structure.

Propranolol is efficacious in the treatment of problematic infantile hemangiomas. Infantile hemangiomas do not start proliferating until after birth, so this is not an infantile hemangioma.

A congenital hemangioma would also appear as a vascular heterogeneous mass rather than a cystic structure, and there is no evidence that congenital hemangiomas respond to propranolol therapy.

REFERENCES:

1. Cho BC, Kim JB, Lee JW, et al. Cervicofacial lymphatic malformations: A retrospective review of 40 cases. *Arch Plast Surg*. 2016 Jan;43(1):10-8.
2. Tu JH, Do HM, Patel V, et al. Sclerotherapy for lymphatic malformations of the head and neck in the pediatric population. *J Neurointerv Surg*. 2016 Oct 5.
3. Ud Din N, Minhas K, Shamim MS, et al. Congenital (infantile) fibrosarcoma of the scalp: a case series and review of literature. *Childs Nerv Syst*. 2015 Nov;31(11):2145-9.

105. An 80-year-old man presents with floor of mouth cancer on the right side. In addition to the 1-cm area of ulceration, there is a hard, warm, nonmobile, painful mass in the submandibular area. This mass most likely originated from which of the following types of tissue?

- A) Bone
- B) Fat
- C) Muscle
- D) Nerve
- E) Salivary

The correct response is Option E.

The submandibular gland duct, also known as the Wharton duct, ends in the area of the floor of the mouth and is typically blocked when cancer invades this area. As a result, there is backup of salivary content, the gland enlarges, becomes firm and painful, and can even become infected. This event has no prognostic implications. However, an enlarged node, such as the perifacial nodes, can mimic this finding and can upstage a cancer patient. If a bimanual examination of the gland cannot be performed because of the patient's pain, a CT scan is easily confirmatory. In general, lymph nodes are mobile, with the rare exception of external bony erosion. Nonetheless, a complete head and neck physical examination can be key to interpreting the findings described.

Bony expansion from a floor-of-mouth cancer is possible, but will not usually present as a painful mass. In general, fat is not involved. Nerve involvement can also occur, and perineural invasion in the lingual nerve can cause its enlargement, but not with this presentation. A sublingual infection or hematoma (e.g., Ludwig angina) can present with what is typically a swollen bilateral submandibular mass, as the infection/abscess extends below the mylohyoid muscle. This process can cause immediate airway compromise and many recommend an emergent tracheostomy. This pathology is almost always related to bacterial infections of the mouth, most commonly related to dental caries.

REFERENCES:

1. Wong DW, Kamisetty A, Lowe D, Rogers SN. Frequency and outcomes of submandibular gland obstruction following resection of squamous cell carcinomas in the vicinity of the submandibular duct. *Ann R Coll Surg Engl.* 2014 Nov;96(8):602-5.
2. Agarwal AK, Kanekar SG. Submandibular and sublingual spaces: diagnostic imaging and evaluation. *Otolaryngol Clin North Am.* 2012 Dec;45(6):1311-23.

106. A 7-year-old girl with a history of cleft lip and palate is brought to the office because of hyponasal speech, which is confirmed by the speech language pathologist. The patient and her family report that people have no trouble understanding her speech. Medical history includes primary cheiloplasty, primary rhinoplasty, primary palatoplasty, and posterior pharyngeal flap. Which of the following is the most appropriate next step in management?

- A) CT scan of the face
- B) Genetics referral
- C) MRI of the palate
- D) Polysomnography
- E) Swallow study

The correct response is Option D.

Hyponasal speech describes the sound production when not enough air gets through the velopharyngeal sphincter, resulting in a muffled nasal voice, as if someone was holding his or her nose. This is in contrast to hypernasal speech, where the velopharyngeal sphincter is incompetent, resulting in leakage of excess air with an airy nasal voice. In this scenario, the most likely reason for hyponasal speech is an exuberant posterior pharyngeal flap that is blocking too much of the velopharyngeal complex. The two reasons to treat this are for speech issues that prevent normal interaction and obstructive sleep apnea (OSA). Given that the patient has no problems with people understanding her speech, the most reasonable next step among the choices is polysomnography to evaluate for OSA.

None of the other choices are appropriate workups for patients with hyponasality. Some centers may proceed with video nasendoscopy to look at the anatomy, but this was not one of the answer choices.

REFERENCES:

1. Gart MS, Gosain AK. Surgical management of velopharyngeal insufficiency. *Clin Plast Surg*. 2014 Apr;41(2):253-70.
2. Hopper RA, Tse R, Smartt J, et al. Cleft palate repair and velopharyngeal dysfunction. *Plast Reconstr Surg*. 2014 Jun;133(6):852e-864e.

3. Sullivan SR, Marrinan EM, Mulliken JB. Pharyngeal flap outcomes in nonsyndromic children with repaired cleft palate and velopharyngeal insufficiency. *Plast Reconstr Surg*. 2010 Jan;125(1):290-8.



107. A 3-year-old boy is brought for evaluation of a right frontotemporal cranial defect. A photograph is shown. Which of the following materials is most appropriate for reconstruction?

- A) Autologous bone
- B) Bone morphogenetic protein (BMP)
- C) Calcium phosphate paste
- D) Porous polyethylene
- E) Titanium mesh

The correct response is Option A.



Autologous bone is the most appropriate material for inlay cranioplasty for a child this age. Each of the other options has been used in the pediatric population, but they carry important limitations. Porous polyethylene can be used to reconstruct large cranial defects, but is expensive to fabricate, has the potential to become unstable in a growing cranium, and has a higher overall infection rate than autologous bone. Bone morphogenetic protein (BMP) has shown promise in animal models for inducing bone formation in large cranial defects, but it is expensive for a defect of this size; it is a powerful mitogen and can result in dural ossification and, potentially, induction of tumor growth. Calcium phosphate pastes also have been advocated but are very expensive and for a defect of this size, the long-term potential osseointegration is dubious. Furthermore, the risk of infection and/or implant extrusion is higher. Titanium mesh may be appropriate for some children with limited life expectancy or functional needs, but these implants can be bent, offer limited impact resistance, and have a higher overall rate of complications than autologous bone.

REFERENCES:

1. Smith DM, Afifi AM, Cooper GM, et al. BMP-2-based repair of large-scale calvarial defects in an experimental model: regenerative surgery in cranioplasty. *J Craniofac Surg*. 2008; 19:1315-1322.
2. Fu KJ, Barr RM, Kerr ML, et al. An outcomes comparison between autologous and alloplastic cranioplasty in the pediatric population. *J Craniofac Surg*. 2016; 27:593-597.
3. Lin, AY, Kinsella CR, Rottger SA, et al. Custom porous polyethylene implants for large-scale pediatric skull reconstruction: early outcomes. *J Craniofac Surg*. 2012; 23:67-70.

108. A 10-year-old boy with a history of obstructive sleep apnea and prior straight-line cleft palate repair is brought for evaluation of stigmatizing, hypernasal speech. There is no oronasal fistula present, and the velum appears to vault, but the palate elevates well with phonation. Which of the following is the best option for improvement of speech in this patient?

- A) Continued speech therapy
- B) Furlow palatoplasty
- C) Posterior pharyngeal flap
- D) Tonsillectomy
- E) Use of a palatal lift device

The correct response is Option B.

This patient has significant hypernasality in the face of a prior straight-line cleft palate repair, but does not have an oronasal fistula. Improving hypernasal speech in patients with prior cleft repairs can be addressed with several different techniques, including sphincter pharyngoplasty, posterior pharyngeal flap, and conversion Furlow palatoplasty. This particular patient has vaulting of the velum, indicative of anterior placement of the levator veli palatini muscles, and also appears to have good palatal elevation. Both of these make him a promising candidate for a conversion Furlow palatoplasty. Posterior pharyngeal flap surgery would be less preferable, given his sleep apnea type symptoms and good palatal mobility.

Further speech therapy would be unlikely to provide the patient with any significant improvement in hypernasality.

Although tonsillectomy may help with his sleep apnea type symptoms, it is unlikely to provide the patient with significant speech improvement.

Although posterior pharyngeal flap surgery is an option in patients with hypernasal speech following palatoplasty, this patient has a history of sleep apnea type symptoms and a mobile velum. Posterior pharyngeal flap would be preferable in a patient with poor motion of the velum, a coronal velopharyngeal port defect, and good lateral wall motion.

The use of a palatal lift device can be beneficial in patients with velopharyngeal insufficiency and poor palatal motion who are not candidates for or do not wish to undergo surgery.

REFERENCES:

1. Nayar HS, Cray JJ, MacIsaac ZM, et al. Improving speech outcomes after failed palate repair: evaluating the safety and efficacy of conversion Furlow palatoplasty. *J Craniofac Surg*. 2014 Mar;25(2):343-7.
2. Noorhashm N, Dudas JR, Ford M, et al. Conversion Furlow palatoplasty: salvage of speech after straight-line palatoplasty and "incomplete intravelar veloplasty". *Ann Plast Surg*. 2006 May;56(5):505-10.
3. Swanson J, Mitchell B, Cohen M, et al. The Effect of Furlow Palatoplasty Timing on Speech Outcomes in Submucous Cleft Palate. *Ann Plast Surg*. 2017 Mar 21.

109. Which of the following layers is included with a posterior pharyngeal flap?

- A) Investing layer of the deep cervical fascia
- B) Palatopharyngeus muscle
- C) Prevertebral fascia
- D) Superior pharyngeal constrictor muscle

The correct response is Option D.

The posterior pharyngeal flap for velopharyngeal insufficiency (VPI) is generally elevated with a superior base to keep the flap high (at the junction of the naso- and oropharynx) rather than low in the oropharynx. The mucosa and superior constrictor muscle and buccopharyngeal fascia (visceral pretracheal fascia) are elevated, exposing the loose areolar tissue of the retropharyngeal space anterior to the prevertebral fascia.

The buccopharyngeal fascia is thin and closely invests the constrictor muscles. Some surgeons elevate the flap superficial to the buccopharyngeal fascia. Some fibers of the middle constrictor may be included in longer pharyngeal flaps for large gaps, but the inferior constrictor is too caudad to be included. The palatopharyngeus muscle is included with sphincter pharyngoplasty, not pharyngeal flaps.

The prevertebral fascia is thick and is attached to the buccopharyngeal fascia by loose areolar tissue. This is an avascular plane that is a potential space called the retropharyngeal space. The prevertebral fascia is the deepest layer of cervical fascia and surrounds the cervical column and associated musculature.

The investing layer of the deep cervical fascia is the most superficial layer and contains the platysma. The pretracheal layer or buccopharyngeal layer invests the constrictors and esophagus musculature.

REFERENCES:

1. Smartt JM Jr, Gerety P, Serletti JM, et al. Application of a Robotic Telemanipulator to Perform Posterior Pharyngeal Flap Surgery: A feasibility Study. *Plast Reconstr Surg*. 2013 Apr;131(4):841-5.
2. Sullivan SR, Marrinan EM, Mulliken JB. Pharyngeal Flap Outcomes in Nonsyndromic Children with repaired cleft palate and Velopharyngeal Insufficiency. *Plast Reconstr Surg*. 2010 Jan;125(1):290-8.

3. Henry FRS, Pickering T, Howden R. *Gray's Anatomy - Anatomy, Descriptive And Surgical - A Revised American, From The Fifteenth English, Edition*. New York: Portland House; 1977:315-332.

110. A 20-year-old man is evaluated after his face was slashed during an attack with a broken beer bottle. Physical examination shows a curvilinear laceration from the lateral corner of the palpebral fissure to the angle of the mandible. Which of the following best describes the location of the Stensen duct ampulla?

- A) Second mandibular molar
- B) Second mandibular premolar
- C) Second maxillary molar
- D) Second maxillary premolar
- E) Third maxillary molar

The correct response is Option C.

Stensen duct enters the buccal mucosa at the level of the second maxillary molar, not the mandibular molar. The mental foramen, where the mental nerve enters, is located at the level of the second mandibular premolar. The second maxillary premolar is not a landmark for nerves or ducts. The palatine foramen, where the descending palatine artery and greater palatine nerve exit, is located at the level of the maxillary third molar.

REFERENCES:

1. Steinberg MJ, Herréra AF. Management of parotid duct injuries. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2005 Feb;99(2):136-141.
2. Tomaszewska IM, Tomaszewski KA, Kmiotek EK, et al. Anatomical landmarks for the localization of the greater palatine foramen--a study of 1200 head CTs, 150 dry skulls, systemic review of literature and meta-analysis. *J Anat.* 2014 Oct;225(4):419-435. Epub 2014 Aug 5.

111. Which of the following muscles is innervated by the marginal mandibular branch of the facial nerve?

- A) Buccinator
- B) Mentalis
- C) Orbicularis oris
- D) Platysma
- E) Risorius

The correct response is Option B.

Although all of the facial muscles listed are innervated by branches of the facial nerve, only the mentalis muscle is innervated by the marginal mandibular branch.

The orbicularis oris, buccinator, and risorius muscles are all innervated by the buccal branches of the facial nerve. The platysma muscle is innervated by the cervical branch of the facial nerve.

REFERENCES:

1. Netter FH. *Atlas of Human Anatomy*. Ciba-Geigy Corporation. Plate 122. 5th ed.
2. Stewart MG. Penetrating Face and Neck Trauma. In: Johnson JT and Rosen CA, eds. *Bailey's Head and Neck Surgery – Otolaryngology*. Lippincott Williams & Wilkins, 2011:1131-1140.
3. Vrabec JT, Lin JW. Acute Paralysis of the Facial Nerve. In: Johnson JT and Rosen CA, eds. *Bailey's Head and Neck Surgery – Otolaryngology*. Lippincott Williams & Wilkins, 2011:2503-2518.

112. A 59-year-old woman who has worked in rubber manufacturing for 35 years is referred by her primary care physician because of a firm, nontender, 1-cm mass with ulceration on the hard palate between the central incisors and the incisive foramen. This suspected minor salivary gland tumor is most likely to drain into which of the following nodal basins?

- A) Submandibular nodes
- B) Parathyroid nodes
- C) Parotid nodes
- D) Posterior triangle nodes
- E) Occipital nodes

The correct response is Option A.

The area of the lips, gums, teeth, tongue, and anterior hard palate will drain to the submental and submandibular region (Level I).

Levels IA (submental) and IB (submandibular) are separated by the anterior digastric muscle.

Group II drains the naso-/oro-/hypopharynx and parotid and is called the upper jugular group.

Group III (middle jugular group) drains the naso-/oro-/hypopharynx and larynx.

The lower jugular group (level IV) drains the larynx, cervical esophagus, and hypopharynx.

Group V is the posterior triangle group and drains the naso- and oropharynx.

Group VI is the anterior central group below the hyoid and above the sternal notch. The group drains the thyroid, parathyroid, cervical esophagus, and larynx. More posteriorly the hard palate and soft palate will drain to the retropharyngeal space and deep cervical nodes.

REFERENCES:

1. Shah JP, Candela FC, Poddar AK. The patterns of cervical lymph node metastases from squamous cell cancer of the oral cavity. *Cancer*. 1990 Jul 1;66(1):109-13.

2. Henry FRS, Pickering T, Howden R. *Gray's Anatomy - Anatomy, Descriptive And Surgical - A Revised American, From The Fifteenth English, Edition*. New York: Portland House; 1977:626-628.

113. A newborn male is evaluated in the office for cleft of the soft palate. Physical examination shows severe micrognathia with labored breathing, underdevelopment of the mid face, microtia, and coloboma of the lower eyelids. Mutation in which of the following genes most likely caused these findings?

- A) *EFNB1*
- B) *FGFR2*
- C) *FGFR3*
- D) *TCOF1*
- E) *TWIST1*

The correct response is Option D.

Treacher Collins syndrome, named after Edward Treacher Collins, the English ophthalmologist who first described this condition in 1900, is characterized by widely varying degrees of micrognathia, underdevelopment and/or clefting of the midfacial bones (e.g., zygoma), microtia or anotia with or without hearing loss or middle ear atresia, eyelid coloboma, and often respiratory compromise. It occurs with an estimated frequency of 1:50,000 live births, and the overwhelming majority of cases are caused by an autosomally inherited mutation in the *TCOF1* gene that leads to underproduction of treacle protein, a neural crest precursor.

Mutations in *FGFR2*, *FGFR3*, *TWIST1*, and *EFNB* genes are commonly associated with syndromic forms of craniosynostosis. Gain-of-function mutations in the fibroblast growth factor receptors (FGFR) can lead to various syndromes that manifest craniosynostosis including: Apert syndrome (*FGFR2*), Pfeiffer syndrome (*FGFR1* and *FGFR2*), Crouzon syndrome (*FGFR2*), Jackson–Weiss syndrome (*FGFR2*), Muenke syndrome (*FGFR3*), Crouzonodermoskeletal syndrome (*FGFR3*), and thanatophoric dysplasia (*FGFR3*). *TWIST1* loss-of-function mutations can lead to another craniosynostosis syndrome—Saethre-Chotzen syndrome. *EFNB1* mutations are associated with craniofrontonasal syndrome, an X-linked disorder characterized by hypertelorism, craniosynostosis, clefting of the nasal tip, and digital anomalies.

REFERENCES:

1. Chang CC, Steinbacher DM. Treacher Collins syndrome. *Semin Plast Surg.* 2012; 26:83-90.

2. Derderian C, Seaward J. Syndromic craniosynostosis. *Semin Plast Surg.* 2012; 26:64-75.
3. Fearon JA. Evidence-based medicine: craniosynostosis. *Plast Reconstr Surg.* 2014; 133:1261-1275.

114. Which of the following is the protein encoded by the gene mutated in van der Woude syndrome and popliteal pterygium syndrome?

- A) Fibroblast growth factor 10 (FGF10)
- B) Fibroblast growth factor receptor 2b (FGFR2b)
- C) Interferon regulatory factor 6 (IRF6)
- D) Membrane-bound signaling molecule jagged 2 (JAG2)
- E) Sonic hedgehog (SHH)

The correct response is Option C.

The mechanism of palatal shelf formation must be regulated precisely so that vertical palatal shelves are adhesion-incompetent while they are in close contact with other structures, but once they are raised above the tongue, they rapidly acquire adhesion capability if they are not to remain cleft. Control of periderm differentiation by the membrane-bound signalling molecule jagged 2 (JAG2) is important in this process. Another factor central to this process is interferon regulatory factor 6 (IRF6). The gene *IRF6*, which has a causal association with van der Woude syndrome, is also linked strongly to the isolated form of clefting. This finding has been replicated in many different populations and ethnic groups. Variants of genes linked to syndromic forms of cleft lip with or without cleft palate that have a mendelian mode of inheritance can also produce phenocopies of non-syndromic clefts. This observation suggests that a strategy of choosing variants of genes associated with syndromic forms of cleft lip with or without cleft palate as candidates for investigations into the cause of non-syndromic clefts could be productive. Other examples of mendelian-inherited syndromes and related genes that, if mutated, could result in or modify the expression of cleft lip with or without cleft palate include Kallmann syndrome (*FGFR1*), ectrodactyly, ectodermal dysplasia, and clefting syndrome (*TP63*), X-linked clefting and ankyloglossia (*TBX22*), Gorlin syndrome (*PTCH1*), and Margarita Island ectodermal dysplasia (*PVRL1*[heterozygous]). Although discovery of the genetic cause of van der Woude or popliteal pterygium syndromes will have no immediate therapeutic benefit, advantages for diagnosis are instant, and this knowledge will be potentially useful in genetic counseling. If one gene mutation, which can be identified by prenatal diagnosis, causes cleft lip, cleft lip and palate, or cleft palate alone in a proportion of people, identification of individuals at high risk for having children with the same defect will be possible.

REFERENCES:

1. Casey LM, Lan Y, Cho E-S, et al. Jag2-Notch1 signaling regulates oral epithelial differentiation and palate development. *Dev Dyn*. 2006 Jul;235(7):1830-44.
2. Kondo S, Schutte BC, Richardson RJ, et al. Mutations in IRF6 cause Van der Woude and popliteal pterygium syndromes. *Nat Genet*. 2002 Oct;32(2):285-9.
3. Stuppia L, Capogreco M, Marzo G, et al. Genetics of syndromic and nonsyndromic cleft lip and palate. *J Craniofac Surg*. 2011 Sep;22(5):1722-6.
4. Salahshourifar I, Wan Sulaiman WA, Halim AS, Zilfalil BA. Mutation screening of IRF6 among families with non-syndromic oral clefts and identification of two novel variants: review of the literature. *Eur J Med Genet*. 2012 Jun;55(6-7):389-93.

115. Which of the following muscles is supplied by the facial nerve?

- A) Cricothyroid
- B) Levator veli palatini
- C) Mylohyoid
- D) Stapedius
- E) Tensor tympani

The correct response is Option D.

The facial nerve (VII) arises from the brainstem and travels through the internal auditory canal where it gives rise to the greater superficial petrosal nerve from the sensory nerve bodies of the geniculate ganglion. The greater superficial petrosal nerve runs through the pterygoid canal and synapses at the pterygopalatine ganglion. Postsynaptic fibers innervate the lacrimal gland and control tear production. From the geniculate ganglion, the facial nerve runs through the tympanic cavity and then downward within the mastoid portion of the temporal bone, where it gives rise to fibers that innervate the stapedius muscle as well as form the chorda tympani nerve, which supplies taste fibers to the anterior two-thirds of the tongue as well as sending fibers to the submandibular ganglion that ultimately control saliva production from the sublingual and submandibular glands. Upon emerging from the stylomastoid foramen, the facial nerve gives rise to the posterior auricular nerve, which controls muscles that move the pinna, as well as motor nerve branches that innervate the posterior belly of the digastric muscle and stylohyoid muscle. The facial nerve then passes through the parotid gland and divides into multiple branches that control the muscles of facial expression. Understanding the anatomy of the facial nerve can often help locate the level of facial nerve lesions or injury. Loss of stapedius muscle function results in greater movement of the stapes bone in response to loud noises, resulting in hyperacusis. Paralysis of the stapedius muscle implies that the facial nerve is injured distal to the geniculate ganglion, but proximal to where it emerges from the stylomastoid foramen and becomes extracranial.

The mylohyoid and tensor tympani muscles are innervated by the trigeminal (V) nerve. The tensor, cricothyroid, and levator veli palatini muscles are innervated by the vagus (X) nerve.

REFERENCES:

1. Kochhar A, Larian B, Azizzadeb B. Facial nerve and parotid gland anatomy. *Otolaryngol Clin North Am.* 2016;49:273-284.

2. Sadler, Thomas W. *Langman's Medical Embryology*. Lippincott Williams & Wilkins. 2009; 366-372.

116. An 80-year-old man comes to the office because of recurrent squamous cell carcinoma of the cervical skin. Following reconstruction with a pectoralis myocutaneous flap, the distal half of the skin paddle appears ischemic and eventually exhibits necrosis and full-thickness skin loss. Transection of which of the following structures is most likely responsible for this complication?

- A) Lateral thoracic artery
- B) Medial pectoral vein
- C) Posterior intercostal vasculature
- D) Thoracodorsal artery
- E) Transverse cervical vessel

The correct response is Option A.

The pectoralis major muscle has three major blood supplies. In general, the internal mammary perforators and the thoracoacromial vessels are dominant, with additional perfusion through the lateral thoracic artery. Turnover pectoralis flaps for sternal reconstruction based on the internal mammary perforators are generally well perfused. Likewise, in most situations a pedicled myofascial or myocutaneous flap based on the thoracoacromial vessels (with the other blood supplies ligated) is robust and can be used for most types of head and neck reconstruction. Although described earlier, the flap became the “workhorse” of head and neck reconstruction after Ariyan’s classic article in 1979. Versus a free tissue transfer, the pectoralis flap has many detractors, including being tethered to its pedicle. In about 6% of cases, the lateral thoracic vessel is the dominant pedicle to the flap and needs to be incorporated for maximal perfusion for head and neck reconstruction. This of course further decreases some of the mobility of the flap. This phenomenon is usually easily discernible by the larger caliber of the lateral thoracic vessels versus the thoracoacromial vessels. In this case, this was the most likely injured vessel, causing the described outcome.

The transverse cervical vessels do supply the posterior thorax, and the intercostal vessels do supply the anterior chest, including breast tissue, but neither gives important perfusion to the pectoralis flap. The lateral pectoral nerve travels with the thoracoacromial vessels and, if not checked when turning the flap, can kink the vascular pedicle and, if not severed, does not allow the flap to decrease in size because of lack of denervation of the muscle. The medial pectoral nerve is another innervation to the pectoralis major muscle and is usually severed during flap elevation. The thoracodorsal artery does not supply the pectoralis muscle.

REFERENCES:

1. Ariyan S. The pectoralis major myocutaneous flap. A versatile flap for reconstruction in the head and neck. *Plast Reconstr Surg*. 1979 Jan;63(1):73-81.
2. Makiguchi T, Yokoo S, Miyazaki H, et al. Supercharged pectoralis major musculocutaneous flap. *J Craniofac Surg*. 2013 Mar;24(2):e179-182.
3. Po-Wing Yuen A. Preservation of lateral thoracic artery to improve vascular supply of distal skin without compromising pedicle length in harvesting pectoralis major myocutaneous flap. *J Plast Reconstr Aesthet Surg*. 2006;59(12):1433-1435.

117. A 63-year-old woman undergoes a rhytidectomy with brow lift. Ipsilateral weakness of the forehead muscles is noted in the recovery room. The suspected injury is most likely immediately deep to which of the following?

- A) Deep layer of the deep temporal fascia
- B) Subdermal connective tissue
- C) Superficial layer of the deep temporal fascia
- D) Superficial temporal fat pad
- E) Temporoparietal fascia

The correct response is Option E.

The temporal branch of the facial nerve is found just deep to the temporoparietal fascia.

The facial nerve exits the stylomastoid foramen and the main trunk, pes anserinus, can be found 1 cm inferior and posterior, midway between the tragal pointer and the posterior belly of the digastric muscle. It then arborizes into 5 branches; temporal, zygomatic, buccal, marginal and cervical. Interconnections between the zygomatic and buccal offer some additional regenerative potential if one of those branches is injured. Most mimetic facial muscles are innervated from the deep surface such as the temporalis. Exceptions are the buccinator, levator anguli oris, and mentalis.

Injury to the temporal or cervical branches can leave more lasting deformities so management of injury is important. Avoiding injury is the best way to prevent injury. Therefore, when dissecting in the temporal zone it is critical to avoid entering deep to the temporoparietal fascia.

REFERENCES:

1. White, Rosenthal. Static and Dynamic repairs of facial nerve injuries. *Oral Maxillofac Surg Clin North Am.* 25 (2013):303-312.
2. Lee, Lyford-Pike et al. Traumatic Facial Nerve Injury. *Otolaryngol. Clin North Am.* 46 (2013): 825-839.

118. An otherwise healthy 5-year-old girl has a yellow, cystic mass on the left sclera, a left preauricular branchial cleft remnant, elevation of the left oral commissure, and soft-tissue deficiency of the left face. It is most appropriate to order which of the following tests to assess for significant comorbidities?

- A) Echocardiography
- B) Fluorescence in situ hybridization of the branchial cleft remnant
- C) Funduscopy examination
- D) MRI of the brain
- E) Plain x-ray studies of the hands

The correct response is Option C.

The patient described has Goldenhar syndrome, a severe form of hemifacial microsomia with variable ear anomalies, mandibular hypoplasia leading to occlusal cant and oral commissure asymmetry, and soft-tissue deficiency on the affected side. Ocular findings associated with Goldenhar syndrome are variable and common (50% incidence) and can occur as epibulbar dermoids as described in this patient as well as microphthalmia, eyelid and optic nerve colobomas (interruption of a circular structure of the eye). Colobomas can be asymptomatic (affecting the iris alone), can lead to exposure keratopathy (in the case of eyelid colobomas), or can lead to visual disturbances (optic disc/nerve coloboma), such as visual field deficits or amblyopia. Care must be taken to identify visual disturbances early in order to implement contralateral eye penalization, or patching, to maximize visual development of the affected eye. The other tests target areas that are not affected in patients with Goldenhar syndrome.

REFERENCES:

1. Smith HB, Verity DH, Collin JR. The incidence, embryology, and oculo-facial abnormalities associated with eyelid colobomas. *Eye (Lond)*. 2015 Apr;29(4):492-8.
2. Heike CL, Wallace E, Speltz ML et al. Characterizing facial features in individuals with craniofacial microsomia: A systematic approach for clinical research. *Birth Defects Res A Clin Mol Teratol*. 2016 Nov;106(11):915-926.
3. El Mansoury J, Mbekeani JN. Late Recognition of a Case of Oculo-Auriculo-Vertebral Spectrum. *Optom Vis Sci*. 2016 Nov;93(11):1449-1453.

119. The hillocks arise from which of the following branchial arches?

- A) First and second
- B) Second and third
- C) Third and fourth
- D) Fourth and fifth

The correct response is Option A.

Hillocks 1 to 3 arise from the first branchial arch and give rise to the tragus, helical root, and helical crus. Hillocks 4 to 6 arise from the second branchial arch and give rise to the antihelix, antitragus, and lobule.

REFERENCES:

1. Graney DO, Sie KCY. Anatomy and developmental embryology of the neck. In: Flint PW, Haughey BH, Lund VJ, et al. *Cummings Otolaryngology—Head and Neck Surgery*. 5th edition. Philadelphia: Mosby Elsevier; 2010.
2. Moore K, Persaud T, Torchia M. *The Developing Human*, 10th Edition. Elsevier Health Sciences; 2015.

120. Proper reduction of a zygomaxillary complex (ZMC) fracture requires reduction and realignment of which of the following?

- A) Zygomatic arch, infraorbital rim, alveolus
- B) Zygomaticofrontal suture, infraorbital rim, alveolus
- C) Zygomaticofrontal suture, zygomaticomaxillary buttress, infraorbital rim
- D) Zygomaticofrontal suture, zygomaticomaxillary buttress, orbital floor
- E) Zygomaticomaxillary buttress, infraorbital rim, alveolus

The correct response is Option C.

A zygoma fracture involves displacement of the zygoma that articulates with the frontal bone, maxilla, and sphenoid. In order to stabilize the fracture after adequate reduction, the zygomaticofrontal, zygomaticomaxillary buttress, and infraorbital rim need to be fixated. If there is a large ($>2 \text{ cm}^2$) defect in the orbital floor after reduction, reconstruction of the orbital floor is also necessary to prevent enophthalmos.

While the nasomaxillary buttress is one of the vertical buttresses of the face, the zygoma does not articulate with the nasal bones.

REFERENCES:

1. Evans BGA and Evans GRD. MOC-PS(SM) CME Article: Zygomatic Fractures. *Plast Reconstr Surg*. 2008 Jan;121(1 Suppl):1-11.
2. Rana M, Warraich R, Tahir S et al. Surgical treatment of zygomatic bone fracture using two points fixation versus three point fixation--a randomised prospective clinical trial. *Trials*. 2012 Apr 12;13:36.

121. A 7-year-old boy is brought to the emergency department after being injured in a domestic violence incident. Physical examination shows bruising around the right eye. The patient reports pain and nausea when looking upward. A CT scan shows an entrapped inferior rectus muscle. Three weeks later, the floor of the orbit is repaired with an orbital floor implant. One year later, he continues to have diplopia. Which of the following is the most likely reason for the persistent diplopia?

- A) Exophthalmos
- B) Location of prosthesis
- C) Nerve damage
- D) Persistent swelling
- E) Timing of surgery

The correct response is Option E.

Timing of pediatric orbital floor fractures is well studied. Unlike adult fractures, significant delays for surgery in children, especially more than 7 days after injury, is associated with varying degrees of diplopia. Many consider this pathology an emergency and should be treated within 24 hours. Assuming a typical, standard of care approach is performed well from a technical standpoint, only delays in time to treat were shown to predict such a poor outcome.

REFERENCES:

1. Neinstein RM, Phillips JH, Forrest CR. Pediatric orbital floor trapdoor fractures: outcomes and CT-based morphologic assessment of the inferior rectus muscle. *J Plast Reconstr Aesthet Surg*. 2012 Jul;65(7):869-74.
2. Gerbino G, Roccia F, Bianchi FA, Zavattero E. Surgical management of orbital trapdoor fracture in a pediatric population. *J Oral Maxillofac Surg*. 2010 Jun;68(6):1310-6.
3. Coon D, Kosztowski M, Mahoney NR, et al. Principles for Management of Orbital Fractures in the Pediatric Population: A Cohort Study of 150 Patients. *Plast Reconstr Surg*. 2016 Apr;137(4):1234-40.

122. For patients with velopharyngeal incompetence, which of the following muscles is used to perform sphincter pharyngoplasty?

- A) Levator veli palatini
- B) Musculus uvulae
- C) Palatoglossus
- D) Palatopharyngeus
- E) Tensor veli palatini

The correct response is Option D.

Sphincter pharyngoplasty is a secondary (speech) procedure for cleft palate that rotates the posterior tonsillar pillars as superiorly based flaps to line the posterior pharynx, thereby narrowing the velopharyngeal sphincter. The posterior tonsillar pillars contain the palatopharyngeus muscles.

The other muscles are not used in sphincter pharyngoplasty: levator veli palatini runs through the palate to elevate the palate; palatoglossus runs through the anterior tonsillar pillar to depress the palate; musculus uvulae is the muscle of the uvula, and tensor veli palatini contributes to eustachian tube pressure modulation.

REFERENCES:

1. Fisher DM, Sommerlad BC. Cleft lip, cleft palate, and velopharyngeal insufficiency. *Plast Reconstr Surg*. 2011 Oct;128(4):342e-360e.
2. Gart MS, Gosain AK. Surgical management of velopharyngeal insufficiency. *Clin Plast Surg*. 2014 Apr;41(2):253-70.
3. Gosain AK, Arneja JS. Management of the black hole in velopharyngeal incompetence: combined use of a Furlow palatoplasty and sphincter pharyngoplasty. *Plast Reconstr Surg*. 2007 Apr 15;119(5):1538-45.

123. A 2-year-old has a midline cleft of the upper lip. This cleft results from failure of fusion of which of the following embryologic structures?

- A) Lateral nasal prominence and maxillary prominence
- B) Maxillary and mandibular prominences
- C) Medial and lateral palatine processes
- D) Medial nasal prominence and maxillary prominence
- E) Medial nasal prominences only

The correct response is Option E.

Median cleft lip results from failed fusion of the medial nasal prominence during embryologic development. A unilateral cleft lip results from failed fusion of the medial nasal prominence and the maxillary prominence. An oblique facial cleft results from failure of fusion of the lateral nasal prominence and the maxillary prominence. A lateral oral commissure cleft is produced by the failed fusion of the mandibular and maxillary prominences. A cleft of the primary palate is produced by failure of fusion of the medial and lateral palatine processes.

REFERENCES:

1. Wantia N, Rettinger G. The current understanding of cleft lip malformations. *Facial Plast Surg*. 2002 Aug;18(3):147-53.
2. Merritt L. Part 1. Understanding the embryology and genetics of cleft lip and palate. *Adv Neonatal Care*. 2005 Apr;5(2):64-71.
3. Gosman AA. Cleft lip and palate I: Embryology, anatomy, epidemiology, and clinical outcomes. Dallas, TX: *Selected Readings in Plastic Surgery*, Inc., 2007:1-52. *Selected Readings in Plastic Surgery*; vol 10, issue 16.
4. Shkoukani MA, Chen M, Vong A. Cleft Lip - A Comprehensive Review. *Front Pediatr*. 2013;1:53.



124. A 50-year-old woman has a Mohs resection defect starting 15 mm below her lower lip vermillion border and extending 3 cm caudally; the width of the defect is 4.5 cm. Exposed bony mandible is noted in the depth of the wound. A photograph is shown. The simplest and most aesthetically pleasing reconstruction is likely to be based on which of the following arterial branches?

- A) Facial
- B) Radial
- C) Superficial temporal
- D) Thoracoacromial
- E) Transverse cervical

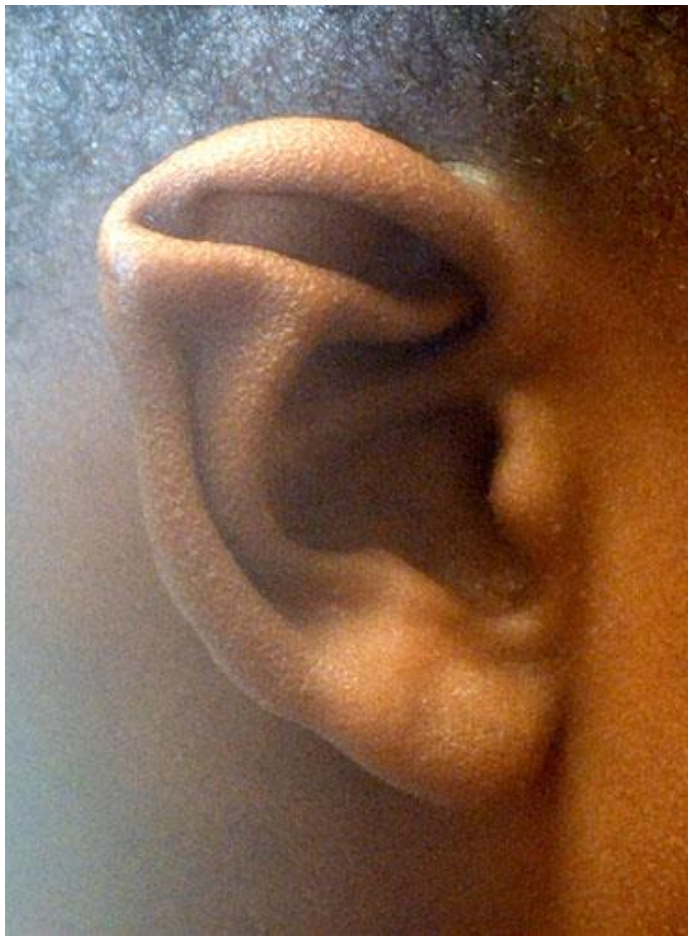
The correct response is Option A.

One of the branches of the facial artery is the submental artery. This vessel provides flow to the so-called submental flap, which can be made myofascial or musculocutaneous as it includes the platysma muscle. The flap is almost adjacent to the defect and provides similar skin in color and texture. The donor site is typically closed primarily after undermining the lower neck.

The thoracoacromial artery provides flow to the pectoralis flap. Although the pectoralis myocutaneous flap could be used here, it would be bulky, would have to exclude breast tissue, would not have a similar color match, and would create a tether from the chest to the chin. The superficial temporal artery can allow for a large laterally based forehead flap; in the era prior to free tissue transfer, this flap was used for even intraoral reconstruction. In theory, such a flap could reach the mental area, but the dissection would be very tedious and the donor site alterations significant. The transverse cervical artery can provide a flap of thin supraclavicular skin that, as a free flap, could be used in this area but certainly would not be the simplest option. Likewise the radial forearm free flap based on the radial vessels would not be a good color match and would be a lengthy, complex surgery.

REFERENCES:

1. Moubayed SP, Rahal A, Ayad T. The submental island flap for soft-tissue head and neck reconstruction: step-by-step video description and long-term results. *Plast Reconstr Surg*. 2014 Mar;133(3):684-6.
2. Tang M, Ding M, Almutairi K, Morris SF. Three-dimensional angiography of the submental artery perforator flap. *J Plast Reconstr Aesthet Surg*. 2011 May;64(5):608-13.
3. Pappas-Politis E, Driscoll DC, Pierpont YN, et al. Treatment of eccrine carcinoma of the chin via submental island flap. *Eplasty*. 2010 Apr 8;10:e27.



125. An 8-year-old boy is brought to the clinic with a right congenital ear anomaly that affects his interaction with his peers. A photograph is shown. Which of the following is the most appropriate treatment?

- A) Ear molding
- B) Multiple stages of surgery for rib cartilage construct, elevation of construct, and soft-tissue reconstruction
- C) Surgery with cadaveric cartilage
- D) Surgery with distant rib cartilage
- E) Surgery with local cartilage

The correct response is Option E.



The photographs show Stahl ear, a congenital ear anomaly that is characterized by an abnormal third crus of the antihelix. This is a fairly uncommon deformity, and multiple surgical methods have been described. Compared with other ear anomalies, there is usually enough local cartilage in Stahl ear, so most authors recommend local cartilage flaps or grafts, and otoplasty techniques, to remove the third crus and reconstruct a more normal antihelical fold.

Ear anomalies that lack significant cartilage may require larger cartilage grafts, such as rib. Multi-stage surgery is for reconstruction of microtia, which has a severe paucity of normal cartilage and soft-tissue structures.

REFERENCES:

1. Liu L, Pan B, Lin L, et al. A new method to correct Stahl's ear. *J Plast Reconstr Aesthet Surg*. 2011 Jan;64(1):48-52.
2. Ogawa R, Hyakusoku H. Crucial incision method for Stahl's ear reconstruction. *J Plast Reconstr Aesthet Surg*. 2007;60(8):961-3.
3. Thorne CH, Wilkes G. Ear deformities, otoplasty, and ear reconstruction. *Plast Reconstr Surg*. 2012 Apr;129(4):701e-16e.
4. Weinfeld AB. Stahl's ear correction: synergistic use of cartilage abrading, strategic Mustarde suture placement, and anterior anticonvexity suture. *J Craniofac Surg*. 2012 May;23(3):901-5.
5. Rodriguez ED, Dorafshar AH, Manson PN. Facial Fractures. In: Neligan P, ed. *Plastic surgery*. Elsevier Saunders, London; New York, 2003;1.

126. A 4-year-old boy is brought to the office for evaluation of the shape of his head. Physical examination shows an asymmetrically shaped head, low frontal hairline, ptosis of the eyelids, and a prominent crus of helix. Which of the following syndromes is most likely affecting this child?

- A) Apert
- B) Crouzon
- C) Muenke
- D) Pfeiffer
- E) Saethre-Chotzen

The correct response is Option E.

Saethre-Chotzen syndrome is an autosomal dominant disorder associated with *TWIST1* gene mutation. It causes an asymmetrical brachycephaly, bicoronal or unicoronal synostosis, low frontal hairline, ptosis of the eyelids, and a prominent crus of helix.

Crouzon syndrome is an autosomal dominant disorder associated with an *FGFR2* gene mutation. The patient with this syndrome typically comes to the office because of hydrocephalus, elevated intracranial pressure, Chiari I malformation, bicoronal synostosis and brachycephaly, exorbitism, mid-face hypoplasia, anterior open bite, and normal extremities.

Apert syndrome is an autosomal dominant disorder and shows symptoms of elevated intracranial pressure, bicoronal synostoses, turribrachycephaly, enlarged anterior fontanel, bitemporal widening, occipital flattening, anterior open bite, and complex syndactyly of the hands and feet.

Pfeiffer syndrome is also an autosomal dominant disorder associated with *FGFR2* mutation and reveals symptoms of hydrocephalus and a high risk of Chiari malformation, turribrachycephaly with bicoronal synostoses, exorbitism, hypertelorism, down-slanting palpebral fissures, an anterior open bite, and broad thumbs and/or broad halluces.

Muenke syndrome is associated with the *FGFR3* gene mutation and comes to the office with coronal synostosis, elevated intracranial pressure, sensorineural hearing loss, and abnormal middle phalanges.

REFERENCES:

1. Derderian C, Seaward J. Syndromic craniosynostosis. *Semin Plast Surg.* 2012 May;26(2):64-75.
2. Derderian CA, Bartlett SP. Craniosynostosis syndromes. In: Thorne C, ed. *Grabb and Smith's Plastic Surgery*, 7th ed. Philadelphia: Lippincott Williams & Wilkins, 2014.
3. Katzen JT, McCarthy JG. Syndromes involving craniosynostosis and midface hypoplasia. *Otolaryngol Clin North Am.* 2000 Dec;33(6):1257-84, vi.

127. A 22-year-old man is scheduled to undergo surgery to correct a displaced symphyseal fracture of the mandible using a vestibular approach. To avoid injury to the mental nerve, the mental foramen is best identified in which of the following locations?

- A) Anterior to the first premolar
- B) Inferior to the lateral incisor
- C) Inferior to the lower canine tooth
- D) Inferior to the second molar
- E) Inferior to the second premolar

The correct response is Option E.

The vestibular approach to the mandible is useful for a number of mandibular procedures. The most important neurovascular structure of significance in the region of the symphysis is the mental neurovascular bundle. The mental nerve is the terminal branch of the inferior alveolar nerve. It gives sensation to the skin and mucosa of the lower lip, skin of the chin, and facial gingiva of the anterior teeth. It is important to preserve this nerve during the surgical dissection in this approach. The mental nerve exits the mental foramen usually inferior to or slightly anterior to the second premolar tooth.

REFERENCES:

1. Ellis E, Zide, MF. Mandibular Vestibular Approach. In: *Surgical Approaches To The Facial Skeleton*. Lippincott Williams & Wilkins; 2006:137-150.
2. Wang C, Gui L, Liu J. A Practical Surgical Technique to Expose the Mental Nerve in Narrowing Genioplasty. *Plast Reconstr Surg Glob Open*. 2015 Nov; 3(11): e554.

128. A 9-year-old boy with Crouzon syndrome is brought to the craniofacial clinic because of obstructive sleep apnea. Apnea hypopnea index is 40. He has a negative overjet of 12 mm, moderate exorbitism, and signs of increased intracranial pressure (>25 mm Hg), which was found during an intracranial pressure monitoring trial last month; intercanthal distance is normal (25 mm). Which of the following types of osteotomy is the most appropriate treatment for this patient?

- A) Facial bipartition
- B) Le Fort I
- C) Le Fort III
- D) Monobloc
- E) Orbital box

The correct response is Option D.

Crouzon-related obstructive sleep apnea and increased intracranial pressure are best treated with frontofacial advancement without adjustment of the orbital width, which is best achieved using the monobloc osteotomy. Orbital box osteotomy will not treat increased intracranial pressure or sleep apnea. Le Fort III osteotomy will treat obstructive sleep apnea but will minimally affect increased intracranial pressure. Lastly, facial bipartition osteotomy is not needed in this case because of the normal intercanthal distance and lack of telorbitism. Le Fort I addresses neither the orbits nor the intracranial pressure.

REFERENCES:

1. Gwanmesia I, Jeelani O, Hayward R, Dunaway D. Frontofacial Advancement by Distraction Osteogenesis: A Long-Term Review. *Plast Reconstr Surg*. 2015 Feb;135(2):553-60.
2. Bradley J, Levitt A, Nguyen J, et al. Roman Arch, Keystone Fixation for Facial Bipartition with Monobloc Distraction. *Plast Reconstr Surg*. 2008 Nov;122(5):1514-23.

129. A patient underwent open reduction and internal fixation of naso-orbital-ethmoid fractures 12 months ago, and epiphora was noted on follow-up examination. After 6 months of observation and persistent epiphora, which of the following is the most appropriate next step to evaluate the function of the patient's nasolacrimal system?

- A) Conjunctivorhinostomy tube placement
- B) Continued observation, as function is likely to return
- C) Jones tests
- D) Lacrimal system flushing
- E) Schirmer tests

The correct response is Option C.

The Jones test is used to evaluate lacrimal drainage. Divided into two parts, the Jones I test investigates lacrimal outflow under normal physiologic conditions. A drop of sterile 2% fluorescein solution or a moistened fluorescein strip is placed into the conjunctival fornix and a cotton-tipped wire applicator is placed into the inferior nasal meatus in the region of the ostium of the nasolacrimal duct at 2 and 5 minutes to check for fluorescein. As this test occasionally yields abnormal results in normal patients, it is not uniformly performed. The Jones II test determines the presence or absence of fluorescein when the residual fluorescein is flushed from the conjunctival sac with clear saline to determine whether there is reflux of fluorescein.

Naso-orbital-ethmoid (NOE) fractures can be challenging fractures, and either through direct instrumentation with transcanthal wiring or from the fractures themselves, the lacrimal drainage system can be affected. Postoperative epiphora can be very common and is present in at least 50% of patients who have undergone open reduction and internal fixation (ORIF) of an NOE fracture. After 3 to 6 months approximately half of this epiphora resolves, with the other half of patients (25%) requiring consideration for other investigations to evaluate lacrimal drainage. Schirmer test is used to evaluate dry eyes and is not appropriate in this patient.

REFERENCES:

1. Becelli R, Renzi G, Mannino G, et al. Posttraumatic obstruction of lacrimal pathways: a retrospective analysis of 58 consecutive naso-orbitoethmoid fractures. *J Craniofac Surg*. 2004 Jan;15(1):29-33.

2. Ali MJ, Gupta H, Honavar SG, et al. Acquired nasolacrimal duct obstructions secondary to naso-orbito-ethmoidal fractures: patterns and outcomes. *Ophthal Plast Reconstr Surg*. 2012 Jul-Aug;28(4):242-245.

130. A 3-year-old girl with a cleft lip and palate is brought to the clinic because her parents are concerned that her teeth are not coming in properly. Given her diagnosis, which of the following is the most likely finding?

- A) Dysplastic teeth
- B) Ectopic teeth
- C) Supernumerary teeth
- D) Tooth agenesis
- E) Tooth translocation

The correct response is Option D.

A higher prevalence of dental anomalies is expected in children with cleft lip and palate. Agenesis is the most prevalent anomaly found typically in greater than 50% of patients. The most commonly affected tooth is the permanent lateral incisor on the cleft side. Supernumerary teeth are the second most frequently occurring dental anomaly. Dysplastic teeth, ectopic teeth, and translocation of the teeth are all less common than tooth agenesis in this patient population.

REFERENCES:

1. Tannure PN, Oliveira CA, Maia LC, et al. Prevalence of dental anomalies in nonsyndromic individuals with cleft lip and palate: a systematic review and meta-analysis. *Cleft Palate Craniofac J*. 2012 Mar;49(2):194-200.
2. Howe BJ, Cooper ME, Vieira AR, et al. Spectrum of Dental Phenotypes in Nonsyndromic Orofacial Clefting. *J Dent Res*. 2015 Jul;94(7):905-12.

131. A 45-year-old man with mucoepidermoid carcinoma of the left parotid gland undergoes parotidectomy. Which of the following complications is most likely in this patient?

- A) Gustatory sweating
- B) Hyperacusis
- C) Loss of taste
- D) Tardive dyskinesia
- E) Tearing while eating

The correct response is Option A.

Parotidectomy is a surgical procedure performed for benign and malignant tumors of the parotid gland and, uncommonly, for hypersalivation. Specific risks for parotidectomy include facial nerve injury, sialocele formation, and gustatory sweating.

Gustatory sweating (or Frey syndrome) results when there is aberrant innervation of cutaneous sweat glands in the cheek skin overlying the parotid bed resulting in sweating and flushing during eating.

Loss of taste to the anterior two thirds of the tongue results from injury to the chorda tympani, which arises from the facial nerve as it crosses the tympanic cavity and joins with the lingual nerve, not from injury to the facial nerve within the parotid gland.

The stapedius is a small muscle in the middle ear that restricts movement of the stapes bone in response to loud noises. Hyperacusis may occur when the facial nerve is interrupted intracranially, before it exits the stylomastoid foramen and becomes extracranial.

Tearing while eating (crocodile tear syndrome or Bogorad syndrome) is an uncommon consequence of nerve regeneration subsequent to Bell's palsy in which efferent fibers from the superior salivary nucleus become improperly connected to nerve axons projecting to the lacrimal glands causing tears while smelling foods or eating.

Tardive dyskinesia is a disorder resulting in involuntary repetitive movements including grimacing, tongue and lip movements, and excessive blinking that usually occur as side effects of antipsychotic drugs. It is unrelated to facial nerve dysfunction.

REFERENCES:

1. Britt CJ, Stein AP, Gessert T, Pflum Z, Saha S, Hartig GK. Factors influencing sialoceles or salivary fistula formation postparotidectomy. *Head Neck*. 2017;39:387-391.
2. Bell RB, Dierks EJ, Homer L, Potter BE. Management and outcome of patients with malignant salivary gland tumors. *J Oral Maxillofac Surg*. 2005;63:917-928.
3. Kochhar A, Larian B, Azizzadeh B. Facial nerve and parotid gland anatomy. *Otolaryngol Clin North Am*. 2016;49:273-284.

132. A 62-year-old woman is evaluated 1 hour after undergoing Mohs micrographic resection of a squamous cell carcinoma of the lower lip. After a clear-margin excision, the resulting defect is a full-thickness 25% central lip defect. Which of the following is the most appropriate repair method for this defect?

- A) Coverage using the Karapandzic technique
- B) Coverage with a V-Y advancement flap
- C) Coverage with an Abbe flap
- D) Full-thickness skin grafting
- E) Primary closure

The correct response is Option E.

Defects of the lip can be categorized by the percentage of the total lip affected. Small full-thickness defects of the lip (25–33%) as described in this case are best repaired with primary closure using a vertical excision of remaining lip structures to enable a tension-free closure. Care should be taken to precisely realign the lip and repair the white roll to avoid step-offs that are easily noticeable. Larger defects (33–50%) are usually repaired using flaps. These flaps can be categorized as transoral flaps (e.g., Abbe or Estlander flaps) or circumoral advancement/rotation flaps (e.g., Gilles flap or Karapandzic technique). Subtotal lip defects may be repaired with bilateral circumoral advancement/rotation flaps, while total lip defects generally require reconstruction with free flaps. Skin grafts are rarely used for lip reconstruction (particularly if the white roll is involved) because these repairs result in a patch-like appearance that is highly noticeable.

REFERENCES:

1. Anvar BA, Evans BC, Evans GR. Lip reconstruction. *Plast Reconstr Surg*. 2007 Sep 15;120(4):57e-64e.
2. Matros E, Pribaz JJ. Reconstruction of Acquired Lip Deformities. In: Thorne CH, ed. *Grabb and Smith's Plastic Surgery*. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2013:372-383.

133. A 32-year-old man is evaluated because of painless swelling of the right cheek 2 months after being assaulted with a knife and sustaining a laceration across the mid cheek. The laceration was sutured by the emergency department physician assistant. Which of the following is the most appropriate management at this time?

- A) Drainage of the collection and administration of antisialagogues
- B) Open debridement with skin grafting
- C) Surgical exploration with reanastomosis of the injured duct
- D) Total parotidectomy with facial nerve preservation
- E) Ultrasound-guided needle aspiration only

The correct response is Option A.

Any penetrating injury on a line from the tragus to the mid upper lip may injure the parotid duct or gland. The parotid system can be divided into 3 regions:

Region A: gland

Region B: duct superficial to the masseter muscle

Region C: duct from the masseter to where it enters the mouth opposite the 2nd maxillary molar

Additionally, the buccal branch of the facial nerve often runs with the duct. It can cross the superficial layer of the masseter after leaving the parotid gland. Injury manifests as weakness of the upper lip on animation.

Injury not repaired acutely can manifest later as salivary fistulae or sialoceles. Most can be managed conservatively with drainage, pressure, and antisialagogues. Trying to find and repair the duct late after the injury is difficult and may not lead to resolution of the symptoms. This is usually reserved for early injury and repair. If these fail, then a superficial parotidectomy can be considered for recalcitrant salivary collections.

REFERENCES:

1. Van Sickels. Management of parotid duct injuries. *Oral Maxillofac Surg Clin North Am.* 2009 May;21(2):243-6.
2. Gordin et al. "Parotid Gland Trauma". *Facial Plast Surg.* 2010 Dec;26(6):504-510.

134. A 17-year-old girl with a left unilateral cleft lip and palate comes to the office because she is dissatisfied with her occlusion and facial appearance. Physical examination shows midface hypoplasia and class III malocclusion. Intraoral examination demonstrates 6 mm of negative overjet and a missing left lateral maxillary incisor with retained space. Occlusal x-ray studies demonstrate 5 mm of alveolar bone height at the cleft margin. Which of the following is the best treatment option for this patient?

- A) Alveolar transport distraction
- B) Observation until skeletal maturity
- C) Prosthodontic rehabilitation with a fixed bridge
- D) Sagittal split of the mandible with osteointegrated implants
- E) Two-piece Le Fort I osteotomy with closure of the alveolar gap

The correct response is Option E.

The above patient scenario is typical of a cleft lip and palate patient with missing lateral incisor on the cleft side and significant maxillary growth restriction leading to class III malocclusion. There are multiple options for surgical correction of the deformity described, however they must address the patient's complaints of malocclusion, address the missing dental unit, and provide a lasting reconstruction. The best option is a two-piece Le Fort I advancement with a surgical canine substitution. This allows restoration of the dental arch and closure of the space, with the canine filling the lateral incisor spot. Postoperatively, the prosthodontist will recontour the canine so it appears like a lateral incisor. This patient is likely skeletally mature at 17 years old (14 to 16 years for females, 16 to 18 years for males). Bilateral sagittal split osteotomy would address the malocclusion without addressing the mid face deficiency. However, there is not enough bone stock for a standard osseointegrated implant, which usually requires at least 10 to 15 mm of alveolar height. Although a fixed bridge will address the missing tooth, neither it nor alveolar transport distraction will fix her malocclusion.

REFERENCES:

1. Lee JC, Slack GC, Walker R et al. Maxillary hypoplasia in the cleft patient: contribution of orthodontic dental space closure to orthognathic surgery. *Plast Reconstr Surg*. 2014 Feb;133(2):355-61.

2. Watts GD, Antonarakis GS, Forrest CR, et al. Single versus segmental maxillary osteotomies and long-term stability in unilateral cleft lip and palate related malocclusion. *J Oral Maxillofac Surg*. 2014 Dec;72(12):2514-21.

135. Which of the following viruses is implicated in the pathogenesis of nasopharyngeal carcinoma?

- A) Epstein-Barr virus
- B) Hepatitis C virus
- C) Human herpesvirus 8
- D) Human immunodeficiency virus
- E) Human papillomavirus

The correct response is Option A.

All phases of the Epstein-Barr virus life cycle are associated with human disease. In immunocompromised individuals, infected cells increase in number, and eventually B-cell growth control pathways are activated, inducing transformation and leading to malignancies such as nasopharyngeal carcinoma, Burkitt lymphoma, post-transplant lymphomas, and gastric carcinomas. Human papillomavirus (HPV) is increasingly recognized as a pathogenic risk factor for oropharyngeal cancer development. Accumulating molecular and epidemiological data now show that high-risk types of HPV are responsible for a subset of oropharyngeal cancer. Oral verrucous and squamous cell carcinomas have been reported in patients infected with hepatitis C virus, and the infection has been found to be more prevalent in patients with oral lichen planus. Infection with HIV is not known to be directly pathogenic in malignant transformation, but rather it increases the susceptibility to opportunistic infections and viral-promoted cancers. Human herpesvirus 8, also known as Kaposi sarcoma-associated herpesvirus, has been found in nearly all tumors in patients with Kaposi sarcoma.

REFERENCES:

1. Coghill AE, Hildesheim A. Epstein-Barr Virus Antibodies and the Risk of Associated Malignancies: Review of the Literature. *Am J Epidemiol*. 2014 Oct 1; 180(7):687–695. Published online 2014 Aug 28.
2. Gondivkar SM, Parikh RV, Gadbail AR, et al. Involvement of viral factors with head and neck cancers. *Oral Oncol*. 2012 Mar;48(3):195-9.

136. Which of the following provides the most significant blood supply to the mandibular condylar head?

- A) Articular disk
- B) Capsule of the temporomandibular joint
- C) Deep branch of the superficial temporal artery
- D) Facial artery
- E) Medullary branch of the inferior alveolar artery

The correct response is Option E.

Concerning the condyle itself, its blood supply is mostly derived from three sources. A branch of the inferior alveolar artery courses upward through the neck of the condylar process, where it anastomoses liberally with vessels from the attached musculature. Another major contributor to the condyle and its articular surface derives from the temporomandibular joint (TMJ) capsule, with its lush vascular plexus. A large supply of blood also comes from branches of the lateral pterygoid muscle through its attachment at the pterygoid fovea. Of these three sources, the medullary blood supply from a branch of the inferior alveolar artery was found to be the most important source in monkeys and, presumably, in man. Fracture of the subcondylar or neck region of the condylar process could therefore disrupt the main vascular supply to the condyle.

There is another ramification of the loss of medullary blood supply from fracture of the condylar process. Surgical access to the condylar process in order to perform open reduction and internal fixation requires exposure and dissection of some of the soft tissues from the condylar process to permit manipulation and attachment of fixation devices. Therefore, surgery further diminishes the blood supply to a segment of bone that has already been severely compromised. If maintenance of blood supply to the condyle is important, the best choice is a surgical approach that can minimize the amount of soft-tissue stripping from the fractured condylar process and maintain, as much as possible, the attachment of the TMJ capsule and the lateral pterygoid muscle. Thus, if the preauricular approach is chosen, one should not enter the capsule of the joint as one might for an intra-articular surgery. Doing so can disrupt the already compromised blood supply to the condyle.

REFERENCES:

1. Castelli WC. Vascular architecture of the human adult mandible. *J Dent Res.* 1963 May-Jun;42:786-92.

2. Boyer CC, Williams TW, Stevens FH. Blood supply of the temporomandibular joint. *J Dent Res*. 1964 Mar-Apr;43:224-8.
3. Stengl J. Blood supply of the temporomandibular joint in man. *Folia Morphol*. 1965;13:20.
4. Mayer R. Vascularization of the temporomandibular joint in the rabbit. *Bull Group Int Rech Sci Stomatol*. 1971 Oct;14(4):291-9.

137. A 25-year-old woman comes to the office because of a 5-year history of stable facial asymmetry. Physical examination shows fullness of the right mandibular angle; no facial tenderness, masses, or lymphadenopathy is noted. Maxillofacial CT scan shows enlargement of the right masseter muscle compared with the left. Which of the following is the most appropriate first-line treatment for this problem?

- A) Fabrication of a bite guard to treat bruxism
- B) Injection of botulinum toxin type A into the right masseter muscle
- C) Open subtotal myectomy of the right masseter muscle
- D) Placement of a left mandibular angle prosthesis
- E) Referral to oncology to rule out systemic amyloidosis

The correct response is Option B.

The patient described has benign or idiopathic masseter hypertrophy. The classic patient comes to the office because of aesthetic complaints but is otherwise asymptomatic. There are numerous treatments, including partial myotomy, mandibular angle reduction, and contralateral augmentation. Of all the options, the best is botulinum toxin type A injections. These injections are minimally invasive and reversible, and they do not require an anesthetic. On the basis of its low-risk profile, it is the best first-line treatment listed. Amyloidosis is a progressive systemic disease that can cause myopathy and painful bilateral masseter hypertrophy. It is unlikely in this stable, unilateral case. Bruxism can cause masseter hypertrophy, which is most often bilateral. A bite guard will prevent tooth damage, but it will not correct hypertrophy.

REFERENCES:

1. Kebede B, Megersa S. Idiopathic Masseter Muscle Hypertrophy. *Ethiop J Health Sci.* 2011 Nov; 21(3): 209–212.
2. Gart MS, Gutowski KA. Overview of Botulinum Toxins for Aesthetic Uses. *Clin Plast Surg.* 2016 Jul;43(3):459-71.
3. Fedorowicz Z, van Zuuren EJ, Schoones J. Botulinum toxin for masseter hypertrophy. *Cochrane Database of Systematic Reviews* 2013, Issue 9. Art.

138. A 25-year-old man with a fracture of the mandibular angle is evaluated for open reduction and internal fixation. Which of the following is the most appropriate location for placement of internal fixation when using the Champy technique in this patient?

- A) External oblique ridge
- B) Lingula
- C) Mandibular notch
- D) Mental tubercle
- E) Mylohyoid line

The correct response is Option A.

This technique for internal fixation of mandibular angle fractures was first described by Michelet in 1972, and biomechanical studies by Champy et al were published in 1976. In his original paper, Champy advocated placement of an internal fixation miniplate along the external oblique line of the mandible. By contouring the plate to this line, rigid fixation is achieved in two planes, taking advantage of the force vectors along the angle of the mandible to help compress the fracture site.

Mylohyoid line is not appropriate because the mylohyoid line is located along the lingual surface of the mandibular body and is not used routinely as a location for plate fixation for mandibular fractures.

Lingula is not appropriate because the lingula is located along the lingual surface of the mandibular ramus, and is the location where the mandibular nerve (V3) enters the mandible. Plate fixation should be avoided in this area because of the difficulty of exposure and the risk for damaging the mandibular nerve.

Mental tubercle is not appropriate because the mental tubercle is not an appropriate place to apply internal fixation when utilizing the Champy technique.

Mandibular notch is not appropriate because it is located between the mandibular condyle and the coronoid process and is not an appropriate place to apply internal fixation when utilizing the Champy technique.

REFERENCES:

1. Gear AJ, Apasova E, Schmitz JP, et al. Treatment modalities for mandibular angle fractures. *J Oral Maxillofac Surg*. 2005 May;63(5):655-663.
2. Laverick S, Siddappa P, Wong H, et al. Intraoral external oblique ridge compared with transbuccal lateral cortical plate fixation for the treatment of fractures of the mandibular angle: prospective randomised trial. *Br J Oral Maxillofac Surg*. 2012 Jun;50(4):344-349. Epub 2012 Mar 14.
3. Turgut G, Kayali MU, Soydan AT, et al. Biomechanical comparison of a new technique of mandibular angle fractures: biplanar and bicortical superior proximal 3 holes and bicortical inferior plate fixation. *J Craniofac Surg*. 2008 Mar;19(2):428-432.

139. A 70-year-old man has a biopsy-confirmed squamous cell carcinoma of the upper eyelid. Excision of the lesion will produce a full-thickness defect of the central upper eyelid that is 70% of its width. Reconstruction of the defect with which of the following is most appropriate?

- A) Cutler-Beard flap
- B) Full-thickness skin graft
- C) Hughes flap
- D) Primary closure
- E) Tenzel flap

The correct response is Option A.

The Cutler-Beard flap is the preferred flap for full-thickness defects of the upper eyelid that are greater than 66% of total eyelid width. This technique utilizes a full-thickness eyelid flap from the lower eyelid to provide a wide flap for eye coverage. In the first stage, the flap is raised and advanced into the upper eyelid defect. The flap is then inset, covering the eye. The inferior pedicle is divided in a second stage at 4 to 6 weeks and final flap inset is performed.

The Tenzel semicircular flap is an excellent technique for anterior lamellar defects of the upper or lower lid, but requires a second flap for posterior lamella reconstruction of full-thickness defects and is not generally the preferred technique for a large defect of the upper eyelid.

The Hughes tarsoconjunctival flap is a similar procedure to the Cutler-Beard flap, but is used for lower lid defects.

Full-thickness skin grafting would not restore the posterior lamellar defect, and direct closure would not likely be able to close a 70% defect of the upper eyelid properly.

REFERENCES:

1. Espinoza GM, Prost AM. Upper Eyelid Reconstruction. *Facial Plas Surg Clin North Am*. 2016 May; 24(2):173-82.
2. McCord CD, Codner MA. Upper Eyelid Reconstruction. In: *Eyelid and Periorbital Surgery*. Quality Medical Publishing, St. Louis, 2008:509-41.

140. A newborn male is evaluated because of asymmetry of the orbit and eyelid. Physical examination shows a dozen 6- to 10-mm tan macules, axillary freckles, pigmented nodules on the iris, and soft, fleshy, raised, soft-tissue lesions on the forehead and scalp. Which of the following is the most likely diagnosis?

- A) Goldenhar syndrome
- B) Kabuki syndrome
- C) Muenke syndrome
- D) Neurofibromatosis
- E) Nevus sebaceous

The correct response is Option D.

The patient described meets the criteria for neurofibromatosis 1 by clinical diagnosis. Genetic testing is also possible. To make a clinical diagnosis, two or more of the following criteria are required:

- Six or more café au lait spots 5 mm or larger (prepubertal) or 15 mm or larger (post-pubertal)
- Family history
- Two or more neurofibromas
- Freckling in armpits or groin
- Lisch nodules
- Bony dysplasia (sphenoid wing in this case)
- Tumor on optic nerve

A patient with Goldenhar syndrome has facial asymmetry, but does not have café au lait spots. Colobomas are common in patients with this syndrome, but Lisch nodules are not.

Muenke syndrome is associated with craniosynostosis.

Kabuki syndrome has distinctive associated facial features with long palpebral fissures, everted lower lids, broad nasal tip, arched brows, protruding ears, intellectual disability, and often microcephaly.

Nevus sebaceous is a well-circumscribed hamartomatous lesion composed of sebaceous glands. There is a risk for malignant transformation.

REFERENCES:

1. Latham K, Buchanan EP, Suver D, Gruss JS. Neurofibromatosis of the Head and Neck: Classification and Surgical Management. *Plast Reconstr Surg*. 2015 Mar;135(3):845-55.
2. Swanson JW, Bartlett SP. Congenital Ocular Dystopia from Orbitofrontal Bone Dysplasia. *Plast Reconstr Surg*. 2016 Jan;137(1):125e-134e.
3. Williams VC, Lucas J, Babcock MA. Neurofibromatosis type 1 revisited. *Pediatrics*. 2009 Jan;123(1):124-33.



141. A 21-year-old woman is evaluated for a painless enlargement along the left lower jaw. Panoramic x-ray study (Panorex) is shown. Which of the following is the most likely diagnosis?

- A) Cherubism
- B) Dentigerous cyst
- C) Desmoid tumor
- D) Giant cell tumor
- E) Tuberous sclerosis

The correct response is Option B.

The findings on the panoramic x-ray study (Panorex) are most consistent with a dentigerous cyst, also referred to as a follicular cyst. These lesions are not tumors, but cysts that originate from the separation of the dental follicle from the crown of an unerupted tooth. Thus, dentigerous cysts arise during development and are odontogenic (from the tooth or its precursors) in origin. The cysts are lined by specialized epithelium that is instrumental in the formation of tooth enamel. This tissue usually atrophies and becomes part of the gingiva after the enamel is formed; a cyst forms when fluid accumulates between the atrophied or reduced enamel epithelium and the crown of an unerupted tooth. These cysts are most common around the mandibular third molar (wisdom tooth) and are seen most often in teenagers/young adults. They present as a painless bone expansion and appear on x-ray study as a well-circumscribed, unilocular radiolucency, often with a sclerotic rim. The relationship between the cyst and the tooth varies.

Giant cell tumor, desmoid tumor, and osseous tumors associated with tuberous sclerosis are solid, not cystic lesions. The former two lesions tend to be more erosive on x-ray study and have a largely solid composition. Bony tumors arising in the context of tuberous sclerosis are uncommon, but tend to be solid. Cherubism is a rare autosomal dominant disorder that begins in childhood and in which mandibular and maxillary bone is replaced by fibrous tissue and cysts. It reportedly improves over time but can be disfiguring.

REFERENCES:

1. Xu GZ, Jiang Q, Yang C, et al. Clinio-pathologic features of dentigerous cysts in the maxillary sinus. *J Craniifac Surg.* 2012; 23:e226-231.
2. Tkaczuk AT, Bhatt M, Caccamese JF Jr, et al. Cystic lesions of the jaw in children: a 15-year experience. *JAMA Otolaryngol Head Neck Surg.* 2015 Sep;141(9):834-9.
3. Eryilmaz T, Ozmen S, Findikcioglu K, et al. Odontogenic keratocyst: an unusual location and review of the literature. *Ann Plast Surg.* 2009; 62:210-212.
4. Sinno H, Zadeh T. Desmoid tumors of the pediatric mandible: case report and review. *Ann Plast Surg.* 2009; 62:213-219.



142. A 19-year-old man sustains a partial amputation fight-bite injury to the ear. The wound has been revised and a photograph of the residual defect is shown. The patient wants the ear to have a normal appearance. Which of the following is the best option to restore normal aesthetics to the ear?

- A) Addition of a silicone framework
- B) Composite cartilage grafting
- C) Reconstruction with a temporoparietal fascia flap with skin grafting
- D) Serial fat injections
- E) Staged autologous reconstruction with costal cartilage

The correct response is Option E.

This patient has sustained a three-dimensional and sizable defect of the ear. He is missing a portion of the helical rim, the scaphoid fossa to the antihelix. This is a difficult reconstructive challenge. The anatomic components that are missing are skin and underlying cartilage. The best option for obtaining a normal-appearing ear would be reconstruction with a cartilage framework carved to replace the cartilage and to support the overlying skin to retain the form of the ear. This could be done as a stage procedure.

Fat injection would not be adequate to replace the missing components or to give adequate shape to the ear.

A silicone framework within a scarred bed would be prone to complication, most notably infection and/or extrusion.

The defect is too large to be replaced by a composite cartilage graft.

Although a temporoparietal fascia flap could potentially be used to cover a cartilage framework, used alone it would not give adequate form to reconstruct this defect.

REFERENCES:

1. Gault D. Post traumatic ear reconstruction. *J Plast Reconstr Aesthet Surg*. 2008;61 Suppl 1:S5-12.
2. Firmin F, Bulstrode NW. Ear reconstruction. In: Bulstrode NW, Cugno S, Farhadieh RD. *Plastic and reconstructive surgery: Approaches and techniques*. Wiley-Blackwell, Chichester, UK: 2015.

143. During genioglossus advancement, which of the following nerves innervates the affected muscle?

- A) Facial nerve
- B) Glossopharyngeal nerve
- C) Hypoglossal nerve
- D) Lingual nerve
- E) Vagus nerve

The correct response is Option C.

During genioplasty or horizontal osteotomy of the mandible, the genioglossus muscle is identified after down fracture and separation of the mobile and nonmobile segments. The genioglossus muscle is not only a source of blood supply but also acts to advance the tongue during skeletal sleep apnea surgery and contributes to posterior pull on potential relapse of the mobilized chin segment. This important muscle is innervated by the hypoglossal nerve.

REFERENCES:

1. Sati S, Havlik R. An Evidence-Based Approach to Genioplasty. *Plast Reconstr Surg.* 2011 Feb;127(2):898-904.
2. Tanna N, Smith B, Zapanta P, et al. Surgical Management of Obstructive Sleep Apnea. *Plast Reconstr Surg.* 2016 Apr;137(4):1263-72.

144. A 22-year-old man is evaluated for multiple facial fractures after he was assaulted. Which of the following fractures is most likely associated with an increased risk of temporomandibular joint dysfunction?

- A) Bilateral parasymphysal mandible
- B) Comminuted unilateral condylar mandible
- C) Complete Le Fort I maxillary
- D) Displaced unilateral subcondylar mandible
- E) Unilateral zygomaticomaxillary

The correct response is Option B.

Temporomandibular joint (TMJ) dysfunction symptoms are serious, often overlooked complications of facial fractures and their treatments. They can range from clicking and pain to locking, malocclusion, and trismus. Overt ankylosis can occur in rare circumstances. Fractures that result in significant disruption of the condylar/glenoid apparatus are more likely to result in TMJ dysfunction symptoms than more anatomically remote fractures. Condylar fractures are most susceptible to post-fracture TMJ dysfunction. This is especially true in comminuted condylar head fractures. One recent study demonstrated an increase in TMJ dysfunction symptoms in patients with condylar fractures and concomitant contralateral mandibular body/angle fractures. Le Fort I and zygomaticomaxillary complex (ZMC) fractures are unlikely to be associated with TMJ symptoms.

REFERENCES:

1. Tabrizi R, Bahramnejad E, Mohaghegh M, et al. Is the frequency of temporomandibular dysfunction different in various mandibular fractures? *J Oral Maxillofac Surg*. 2014 Apr;72(4):755-761. Epub 2013 Oct 31.
2. Al-Hashmi A, Al-Azri A, Al-Ismaily M, et al. Temporomandibular disorders in patients with mandibular fractures: a preliminary comparative case-control study between South Australia and Oman. *Int J Oral Maxillofac Surg*. 2011 Dec;40(12):1369-1372. Epub 2011 Sep 1.

145. A 5-year-old boy is referred for evaluation of facial asymmetry. His parents report that they have noticed asymmetry since birth and believed it would improve with time, but it has not. The patient has no history of surgery or physical therapy. On physical examination, the physician notes skull asymmetry and facial asymmetry, including the orbits; there is no obvious neck tilt. A CT scan of the head is most likely to show which of the following?

- A) Deformational plagiocephaly
- B) Lambdoid craniosynostosis
- C) Torticollis
- D) Unicoronal craniosynostosis
- E) Zygomaticotemporal craniosynostosis

The correct response is Option A.

Since the early 1990's when positional deformational cranial deformities were first identified with the "back-to-sleep" campaigns, they have now become the most common etiology of cranial and facial asymmetry. Prior to that time, torticollis was the most common cause. Craniosynostosis is a much less frequent cause and occurs in the following order of decreasing frequency: unicoronal, lambdoid, zygomaticotemporal. Correct identification of most of the causes of this clinical constellation of findings can be made on clinical examination, but most would still get a CT scan to verify the diagnosis and rule out associated anomalies except for torticollis, which is always a clinical diagnosis.

REFERENCES:

1. Morris LM. Nonsyndromic Craniosynostosis and Deformational Head Shape Disorders. *Facial Plast Surg Clin North Am.* 2016 Nov;24(4):517-530.
2. Martiniuk A, Jacob J, Faruqui N, Yu W. Positional plagiocephaly reduces parental adherence to SIDS Guidelines and inundates the health system. *Child Care Health Dev.* 2016 Nov;42(6):941-950.
3. Tamber MS, Nikas D, Beier A, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guideline on the Role of Cranial Molding Orthosis (Helmet) Therapy for Patients With Positional Plagiocephaly. *Neurosurgery.* 2016 Nov;79(5):E632-E633.

146. A 60-year-old woman undergoes left hemiglossectomy for squamous cell carcinoma of the oral tongue. Reconstruction with which of the following is most likely to achieve the best functional outcome?

- A) Pectoralis major myocutaneous pedicled flap
- B) Radial forearm fasciocutaneous free flap
- C) Rectus abdominis myocutaneous free flap
- D) Split-thickness skin graft
- E) Temporalis muscle pedicled flap

The correct response is Option B.

Reconstructive strategies for partial and hemiglossectomy reconstruction are different than for subtotal and total glossectomy reconstruction. For partial and hemiglossectomies, the ideal reconstruction preserves the mobility of the remaining tongue, maintaining its ability to manipulate foods, articulate words, and sweep the oral cavity clean. Such defects are best reconstructed with a thin, pliable flap that resists contraction during the healing process. Of the choices listed, the radial forearm fasciocutaneous free flap best fits those requirements.

The pectoralis major myocutaneous pedicled flap is usually too thick to permit ideal movement and can have problems with reach and tethering to the chest as the proximal flap and pedicle contact during healing. The temporalis muscle pedicled flap is unlikely to reach the entire defect and the muscle is likely to contract and stiffen with time, limiting tongue movement. The rectus abdominis myocutaneous free flap is usually too thick to permit unrestricted movement of the remaining hemitongue and is better suited to subtotal and total glossectomy reconstruction, which is best effected with a bulky flap that diverts food and liquids laterally into the pharynx rather than into the larynx. A split-thickness skin graft, while thin, usually contracts substantially, limiting tongue movement. Also, if there is communication into the neck following tongue resection with neck dissection, the skin graft would be at high risk for resulting in a fistula.

REFERENCES:

1. Chang EI, Yu P, Skoracki RJ, Liu J, Hanasono MM. Comprehensive analysis of functional outcomes and survival after microvascular reconstruction of glossectomy defects. *Ann Surg Oncol*. 2015;3061-3069.

2. Chepeha DB, Spector ME, Chinn SB et al. Hemiglossectomy tongue reconstruction: modeling of elevation, protrusion, and functional. *Head Neck*. 2016 Jul;38(7):1066-73.

147. Which of the following represents the percentage of patients with isolated cleft palate who are most likely to have middle ear effusion?

- A) 10%
- B) 30%
- C) 50%
- D) 70%
- E) 90%

The correct response is Option E.

More than 90% of patients have chronic effusion of middle ear prior to repair. Therefore, all patients with cleft palate should be screened for hearing loss and for fluid in the middle ear due to eustachian tube dysfunction. There is emerging evidence and controversy with regard to treatment of the tensor veli tendon and the hamulus. However, this controversy and the tensor tenopexy, tensor transection, or fracture of the hamulus and their effects on the eustachian tube are beyond the scope of the question. What is clear is that the cleft patient population is at risk for complications related to fluid in the middle ear. Unfortunately, if this condition is unrecognized, elements of preventable hearing loss will occur.

REFERENCES:

1. Huang MH, Lee ST, Rajendran K. A fresh cadaveric study of the paratubal muscles: implications for eustachian tube function in cleft palate. *Plast Reconstr Surg*. 1997 Sep;100(4):833-42.
2. Paradise JL, Bluestone CD, Felder H. The universality of otitis media in 50 infants with cleft palate. *Pediatrics*. 1969 Jul;44(1):35-42.
3. Robinson PJ, Lodge S, Jones BM, et al. The effect of palate repair on otitis media with effusion. *Plast Reconstr Surg*. 1992 Apr;89(4):640-5.

148. A 6-year-old boy is brought to the clinic for evaluation of speech problems. His parents report that his teacher and peers have difficulty understanding him at school. He has no history of oral surgery. Speech testing shows hypernasality. Nasopharyngoscopy confirms the diagnosis and shows good lateral wall motion, involution of the tonsils and adenoids, and no overt submucous cleft palate. Which of the following is the most common complication of the procedure recommended to correct the patient's speech?

- A) Failure to correct the hypernasality
- B) Hyponasality
- C) Infection
- D) Obstructive sleep apnea
- E) Snoring

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option E.

In the clinical scenario described above, the recommended procedure would be a superiorly based pharyngeal flap. Certainly all of the complications listed above can occur with a pharyngeal flap, but the majority of patients will snore for several weeks following surgery as the swelling is resolving. A flap that is too wide may result in obstructive sleep apnea in up to 38% of patients, but this too usually improves with time. The surgical failure rate ranges from 2 to 22%. Hyponasality and infection are less common complications but have been described in the literature as well.

REFERENCES:

1. Rogers C, Konofaos P, Wallace RD. Superiorly Based Pharyngeal Flap for the Surgical Treatment of Velopharyngeal Insufficiency and Speech Outcomes. *J Craniofac Surg*. 2016 Oct;27(7):1746-1749.
2. Kummer AW, Marshall JL, Wilson MM. Non-Cleft Causes of Velopharyngeal Dysfunction: Implications for Treatment. *Int J Pediatr Otorhinolaryngol*. 2015 Mar;79(3):286-95.
3. Kirschner RE, Baylis AL. Surgical Considerations in 22Q11.2 Deletion Syndrome. *Clin Plast Surg*. 2014 Apr;41(2):271-82.

4. Sullivan SR, Marrinan EM, Mulliken JB. Pharyngeal Flap Outcomes in Nonsyndromic Children with Repaired Cleft Palate and Velopharyngeal Insufficiency. *Plast Reconstr Surg*. 2010 Jan;125(1):290-8.

149. During a Le Fort I osteotomy, the descending palatine artery is disrupted and ligated. The blood supply to the mobilized maxilla is primarily from which of the following arteries?

- A) Ascending pharyngeal
- B) Greater palatine
- C) Internal maxillary
- D) Lesser palatine

The correct response is Option A.

The vascular supply of the Le Fort I osteotomy segment was studied by utilizing standard latex injection techniques. Anatomic dissections of 10 fresh cadavers demonstrated interruption of the descending palatine arteries with preservation of the ascending palatine branch of the facial artery and the anterior branch of the ascending pharyngeal artery within the attached posterior palatal soft-tissue pedicle in all specimens following Le Fort I maxillary osteotomy. These ascending arterial branches entered the soft palate at a position approximately 1 cm posterior to the pterygomaxillary junction, which was disrupted during the Le Fort I maxillary osteotomy. Separate ink injections of total maxillary osteotomy segments confirmed vascular perfusion of the ipsilateral hemimaxillary segment by the ascending palatine artery. Thus vascular supply of the mobilized Le Fort I maxillary segment is by means of the ascending palatine branch of the facial artery and the anterior branch of the ascending pharyngeal artery in addition to the rich mucosal alveolar anastomotic network overlying the maxilla.

REFERENCES:

1. Siebert J, Angrigiani C, McCarthy J, et al. Blood Supply of the Le Fort I Maxillary Segment: An Anatomic Study. *Plast Reconstr Surg*. 1997 Sep;100(4):843-51.
2. Patel PK, Novia MV. The surgical tools: the LeFort I, bilateral sagittal split osteotomy of the mandible, and the osseous genioplasty. *Clin Plast Surg*. 2007 Jul;34(3):447-75.



150. A 33-year-old woman is evaluated for hypernasal speech and nasal escape with phonation. She underwent removal of the tonsils and adenoids 10 weeks ago. Transillumination of the palate is shown. Which of the following is the most appropriate approach to restore normal speech in this patient?

- A) Fat grafting to tonsil pillars
- B) Orticochea pharyngoplasty
- C) Palatoplasty
- D) Tensor tenopexy
- E) Observation and speech pathology

The correct response is Option C.

The photograph demonstrates through transillumination an absent normal levator muscle sling found in an occult submucous cleft palate. Velopharyngeal insufficiency (VPI) after tonsillectomy is a rare but known complication but can occur as frequently as 1:3000 to 1:10,000 tonsillectomies. Most of these complications occur in patients with either an occult or overt submucous cleft palate. With this anatomic variant, the principle of repair is either to restore normal anatomy with a two-flap palatoplasty or to pair the levator muscles into a functional sling. Techniques to lengthen the palate, such as a Furlow repair, help to obturate the nasal escape and also to improve VPI speech. As such, 8 weeks after VPI onset, the speech pathologist will have difficulty correcting the anatomic deficiency of lacking levator sling. The tensor tenopexy stabilizes the tendon of the tensor tympany to the hamulus during cleft palate repair, and stents open the eustachian tube but will not improve VPI speech.

REFERENCES:

1. Saunders NC, Hartley BE, Sell D, et al. Velopharyngeal insufficiency following adenoidectomy. *Clin Otolaryngol Allied Sci*. 2004 Dec;29(6):686-688.
2. Caterson EJ, Tsai DM, Cauley R, et al. Transillumination of the occult submucous cleft palate. *J Craniofac Surg*. 2014 Nov;25(6):2160-2163.

Section 4: Breast and Cosmetic

151. A 44-year-old woman, gravida 4, para 3, is evaluated because of symptomatic macromastia. Bilateral reduction mammoplasty is planned. The patient's mother was diagnosed with postmenopausal breast cancer at 53 years of age; the patient underwent genetic testing which was negative for *BRCA* mutation. Physical examination shows the patient wears a size 32F brassiere and has grade III ptosis, shoulder grooving, dense breast tissue without palpable masses or nipple discharge, and intertrigo. According to current American Cancer Society recommendations, which of the following breast imaging methods should be used before the planned reduction mammoplasty in this patient?

- A) Diagnostic mammography
- B) MRI
- C) Screening mammography
- D) Thermography
- E) Ultrasonography

The correct response is Option C.

The American Society of Plastic Surgeons participates in the Choosing Wisely campaign, which advocates for evidence-based guidelines in determining diagnostic and therapeutic interventions.

The American College of Surgeons' recommendations for breast cancer screening in average-risk, asymptomatic women are for an opportunity for a baseline mammogram at 40 to 44 years of age, annual screening from 45 to 54 years of age, and biennial screening for women older than 55 years of age who are in good health and have a life expectancy of at least ten years.

This patient is asymptomatic, and is not a *BRCA* carrier, and meets criteria for a screening mammogram.

A diagnostic mammogram is performed to evaluate abnormalities found on screening mammogram, in the context of breast cancer history, or with physical exam findings such as a breast mass, nipple discharge, or breast pain.

MRI is recommended as an adjunct to mammography in the case of a known *BRCA* mutation, if the first-degree relative is known to have the *BRCA* mutation but the patient is untested, or if there is a lifetime risk of 20 to 25% of breast cancer.

Thermography uses an infrared camera to show patterns of blood flow and heat on the surface of the breast. It is not a replacement for mammography, not recommended as part of screening protocols, and is not associated currently with any quality studies that demonstrate that it can be used effectively as a screening tool for breast cancer.

Ultrasonography is also used as an adjunct to screening mammography.

It is important to note that different societies have different recommendations on timing of screening mammography. The ACS recommends screening at 45 years of age, the American College of Radiology recommends screening starting at 40 years of age, and the USPSTF recommends biennial mammograms between 50 and 74 years of age.

REFERENCES:

1. Saslow D, Boetes C, Burke W, et al. American Cancer Society guidelines for breast screening with MRI as an adjunct to mammography. *CA Cancer J Clin.* 2007; 57:75-89.
2. Oeffinger KC, Fontham EL, Etzioni R et al. Breast cancer screening for women at average risk: 2015 Guideline update from the American Cancer Society. *JAMA.* 2015; 314:1599-1614.
3. Breast Cancer Screening - Thermography is Not an Alternative to Mammography: FDA Safety Communication. *U.S. Food & Drug Administration.* Published June 2, 2011. <http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm257259.htm>

152. A patient is evaluated because of nasal airway obstruction that is worse on the right side. Physical examination shows the inferior nasal turbinate has significant anterior extension and mucosal thickening with bony hypertrophy. There is a posttraumatic septal deviation and a 10-degree internal nasal valve angle. In consideration of surgery to improve the nasal airflow, which of the following factors is most important in determining the need for a submucous resection of the turbinate?

- A) Anterior extension of the turbinate
- B) Bony hypertrophy
- C) Decreased internal nasal valve angle
- D) Deviated septum
- E) Mucosal thickening

The correct response is Option B.

All of the answers listed can play a part in this patient's nasal obstruction and poor airflow in the right nostril. Of the answers listed, the bony hypertrophy of the inferior turbinate is the finding which most suggests the need for a submucous resection. The anterior extension of the inferior turbinate certainly can play a role in decreased air flow, but this by itself does not suggest the need for submucous resection. Simple mucosal thickening of the inferior turbinate without bony hypertrophy can be addressed with outfracture. Septal deviation can be addressed with septoplasty. Decreased internal nasal valve angle can be addressed with, for instance, a spreader graft.

REFERENCES:

1. Rohrich RJ, Ahmad J. A Practical Approach to Rhinoplasty. *Plast Reconstr Surg*. 2016 Apr;137(4):725e-746e.
2. Rohrich RJ, Ahmad J. Rhinoplasty. *Plast Reconstr Surg*. 2011;128:49e–73e.
3. Batra PS, Seiden AM, Smith TL. Surgical management of adult inferior turbinate hypertrophy: A systematic review of the evidence. *Laryngoscope*. 2009;119:1819-1827.

153. A 23-year-old woman undergoes augmentation mammoplasty with round, smooth silicone implants placed in the dual-plane position. Postoperatively, unilateral erythema and warmth are noted, and they slowly resolve over 10 days of oral antibiotic treatment. The patient asks what this might mean for future satisfaction with the outcomes. Which of the following is the most likely sequela of this patient's clinical course?

- A) Breast gland ptosis
- B) Capsular contracture
- C) Double-bubble appearance
- D) Implant rupture
- E) Nipple numbness

The correct response is Option B.

One of the most often mentioned potential risk factors for capsular contracture is biofilm, and this may be related to bacterial contamination. History of infection is unlikely to impact nipple sensation, implant rupture, true breast gland ptosis, or effacement of the inframammary fold with downward descent of the implant.

REFERENCES:

1. Ajdic D, Zoghbi Y, Gerth D, Panthaki ZJ, Thaller S. The Relationship of Bacterial Biofilms and Capsular Contracture in Breast Implants. *Aesthet Surg J*. 2016 Mar;36(3):297-309.
2. Chong SJ, Deva AK. Understanding the Etiology and Prevention of Capsular Contracture: Translating Science into Practice. *Clin Plast Surg*. 2015 Oct;42(4):427-36.
3. Constantine RS, Constantine FC, Rohrich RJ. The ever-changing role of biofilms in plastic surgery. *Plast Reconstr Surg*. 2014 Jun;133(6):865e-872e.

154. A 59-year-old man is scheduled for reconstruction of a central abdominal wall hernia measuring 10 cm wide × 30 cm long. A surgical approach using posterior component separation is planned. Which of the following locations for fascial incision most accurately describes the technical considerations of this procedure?

A) Across the lateral intercostal neurovascular bundles

B) Along the mid-axillary line

C) Medial to the linea semilunaris

D) Parallel to the subcostal border

E) Vertical bisection of the rectus muscles

The correct response is Option C.

Component separation of the abdominal wall was initially described for the anterior components, that is, those which are located anterior to the rectus muscle. A more recent development involves component separation of the layers located posterior to the rectus fascia. The technique of posterior component separation begins with a vertical incision of the posterior rectus sheath 0.5 cm medial to the linea semilunaris and continues laterally in the avascular plane posterior to the transversalis muscle. It can extend as far posteriorly as the psoas muscle if needed. In the event that the posterior layer cannot be approximated in the midline, an interposition patch of omental fat, hernia sac, or absorbable mesh is used. Concurrent use of non-absorbable mesh to reconstruct deficient anterior layers may be used in conjunction with the posterior separation technique as long as the mesh is separated from viscera with an intact posterior layer. A benefit of the posterior separation technique is the preservation of the lateral neurovascular bundles preserving the dynamic function of the rectus muscles. The technique may be utilized even when fascial defects are not situated in the midline or are located adjacent to bony landmarks.

REFERENCES:

1. Rodriguez ED, Bluebond-Langner R, Silverman RP, et al. Abdominal wall reconstruction following a severe loss of domain: the R Adams Cowley Shock Trauma Center algorithm. *Plast Reconstr Surg.* 2007; 120(3):669-680.

2. Jones CM, Potochny JD, Pauli, EM. Posterior component separation with transversus abdominis release: technique and utility in challenging abdominal wall reconstruction cases. *Plast Reconstr Surg.* 2014; 134(4S-1):116.
3. Jones CM, Winder JS, Potochny JD, Pauli EM. Posterior component separation with transversus abdominis release: technique, utility, and outcomes in complex abdominal wall reconstruction. *Plast Reconstr Surg.* 2016; 137(2):636-646
4. Agur AMR, Dalley, AF. *Grant's Atlas of Anatomy*, 13th ed. Wolters Kluwer, Philadelphia; 2013; 109.

155. A 48-year-old woman returns to the office 1 hour after receiving hyaluronic acid filler into the nasolabial area. She reports pain in the right cheek and a mottled appearance of the nose and cheek. Physical examination shows reticulated discoloration of the nose and right cheek. An intravascular injection with occlusion is suspected. Which of the following is the most appropriate initial dose in units of hyaluronidase for this patient?

- A) 10 to 20
- B) 50 to 100
- C) 150 to 300
- D) 600 to 750
- E) 1000 to 1500

The correct response is Option C.

Intravascular injection of hyaluronic acid (HA) fillers can lead to devastating outcomes including soft tissue necrosis, scarring, blindness, and stroke. The pivotal treatment for this complication is injection of hyaluronidase into the injection site as well as into the area of vascular compromise. Hyaluronidase is able to degrade the HA. There is also evidence that this effect can degrade the HA embolus. The recommended initial dose is 150 to 300 units. These doses can be repeated as needed. Smaller doses can be used if non-intravascular occlusion is suspected.

Doses of 10 to 20 and 50 to 100 units would be appropriate for overfilling deformities or overfilling external occlusions. Patients with intravascular occlusion may require doses of 600 to 750 and 1000 to 1500 units over hours or days; however, this would not be the initial dose.

REFERENCES:

1. Signorini M, Liew S, Sundaram H, et al. Global Aesthetics Consensus: Avoidance and Management of Complications from Hyaluronic Acid Fillers-Evidence and Opinion-Based Review and Consensus Recommendations. *Plast Reconstr Surg*. 2016; 137:961e-971e.
2. Sun Z, Zhu G, Wang H, et al. Clinical Outcomes of Impending Nasal Skin Necrosis Related to Nose and Nasolabial Fold Augmentation with Hyaluronic Acid Fillers. *Plast Reconstr Surg*. 2015; 136:434e-441e.

156. A 52-year-old woman comes to the office to discuss revision of breast reconstruction following mastectomy for breast cancer. She is undergoing adjuvant treatment with an agent that interferes with her body's natural mechanisms that promote native breast growth, but she cannot remember its name. She is most likely being treated with which of the following agents?

A) Alkylating agent (cyclophosphamide)

B) Anthracycline (doxorubicin)

C) Aromatase inhibitor (anastrozole)

D) Platinum agent (cisplatin)

E) Taxane (paclitaxel)

The correct response is Option C.

Aromatase inhibitors such as anastrozole impair conversion of androgens to estrogens. Estrogens promote normal breast tissue growth as well as growth of many breast cancers. The other options (taxanes, anthracyclines, alkylating agents, and platinum agents) are all chemotherapeutic agents that do not particularly target hormones involved in normal breast growth mechanisms.

REFERENCES:

1. Russo J, Russo IH. The role of estrogen in the initiation of breast cancer. *J Steroid Biochem Mol Biol*. 2006 Dec;102(1-5):89-96.
2. Miller WR. Mechanism of action and role in the treatment of breast cancer. *Semin Oncol*. 2003 Aug;30(4 Suppl 14):3-11.
3. National Comprehensive Cancer Network. *NCCN Guidelines for Breast Cancer*. https://www.nccn.org/professionals/physician_gls/f_guidelines.asp. Accessed Dec. 2016. Last updated: 2017.

157. A 32-year-old woman is evaluated for trunk contouring 12 months after undergoing laparoscopic gastric bypass surgery. Hypertension and sleep apnea have resolved. Current BMI is 32.7 kg/m². She reports an 80-lb (36.2-kg) weight loss and is still actively losing weight. Which of the following is the most appropriate next step in management?

- A) Complete blood cell count
- B) CT scan of the abdomen
- C) Panniculectomy
- D) Re-evaluation in 6 months
- E) Referral to psychiatry

The correct response is Option D.

In patients who have undergone gastric bypass surgery, consensus recommendations are to wait to proceed with body contouring surgery until the patient is at least 1 year from surgery. Additionally, recommendations are to wait until the patient has had a stable weight for at least 3 months and some authors advocate 6 months of weight stability. This is due to the fact that additional weight loss after surgery may result in recurrence of skin laxity. Stability of the long-term result is best achieved when there is stability of the underlying weight. Furthermore, risk of surgery increases with increasing BMI, thus waiting for the patient to achieve their lowest BMI prior to performing surgery will limit weight-associated risks. It is for these reasons that a return visit for reassessment in 6 months is the best choice as opposed to proceeding to panniculectomy at this time.

A CT scan is indicated in those patients where a physical examination is unable to rule out an abdominal wall hernia. In an otherwise asymptomatic patient from a hernia standpoint, reassessment of the physical examination once the patient has achieved a stable weight is the time to determine if there is an abdominal wall hernia that would be addressed at the time of body contouring surgery. At this point in time, the patient may have lost enough weight to adequately assess the abdominal wall for a hernia, and thus make a CT scan unnecessary.

Most post-bariatric patients will be obtaining laboratory assessments from their bariatric surgeon to assess for nutritional deficiencies and will be on supplements as indicated. After undergoing bariatric surgery, many patients have iron deficiency anemia. A complete blood count may be indicated for those who have symptoms or signs of anemia, or in whom a significant blood loss is anticipated. In relation to the body contouring surgery, this test is

best undertaken once the plan to proceed with surgery is made. Again, this would occur once a stable weight has been achieved.

Many patients with weight control issues suffer from mental health pathology. A referral to a psychiatrist would be indicated in any patient who has a history of mental health issues or demonstrates signs or symptoms of psychopathology prior to embarking on post bariatric body contouring. As this patient has no medical issues noted, the routine referral to a mental health provider is not indicated.

REFERENCES:

1. Almutairi K, Gusenoff JA, Rubin JP. Body Contouring. *Plast Reconstr Surg*. 2016 Mar;137(3):586e-602e.
2. Colwell AS. Current concepts in post-bariatric body contouring. *Obes Surg*. 2010 Aug;20(8):1178-82.
3. Herman CK, Hoschander AS, Wong A. Post-Bariatric Body Contouring. *Aesthet Surg J*. 2015 Aug;35(6):672-87.
4. Sebastian JL. Bariatric surgery and work-up of the massive weight loss patient. *Clin Plast Surg*. 2008 Jan;35(1):11-26.

158. Improvement in which of the following is an advantage of nipple-areola complex reconstruction?

- A) Breast feeding ability
- B) Breast mound shape
- C) Reactivity to touch
- D) Satisfaction with reconstruction
- E) Sexual sensation

The correct response is Option D.

Satisfaction with reconstruction, quality of life, and feeling of completeness with reconstruction have all been shown to be linked to nipple and/or areola reconstruction. The reconstruction does not restore nipple function; therefore, breast feeding, sexual sensation, and reactivity to touch are not accomplished with nipple and/or areola reconstruction. Often the nipple reconstruction, if using local tissue techniques, may actually flatten the anterior aspect of the breast and is not thought to positively impact the breast mound shape.

REFERENCES:

1. Momoh AO, Colakoglu S, de Blacam C, et al. The impact of nipple reconstruction on patient satisfaction in breast reconstruction. *Ann Plast Surg.* 2012; 69:389–393.
2. Bykowski MR, Emelife PI, Emelife NN, et al. Nipple-areola complex reconstruction improves psychosocial and sexual well-being in women being treated for breast cancer. *J Plast Reconstr Aesthet Surg.* Nov 2016; epub ahead of print.
3. Weissler EH, Schnur JB, Lamelas AM, et al. The Necessity of the Nipple: Redefining Completeness in Breast Reconstruction. *Ann Plast Surg.* Nov 2016; epub ahead of print.

159. Which of the following newborns would be the best candidate for ear molding?

- A) One-day-old newborn with helical rim deformation
- B) One-day-old newborn with helical rim malformation
- C) One-week-old newborn with conchal deformation
- D) One-week-old newborn with conchal malformation

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option C.

The correct response is a patient with ear deformation at 1 week of age. When deciding on molding, the first question to ask is what is the difference between malformation and deformation. An ear malformation is when there is a partial absence of either the skin or cartilage of the external ear. These patients tend to be less optimal candidates for molding. Patients with ear deformations have fully developed but misshapen ears and therefore are better candidates for molding. The plasticity of the cartilage is due to maternal circulating estrogen which peaks at day 3 and returns to baseline at week 6, and up to 30% of infants will self correct in the first week of life. One-day-old is too soon to begin molding because in 24 hours, some of these deformities will spontaneously resolve.

REFERENCES:

1. Doft M, Goodkind A, Diamond S. The Newborn Butterfly Project: A Shortened Treatment Protocol for Ear Molding. *Plast Reconstr Surg*. 2015 Mar;135(3):577e-583e.
2. Byrd HS, Langevin CJ, Ghidoni LA. Ear Molding in Newborn Infants with Auricular Deformities. *Plast Reconstr Surg*. 2010 Oct;126(4):1191-200.

160. A 35-year-old man comes to the office for a consultation because he is dissatisfied with the result of a rhinoplasty performed 2 years ago. The patient reports that his nasal openings collapse on deep inspiration and his nasal tip is deformed. Physical examination shows collapse of the external nasal valve on deep inspiration and bilateral asymmetric alar rim collapse with alar retraction of 1 to 2 mm. Revision rhinoplasty is planned. Which of the following grafts is most appropriate to correct these conditions?

- A) Columella strut
- B) Composite alar rim
- C) Lateral crural strut
- D) Spreader
- E) Subdomal

The correct response is Option C.

The lateral crural strut graft is a strip of septal cartilage that (if available for harvest) is sutured to the underside of the lower lateral cartilage and provides increased support and position control. It is a very powerful graft that can reposition lower lateral cartilages, correct alar retraction, and correct external valve collapse.

The columella strut graft is for increased tip projection and support.

The composite alar rim graft includes both skin and cartilage. This graft is used for severe alar retraction and soft tissue loss of the alar rim.

Spreader grafts are used to increase airflow through the internal nasal valve as well as straighten a deviated dorsal septum and improve dorsal aesthetic lines.

The subdomal graft is placed under the domes of the lower cartilages and can correct asymmetry of the nasal tip and improve a pinched tip.

REFERENCES:

1. Gunter JP, Landecker A, Cochran CS. Frequently Used Grafts in Rhinoplasty: Nomenclature and Analysis. *Plast Reconstr Surg.* 2006;118:14e-29e.
2. Gunter JP, Friedman RM. Lateral Crural Strut Graft: Technique and Clinical Applications in Rhinoplasty. *Plast Reconstr Surg.* 1997;99,4:943-952.

3. Gruber RP, Fox P, Peled A, et al. Grafting the Alar Rim: Application as Anatomical Graft. *Plast Reconstr Surg*. 2014;134:880e-887e.

161. A 35-year-old woman with a Stage T2 infiltrating ductal carcinoma is scheduled to undergo a skin-sparing, right total mastectomy and a nipple-sparing, left prophylactic mastectomy. The possibility of adjuvant radiation therapy to the right breast depends on the final surgical pathology. The patient has a history of smoking. BMI is 28 kg/m². She wears a brassiere with a D cup and would like the postoperative result to be of a similar size. Which of the following immediate bilateral reconstructive techniques is most appropriate for this patient?

- A) Abdominal-based free flaps
- B) Gluteal-based free flaps
- C) Latissimus dorsi myocutaneous flaps and silicone implants
- D) Silicone implants and acellular dermal matrix
- E) Tissue expanders and acellular dermal matrix

The correct response is Option E.

For this patient in whom postoperative radiation therapy is possible, the best first-stage, immediate reconstructive approach is placement of tissue expanders with acellular dermal matrix. The outcome of immediate autologous flap reconstruction may be compromised if subjected to adjuvant radiation therapy and is best delayed until after such treatment has been rendered. Although successful, cost-effective outcomes are possible with a single-stage, direct-to-implant approach, this patient has risk factors for early revision and implant failure due to her large breasts and history of smoking.

REFERENCES:

1. Razdan SN, Cordeiro PG, Alborno CR, et al. Cost-effectiveness analysis of breast reconstruction options in the setting of postmastectomy radiotherapy using the BREAST-Q. *Plast Reconstr Surg*. 2016; 137(3):510e-517e.
2. Gdalevitch P, Ho A, Genoway K, et al. Direct-to-implant single-stage immediate breast reconstruction with acellular dermal matrix: predictors of failure. *Plast Reconstr Surg*. 2014;133(6): 738e-747e.
3. Kronowitz SJ, Robb GL. Radiation therapy and breast reconstruction: a critical review of the literature. *Plast Reconstr Surg*. 2009;124(2):395-408.

162. Which of the following measures reduces the risk for the most common complication in abdominoplasty?

- A) Administration of preoperative intravenous antibiotics within 1 hour of incision
- B) Attention to offloading pressure points and keeping upper extremities in neutral position
- C) Discontinuation of NSAIDs and herbal supplements 4 weeks before surgery
- D) Use of pneumatic compression devices before the induction of general anesthesia
- E) Use of progressive tension sutures and drain placement

The correct response is Option E.

Seroma is the most common complication following abdominoplasty. Progressive tension sutures and/or use of drains have been shown to be effective in preventing this complication.

Use of antibiotics is intended to prevent infection. Discontinuation of NSAIDs, fish oil, and herbal supplements is intended to decrease the incidence of hematoma.

Offloading pressure points and extremities in neutral position is to decrease the incidence of neuropathies postoperatively.

Pneumatic compression devices and subcutaneous heparin and enoxaparin are intended to decrease the incidence of venous thromboembolism.

REFERENCES:

1. Jabbour S, Awaida C, Mhawej R, et al. Does the Addition of Progressive Tension Sutures to Drains Reduce Seroma Incidence After Abdominoplasty? A Systematic Review and Meta-Analysis. *Aesthet Surg J*. 2016 Oct 27.
2. Epstein S, Epstein MA, Gutowski KA. Lipoabdominoplasty without drains or progressive tension sutures: an analysis of 100 consecutive patients. *Aesthet Surg J*. 2015 May;35(4):434-40.

163. A 35-year-old woman comes to the office to discuss improving the contour of her thighs. History includes gastric bypass surgery two years ago, followed by a stable 150-lb (68-kg) weight loss. Along with moderate horizontal excess skin, she has significant vertical excess skin, and a full-length vertical thighplasty is considered. This patient is at greatest risk for which of the following complications?

- A) Hematoma
- B) Infection
- C) Labial spreading
- D) Prolonged edema
- E) Seroma

The correct response is Option D.

Each of the complications listed in this question has a significant occurrence with thighplasty in the massive-weight-loss population, but prolonged edema has been shown to be a particular risk factor in patients getting a full-length vertical component in their thighplasty, presumably due to circumferential compression of the low pressure lymphatic system. Labial spreading is possible but not likely.

REFERENCES:

1. Gusenoff JA, Coon D, Nayar H. Medial Thigh Lift in the Massive Weight Loss Population: Outcomes and Complications. *Plast Reconstr Surg*. 2015 Jan;135(1):98-106.
2. Moreno CH, Neto HJ, Junior AH, Malheiros CA. Thighplasty after bariatric surgery: Evaluation of lymphatic drainage in lower extremities. *Obes Surg*. 2008 Sep;18(9):1160-4.

164. In women with breast ptosis, which of the following is an advantage of performing combined one-stage augmentation mammoplasty with mastopexy compared with mastopexy alone?

- A) Better predictability of cosmetic outcome
- B) Decreased complication rates
- C) Decreased revision rates
- D) Improved upper pole projection
- E) Lower operative costs

The correct response is Option D.

Early reports have raised concerns about the safety of combined augmentation mammoplasty with mastopexy surgeries. However, in patients who wish to correct their breast ptosis these two procedures are often combined to a one-stage surgery and can show favorable outcomes. Nevertheless, plastic surgeons advocate that these cases should only be performed by experienced physicians.

Reasons are that the overall aesthetic results are harder to predict in one-stage augmentation/mastopexy procedures compared to mastopexy alone or even the two-stage augmentation mammoplasty followed by mastopexy. Both complication and revision rates are highest in the one-stage approach that combines augmentation mammoplasty with mastopexy. Longer operative time and the need for implants naturally increase operative costs.

The advantage of the simultaneous insertion of implants is the improved superior pole projection that cannot be achieved by mastopexy alone.

REFERENCES:

1. Beale EW, Ramanadham S, Harrison B, Rasko Y, Armijo B, Rohrich RJ. Achieving predictability in augmentation mastopexy. *Plast Reconstr Surg*. 2014;133:284e-292e.
2. Calobrace MB, Herdt DR, Cothron KJ. Simultaneous augmentation/mastopexy: a retrospective 5-year review of 332 consecutive cases. *Plast Reconstr Surg*. 2013;131:145-156.
3. Swanson E. A retrospective photometric study of 82 published reports of mastopexy and breast reduction. *Plast Reconstr Surg*. 2011;128:1282-1301.

4. Whidden PG. Simultaneous breast augmentation and mastopexy. *Can J Plast Surg*. 2003 Summer; 11(2):73–78.

165. A 23-year-old woman of Asian ancestry comes to the office to discuss augmentation rhinoplasty to address dorsal projection. She refuses harvest of graft material from a secondary donor site. Which of the following materials would most likely provide the desired augmentation, the least surgical risk, and the greatest longevity of result?

- A) Ear cartilage
- B) Homologous irradiated rib cartilage
- C) Porous polyethylene implant
- D) Septal cartilage
- E) Stacked acellular dermal matrix

The correct response is Option D.

There are many options for materials to use for augmentation rhinoplasty. Most options fall into one of several categories including autologous soft tissue, cartilage, and bone; processed allografts such as acellular dermal matrix; homologous grafts, most often irradiated rib; and alloplastic materials including silicone, ePTFE (expanded polytetrafluoroethylene sheeting), and porous polyethylene. There are advantages and disadvantages of each. In this case, the patient refuses a donor site outside of the nasal surgery, which eliminates the options of ear or rib cartilage and the option of cultured autologous auricular chondrocytes, as this too requires harvest of ear cartilage prior to the rhinoplasty. Homologous irradiated rib cartilage is a good alternative to autologous cartilage grafts and requires no donor site but has a somewhat higher risk profile than autologous septal cartilage. Silicone implants, and alloplastic implants in general, are popular in Asian augmentation rhinoplasties and have the advantage of availability, affordability, and no donor site, but they carry a higher risk for postoperative complications, including extrusion, skin changes, and infection, all of which create significant issues when they require secondary rhinoplasty procedures. Acellular dermal matrix has the disadvantage of a resorption rate of 20 to 30 percent, too much to perform precise corrections. An ear cartilage graft would be from a secondary site.

REFERENCES:

1. Lee MR, Unger JG, Rohrich RJ. Management of the nasal dorsum in rhinoplasty: a systematic review of the literature regarding technique, outcomes, and complications. *Plast Reconstr Surg*. 2011 Nov;128(5):538e-550e.
2. Malone M, Pearlman S. Dorsal Augmentation in Rhinoplasty: A Survey and Review. *Facial Plast Surg*. 2015 Jun;31(3):289-94.

3. Nguyen AH, Bartlett EL, Kania K, Bae SM. Simple Implant Augmentation Rhinoplasty. *Semin Plast Surg*. 2015 Nov;29(4):247-54.

166. Which of the following nerves passes from the middle cranial fossa into the orbit via the superior orbital fissure?

- A) Mandibular (cranial V)
- B) Maxillary (cranial V)
- C) Oculomotor (cranial III)
- D) Olfactory (cranial I)
- E) Optic (cranial II)

The correct answer is Option C.

The superior orbital fissure is a bony hiatus situated between the lesser and greater wings of the sphenoid bone. Through it pass multiple vascular and neural structures from the middle cranial fossa into the orbit. These include the superior and inferior divisions of the ophthalmic vein, sympathetic fibers from the cavernous plexus, and several cranial nerves. The mnemonic “Live Frankly To See Absolutely No Insult” is a helpful aid to identify the nerves which traverse the superior orbital fissure:

L- lacrimal division, ophthalmic nerve (V1)

F- frontal division, ophthalmic nerve (V1)

T- trochlear nerve (IV)

S- superior division of the oculomotor nerve (III)

A- abducens (VI)

N- nasociliary branch of the ophthalmic nerve (V1)

I- inferior division of the oculomotor nerve (III)

The optic nerve enters the orbit via the optic foramen which lies at the apex of the orbit and perforates the sphenoid bone. Fractures of the orbit which involve the superior orbital fissure may have severe consequences for the involved soft tissue structures. Injury to one or more of the structures passing through the superior orbital fissure may cause pain, ophthalmoplegia, or even blindness.

REFERENCES:

1. Gart MS, Gosain AK. Evidence-Based Medicine: Orbital Floor Fractures. *Plast Reconstr Surg*. 2014; 134(6):1345-1355.
2. Rohrich RJ, Hackney FL, Parikh RS. Superior orbital fissure syndrome: current management concepts. *J Craniomaxillofac Trauma*. 1995; 1(2):44-48.
3. Agur AMR, Dalley, AF. *Grant's Atlas of Anatomy*, 13th ed. 2013 pg 664. Wolters Kluwer, Philadelphia, 2013.

167. In grade II ptosis of the breast, which of the following best describes the position of the nipple?

- A) At the apex of the breast mound
- B) At the lowest contour of the breast
- C) At the transposed inframammary fold
- D) Between the inframammary fold and the lowest contour of the breast
- E) On the posterior aspect of the breast as it rests on the chest wall

The correct response is Option D.

The classic Regnault definition of breast ptosis classifications are as follows:

Grade I: Nipple at the level of the inframammary fold

Grade II: Nipple between the level of the inframammary fold and the lowest contour of the breast

Grade III: Nipple at the lowest contour of the breast

REFERENCES:

1. Regnault P. Breast ptosis: definition and treatment. *Clin Plast Surg.* 1976;3:193-203.
2. Thorne C, Gurtner G, Chung K. *Grabb and Smith's Plastic Surgery*, 7th Edition. Wolters Kluwer, Lippincott, Williams, and Wilkins; 2013.

168. During secondary open rhinoplasty through an existing transcolumellar incision, division of which of the following arteries is most likely to result in vascular ischemia of the nasal tip?

- A) Anterior ethmoid
- B) Columellar
- C) Dorsal nasal
- D) External nasal
- E) Lateral nasal

The correct response is Option E.

A detailed knowledge of the nasal tip blood supply is critical for safe conduct when using a transcolumellar incision during primary or secondary rhinoplasty. There are several sources of arterial blood supply to the nasal tip. Some of these can be sacrificed without compromising the viability of the nasal tip skin. Rohrich et al. determined that the nasal tip has a dual blood supply derived from the ophthalmic and facial arteries. While contributions from the ophthalmic circulation's anterior ethmoid, dorsal nasal, and external nasal arteries are present, the dominant supply is derived from branches of the facial artery. Its branches, the columellar artery (present in 68.2% of cadavers in one study) and the lateral nasal artery (present in 100% of cadavers), are more likely to provide the nasal tip with inflow even if the ophthalmic arterial branches are sacrificed during the dissection. Regardless of the presence of a prior transcolumellar incision, the nasal tip blood supply is secure if the lateral nasal arteries are preserved. Guidelines for assuring that the lateral nasal arteries remain uninjured include "hugging" the cartilage of the lateral crura in a subperichondrial plane, limiting dissection superiorly to the level of the alar groove, limiting alar base excision to a level below the alar grooves, and limited defatting of the subdermal plane of the tip.

REFERENCES:

1. Rohrich RJ, Muzaffar AR, Gunter JP. Nasal tip blood supply: Confirming the safety of the transcolumellar incision in rhinoplasty. *Plast Reconstr Surg.* 2000; 106(7):1640-1641.
2. Unger JG, Roostaeian J, Cheng DH, et al. The open approach in secondary rhinoplasty: choosing an incision regardless of prior placement. *Plast Reconstr Surg.* 2013; 132(4):780-786.

169. After a nipple-sparing mastectomy, which of the following branches of an intercostal nerve predominantly provides remaining sensation to the nipple-areola complex?

- A) Anterior branch of the fifth
- B) Anterior branch of the fourth
- C) Lateral branch of the fifth
- D) Lateral branch of the fourth
- E) Lateral branch of the third

The correct response is Option B.

The cutaneous innervation of the female breast is derived medially from the anterior cutaneous branches of the first to sixth intercostal nerves and laterally from the lateral cutaneous branches of the second to seventh intercostal nerves. The nipple-areola complex is physiologically innervated by the lateral and anterior branches of the third to fifth intercostal nerves. The fourth intercostal nerve has further shown to be most consistent in various anatomical studies.

However, the anterior branches take a superficial course within the subcutaneous tissues of the medial breast while the lateral branches take a deep course within the pectoral fascia and reach the nipple via the breast parenchyma. Therefore, the lateral branches are most likely resected during mastectomy and contribute little to the postoperative innervation of the nipple-areola complex.

REFERENCES:

1. Jaspars JJ, Posma AN, van Immerseel AA, Gittenberger-de Groot AC. The cutaneous innervation of the female breast and nipple-areola complex: implications for surgery. *Br J Plast Surg*. 1997;50:249-259.
2. O'Connell RL, Rusby JE. Anatomy relevant to conservative mastectomy. *Gland Surgery*. 2015;4:476-483.
3. Sabri E, Sawaya E, Pellissier P. The Restoration of Nipple-Areola Complex Sensation and Nipple Erection after More Than a Year From Reduction Mammoplasty: A Comparative Study between Superior and Posterior Pedicle Techniques. *J Plast Reconstr Surg*. 2010;34:71-75.

170. A healthy 29-year-old woman undergoes suction-assisted lipectomy with a tumescent solution for thigh lipodystrophy. A maximal dose of lidocaine 55 mg/kg is planned through the tumescent solution, and aspiration is planned through a 4-mm blunt-tipped cannula. Which of the following best approximates the expected percentage of local anesthetic in the aspirated material?

- A) 20%
- B) 50%
- C) 70%
- D) 90%

The correct response is Option A.

While there is evidence that doses of up to 55 mg/kg can be safely used in liposuction, the safe dose is likely dependent on the vascularity of the tissue injected rather than aspiration of the local anesthetic during the procedure. Studies have shown that between approximately 10 and 30% of local anesthetic is present in the aspirate, and one study showed that a mean of 9.8% of wetting solution was removed.

The knowledge that the majority of tumescent solution remains in vivo is important because lidocaine toxicity is a risk after tumescent liposuction.

REFERENCES:

1. Ostad A, Kageyama N, Moy RL. Tumescent anesthesia with a lidocaine dose of 55 mg/kg is safe for liposuction. *Dermatol Surg.* 1996; 22:921-927.
2. Swanson, E. Prospective study of lidocaine, bupivacaine, and epinephrine levels and blood loss in patients undergoing liposuction and abdominoplasty. *Plastic Recon Surg.* 2012; 130(3):702-722.
3. Chia, CT, Theodorou, J. 1000 consecutive cases of laser-assisted liposuction and suction-assisted lipectomy managed with local anesthesia. *Aesthetic Plast Surg.* 29(4):795-802, 2012.

171. A 48-year-old man who underwent laparoscopic gastric bypass surgery 2 years ago is evaluated for a belt lipectomy after a massive weight loss of 150 lb (68 kg). He has maintained a stable weight for over 6 months. Current BMI is 30 kg/m². Which of the following factors most increases the risk for hematoma in this patient?

- A) Age
- B) Gender
- C) Location of incision
- D) Postoperative BMI

The correct response is Option B.

Male gender is an increased risk factor for hematoma and seroma in body contouring patients, independent of hypertension. Age, incision site, and postoperative BMI have not been shown to increase the risk for hematoma.

REFERENCES:

1. Chong T, Coon D, Toy J, et al. Body Contouring in the Male Weight Loss Population: Assessing Gender as a Factor in Outcomes. *Plast Reconstr Surg.* 2012; 130:325e-330.
2. Fischer JP, Wes AM, Serletti, JM, Kovach SJ. Complications in Body Contouring Procedures: An Analysis of 1797 Patients from the 2005 to 2010 American College of Surgeons National Surgical Quality Improvement Program Databases. *Plast Reconstr Surg.* 2013; 132:1411-1420.
3. Winocour J, Gupta V, Ramirez JR, et al. Abdominoplasty: Risk Factors, Complication Rates, and Safety of Combined Procedures. *Plast Reconstr Surg.* 2015; 136:597e-606e.

172. A 65-year-old woman with a history of left mastectomy for breast cancer 10 years ago undergoes biopsy of a suspicious lesion of the right breast found on a recent mammogram. Examination of the biopsy specimen confirms a right breast carcinoma. This lesion most likely originated from which of the following structures?

- A) Adipose tissue
- B) Areolar skin
- C) Lactiferous duct
- D) Lymph node
- E) Pectoralis major muscle

The correct response is Option C.

Women who were previously treated for breast cancer are at increased risk for development of a metachronous lesion of the contralateral breast. Cancers of the breast are typically adenocarcinomas, arising from the glandular tissue such as the ducts or lobules. Paget disease of the breast would involve the areolar skin but is fairly uncommon. Sarcomas arising from the connective tissue (such as adipose or muscle) are also rare. Breast adenocarcinomas do not originate from lymphatic tissue.

REFERENCES:

1. Breast Cancer Treatment (PDQ®)—Health Professional Version. *National Cancer Institute* website. <http://www.cancer.gov/types/breast/hp/breast-treatment-pdq>. Updated 10/21/2016. Accessed 11/17/2016.
2. Corben AD. Pathology of Invasive Breast Disease. *Surg Clin North Am*. 2013; 93(2):363-392.
3. Yi M, Meric-Bernstam F, Middleton LP, et al. Predictors of Contralateral Breast Cancer in Patients With Unilateral Breast Cancer Undergoing Contralateral Prophylactic Mastectomy. *Cancer*. 2009; 115(5):962-971.

173. Which of the following is the most common complication after undergoing hyaluronidase injection for the treatment of HA nodules?

- A) Hyperpigmentation
- B) Local allergic reaction
- C) Neurapraxia
- D) Scar contracture
- E) Skin necrosis

The correct response is Option B.

Overinjection of hyaluronic acid can result in subcutaneous nodules that are often visible and/or palpable. Isolated nodules can be treated with simple incision and drainage using a sharp needle. However, multiple nodules due to excessive injection may require treatment with hyaluronidase. Hyaluronidase is a mucolytic enzyme that hydrolyzes hyaluronic acid dermal fillers. The recommended treatment is injection of 25 to 100 IU into the affected area followed by gentle massage.

The most common complication following the injection of hyaluronidase is local allergic reaction. Hyperpigmentation, skin necrosis, and scar contracture have not been reported with the use of hyaluronidase. Neurapraxia is an unusual complication.

REFERENCES:

1. Cavallini M, Gazzola R, Metalla M, Vaienti L. The role of hyaluronidase in the treatment of complications from hyaluronic acid dermal fillers. *Aesthet Plast Surg.* 2015;1-13.
2. Menon H, Thomas M, D'silva J. Low dose of hyaluronidase to treat over correction of HA filler: a case report. *J Plast Reconstr Aesthetic Surg.* 2010;63:416-417.
3. Narins RS, Coleman WP, Glogau RG. Recommendations and treatment options for nodules and other filler complications. *Dermatol Surg.* 2009;35:1667-1671.
4. Delorenzi, C. Complications of injectable fillers, part I. *Aesthet Plast Surg.* 2013;33(4)561-575.

174. A 43-year-old woman, gravida 3, para 3, undergoes a combined panniculectomy and hernia repair. The planned hernia repair is a retrorectus repair without components separation with polypropylene mesh. Which of the following best describes an advantage of using polypropylene mesh compared with a biologic scaffold?

- A) Decreased need for components separation
- B) Decreased recurrence rate
- C) Increased collagen cross-linking
- D) Increased resistance to infection

The correct response is Option B.

In general, the indication to use biologic scaffolds in hernia repairs and abdominal reconstruction is in contaminated beds. Biologic scaffolds provide an intact extracellular matrix and support tissue regeneration, and are more resistant to infection than synthetic mesh, likely because of this tissue ingrowth. Biologic scaffolds, unlike synthetic mesh, are degraded over time by collagenase. This accounts for at least some of the higher recurrence rates seen with biologics compared to synthetic mesh. Cross-linking of the scaffold may provide resistance to collagenase and improve long-term stability.

Thus, better resistance to infection is a property of biologic scaffolds, as is collagen cross-linking, although the degree of cross-linking varies based on the particular scaffold. They are associated with a higher cost and an increased recurrence rate. Their high cost compared with synthetic mesh does not justify their routine use, and the recommendation for their use by the Ventral Hernia Working Group is in contaminated fields, with infected mesh and septic dehiscence.

The need for components separation is based on the properties of the hernia itself and is independent of the type of mesh used. Components separation without mesh is, however, associated with a high recurrence rate.

REFERENCES:

1. de Vries Reilingh TS, van Goor H, Rosman C, et al. "Components separation technique" for the repair of large abdominal wall hernias. *J Am Coll Surg*. 2003; 196(1):32-7.

2. Breuing K, Butler CE, Ferzoco S, et al. Incisional ventral hernias: Review of the literature and recommendations regarding the grading and technique of repair. *Surgery*. 2010 Sep;148(3):544-58.

175. In an adult patient, which of the following physical findings is most likely to support a diagnosis of involutional blepharoptosis of the upper eyelids?

- A) Excess upper eyelid skin
- B) Eyelid margin-to-reflex distance of 4.5 mm
- C) Higher than normal tarsal crease
- D) Less than 8 mm of levator function
- E) Upper eyelid eversion upon downgaze

The correct response is Option C.

Blepharoptosis occurs as a result of acquired or congenital causes. Among the former causes is the most common one, involutional (senile), as well as traumatic, mechanical, neurogenic, and myogenic. The latter category includes myogenic or neurogenic causes only. Because surgical correction is the only effective, definitive therapy for acquired ptosis, it is important for the clinician to be able to differentiate between the causes. The involutional variety is due to attrition or dehiscence of the levator aponeurosis from the anterior upper part of the tarsal plate. Diagnosis of ptosis is confirmed when there is less than 2.5 mm of distance between the upper eyelid margin and the papillary light reflex. Physical findings that support the diagnosis of involutional ptosis include a lid drop during downgaze, a higher than normal upper lid crease, visibility of the eye through the thinned upper eyelid, and preservation of good levator excursion (greater than 10 mm). Rating the degree of ptosis is based on the upper eyelid margin to pupillary light reflex distance: greater than 4 mm is considered normal. Excess upper eyelid skin can obstruct visual field; however, it is not indicative of involutional ptosis.

REFERENCES:

1. Chang S, Lehrman C, Itani K, Rohrich, RJ. A systemic review of comparison of upper eyelid involutional ptosis repair techniques: efficacy and complication rates. *Plast Reconstr Surg*. 2012; 129(1): 149-157.
2. Carraway JH, Tran P. Blepharoplasty with ptosis repair. *Aesthetic Surg J*. 2008;29(1):54-61.
3. McCand CD, Seify H, Gardner MA. Transblepharoplasty ptosis repair: three-step technique. *Plast Reconstr Surg*. 2007; 120:1037-1044.

176. A 35-year-old woman is evaluated for long-term follow-up 9 years after undergoing bilateral augmentation mammoplasty for hypomastia by another surgeon. The mammoplasty was performed with 450-mL smooth, round, silicone subglandular implants. The patient recently found out she is *BRCA2* positive and underwent MRI of the breasts as part of a surveillance study. The MRI showed a “linguine sign” in the right breast. Which of the following findings on physical examination is most consistent with the diagnosis associated with the “linguine sign”?

- A) The right breast has more rippling than the left breast
- B) The right breast is not significantly different from the left breast
- C) The right breast is significantly larger than the left breast
- D) The right breast is significantly smaller than the left breast

The correct response is Option B.

The right breast is not significantly different from the left breast. The linguine sign describes multiple low-signal curvilinear lines on MRI that correlated to the collapsed implant shell. It is an indication of intracapsular rupture. Physical examination alone is not specific or sensitive enough to diagnose all cases of intracapsular rupture.

Ultrasound and/or MRI is recommended. The physical examination finding of one breast that is smaller, firmer, and higher than the other is indicative of capsular contracture. MRI is not a sensitive predictor of capsular contracture. A right breast that is significantly larger than the left breast would indicate a late seroma and a workup for breast implant-associated anaplastic large-cell lymphoma would be indicated. A right breast that is significantly smaller than the left breast would be indicative of a ruptured saline implant. Increased rippling is not expected with an intracapsular rupture.

REFERENCES:

1. Hölmich LR, Fryzek JP, Kjøller K, et al. The diagnosis of silicone breast-implant rupture: Clinical findings compared with findings at magnetic resonance imaging. *Ann Plast Surg.* 2005 Jun;54(6):583-9.
2. Baek WY, Lew DH, Lee DW. A retrospective analysis of ruptured breast implants. *Arch Plast Surg.* 2014 Nov; 41(6): 734–739.
3. Vestito A, Mangieri FF, Ancona A, et al. Study of breast implant rupture: MRI versus surgical findings. *Radiol Med.* 2012 Sep;117(6):1004-18.

4. Venkataraman S, Hines N, Slanetz PJ. Challenges in mammography: Part 2, multimodality review of breast augmentation – imaging findings and complications. *AJR Am J Roentgenol*. 2011 Dec;197(6):W1031-45.

177. A 35-year-old woman, gravida 3, para 3, is interested in a “mommy makeover,” with liposuction of the flanks, extended tummy tuck, brachioplasty, and augmentation mammoplasty. In this combination of surgeries, which of the following percentages best represents the cumulative risk in the general population for postoperative complications requiring reoperation or hospitalization?

- A) 3%
- B) 12%
- C) 25%
- D) 35%
- E) 50%

The correct response is Option B.

Abdominoplasty is known to have a higher complication rate than many common aesthetic procedures. A recent study by Grotting and associates examining complication rates in more than 25,000 abdominoplasties in a multi-surgeon database confirmed that the risk for a complication requiring hospitalization or reoperation increases significantly when abdominoplasty was combined with other surgeries.

In particular, abdominoplasty alone had a complication rate of 3.1%.

Abdominoplasty combined with liposuction – 3.8%

Abdominoplasty combined with a breast procedure – 4.3%

Abdominoplasty combined with a breast procedure and liposuction – 4.6%

Abdominoplasty combined with liposuction and a body contouring procedure – 10.4%

Abdominoplasty combined with liposuction, a breast procedure, and a body procedure – 12.0%

In this study, body procedures included brachioplasty, buttock lift, calf implant, labiaplasty, lower body lift, thigh lift, and upper body lifts.

Hematoma, infection, and suspected or confirmed venous thromboembolism represented 31.5%, 27.2%, and 20.2% of overall abdominoplasty complications in this study.

A second study, by the same group, looking at 129,000 cosmetic surgery patients as a group also confirmed an increased risk for major surgical site infections in cosmetic patients undergoing multiple simultaneous procedures.

Thus, caution is advised when considering multiple procedures concurrently in a higher risk patient.

REFERENCES:

1. Winocour J, Gupta V, Ramirez J, et al. Abdominoplasty: Risk Factors, Complication Rates, and Safety of Combined Procedures. *Plast Reconstr Surg*. 2015 Nov;136(5):597e-606e.
2. Kaoutzanis C, Gupta V, Winocour J, et al. Incidence and Risk Factors for Major Surgical Site Infections in Aesthetic Surgery: Analysis of 129,007 Patients. *Aesth Surg J*. 2017;37(1):89-99.

178. A 40-year-old woman who underwent a subglandular augmentation mammoplasty with smooth round silicone breast implants 5 years ago returns to the office for evaluation of an increasingly firm left breast. Surgical revision of the left breast is planned. Which of the following measures is most likely to decrease the recurrence of the symptoms?

- A) Conversion to a new plane or pocket
- B) Performing a total capsulectomy
- C) Using botulinum toxin type A in and around the implant pocket
- D) Using fat grafting in and around the implant pocket

The correct response is Option A.

Site change and implant exchange are the only factors that have consistently been shown to decrease recurrence of capsular contracture, although other factors including use of a textured implant and fat grafting used are in augmentation mammoplasty revision. Botulinum toxin type A has been described for prevention of capsular contracture however; no consensus that these treatments decrease recurrence of capsular contracture exists.

Furthermore, there are no data to support performing total versus partial capsulectomy, or even the superiority of capsulectomy over capsulotomy.

REFERENCES:

1. Wan D, Rohrich RJ. Revisiting the Management of Capsular Contracture in Breast Augmentation: A Systematic Review. *Plast Reconstr Surg*. 2016 Mar;137(3):826-41.
2. Lee SD, Yi MH, Kim DW, et al. The effect of botulinum neurotoxin type A on capsule formation around silicone implants: the in vivo and in vitro study. *Int Wound J*. 2016 Feb;13(1):65-71.
3. Xiao Z. Effect of botulinum toxin type A on the capsule around a subpectoral implant for breast augmentation. *Aesth Plast Surg*. 2009 Sept;33(5):782-3.
4. Roça GB, Graf R, da Silva Freitas R, et al. Autologous Fat Grafting for Treatment of Breast Implant Capsular Contracture: A Study in Pigs. *Aesthet Surg J*. 2014 Jul;34(5):769-75.
5. Serra-Renom JM, Muñoz-Olmo JL, Serra-Mestre JM. Fat grafting in postmastectomy breast reconstruction with expanders and prostheses in patients who have received radiotherapy: formation of new subcutaneous tissue. *Plast Reconstr Surg*. 2010 Jan;125(1):12-8.

6. Sarfati I, Ihrai T, Kaufman G, Nos C, Clough KB. Adipose-tissue grafting to the post-mastectomy irradiated chest wall: preparing the ground for implant reconstruction. *J Plast Reconstr Aesthet Surg*. 2011 Sep;64(9):1161-6.

179. Which of the following is the most likely result of performing liposuction in conjunction with brachioplasty?

- A) Facilitated tissue dissection
- B) Lymphedema
- C) Skin necrosis
- D) Upper arm paresthesia
- E) Wound dehiscence

The correct response is Option A.

Liposuction is often used in conjunction with excisional brachioplasty to facilitate dissection of the soft tissue, improve contour, and decrease the risks for nerve injury and lymphedema. There are many different techniques posed in the literature. Liposuction of the planned tissues of excision can ease the dissection planes. It can also be performed in the posterior upper arm to improve contour of the remaining tissues. Nerves and lymphatics are more protected by using liposuction instead of excision to debulk the arm. The use of liposuction does not increase the incidence of skin necrosis or wound dehiscence.

REFERENCES:

1. Shermak, MA. Aesthetic Refinements in Body Contouring in the Massive Weight Loss Patient: Part 2. Arms. *Plast Reconstr Surg*. 2014; 134: 726e-735e.
2. Hurwitz, D. Brachioplasty. *Clin Plast Surg*. 2014 Oct; 41 (4): 745-51.

180. Which of the following is the most common complication after cryolipolysis?

- A) Hematoma
- B) Paradoxical adipose hyperplasia
- C) Seroma
- D) Surface contour irregularities
- E) Transient hypoesthesia

The correct response is Option E.

Cryolipolysis is a noninvasive technique to preferentially destroy adipose cells through controlled thermal reduction. Exposure of adipose cells to below normal temperatures results in apoptosis-mediated cell death. Adipose cells are more susceptible to thermal reduction as compared with adjacent tissue. The subsequent inflammatory response results in the removal of damaged adipose cells within 3 months. The most common complication following cryolipolysis is hypoesthesia or decreased sensation of the treated areas, which resolves within 6 months. Other complications, which are less common, include paradoxical adipose hyperplasia, surface contour irregularities, and chronic pain. No hematomas or seromas have been reported in the literature.

REFERENCES:

1. Derrick CD, Shridharani SM, Broyles JM. The safety and efficacy of cryolipolysis: a systematic review of available literature. *Aesthet Surg J*. 2015; 35(7):83-836.
2. Coleman SR, Sachdeva K, Egbert BM, et al. Clinical efficacy of non-invasive cryolipolysis and its effects on peripheral nerves. *Aesthetic Plast Surg*. 2009; 33:482-488.
3. Kotlus B, Mok C. Evaluation of cryolipolysis for subcutaneous fat reduction. *Am J Cosmet Surg*. 2013;30:89-93.

181. In addition to the typical chest wall deformities, which of the following is the most common associated clinical presentation of patients suffering from Poland syndrome?

- A) Dextrocardia
- B) Lung hernia
- C) Renal malformation
- D) Thyroid malignancies
- E) Upper extremity anomalies

The correct response is Option E.

Poland syndrome is the rare congenital condition describing the absence of the breast or nipple, hypoplasia of subcutaneous tissue, absence of the costosternal portion of the pectoralis major muscle, absence of the pectoralis minor muscle, and absence of costal cartilages or ribs 2, 3, and 4 or 3, 4, and 5, occasionally even rib 6. Its aesthetic and functional impairment varies between individuals and highly depends on the severity of the disease. Boys are three times as likely to be affected as girls. Incidence ranges between 1:100,000 to 1:7,000 cases per live births.

Various concomitant anomalies have been published in association with Poland syndrome that typically necessitate a multi-disciplinary approach towards the diagnosis and treatment of this congenital illness. Upper extremity anomalies, renal malformation, lung hernia, and dextrocardia have all been described in literature as related to Poland syndrome. Anomalies of the upper extremity are the most common concomitant malformation besides the chest wall defects.

REFERENCES:

1. Urschel HC, Jr. Poland syndrome. *Semin Thorac Cardiovasc Surg.* 2009;21:89-94.
2. Moir CR, Johnson CH. Poland syndrome. *Semin Pediatr Surg.* 2008;17:161-166.
3. Lacorte D, Marsella M, Guerrini P. A case of Poland Syndrome associated with dextroposition. *Ital J of Pediatr.* 2010;36:21-21.
4. Catena N, Divizia MT, Calevo MG, et al. Hand and upper limb anomalies in Poland syndrome: a new proposal of classification. *J Pediatr Orthop.* 2012;32:727-731.

182. A 28-year-old woman comes to the office for a consultation on liposuction of the abdomen. She has already had consultations with several other physicians and is unsure whether to undergo suction-assisted liposuction (SAL) or ultrasound-assisted liposuction (UAL). Which of the following is the most significant advantage of choosing UAL over SAL?

- A) Better aesthetic outcome
- B) Better skin tightening
- C) Greater patient satisfaction
- D) Less surgeon fatigue
- E) Lower complication rates

The correct response is Option D.

The main advantage of ultrasound-assisted liposuction over suction-assisted liposuction is less surgeon fatigue.

In traditional or suction-assisted liposuction, the fat is removed by the repetitive arm movements breaking up the fat. The suction then aspirates the loosened fat. In ultrasound-assisted liposuction, ultrasound energy breaks the fat apart and emulsifies it, thus allowing it to be removed by the suction cannula. The main advantage of this is to decrease surgeon fatigue from the repetitive arm movements and also to help break apart the fat in fibrous areas or areas of scar from prior procedures.

Peer-reviewed studies have not shown any consistent evidence-based benefits for the use of ultrasound-assisted liposuction over suction-assisted liposuction. The aesthetic outcomes, patient satisfaction, and rates of long-term complications appear to be more related to technique and not technology. As a result, suction-assisted liposuction continues to remain the predominant technique of liposuction due to its relatively low cost and the rapid rate at which new technologies are introduced with little objective evidence supporting any additional benefit.

REFERENCES:

1. Ahmad J, Eaves FF, Rohrich RJ, Kenkel JM. The American Society for Aesthetic Plastic Surgery (ASAPS) survey: current trends in liposuction. *Aesthet Surg J*. 2011 Feb;31(2):214-24.
2. Iverson RE, Pao VS. Liposuction. *Plast Reconstr Surg*. 2008;121(suppl):1-11.

3. Matarasso A, Levine SM. Evidence-based medicine: liposuction. *Plast Reconstr Surg*. 2013 Dec;132(6):1697-705.
4. Shridharani SM, Broyles JM, Matarasso A. Liposuction devices: technology update. *Med Devices (Auckl)*. 2014 Jul 21;7:241-51.
5. Stephan PJ, Kenkel JM. Updates and advances in liposuction. *Aesthet Surg J*. 2010 Jan;30(1):83-97.
6. Triana L, Triana C, Barbato C, Zambrano M. Liposuction: 25 years of experience in 26,259 patients using different devices. *Aesthet Surg J*. 2009 Nov-Dec;29(6):509-12.

183. The superficial musculoaponeurotic system is continuous with which of the following?

- A) Parotidomasseteric fascia and deep cervical fascia
- B) Superficial layer of deep temporal fascia and deep cervical fascia
- C) Superficial layer of deep temporal fascia and platysma
- D) Temporalis muscle and platysma
- E) Temporal parietal fascia and platysma

The correct response is Option E.

The superficial musculoaponeurotic system is continuous with the temporoparietal fascia superiorly and the platysma inferiorly. Superiorly to inferiorly, the superficial layer continuous with the superficial musculoaponeurotic system consists of galea, temporoparietal fascia, cheek superficial musculoaponeurotic system, platysma, and superficial cervical fascia. The deep cervical fascia (DCF) makes up the most inferior extent of the layer deep to the superficial musculoaponeurotic system. Superiorly to inferiorly, this layer consists of cranial periosteum, deep temporal fascia (DTF), parotidomasseteric fascia, and DCF. The DTF splits into two layers, superficial and deep, which surround the superficial temporal fat pad as they extend inferiorly toward the zygomatic arch. The superficial and deep layers of the DTF extend anteriorly and posteriorly to the zygomatic arch, respectively. The superficial layer then becomes the parotidomasseteric fascia, and the deep layer becomes the posterior masseteric fascia. The temporalis muscle lies deep to the DTF and, therefore, is also deep to the superficial temporal fascia, which is continuous with the superficial musculoaponeurotic system.

REFERENCES:

1. Rees TD, Aston SJ, Thorne CH. Blepharoplasty and facialplasty. In: McCarthy JG, ed. *Plastic Surgery*. Philadelphia: WB Saunders; 1990:2373-2376.
2. Stuzin JM, Wagstrom L, Kawamoto HK, et al. Anatomy of the frontal branch of the facial nerve: the significance of the temporal fat pad. *Plast Reconstr Surg*. 1989;83:265-271.

184. A 46-year-old woman with cancer of the right breast comes to the office to discuss a right mastectomy with immediate implant reconstruction and a symmetry procedure for the contralateral breast. Physical examination shows bilateral Grade 3 ptosis with volume symmetry. The patient currently wears a size 34C brassiere and desires to remain the same size. Which of the following is the most appropriate procedure for the contralateral breast?

- A) Augmentation mammaplasty
- B) Fat injections
- C) Mastopexy
- D) Reduction mammaplasty

The correct response is Option C.

Contralateral breast procedures are frequently necessary to achieve symmetry following mastectomy and reconstruction. Options to achieve symmetry include mastopexy, reduction mammaplasty, or augmentation mammaplasty combined with mastopexy. Volume symmetry can be achieved through reduction mammaplasty or fat injections. Positional asymmetry of the contralateral breast and the nipple-areola complex may require correction with mastopexy. Augmentation mammaplasty with mastopexy may be indicated for the correction of volume and positional asymmetry. The most appropriate contralateral procedure in a patient with symmetric volumes of the breast and ptosis of the contralateral breast is mastopexy.

REFERENCES:

1. Spear SL, Willey SC. *Surgery of the breast: Principles and Art*, 3rd edition. Lippincott Williams & Wilkins Inc, Philadelphia: 2010;803-837.
2. Menon H, Thomas M, D'silva J. Low dose of hyaluronidase to treat over correction of HA filler: a case report. *J Plast Reconstr Aesthetic Surg*. 2010;63:416-417.
3. Chang EI, Selber JC, Hanasono MM, et al. Comprehensive analysis of revisional surgery and contralateral symmetry procedures following unilateral free flap breast reconstruction: a ten-year experience. *J Plast Reconstr Surg*. 2012;130(1S):86.

185. A 67-year-old woman with marked lower facial and neck laxity is scheduled to undergo an extended superficial musculoaponeurotic system (SMAS) rhytidectomy. Excessive trimming of the skin flap adjacent to the base of the earlobe is most likely to result in which of the following outcomes?

- A) Earlobe ptosis
- B) Lop ear deformity
- C) Pixie ear deformity
- D) Reverse telephone ear deformity
- E) Telephone ear deformity

The correct response is Option C.

While there are a number of successful methods to perform a facelift, there are certainly common principles they share. These include:

- Making an artfully placed incision which follows anatomic contours
- Skin elevation to allow access to the superficial musculoaponeurotic system (SMAS) and release of any tethered points of the facial skin following SMAS manipulation
- Some method (elevation, plication, imbrication, or direct suturing) of tightening the mobile SMAS
- Anchoring of the SMAS in its new position with some stable method of fixation
- Re-draping the soft-tissues using appropriate vectors
- Careful skin closure where minimal tension is placed on the earlobe and posterior hairline incision

Placement of significant tension on the earlobe caused by excessive trimming of the skin flap in the region of the otobasion inferius is well known to commonly produce a distinctive postoperative distortion of this structure, also known as a “pixie ear.” The study by Mowlavi and associates showed an incidence of approximately 6% in a facelift population.

A tension-free closure of the earlobe to the skin flap should be the goal, avoiding tension on the delicate earlobe tissues from the cheek flap, to avoid the issue of inferior and anterior migration of the otobasion. A number of corrective techniques have been described, ranging from local V-Y closures to readvancement of the facelift flap. Earlobe ptosis, in which the vertical height of the earlobe increases with aging, is

unchanged by skin trimming errors. Telephone and reverse telephone deformities are complications in otoplasty for prominent ears, and do not apply to this case. Lop ear deformity is a congenital ear deformity involving the superior portion of the helix, and is not relevant to this case.

REFERENCES:

1. Mowlavi A Meldrum DG Wilhelmi BJ et al. The “pixie” ear deformity following facelift surgery revisited. *Plast Reconstr Surg.* 2005;115:1165–1171.
2. Stuzin JM. Extended SMAS Technique in Facial Rejuvenation. In: Nahai F. *The Art of Aesthetic Surgery: Principles & Techniques*. Quality Medical Publishing: St. Louis, Missouri; 2011:1472-1509.

186. A 22-year-old man comes to the office reporting breast enlargement that began 7 years ago. Physical examination shows bilateral breast enlargement. Testicular examination is normal. BMI is 27 kg/m². Which of the following evaluations is best for distinguishing gynecomastia from pseudogynecomastia in this patient?

- A) History of medication use
- B) Laboratory testing
- C) Mammography
- D) MRI
- E) Physical examination

The correct response is Option E.

Gynecomastia is benign enlargement of the glandular breast tissue in a man. It is often related to factors that either results in an increase in estrogen production, or a decrease in androgen production. This can be due to the transient imbalances during puberty, or secondary to medication use, drug use (such as marijuana), testicular pathology, thyroid disease, liver disease, breast cancer, etc.

This is in contrast to pseudogynecomastia, which is enlargement of the breast due to fat deposition in the absence of glandular hypertrophy. Pseudogynecomastia is typically seen in the patient who is overweight or obese.

Pseudogynecomastia is distinguished from gynecomastia by physical examination. In true gynecomastia, one will palpate enlarged firm glandular breast tissue, as opposed to in pseudogynecomastia, where palpation will reveal a soft fatty breast throughout with no enlargement of the subareolar tissue.

History may suggest a pathologic etiology that will be confirmed on laboratory testing. Medication and drug use questioning will show if the gynecomastia is pharmacologic in origin. Mammography and MRI will aid in determining if there is a malignant etiology causing the breast tissue enlargement. However, it is not standard for gynecomastia evaluation.

REFERENCES:

1. Braunstein GD. Gynecomastia. *N Engl J Med*. 2007 Sep 20;357(12):1229-37.

2. Carlson HE. Approach to the patient with gynecomastia. *J Clin Endocrinol Metab.* 2011 Jan;96(1):15-21.
3. Johnson RE, Murad MH. Gynecomastia: pathophysiology, evaluation, and management. *Mayo Clin Proc.* 2009 Nov;84(11):1010-5.
4. Jonathan W, Toy, Rubin P. Contouring of the arms, breast, upper trunk, and male chest in the massive weight loss patient. In: Neligan PC, et al, eds. *Plastic Surgery*. 3rd Edition: London: Elsevier: 2013; 2:558-581.

187. In a Wise-pattern reduction mammoplasty using the superior medial pedicle, sensation is provided to the nipple-areola complex by which of the following nerves?

- A) Lateral cutaneous branch of the fourth intercostal nerve
- B) Lateral cutaneous branch of the second intercostal nerve
- C) Medial pectoral nerve
- D) Terminal branches of the fourth and fifth anterior intercostal nerves
- E) Terminal branches of the second and third anterior intercostal nerves

The correct response is Option D.

The nipple-areola complex is innervated by the lateral cutaneous branch of the fourth intercostal nerve as well as the terminal branches of the fourth and fifth anterior intercostal nerves. However, when a superior medial pedicle in a reduction mammoplasty is used, the contribution from the lateral branch of the fourth intercostal nerve is excised. The lateral cutaneous branch of the second intercostal nerve is also known as the intercostobrachial nerve, which provides sensation to the medial and posterior upper arm. The medial pectoral nerve innervates portions of the pectoralis major and minor.

REFERENCES:

1. O'Connell RL, Rusby JE. Anatomy relevant to conservative mastectomy. *Gland Surg.* 2015 Dec; 4(6): 476–483.
2. Michelle le Roux C, Kiil BJ, Pan WR, et al. Preserving the neurovascular supply in the Hall-Findlay superiomedial pedicle breast reduction: an anatomical study. *J Plast Reconstr Aesthet Surg.* 2010 Apr;63(4):655-62.

188. A 39-year-old woman comes to the office for a consultation regarding abdominoplasty. Three years ago, she underwent gastric sleeve bariatric surgery, which was followed by a 100-lb (43-kg) weight loss. Weight has been stable for 1 year. Past medical history includes mitral valve prolapse, sleep apnea, and exercise-induced asthma. The patient is gravida 5, para 2, with 3 miscarriages. Her mother had deep vein thrombosis at 70 years of age while on a 5-hour flight. BMI is 31 kg/m². Physical examination shows an overhanging panniculus with intertrigo. An evaluation by which of the following is the most appropriate next step?

- A) Cardiologist
- B) Dermatologist
- C) Hematologist
- D) Nutritionist
- E) Sleep specialist

The correct response is Option C.

This patient presents with multiple risk factors for deep vein thrombosis (DVT). According to the 2005 Caprini Tool for DVT Risk Assessment, this patient has a minimum of 7 points (3 points for family history of thrombosis, 1 point multiple miscarriages (>3 miscarriages), 1 point for BMI > 25, and 2 points for Major Surgery > 45 minutes). With both a family history of thrombosis and multiple miscarriages, there is a significant likelihood that the patient has a genetic thrombophilia. A hematologist will be able to diagnose and quantify the significance of a genetic thrombophilia. A genetic thrombophilia such as Positive factor V Leiden gene mutation, if present, would add an additional 3 points of risk for DVT and pulmonary embolus, bringing the total risk score from 7 to 10. If abdominoplasty were performed, chemoprophylaxis would be highly recommended with these risk factors.

The mechanism of multiple miscarriages in women with thrombophilia is clotting of the placenta and subsequent fetal loss. These women are given anticoagulation chemoprophylaxis during pregnancy to help prevent placental thrombosis.

The most common inherited thrombophilia is factor V Leiden, which is present in 3 to 7% of the Caucasian population. Multiple inherited thrombophilia conditions can be present in the same individual.

Consultations with a sleep apnea specialist, cardiologist, dermatologist, and nutritionist are all reasonable considerations; however, the evaluation for genetic thrombophilia is most crucial to this patient's evaluation for abdominoplasty.

REFERENCES:

1. Pannucci CJ, Barta RJ, Dreszer G, et. al. Assessment of Postoperative Venous Thromboembolism Risk in Plastic Surgery Patients Using the 2005 and 2010 Caprini Risk Score. *Plast Reconstr Surg*. 2012; 130:343-353.
2. Murphy RX, Alderman A, Gutowski K, et. al. Evidence-Based Practices for Thromboembolism Prevention: Summary of the ASPS Venous Thromboembolism Task Force Report. *Plast Reconstr Surg*. 2012; 130:168e-175e.
3. Ford HB, Schust DJ. Recurrent Pregnancy Loss: Etiology, Diagnosis, and Therapy. *Rev Obstet Gynecol*. 2009; v.2 (2):76-83.
4. D'Uva M, Di Micco P, Stina I, et al. Etiology of hypercoagulable state in women with recurrent fetal loss without other causes of miscarriage from Southern Italy: new clinical target for antithrombotic therapy. *Biologics*. Dec 2008; v.2(4):897-902.

189. A 32-year-old woman is interested in post-pregnancy body contouring. BMI is 34 kg/m². When combined with abdominoplasty, liposuction of which of the following areas has an increased risk for wound healing complications?

- A) Flank
- B) Lateral hip
- C) Lateral thigh
- D) Mons pubis
- E) Supraumbilical abdomen

The correct response is Option E.

Traditionally, the supraumbilical abdomen has been considered the area where liposuction might further disrupt blood supply already interrupted by the abdominoplasty undermining. Techniques to minimize undermining and preserve blood supply to allow more aggressive liposuction in this area have been reported and are in use. The mons pubis, lateral hip, flank, and lateral thigh blood supplies are less affected by abdominoplasty, and therefore, these areas have traditionally been less prone to complications when liposuction is performed in them at the time of abdominoplasty.

REFERENCES:

1. Smith LF, Smith LF Jr. Safely combining abdominoplasty with aggressive abdominal liposuction based on perforator vessels: Technique and a review of 300 consecutive cases. *Plast Reconstr Surg*. 2015 May;135(5):1357-66.
2. Samra S, Sawh-Martinez R, Barry O, Persing JA. Complication rates of lipoabdominoplasty versus traditional abdominoplasty in high-risk patients. *Plast Reconstr Surg*. 2010 Feb;125(2):683-90.
3. Brauman D, Capocci J. Liposuction abdominoplasty: An advanced body contouring technique. *Plast Reconstr Surg*. 2009 Nov;124(5):1685-95.

190. A patient comes to the office 6 months after undergoing bilateral vertical mastopexy because she is dissatisfied with her postoperative appearance. Height is 5 ft 5 in (165 cm). Physical examination shows the distance from nipple to sternal notch is 16 cm bilaterally, and the distance from nipple to inframammary fold is 14 cm bilaterally. Which of the following is the most appropriate next step in management?

- A) Conversion to free nipple grafts
- B) Placement of a dual-plane breast implant
- C) Placement of a subglandular breast implant
- D) Resection of excess skin at the level of the inframammary fold
- E) Reassurance, massage, and observation

The correct response is Option D.

This case illustrates superior nipple malposition. The distance from nipple to inframammary (IMF) fold of 14 cm is much too long. The correct answer is to resect the lower pole skin at the IMF in order to move the nipple down. This would create a “T” scar and improve nipple position. Vertical mastopexies and reduction mammoplasties have a learning curve and much of this is predicting the nipple position postoperatively. The nipple should be designed lower on the breast than is done during marking a Wise pattern. At 6 months, it is unlikely the nipple position will change dramatically, so observation is not recommended. Addition of an implant will not help the nipple position. Conversion to free nipple grafts, while possible, will not lead to an aesthetic scar pattern.

REFERENCES:

1. Higdon KK, Grotting JC. Mastopexy. In: *Plastic Surgery*, 3rd edition, Vol. 5, ed. 2012.
2. Spear SL, Albino FP, Al-Attar A. Classification and Management of the Postoperative, High-Riding Nipple. *Plast Reconstr Surg*. 2013 Jun;131(6):1413-21.

191. A 15-year-old girl presents with a cleft lip nasal deformity. In infancy, she was treated in a cleft center with appropriate management and surgical correction of unilateral cleft lip and palate. Which of the following current findings is most consistent with the deformity?

- A) Cleft-side alar base is more anterior than the noncleft-side alar base
- B) Cleft-side piriform margin is farther anterior than the noncleft-side piriform margin
- C) Columellar base is deviated to the cleft side
- D) Medial to lateral crural angle is more acute on the cleft side
- E) Noncleft-side alar base is farther from the midline than the cleft-side alar base

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option E.

Studies using three-dimensional CT scanning have demonstrated five consistent findings in unilateral cleft lip nasal deformity:

1. The columellar base is deviated to the noncleft side
2. The cleft-side alar base is more posterior than the noncleft-side alar base
3. The noncleft-side alar base is farther from the midline than the cleft-side alar base
4. The cleft-side piriform margin is farther posterior than the noncleft-side piriform margin
5. The angle made by the medial and lateral crura would be more obtuse on the cleft side

REFERENCES:

1. Zbar RIS, Canady JW. An Evidence-Based Approach to Secondary Cleft-Lip Nasal Deformity. *Plast Reconstr Surg*. 2011;905-909.
2. Fisher DM, Tse R, Marcus JR. Objective measurements for grading the primary unilateral cleft lip nasal deformity. *Plast Reconstr Surg*. 2008;874–880.

192. A 23-year-old woman with micromastia and bilaterally tuberous breasts comes to the office to discuss augmentation mammoplasty and improving the overall appearance of her breasts. Physical examination shows bilateral mildly ptotic breasts with glandular tissue herniating through the nipple-areola complex. The lower pole appears mildly deficient in the lower medial and lateral quadrants, and the distance from the nipple to the inframammary crease is 5.5 cm on stretch. Which of the following is the most appropriate operative approach for this patient?

- A) Implant placement with circumareolar mastopexy
- B) Implant placement without mastopexy
- C) Implant placement with vertical mastopexy
- D) Implant placement with Wise-pattern mastopexy
- E) Two-stage reconstruction with tissue expander, followed by placement of a permanent implant

The correct response is Option A.

The tuberous breast deformity was first described by Aston and Rees in 1976. While most of the surgical approaches listed, with the exception of implants together with Wise-pattern mastopexy, have been described for the spectrum of tuberous breast deformities, the key is to select the right procedure for the right patient. In this case, a mild form of the deformity is described. Implant placement alone, even with parenchymal scoring and lowering of the inframammary crease, is unlikely to correct the deformity of the nipple-areola complex. In cases of severe ptosis, vertical mastopexy may be used but would be unnecessary in this patient with mild ptosis. In severely deficient cases, a two-stage approach with tissue expansion may be necessary, but it would be over-operating in this mildly deficient patient. Recently, fat grafting has also been advocated for this procedure.

In the case described, which is a common presentation, a periareolar approach is typically used to place the implant in a dual-plane configuration. Subglandular placement is also described. The inframammary crease is commonly adjusted downward. Radial scoring of the parenchyma and a circumareolar mastopexy are typically performed.

In the recent review by Kolker and Collins, 92% of tuberous breast patients had a one-stage procedure. Ninety-six percent of these were treated with implant placement and circumareolar mastopexy, combined with inframammary crease adjustment and radial scoring of the parenchyma.

REFERENCES:

1. Kolker AR, Collins MS. Tuberous breast deformity: classification and treatment strategy for improving consistency in aesthetic correction. *Plast Reconstr Surg.* 2015 Jan;135(1):73-86.
2. Mandrekas AD, Zambacos, GJ. Aesthetic Reconstruction of the Tuberous Breast Deformity: A 10-Year Experience. *Aesthetic Surg J.* 2010 30(5) 680-692.

193. A 35-year-old woman is evaluated because of swelling of the right breast 3 years after undergoing augmentation mammoplasty. The implant type is unknown. Ultrasonography shows a seroma, and a fine-needle aspiration is performed. Which of the following immunohistochemical stains of the aspirate is most appropriate?

- A) CCD79a
- B) CD30
- C) CK20
- D) E-cadherin
- E) p63

The correct response is Option B.

Patients who present with a late seroma should be evaluated for possible breast implant-associated anaplastic large cell lymphoma (BI-ALCL). A late seroma is usually accepted as occurring 1 year following surgery; however, there are cases of BI-ALCL seromas that have presented as early as 4 months.

The first step in evaluating BI-ALCL is ultrasonography, followed by fine-needle aspiration if indicated. The fluid requires evaluation beyond routine cell cytology.

Immunohistochemistry test for CD30 was the most commonly positive marker for BI-ALCL. Immunohistochemistry stains specific antigens in cells by binding to this antigen in an antibody/antigen reaction. The specific stain can then be seen under light microscopy. The CD30 antibody labels anaplastic large cell lymphoma cells. CD30 is a transmembrane cytokine receptor belonging to the tumor necrosis factor receptor family.

CK20 and CCD79a were negative for tested BI-ALCL specimens.

P63 stains myoepithelial cells and is used to rule out invasive breast tumors.

E-cadherin helps distinguish ductal from lobular carcinoma.

REFERENCES:

1. Brody GS, Deapen D, Taylor CR, et al. Anaplastic Large Cell Lymphoma Occurring in Women with Breast Implants: Analysis of 173 Cases. *Plast Reconstr Surg*. 2015; 135:695-705.

2. Di Pompeo FS, Laporta R, Sorotos M, et al. Breast Implant-Associated Anaplastic Large Cell Lymphoma: Proposal for a Monitoring Protocol. *Plast Reconstr Surg*. 2015; 136:144e-151e.
3. Clemens M, Butler C. "PROFILE registry: PSF, ASPS and FDA efforts lead to BIA-ALCL registry, need your data." *Plastic Surgery News* October/November 2015:8-9.

194. A 50-year-old woman returns to the office 2 weeks after undergoing an endoscopic brow lift and reports numbness in the central forehead. Which of the following nerves is most likely injured?

- A) Frontal branch of the facial
- B) Infraorbital
- C) Supraorbital
- D) Zygomaticofacial
- E) Zygomaticotemporal

The correct response is Option C.

Central forehead paresthesias are typically related to traction injury to the supraorbital nerve, a division of ophthalmic (V1) nerve. The supraorbital and supratrochlear nerves supply the central forehead. The frontal branch of the facial nerve is a motor nerve to the frontalis muscle and, although at risk during brow lift, it has no sensory supply. The zygomaticotemporal nerve supplies the anterior temporal area. The zygomaticofacial nerve supplies the skin of the lateral orbit and cheek. The infraorbital nerve supplies the central face and upper lip.

REFERENCES:

1. Lighthall JG, Wang TD. Complications of forehead lift. *Facial Plast Surg Clin North Am.* 2013 Nov;21(4):619-24.
2. De Cordier BC, de la Torre JI, Al-Hakeem MS, et al. Endoscopic Forehead Lift: Review of Technique, Cases, and Complications. *Plast Reconstr Surg.* 2002.110(6):1558-1568.
3. Netter FH. *Netter's Atlas of Human Anatomy.* Elsevier; 2014.

195. Which of the following is most commonly associated with alloplastic breast reconstruction in the setting of adjuvant radiation therapy?

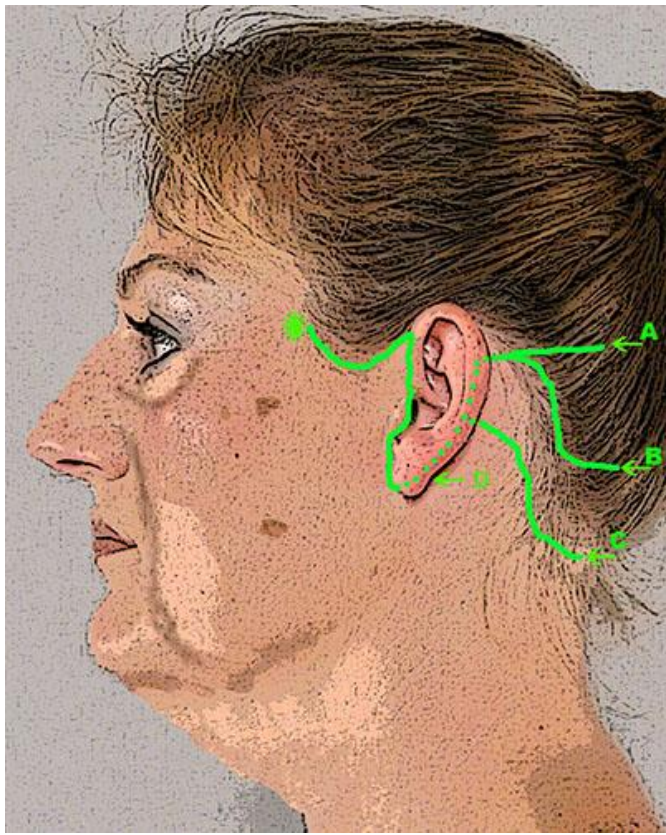
- A) Decreased rates of implant rupture
- B) Decreased rates of seroma
- C) Increased patient satisfaction
- D) Increased risk for capsular contracture

The correct response is Option D.

Alloplastic breast reconstruction increases the risk for capsular contracture in the setting of adjuvant radiation therapy. It can also increase the risks for seroma, wound healing complications, and infections. Radiation would not decrease the rates of implant rupture and would not increase patient satisfaction.

REFERENCES:

1. Cordeiro PG, Albornoz CR, McCormick B, et al. The impact of postmastectomy radiotherapy on two-stage implant breast reconstruction: an analysis of long-term surgical outcomes, aesthetic results, and satisfaction over 13 years. *Plast Reconstr Surg*. 2014 Oct;134(4):588-95.
2. Lam TC, Hsieh F, Bovages J. The effects of postmastectomy adjuvant radiotherapy on immediate two-stage prosthetic breast reconstruction: a systemic review. *Plast Reconstr Surg*. 2013 Sep;132(3):511-8.



196. A 65-year-old woman comes to the office for consultation regarding rhytidectomy. On physical examination, skin pinch demonstrates greater than 2 inches of excess neck skin on each side of the face. In the illustration shown, all incisions (A to D) begin at the pre-hairline of the temporal area, extend to the tragal edge, and then go around the ear lobule to the posterior auricular sulcus. Which of the following incision paths is most appropriate to correct the patient's neck deformity?

- A) High transverse extending into the posterior scalp
- B) Posterior scalp pre-hairline with an inferior extension into the hair-bearing scalp
- C) Low transverse in the non-hair-bearing neck skin
- D) Extension to the lower aspect of the posterior auricular sulcus

The correct response is Option B.

A patient with significant excess neck skin laxity requires excision of skin. The goals of this surgery must be rejuvenation while maintaining a normal appearing hairline with inconspicuous scars. An incision that follows the hairline of the posterior scalp allows neck skin to be removed without creating irregular and misplaced hair lines. The final extension into the scalp hair allows better camouflage of the end of the scar.

Incision A is appropriate when the excess neck skin is mild to moderate. When there is a large neck skin excess, this incision design will pull non-hair-bearing skin into the scalp.

Incision C will effectively remove excess neck skin; however, the low transverse component leaves a scar that is easily seen.

Incision D stops at the lower retro-auricular sulcus. This incision is used in a short scar facelift. It is effective for improving jowling; however, only minor neck skin laxity can be improved with this technique. A superior vector pull of the face/neck skin is necessary to tighten the neck in a short scar technique. Skin bunching at the ear lobule and skin draping deformities are a risk.

REFERENCES:

1. Marten, TJ. "Lamellar High SMAS Face and MidfaceLift: A Comprehensive Technique for Natural-Appearing Rejuvenation of the Face." In: Nahai F, ed. *The Art of Aesthetic Surgery Principles & Techniques*. 2nd ed. St. Louis, Missouri, Quality Medical Publishing, Inc. 2011:1535-1548.
2. Warren RJ, Aston SJ, Mendelson BC. Face Lift. *Plast Reconstr Surg*. 2011; 128:747e-764e.
3. Antel DF, May JM, Bonnano Mj, et al. A Comparison of the Full and Short-Scar Face-Lift Incision Techniques in Multiple Sets of Identical Twins. *Plast Reconstr Surg*. 2016; 137:1707-1714.

197. A 43-year-old woman comes to the office for consultation for reduction mammoplasty. She wears a DDD brassiere and wants her brassiere size to be decreased to a C cup. Current medications include oral contraceptive pills. She does not smoke cigarettes. Height is 5 ft 5 in (167 cm) and weight is 145 lb (65.7 kg). BMI is 23.8 kg/m². Physical examination shows the suprasternal notch to nipple distance is 29 cm and inframammary fold to nipple distance is 16 cm. Regardless of technique, which of the following factors is most likely to result in an increased risk for postoperative fat necrosis in this patient?

- A) Massive weight loss
- B) Oral contraceptive use
- C) Patient age
- D) Suprasternal notch to nipple distance
- E) Tissue resection weight

The correct response is Option E.

Fat necrosis is one of the more common complications associated with reduction mammoplasty. Regardless of technique, the rates of fat necrosis have been reported in the 2 to 10% range. Fat necrosis presents as firm, soft-tissue masses that usually resolve spontaneously. It can be associated with redness and mild discomfort and may be confused with an infectious process. The literature is inconsistent with respect to detailed cause and effect or definitive correlations between fat necrosis and risk factors. However, some are generally agreed upon as significant and are mostly consistent in studies. Some of these risk factors for the development of fat necrosis include greater BMI, larger resection weights (both absolute and controlled for preoperative breast size), and long suprasternal notch to nipple distance (especially over 37 cm). Other factors that less clearly affect the rate of fat necrosis are smoking and the surgical technique employed.

Multiple studies have demonstrated increased risk of fat necrosis with greater obesity.

Although there have been some studies that suggest a correlation between fat necrosis and age, the studies have not reached a consensus nor have they shown statistical significance when evaluated in a controlled fashion. One study by Shermak et al. looked specifically at age-related risks and was not able to find a significant correlation with fat necrosis. There have been no studies or associations found to link exogenous hormone therapy or oral contraceptive use to increased fat necrosis. Alternatively, there has been some evidence to suggest that hormone supplementation might decrease the rate of infectious complications.

The rate of fat necrosis and complication in general increases with longer suprasternal notch to nipple distances, most notably greater than 37 cm.

Massive weight loss is not associated with an increased risk for fat necrosis in the breast.

REFERENCES:

1. Cardenas-Camarena L. Reduction mammoplasty with superolateral dermoglandular pedicle: details of 15 years of experience. *Ann Plast Surg.* 2009 Sep;63(3):255-61.
2. Shermak MA, Chang D, Buretta K, et al. Increasing age impairs outcomes in breast reduction surgery. *Plast Reconstr Surg.* 2011 Dec;128(6):1182-7.
3. Lewin R, Göransson M, Elander A, et al. Risk factors for complications after breast reduction surgery. *J Plast Surg Hand Surg.* 2014 Feb;48(1):10-4.
4. Manahan MA, Buretta KJ, Chang D, et al. An outcomes analysis of 2142 breast reduction procedures. *Ann Plast Surg.* 2015 Mar;74(3):289-92.

198. Which of the following surgical options is most important for gynecomastia patients with significant glandular hypertrophy?

- A) Areolar reduction
- B) Excess skin removal
- C) Lateral lipectomy
- D) Subtotal glandular resection
- E) Ultrasonic liposuction

The correct response is Option D.

In patients with a significant glandular component, it is important to do a subtotal glandular resection to prevent recurrence and provide the best chance at adequate contour. Ultrasonic liposuction has been used to attempt subtotal removal of gland tissue, but it does not reliably produce a subtotal resection. Areolar reduction is usually not necessary due to the contractile nature of the tissue. Skin resection may be necessary, most commonly in the massive weight loss patient, but does not necessarily play a role in the glandular component of the resection. Lateral suction lipectomy does not correct glandular hypertrophy.

REFERENCES:

1. Blau M, Hazani R. Correction of Gynecomastia in Body Builders and Patients with Good Physique. *Plast Reconstr Surg*. 2015 Feb;135(2):425-32.
2. Hurwitz DJ. Boomerang Pattern Correction of Gynecomastia. *Plast Reconstr Surg*. 2015 Feb;135(2):433-6.

199. Which of the following muscles is responsible for vertical glabellar rhytides and can be inhibited in its function by injection of botulinum toxin type A for aesthetic purposes?

- A) Corrugator supercilii
- B) Frontalis
- C) Nasalis
- D) Orbicularis oculi
- E) Procerus

The correct response is Option A.

The corrugator supercilii is a small and narrow muscle in the upper third of the face. It arises from the medial supraorbital ridge and stretches laterally and upward between the frontalis and orbicularis oculi muscles. Its almost horizontal position causes the vertical glabellar wrinkles between the eyebrows upon contracture. The natural function of that muscle is to move the eyebrow both medially and downward.

The frontalis muscle is a brow elevator and causes horizontal forehead wrinkles, the procerus muscle leads to transverse glabellar lines, the orbicularis oculi muscle results in lateral canthal, so-called “crow’s feet” wrinkles, and the nasalis muscle can cause small nasal lines upon contracting.

REFERENCES:

1. Bagheri SC. Facial Cosmetic Surgery. In: Bagheri SC, ed. *Clinical Review of Oral and Maxillofacial Surgery*. 2nd ed: Elsevier; 2013.
2. McClellan WTS, Brooke R. Non-Surgical Rejuvenation of the Aging Face. In: Weinzwieg J, ed. *Plastic Surgery Secrets Plus*. 2nd ed: Mosby; 2010.

200. A 65-year-old woman with extensive photodamage undergoes a deep chemical peel of the face and forehead using the Baker-Gordon peel formula during general anesthesia. The treatment takes approximately 20 minutes. Near completion, the anesthesiologist reports that the EKG monitor has shown frequent premature ventricular contractions for the last 2 to 3 minutes, then multiple sustained runs of bigeminy, followed by one short run of ventricular tachycardia. Oxygen saturation is 98%, and blood pressure is 105/70 mmHg. Intravenous administration of which of the following is the most appropriate management?

- A) Adenosine 4 mg
- B) Atropine 1 mg
- C) Lidocaine 1 mg/kg
- D) Lipid emulsion 100 mL
- E) Magnesium sulfate 1 g

The correct response is Option C.

Cardiotoxicity is an uncommon but feared complication of chemical peels that, like the Baker-Gordon formula, contain phenol. EKG changes can include tachycardia, frequent premature ventricular contractions, premature atrial contractions, bigeminy, and ventricular tachycardia. In the study by Landau, the incidence of these issues was 6.6% and was increased in patients with diabetes, hypertension, and depression. Of the 12 patients out of 181 who developed arrhythmias in this study, eight were successfully treated with lidocaine, and the other four resolved without treatment.

EKG monitoring is therefore mandatory whenever a phenol-containing peel is performed. Performing the peel in segments, in no less than 45 to 60 minutes, also has been reported to reduce the chances of EKG changes. Good intravenous hydration is also recommended. If these precautions are taken, it is rare to have to treat cardiac arrhythmias.

Of the choices listed, the most appropriate advanced cardiac life support drug would be lidocaine 1 mg/kg. While the other drugs are part of the typical crash cart, they are not indicated in this case. Atropine is used for symptomatic bradycardia. Adenosine is used for narrow-complex supraventricular tachycardias, but the correct dose is 6 to 12 mg, not 4 mg. Magnesium is used in cardiac arrest only if the patient is suspected of having hypomagnesemia, in torsades de pointes, or in cases of suspected digoxin toxicity. Lipid emulsion is used for local anesthetic toxicity, which is not suspected in this case.

Procainamide or amiodarone would be other antiarrhythmic agents that could be considered for this case, but they are not listed in the choices.

REFERENCES:

1. RH Bensimon, MB Locke. Chemical Peels. In: F. Nahai, *The Art of Aesthetic Surgery: Principals & techniques*. Quality Medical Publishing, St. Louis, MI; 2011.
2. Landau M. Cardiac complications in deep chemical peels. *Dermatol Surg*. 2007;Feb 33(2);190-193.

Section 5: Core Surgical Principles

201. A 65-year-old man undergoes microvascular reconstruction with a radial forearm flap following total laryngectomy and partial pharyngectomy for a T4 N3 M0 laryngopharyngeal squamous cell carcinoma. Postoperatively, the patient reports perioral numbness and tingling. Which of the following electrolyte abnormalities is most likely in this patient?

- A) Hypercalcemia
- B) Hyperkalemia
- C) Hypernatremia
- D) Hypocalcemia
- E) Hyponatremia

The correct response is Option D.

Patients who undergo laryngopharyngectomy often have the thyroid gland removed as part of the operation. Sometimes, the parathyroid glands are removed accidentally or the blood supply is transiently interrupted, causing poor function. The parathyroid glands regulate calcium metabolism, and injury or removal of these glands manifests first as perioral tingling and numbness before more severe symptoms such as tetani.

Hypernatremia is incorrect because, when symptomatic, it causes nausea, vomiting, and confusion. Hyponatremia is incorrect because, when symptomatic, it causes nausea, vomiting, lethargy, and confusion. Hypocalcemia is the correct answer because it is a concern for any patient who has this operation and reconstruction. Perioral tingling and numbness is an early sign of problems. Hypercalcemia is incorrect because, when symptomatic, it causes gastrointestinal issues such as vomiting, diarrhea, constipation, and skeletal muscle pain. Hyperkalemia is most likely to cause EKG changes and metabolism is not associated with parathyroid function.

REFERENCES:

1. Krespi Y, Wurster C, Wang T, et al. Hypoparathyroidism following total laryngopharyngectomy and gastric pull-up. *Laryngoscope*. 1985;95(10):1184-1187.
2. Clark JR, Gilbert R, Irish J, Brown D, Neligan P, Gullane PJ. Morbidity after flap reconstruction of hypopharyngeal defects. *Laryngoscope*. 2006;116:173181

202. A 48-year-old woman undergoes delayed reconstruction of the right breast with a deep inferior epigastric artery perforator (DIEP) flap. Medical history includes failed tissue expander–based right breast reconstruction because of infection 5 months ago. On postoperative day 5, the patient comes to the emergency department with a swollen, purple flap, which she noticed after showering. The venous anastomosis is revised and flap thrombolysis is performed with tissue plasminogen activator, successfully restoring flap perfusion. Which of the following clinical factors is LEAST likely to increase this patient's risk of thrombotic flap complications?

- A) Antiphospholipid syndrome
- B) Antithrombin deficiency
- C) *BRCA1* or *BRCA2* genetic mutation
- D) Factor V Leiden mutation
- E) Perioperative tamoxifen therapy

The correct response is Option C.

This patient has developed a late venous thrombosis and may be predisposed to a hypercoagulable state. The *BRCA1* and *BRCA2* genes are tumor suppressor genes involved in DNA repair. Mutations in these genes dramatically increase a woman's risk of developing breast and ovarian cancer over her lifetime, and are the most common cause of hereditary forms of breast and ovarian cancer. But *BRCA* genetic mutations do not appear to increase the risk of blood clots over baseline and would be unlikely to contribute to this patient's condition.

The other options are incorrect because each carries higher than average risk of blood clots. Perioperative tamoxifen therapy increases the risk of thromboembolic events in general and for flap complications and flap loss during microvascular breast reconstruction in particular. Tamoxifen is an estrogen receptor antagonist and is used both to treat and prevent breast cancer. Some authors recommend cessation of tamoxifen at least 14 days prior to microvascular breast reconstruction to minimize thrombosis risk.

Factor V is a protein involved in the coagulation cascade. Factor V Leiden mutation is an inherited condition that confers a hypercoagulable state, increasing the risk of thrombotic complications.

Antithrombin III is a protein similarly involved in anticoagulation. Deficiency may be either inherited or acquired, and it confers an increased risk of venous thrombotic events.

Antiphospholipid syndrome is an acquired autoimmune disorder which also confers a hypercoagulable state. Venous or arterial thrombosis, as well as fetal loss, are characteristic of this disorder. Some patients will have an associated autoimmune disease, such as systemic lupus erythematosus.

REFERENCES:

1. McCarthy AM, Armstrong K. The role of testing for BRCA1 and BRCA2 mutations in cancer prevention. *JAMA Intern Med.* 2014; 174:1023-4.
2. Kelley BP, Valero V, Yi M, et al. Tamoxifen increases the risk of microvascular flap complications of patients undergoing microvascular breast reconstruction. *Plast Reconstr Surg.* 2012; 129:305-14.

203. A 65-year-old man is referred for evaluation of a 3 × 4-cm wound with exposed tendon over the distal anterior tibia after sustaining fracture to the lateral malleolus, which was successfully treated with cast immobilization. The wound had been managed with local wound care for the past several weeks. Physical examination shows a clean wound with some fibrinous exudate. Periosteum and peritenon are intact. Pulses cannot be palpated. Pencil Doppler signals in dorsalis pedis and posterior tibialis are noted. Which of the following studies is the most appropriate next step in management?

- A) Ankle brachial index
- B) CT angiography
- C) MRA
- D) MRI
- E) Percutaneous angiography

The correct response is Option A.

This patient has a pressure sore from cast immobilization. He also has asymptomatic peripheral vascular disease, as is evidenced from his clinical examination. For the lower extremity to heal, adequate blood flow is required and this can be most effectively quantified with an ankle brachial index measurement. Ankle brachial index less than or equal to 0.9 establishes the presence of peripheral artery disease. Ankle brachial index between 0.5 and 0.79 yields wound healing issues and less than 0.5 results in rest pain and arterial insufficiency.

CT angiography, MRI, MRA, and percutaneous angiography can assist in delineating anatomy but they do not yield clinically helpful information about perfusion, prognosis, or stratification of peripheral artery disease.

REFERENCES:

1. McDermott MM, Criqui MH, Lui K, et al. Lower ankle/brachial index, as calculated by averaging the dorsalis pedis and posterior tibial arterial pressures and association with leg functioning in peripheral arterial disease. *J Vasc Surg*. 2000 Dec;32(6):1164-71.

2. Conte MS, Pomposelli FB, Clair DG, et al. Society for Vascular Surgery Practice Guidelines for Atherosclerotic occlusive disease of the lower extremities: Management of asymptomatic disease and claudication. *J Vasc Surg*. 2015 Mar;61(3 Suppl):2S-41S.

204. A 35-year-old primigravid woman at 10 weeks' gestation is diagnosed with a 1.5-mm deep melanoma of the right cheek. Lymphoscintigraphy is planned. Which of the following is the most appropriate treatment of this patient?

- A) Wide local excision during general anesthesia with 0.5-cm margins and concurrent sentinel node biopsy
- B) Wide local excision during general anesthesia with 1-cm margins and concurrent sentinel node biopsy
- C) Wide local excision during general anesthesia with 2-cm margins and concurrent sentinel node biopsy
- D) Wide local excision during local anesthesia with 0.5-cm margins and second trimester sentinel node biopsy
- E) Wide local excision during local anesthesia with 1-cm margins and second trimester sentinel node biopsy

The correct response is Option E.

The most recent guidelines for nonobstetric surgery during pregnancy from the American College of Obstetricians and Gynecologists Committee on Obstetric Practice (2011) recommend performing nonurgent surgery in the second trimester to minimize the risk of preterm contractions and spontaneous abortion. For patients and physicians who consider these risks unacceptable, then wide local excision with administration of a local anesthetic agent after preoperative lymphoscintigraphy, with delayed sentinel node biopsy during general anesthesia, after delivery, is recommended. For a 1.5-mm melanoma, the excision margin is 1 cm.

REFERENCES:

1. Doecker MP, Thompson ZJ, Yamamoto M, et. Al. Is a wider margin (2 cm vs 1 cm) for a 1.01-2.0 mm melanoma necessary? *Ann Surg Oncol*. 2016 Jul;23(7):2336-42.
2. Pavri SN, Clune J, Ariyan S, et al. Malignant melanoma: beyond the basics. *Plast Reconstr Surg*. 2016;138:330e.

205. A 36-year-old woman undergoes reduction mammoplasty. An intravenous infusion of vancomycin 1.5 g is started preoperatively as antibiotic prophylaxis. Medical history includes allergies to penicillin and clindamycin, but the patient has never received vancomycin. After 5 minutes of continuous infusion, an erythematous rash develops over the patient's torso, neck, and face, and she reports headache and generalized pruritus. She remains hemodynamically stable and is otherwise asymptomatic. After discontinuing the antibiotic infusion, which of the following is the most appropriate next step in management?

- A) Administer epinephrine intramuscularly
- B) Administer morphine intravenously
- C) Document the patient's allergy to vancomycin in the medical record
- D) Order a STAT vancomycin serum level
- E) Resume the infusion at a slower rate once the patient's symptoms improve

The correct response is Option E.

This patient developed a mild form of red man syndrome (RMS), caused by vancomycin administration. The most appropriate next step in management after discontinuing the antibiotic infusion is symptomatic treatment with an antihistamine drug (eg, intravenous or oral administration of diphenhydramine). The vancomycin infusion can be resumed after resolution of the rash and other symptoms, albeit at a slower rate.

Vancomycin can cause a plethora of hypersensitivity reactions, ranging from localized skin reactions to anaphylactic shock. RMS is its most common form and consists of an erythematous rash that involves the face, neck, and upper torso, commonly associated with generalized discomfort and cutaneous pruritus or burning. Patients can experience headache, chills, fever, perioral paresthesia, and/or dizziness. Although rare, chest pain, diffuse muscle spasms, angioedema, and hypotension can also occur. RMS is associated with rapid intravenous infusion of vancomycin, occurring in less than 10% of patients with serious infections who receive 1 g infused over 1 hour. However, healthy patients may have a higher susceptibility. Contrary to true anaphylaxis, RMS is not thought to be mediated by vancomycin-specific antibodies, and can occur even with its first administration.

Intramuscular injection of epinephrine is indicated for anaphylactic reactions. Morphine and other opioids have been shown to increase the rate of RMS in patients receiving vancomycin infusion, and, therefore, should be avoided. A vancomycin serum level at this

time would unlikely provide any valuable information. RMS is not considered a patient-specific allergy, but rather an idiosyncratic reaction related to speed of drug infusion.

REFERENCES:

1. Sivagnanam S, Deleu D. Red man syndrome. *Crit Care*. 2003;7:119-120.
2. Myers AL, Gaedigk A, Dai H, et al. Defining risk factors for red man syndrome in children and adults. *Pediatr Infect Dis J*. 2012;31:464-468.
3. Bruniera FR, Ferreira FM, Saviolli LR, et al. The use of vancomycin with its therapeutic and adverse effects: a review. *Eur Rev Med Pharmacol Sci*. 2015;19:694-700.

206. A 45-year-old man is brought to the emergency department after sustaining a gunshot wound to the chest. He is in respiratory distress and has decreased breath sounds on the right side. Needle decompression is performed in the right chest, and a tube thoracostomy is placed. The patient stabilizes. Which of the following initial findings is most likely in this patient?

- A) Cardiac murmur
- B) Decreased urine output
- C) Hyperresonance of the left chest
- D) Hypertension
- E) Tracheal deviation to the left

The correct response is Option E.

Tension pneumothorax occurs when there is injury to the lung and air leakage into the pleural space that cannot escape. Each subsequent breath increases the volume of air in the pleural space and increases the intrapleural pressure. As pressure builds, structures of the chest are compressed, impairing ventilation and decreasing venous return.

Tension pneumothorax is a clinical diagnosis. Features include tachypnea, dyspnea, jugular venous distention, decreased air entry, hyperresonance on the affected side, tracheal deviation to the opposite side, and hypotension. Treatment is immediate decompression of the pleural space with a long, large-bore needle followed by insertion of a chest tube.

In this patient with a history of penetrating chest trauma, decreased breath sounds, and respiratory distress, tension pneumothorax is diagnosed. The trachea will be deviated to the contralateral side (left) and the patient will be hyperresonant to percussion on the right side. Cardiac murmur and hypertension are not features of tension pneumothorax. Urine output is irrelevant.

REFERENCES:

1. Noppen M, Keukeleire T. Pneumothorax. *Respiration*. 2008;76:121-127.
2. Yarmus L, Feller-Kopman D. Pneumothorax in the critically ill Patient. *Chest*. 2012 Apr;141(4):1098-105.
3. Haynes D, Baumann MH. Management of pneumothorax. *Semin Respir Crit Care Med*. 2010 Dec;31(6):769-80.

207. A 37-year-old woman comes to the office for evaluation for cosmetic rhinoplasty. The patient repeatedly reports to the surgeon that she “is ugly” and “can’t stand” her nose. Physical examination shows no abnormalities consistent with her concerns. Medical history includes five visits to different plastic surgeons in the past 4 months and each surgeon has declined to perform surgery. The surgeon refuses to perform the surgery and refers the patient to a health psychologist. The surgeon's decision is a demonstration of which of the following principles?

- A) Beneficence
- B) Iniquity
- C) Justice
- D) Maleficence
- E) Noxiousness

The correct response is Option A.

In refusing to operate on a patient with body dysmorphic disorder and instead referring the patient to a health psychologist, the surgeon is practicing the ethical principle of beneficence—the doing of good. In cases of medical ethics, the terms maleficence, iniquity, and noxiousness are all associated with doing harm. In this scenario, the surgeon is clearly not doing harm. Justice, the ethical principle requiring doctors to ensure that medical care is available to all, is not applicable to this scenario.

REFERENCES:

1. Mousavi S. The Ethics of Aesthetic Surgery. *J Cutan Aesthet Surg*. 2010 Jan-Apr; 3(1): 38-40.
2. Degrazia D, Mapples T, Ballard J. *Biomedical Ethics*, 7th edition. McGraw-Hill Education, 2010.

208. An 85-year-old man who takes an anticoagulant medication comes to the office for evaluation of a recurrent 1-cm nodular basal cell carcinoma at his nasal tip that has started to bleed intermittently. Medical history includes placement of a cardiac stent 1 month ago, after myocardial infarction. Which of the following is the most appropriate treatment for this patient?

- A) Electrodesiccation
- B) Excision with forehead flap
- C) Pembrolizumab therapy
- D) Superficial radiation therapy
- E) Topical application of 5-fluorouracil

The correct response is Option D.

With a 5-year recurrence rate of about 3% for nodular basal cell carcinomas (BCC), superficial radiation therapy has become a viable alternative to Mohs micrographic surgery, which remains the gold standard for treatment of nonmelanomatous skin cancers.

Electrodesiccation has a high recurrence rate and would subject this anti-coagulated patient to the risk of bleeding after surgery or thrombosis should his anticoagulation be discontinued.

Excision with forehead flap would not be safe for a patient with a recent myocardial infarction.

Topical 5-fluorouracil is not indicated in the management of nodular BCC.

Pembrolizumab therapy is indicated for Stage IV melanoma.

REFERENCES:

1. McGregor, S, Minni J, Herold D. Superficial Radiation Therapy for the Treatment of Nonmelanoma Skin Cancers. *J Clin Aesthet Dermatol*. 2015 Dec; 8(12):12-14.
2. Rodriguez-Vigil T, Vázquez-López F, Perez-Oliva N. Recurrence rates of primary basal cell carcinoma in facial risk areas treated with curettage and electrodesiccation. *J Am Acad Dermatol*. 2007 Jan;56(1):91-5.

209. A 24-year-old woman gives birth to thoracopagus conjoined twins. Which of the following is the genetic, placental, and amniotic relationship of the newborns?

- A) Dizygotic, monochorionic, diamniotic
- B) Dizygotic, monochorionic, monoamniotic
- C) Monozygotic, dichorionic, diamniotic
- D) Monozygotic, monochorionic, diamniotic
- E) Monozygotic, monochorionic, monoamniotic

The correct response is Option E.

In humans, there are several points developmentally where the embryo may divide to form monozygotic (or identical) twins. The earliest point, at the blastocyst stage, results in dichorionic twins (each twin has its own placenta) and diamniotic twins (each twin has its own amniotic sac). This separation accounts for about 30 to 40% of monozygotic twins in humans. If the blastocyst divides closer to the implantation, this results in monochorionic (the twins share a placenta) and dichorionic twins. This accounts for 60 to 70% of monozygotic twins. The most uncommonly encountered group, monochorionic and monoamniotic (the twins share an amniotic sac), undergoes division when the embryonic axis divides into two parallel axes, giving rise to two embryos that develop in a single amniotic sac. It is within this subset of identical twins that conjoined twins occur. When only partial division of the embryonic axis occurs, conjoined twins develop.

REFERENCES:

1. Tannuri AC, Batatinha JA, Velhote MC, Tannuri U. Conjoined twins: twenty years' experience at a reference center in Brazil. *Clinics* (Sao Paulo). 2013; 68(3):371-7.
2. Trost JG Jr, Lin LO, Clark SJ, et al. Separation of Thoraco-Omphalo-Ischiopagus Conjoined Twins: Surgical Planning, Management and Outcomes. *Plast Reconstr Surg*. 2016 Nov;138(5):1064-1072.
3. Kaufman MH. The embryology of conjoined twins. *Childs Nerv Syst*. 2004 Aug;20(8-9):508-25. Epub 2004 Jul 27.

210. A 30-year-old man comes to the emergency department 4 months after undergoing transplantation of the right hand because he has a painful, burning rash on the transplanted hand. Physical examination of the hand shows a maculopapular erythematous rash. Which of the following types of rejection is most likely in this patient?

- A) Hyperacute
- B) Accelerated
- C) Acute
- D) Chronic
- E) Graft-versus-host

The correct response is Option C.

In transplantation, rejection is categorized as hyperacute, accelerated, acute, and chronic.

Hyperacute rejection is a humoral response mediated by antibodies that are already present in the host at the time of transplantation. It starts in the operating room, at the time blood flow to the transplanted organ is reestablished. Exposure to the graft tissue activates preexistent antibodies, which then activate the complement system, causing diffuse thrombosis in the graft's microcirculation and rapid ischemic failure, usually within the first few minutes to hours of graft reperfusion.

Accelerated rejection is a cellular and humoral response that usually occurs between the second and fifth day after transplantation. Considered a variant of hyperacute rejection, it also results from recipient presensitization to donor tissue antigens, but without the formation of large numbers of preexistent antibodies. Instead, memory cells mediate a rapid immune response against the graft. Complement activation and intravascular thrombosis usually leads to graft loss.

This patient is experiencing acute rejection, which is regulated by the activation of T-cells. It can occur at any time after the fifth postoperative day, although it is more common within the first 4 to 6 months. Clinical presentation depends on the transplanted organ, but is usually characterized by short-term organ dysfunction (eg, liver, kidney) or graft cutaneous/mucosal manifestations. A graft biopsy is usually necessary for diagnosis. The majority of acute rejections respond well to higher levels of immunosuppressive therapy, although recurrent events might be predictive of the development of chronic rejection.

Chronic rejection is both an antibody- and cell-mediated immune response that causes indolent, progressive arterial sclerosis and fibrosis of the transplanted organ (eg, coronary atherosclerosis in hearts, bronchiolitis obliterans in lungs, vanishing bile duct syndrome in livers, etc). It usually clinically manifests itself several months to years after transplantation. Initial measurable organ dysfunction usually progresses to failure.

Graft-versus-host disease is a cellular response caused by activation of the transplanted graft's immune cells by the recipient's tissues. It most commonly occurs several months after bone marrow or stem cell transplantation. Clinical manifestation varies, but usually involves tissues/organs of the recipient individual.

REFERENCES:

1. Sieminow M, Klimczak A. Basic Immune Response in Transplantation in Preparation for Application of Composite Tissue Allografts in Plastic and Reconstructive Surgery: Part I. *Plast Reconstr Surg*. 2008 Jan;121(1):4e-12e.
2. Sarhane K, Tuiffaha S, Broyles J, et al. A Critical Analysis of Rejection in Vascularized Composite Allotransplantation: Clinical, Cellular and Molecular Aspects, Current Challenges, and Novel Concepts. *Front Immunol*. 2013; 4: 406.

211. A 53-year-old woman undergoes bilateral mastectomy and autologous breast reconstruction. Four days postoperatively, the patient reports moderate abdominal discomfort and multiple episodes of diarrhea. Vital signs are within normal range. Physical examination shows a mildly distended abdomen. Stool sample is positive for *Clostridium difficile* toxin. Treatment with which of the following drugs is most appropriate first-line treatment in this patient?

- A) Fidaxomicin
- B) Metronidazole
- C) Rifaximin
- D) Teicoplanin
- E) Vancomycin

The correct response is Option B.

Oral metronidazole is the most appropriate treatment for this patient with a mild/moderate form of *Clostridium difficile* infection.

Oral vancomycin is recommended for treatment of those with severe disease, or with mild/moderate disease who did not respond to metronidazole.

Patients who cannot tolerate oral medications (eg, postoperative ileus) or who have an intestinal diversion (eg, ileostomy) can be treated with intravenous metronidazole or with vancomycin enemas. Vancomycin is not excreted into the colon and therefore should not be given intravenously to treat *C. difficile* infection.

Oral fidaxomicin has been shown to be as effective as oral vancomycin in the treatment of *C. difficile* infections. Although further clinical experience is still needed, this drug has been associated with increased cure rate in patients receiving concomitant antibiotics and decreased infection recurrence when compared to vancomycin.

Teicoplanin and rifaximin are not generally recommended for treatment of *C. difficile*, although isolated reports of successful therapy can be found in the literature.

REFERENCES:

1. Nelson RL, Kelsey P, Leeman H, et al. Antibiotic treatment for *Clostridium difficile*-associated diarrhea in adults. *Cochrane Database Syst Rev*. 2011;9:CD004610.

2. Sartelli M, Malangoni M, Abu-Zidan FM, et al. World Society of Emergency Surgery's guidelines for management of *Clostridium difficile* infection in surgical patients. *World J Emerg Surg.* 2015; 10:38.
3. Bagdasarian N, Rao K, Malani PN. Diagnosis and treatment of *Clostridium difficile* in adults: a systematic review. *JAMA.* 2015 Jan 27; 313(4):398-408.
4. Cornely OA, Crook DW, Esposito R, et al. Fidaxomicin versus vancomycin for infection with *Clostridium difficile* in Europe, Canada, and the USA: a double-blind, non-inferiority, randomized controlled trial. *Lancet Infect Dis.* 2012; 12(4):281-289.

212. A 48-year-old man undergoes revision ventral hernia repair. Medical history includes poorly controlled type 1 diabetes mellitus and liver transplantation 3 years ago. The duration of the operation is 6 hours and the procedure is complicated by extensive lysis of adhesions. Three days postoperatively, the patient is noted to have decreased urine output and hypotension despite crystalloid and colloid fluid resuscitation. Intrinsic renal failure is suspected. On analysis of serum and urinary electrolytes, which of the following values is expected to be normal with intrinsic renal failure in this patient?

- A) BUN:serum creatinine ratio
- B) Fractional excretion of sodium (FENa)
- C) Urinalysis
- D) Urinary sodium concentration
- E) Urine osmolality

The correct response is Option A.

Assessment of renal failure begins with a thorough history and physical examination as well as evaluation of key laboratory measurements including complete blood count, metabolic panel, coagulation profile, urinalysis, and urine electrolytes. Early signs of renal failure may include orthostatic hypotension, tachycardia, and dry mucous membranes on examination.

Renal failure may be divided into three categories: prerenal (causes include hypovolemia, cardiac failure, sepsis), renal/intrinsic (causes include disorders of the renal parenchyma, glomerular disease, acute tubular necrosis), and postrenal (causes included renal vein occlusion, urinary tract obstruction).

Assessment of serum and urinary electrolytes and a urinalysis aid with the identification of the cause of renal failure. In prerenal failure, the urinalysis is normal, the ratio of blood urea nitrogen (BUN) to serum creatinine is elevated above 20:1, the urinary sodium concentration is less than 20 mEq/L, urine osmolality is higher than 500 mOsmol/kg H₂O, and the fractional excretion of sodium (FENa), which compares the differences of the sodium and creatinine in the plasma and urine, is less than 1%.

Intrinsic renal failure usually presents with a normal BUN and serum creatinine, urinary sodium concentration higher than 40 mEq/L, urine osmolality less than 350 mOsmol/kg H₂O, and an abnormal urinalysis.

Postrenal failure typically has an elevated BUN to serum creatinine, a FENa greater than 1%, and a normal urinalysis.

REFERENCES:

1. Carrasco LR, Chou JC. Perioperative management of patients with renal disease. *Oral Maxillofac Surg Clin North Am.* 2006 May;18(2):203-12.
2. Apel M, Maia VP, Zeidan M, et al. End-stage renal disease and outcome in a surgical intensive care unit. *Crit Care.* 2013 Dec 23;17(6): R298.
3. Sear JW. Kidney dysfunction in the postoperative period. *Br J Anaesth.* 2005 Jul;95(1):20-32.

213. Which of the following items are required for the surgeon to perform along with the nurse and anesthesiologist on the World Health Organization Surgical Safety Checklist before the induction of anesthesia?

- A) Confirmation of instrument, sponge, and needle counts
- B) Confirmation of patient identity, surgical site, procedure, and consent
- C) Discussion of specimen labeling
- D) Discussion of whether essential imaging needs to be displayed
- E) Discussion of whether there were any equipment problems during case

The correct response is Option B.

Confirmation of patient identity, surgical site, procedure, and consent is the only item out of the above answer choices that is required before the induction of anesthesia. The discussion of imaging display occurs after anesthesia induction and before skin incision. Confirmation of instrument, sponge, and needle counts; specimen labeling; and equipment problems are not appropriate before induction of anesthesia, and are performed before the patient leaves the operating room.

REFERENCES:

1. World Health Organization. *Surgical Safety Checklist*. Updated January, 2009. Accessed May, 2017. http://apps.who.int/iris/bitstream/10665/44186/2/9789241598590_eng_Checklist.pdf.

214. A 45-year-old man is brought to the emergency department/intensive care unit after sustaining multiple facial fractures and a closed head injury with intraparenchymal hemorrhage in a motor vehicle collision. He is currently intubated and unresponsive. Serum sodium concentration is 140 mEq/L. Which of the following is this patient's free water deficit?

- A) 0 L
- B) 1 L
- C) 2 L
- D) 3 L
- E) 4 L

The correct response is Option A.

Free water deficit is calculated by the formula: $\text{Water deficit} = \text{normal body water} \times (1 - (\text{Serum Na}/140))$. The calculated free water deficit is the amount of free water required to bring the sodium concentration back to normal. Free water deficits and the associated hypernatremia can occur with diabetes insipidus after closed head injuries and need to be corrected if present. Although this patient does have a closed head injury and is unresponsive, his serum sodium concentration is in the normal range, and no calculated free water replacement is necessary.

REFERENCES:

1. Adroge HJ, Madias NE. Hypernatremia. *N Engl J Med*. 2000 May 18;342(20):1493-9.

215. Injury to which of the following structures is most common in patients with Zone 1 penetrating neck trauma?

- A) Esophagus
- B) Lung apex
- C) Major artery
- D) Major vein
- E) Recurrent laryngeal nerve

Please note: Upon further review, this item was not scored as part of the examination.

The correct response is Option D.

The most commonly injured structures in the neck are the major veins and the major arteries. Zone 1 extends from the sternal notch/clavicles to the cricoid cartilage and includes thoracic outlet vasculature, proximal carotid arteries, vertebral artery, apices of the lungs, trachea, esophagus, spinal cord, thoracic duct, and the thyroid gland. Zone 2 continues cephalad from the cricoid cartilage to the angle of the mandible and contains the common carotid arteries, internal and external branches of the carotid arteries, vertebral arteries, jugular veins, trachea, esophagus, larynx, pharynx, spinal cord, vagus, and recurrent laryngeal nerves. Zone 3 covers the region above the angle of the mandible up to the base of the skull and contains the distal portion of the internal carotid arteries, vertebral arteries, jugular veins, pharynx, spinal cord, cranial nerves IX, X, XI, XII, and the sympathetic chain.

Since the 1970s, because of advances in diagnostic imaging and the risks associated with negative explorations, a "no-zone" management strategy has been adopted for penetrating neck injury. With this approach, patients are identified as unstable or stable, more so than by the zone of the neck injury. Unstable patients are transferred rapidly to the operating room. However, those who are stable but symptomatic undergo a comprehensive physical examination followed by CT angiography (CTA) as the first imaging test. The results of this test, in combination with examination findings, can then help to determine whether further diagnostic tests are performed or surgical intervention is needed. Esophagogastrosocopy, bronchoscopy, and a barium swallow may then be indicated based on the findings of the CTA.

Immediate surgical intervention is no longer indicated in the stable patient with penetrating Zone 1 or 3 neck trauma prior to a complete workup. Immediate surgical exploration in penetrating Zone 2 neck trauma can still be considered controversial.

REFERENCES:

1. Bell RB, Osborn T, Dierks EJ, et al. Management of penetrating neck injuries: a new paradigm for civilian trauma. *J Oral Maxillofac Surg.* 2007;65(4):691.
2. Mahmoodie M, Sanei B, Moazeni-Bistgani M, Namgar M. Penetrating Neck Trauma: Review of 192 Cases. *Arch Trauma Res.* 2012 Spring; 1(1): 14–18.
3. Shiroff AM, Gale SC, Martin ND, et al. Penetrating neck trauma: a review of management strategies and discussion of the 'No Zone' approach. *Am Surg.* 2013 Jan;79(1):23-9.

216. A 43-year-old woman comes to the office for postoperative care 3 weeks after reconstruction of the left breast with placement of a tissue expander. Localized seroma is palpated just above the inframammary fold. The seroma is aspirated, and the expander is instilled with 90 mL of saline solution. Which of the following is the most appropriate CPT billing description for this office visit?

- A) Level II new patient visit for new problem of seroma
- B) Level III established patient office visit
- C) Percutaneous seroma drainage and expander filling
- D) Percutaneous seroma drainage only
- E) Postoperative visit

The correct response is Option E.

Tissue expander reconstruction is a major operation for which a 90-day global period is included in the operation. During such time, all postoperative care is included in the operative service and no additional fees are payable. The exception is for a return to the operating room for complications such as hematoma or infection. Expansion and percutaneous seroma drainage are both part of routine care and cannot be billed for during the 90-day global period. The patient billing code for the visit is for postoperative visit 99024.

REFERENCES:

1. Medicare Global Surgery Fact Sheet. *Department of Health and Human Services*. <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/GlobalSurgery-ICN907166.pdf>. March 2015.
2. Tissue Expansion After Mastectomy. John Verhovshek. AAPC: <https://www.aapc.com/blog/27083-tissue-expansion-after-mastectomy>

217. Temporary paresthesia is most likely in which of the following teeth after an infraorbital nerve block is performed?

- A) Both central incisors, ipsilateral lateral incisor and canine
- B) Both central incisors, ipsilateral lateral incisor, canine, and first and second molars
- C) Ipsilateral central incisor, lateral incisor, canine, and both bicuspid
- D) Ipsilateral lateral incisor, canine, both bicuspid, and first and second molars
- E) Ipsilateral canine, both bicuspid, and first and second molars

The correct response is Option C.

Anesthetic blocks are routinely performed for office procedures. They are especially useful for facial procedures because of their reliable anatomy. Understanding the anatomy of each of the branches of the trigeminal nerve is important to successfully use this technique. The superior alveolar branch is a branch of the infraorbital nerve that controls sensation to the central and lateral incisor, the canine, and both bicuspid teeth.

The first and second molars are not innervated by branches of the infraorbital nerve. The contralateral central incisor is not innervated by the contralateral infraorbital nerve.

REFERENCES:

1. Zide B, Swift R. How to Block and Tackle the Face. *Plast Reconstr Surg.* 1998;101:840–851.
2. Cok OY, Deniz S, Eker HE, Oguzkurt L, Aribogan A. Management of isolated infraorbital neuralgia by U/S guided infraorbital nerve block with combination of steroid and local anesthetic. *J Clin Anesth.* 2017;37:146-148

218. A 36-year-old woman with invasive ductal carcinoma of the left breast comes to the office to discuss options for immediate breast reconstruction. Examination shows that the tumor is positive for estrogen receptor (ER) and progesterone receptor (PR) expression. Family history is negative for breast and ovarian cancer, and genetic testing shows no abnormalities. Bilateral mastectomy is planned. Which of the following outcomes is most likely in this patient following contralateral prophylactic mastectomy of the right breast?

- A) Decreased number of anticipated overall operations
- B) Decreased risk of recurrence of the known cancer
- C) Increased cure rate for her known cancer
- D) Increased possibility of future breast-feeding
- E) Increased risk of surgical site complications

The correct response is Option E.

Contralateral prophylactic mastectomy (CPM) has become increasingly common in recent years. Women who are at higher than average risk of developing breast cancer may have a clear oncologic benefit from CPM in terms of risk reduction. This would include women who are carriers of high-risk genetic mutations such as *BRCA1* and *BRCA2*, women with a strong family history of breast cancer, and young women with high risk of aggressive tumors. However, for women with average risk of contralateral breast cancer (2 to 6% over 10 years), studies have not supported an oncologic benefit to CPM, attitudes of the lay public and media attention notwithstanding.

Since the surgeries of each breast, involving both mastectomy and reconstruction, are largely (although not completely) independent of one another, the risk of surgical complications to one side or the other is nearly additive, resulting in an approximate doubling of those risks.

CPM has not been shown to improve the cure rate for the known cancer treated with therapeutic mastectomy.

CPM has not been shown to reduce risk of recurrence for the known cancer on the primary side.

CPM would not be expected to decrease the number of anticipated operations. Given the increased likelihood of complications, one may reasonably expect the same number of operations or greater (for treatment of complications), but not fewer.

Removal of both breasts eliminates the ability to breast-feed in the future.

REFERENCES:

1. Boguey JC, Attai DJ, Chen SL, et al. Contralateral prophylactic mastectomy consensus statement from the American Society of Breast Surgeons: additional considerations and a framework for shared decision making. *Ann Surg Oncol*. 2016; 23:3100-5.
2. Miller ME, Czechura T, Martz B, et al. Operative risks associated with contralateral prophylactic mastectomy: a single institution experience. *Ann Surg Oncol*. 2013; 20:4113-20.

219. A 37-year-old man comes to the office for evaluation of whitish papules of the oral mucosa 3 weeks after undergoing successful face transplantation encompassing the maxilla, palate, oral mucosa, and overlying skin. Examination shows that the patient is afebrile and has no leukocytosis. No changes have been made to the initial acute postoperative immunomodulation therapy. Which of the following is the most appropriate initial management of this patient?

- A) Apply topical nystatin
- B) Biopsy for allograft rejection
- C) Increase the dose of tacrolimus
- D) Initiate oral amoxicillin therapy
- E) Reexamine the patient in 4 weeks

The correct response is Option A.

Post-transplant infections can be divided into three phases: early postoperative infections (0 to 2 months), intermediate (2 to 9 months), and late (greater than 9 months). Because of the variation in tissue type and anatomy between solid organ transplantation and composite tissue allograft transplantation, there are differences between types of infection. In all transplant patients, cytomegalovirus (CMV) infection/reactivation is the most common infectious complication. As a result, the protocol for composite tissue allograft recipients includes CMV prophylaxis.

In this particular scenario, facial transplantation is unique in that there are oral and sinus cavities with colonization with native flora. *Candida* is the most ubiquitous and most common flora. Treatment is topical nystatin and clotrimazole.

Although there is constant wariness for rejection, this does not occur commonly in the immediate postoperative period. Biopsy would be warranted if there is no improvement with topical antifungals.

As there is no indication of acute rejection, increasing tacrolimus is not an appropriate initial treatment.

Amoxicillin is a bactericidal antibiotic and is not an appropriate treatment for this fungal infection.

REFERENCES:

1. Broyles, JM, Alrakean M, Esnor C, et al. Characterization, Prophylaxis, and Treatment of Infectious Complications in Craniomaxillofacial and Upper Extremity Allotransplantation: A Multicenter Perspective. *Plast Reconstr Surg*. 2014 Apr;133(4):543e-51e.
2. Avery RK. Update on Infections in Composite tissue transplantation. *Curr Opin Organ Transplant*. 2013 Dec;18(6):659-64.
3. Hammond, SP. Infections in Composite Tissue Allograft Recipients. *Infect Dis Clin North Am*. 2013 27:379-393.

220. A 65-year-old man with Stage II squamous cell cancer at the base of the tongue comes to the office. He has a 30-year history of smoking. Which of the following type of neck dissection is most appropriate for this patient?

- A) Modified: levels I to V nodes
- B) Radical: levels I to V nodes, CN XI, internal jugular vein, sternocleidomastoid muscle removed
- C) Selective (anterior compartment): VI
- D) Selective (lateral neck): levels II to IV
- E) Selective (supraomohyoid): levels I to III

The correct response is Option E.

Selective removal of nodes in levels I to III is the procedure of choice for N0 and N1 cancers in the oral cavity. Lateral and anterior compartment dissections miss Level I, which is the closest lymphatic level to a base of tongue cancer. Modified neck dissections are indicated for clinically palpable metastatic disease. Radical neck dissections are indicated for involvement of the nerve, vein, or muscle.

REFERENCES:

1. Deschler DG and Day T. *TNM Staging of Head and Neck Cancer and Neck Dissection Classification*. 3rd Edition. Alexandria, VA: American Academy of Otolaryngology – Head and Neck Surgery Foundation, Inc.; 2008.
2. Barzan L, Talamini R, Franchin G, et al. Effectiveness of selective neck dissection in head and neck cancer: the experience of two Italian centers. *Laryngoscope*. 2015 Aug;125(8):1849-55.

221. Which of the following patient positioning interventions is most appropriate for prevention of perioperative peripheral neuropathy?

- A) Abducting the arms at 100 degrees in supine patients
- B) Pronating the forearms in supine patients with arms tucked at side
- C) Securing the arms in dorsal extension in supine patients
- D) Stabilizing the neck in extended position in prone patients
- E) Using leg holders with heel support in lithotomy position

The correct response is Option E.

For patients in lithotomy position, the use of leg holders that incorporate heel support may prevent compression injury to the peroneal nerve. Contrarily, leg holders without heel support or the use of wraps to maintain the leg on leg rests may increase the risk of compression injuries to this nerve.

For prevention of brachial plexus perioperative neuropathy in the supine patient, arm abduction should be limited to no greater than 90 degrees. In addition, dorsal extension of the arm (poorly padded or sagging arm boards) should be avoided.

For prevention of ulnar perioperative neuropathy in the supine patient, care should be taken to decrease pressure on the post-condylar (ulnar) groove of the humerus. When the upper extremity is on an arm board, the forearm should be positioned in either supination or neutral positions. When tucked at side, the forearm should be in a neutral position.

When in prone position, the patient's neck should be well stabilized in neutral, nonextended position. Although neck extension has not been reportedly associated with peripheral neuropathies, authors have reported cases of vertebral artery injury.

REFERENCES:

1. American Society of Anesthesiologists Task Force on Prevention of Perioperative Peripheral Neuropathies. Practice advisory for the prevention of perioperative peripheral neuropathies: an updated report by the American Society of Anesthesiologists Task Force on prevention of perioperative peripheral neuropathies. *Anesthesiology*. 2011;114(4):741-54.
2. Winfree CJ, Kline DG. Intraoperative positioning nerve injuries. *Surg Neurol*. 2005; 63(1):5-18.

3. Shermak M, Shoo B, Deune EG. Prone positioning precautions in plastic surgery. *Plast Reconstr Surg*. 2006; 117(5):1584-8.
4. Agostini J, Goasguen N, Mosnier H. Patient positioning in laparoscopic surgery: tricks and tips. *J Visc Surg*. 2010 Aug;147(4):e227-32.

222. A 28-year-old woman, gravida 2, para 1, is brought to the emergency department after a motor vehicle collision in which she was a restrained passenger. ATLS evaluation shows that her vital signs are stable, and she is calm and lucid. The patient reports that she is 32 weeks' pregnant. Repeat blood pressure is 80/60 mmHg, and the patient reports that she feels light-headed; tachycardia is noted. After maintaining cervical spine precautions, which of the following is the most appropriate initial management of this patient?

- A) Administer 2 L crystalloid bolus
- B) Intubate the patient
- C) Logroll the patient onto her left side
- D) Place patient in Trendelenburg position
- E) Transfuse 2 units of blood

The correct response is Option C.

Pregnancy alters normal physiology as well as anatomy. At 32 weeks' pregnancy, gravid uterus and fetus is anatomically at the costal margin and can be somewhat protective of bowel injury in a restrained passenger. A hematocrit of 31 to 35% is within normal range; however, the overall volume has increased dramatically and a loss of 1.2 to 1.5 L is well tolerated without symptoms.

Another crucial anatomical difference is the gravid uterus and its ability to compress the vena cava while in the supine position. Thirty percent decreased cardiac output can occur from the uterus occluding venous return from the lower extremity. In order to avoid this, the uterus should be physically displaced to the patient's left side to allow return from the inferior vena cava. Should there be cervical spine precautions, the board can be rolled to the left 4 to 6 inches, thus alleviating pressure. In general, pregnant patients should be monitored on their left side.

Maternal well-being is the most crucial for fetal well-being, as the number one cause of fetal death is maternal hypotension and maternal death. The second most common cause of fetal death is abruption of the placenta. Fetal monitoring is extremely important, especially after 20 to 24 weeks' gestation. However, in this case there is no evidence of cramping or tender abdomen.

Advanced Trauma Life Support (ATLS) protocol dictates airway, breathing, and circulation are normal, and, in this case, her airway and breathing are normal. The most appropriate next step is reestablishing this patient's circulation, which is alleviating the initial possibility of decreased venous return. Should this not occur, then following the protocol for crystalloid resuscitation would be the most appropriate.

REFERENCES:

1. ATLS Subcommittee, American College of Surgeons' Committee on Trauma, International ATLS working group. *Advanced trauma life support: the tenth edition*. American College of Surgeons, 2014.
2. Lucia A, Dantoni SE. Trauma Management of the Pregnant Patient. *Crit Care Clin*. 2016 Jan;32(1):109-17.

223. Which of the following is a Type I error?

- A) Accepting the alternate hypothesis when it is actually true
- B) Accepting the null hypothesis when it is actually false
- C) Accepting the null hypothesis when it is actually true
- D) Rejecting the alternate hypothesis when it is actually true
- E) Rejecting the null hypothesis when it is actually true

The correct response is Option E.

A Type 1 error is the error of rejecting the null hypothesis when it is actually true. A Type 2 error is the error of not rejecting the null hypothesis when it is actually false. All the other answers are not correct.

REFERENCES:

1. Kirkwood BR and Sterne JAC. *Essential Medical Statistics*. 2nd edition. Malden, Massachusetts: Blackwell Sciences Ltd; 2003.
2. Ruffenburgh RH. *Statistics in Medicine*. 3rd edition. San Diego, California: Elsevier Inc; 2012.

224. A 42-year-old woman who is *BRCA2*-positive undergoes delayed reconstruction of both breasts with deep inferior epigastric artery perforator (DIEP) flaps. Medical history includes prophylactic mastectomy and failed implant reconstruction 3 months ago. After closure of the fascia of the rectus abdominis muscles, the triangle bounded by the latissimus dorsi, external oblique, and iliac crest is identified on each side. Infiltration of bupivacaine into which of the following planes is most likely to provide postoperative pain control of the abdominal flap donor site in this patient?

- A) Between the external oblique and the internal oblique
- B) Between the internal oblique and the transversus abdominis
- C) Between the transversalis fascia and the peritoneum
- D) Between the transversus abdominis and the transversalis fascia
- E) In the deep subcutaneous tissues, superficial to the external oblique

The correct response is Option B.

The peripheral nerve block described is a transversus abdominis plane, or TAP, block. The lumbar (Petit) triangle, which is located at the lateral extent of the abdomen, is formed by the borders of the latissimus dorsi muscle posteriorly, the external oblique anteriorly, and the iliac crest inferiorly. Furthermore, the location can be estimated by the intersection of a horizontal line through the umbilicus and the vertical anterior axillary line. The intercostal nerves providing sensation to the anterior abdominal wall from T6 to L1 are located in the plane between the internal oblique and the transversus abdominis muscles. Long-acting local anesthetic infiltration in this plane is generally approached through the lumbar triangle. Multiple techniques have been described. These include visualized injection with the assistance of ultrasound guidance, catheter insertion under direct vision with surgical cutdown to the appropriate plane, and blind injection using a blunt needle, feeling for the two punctures of the external and internal obliques, respectively. Multiple studies have shown improved postoperative pain control in the abdominal donor site with this technique in breast reconstruction, and patients have demonstrated marked decreases in opioid consumption as well. The other options would be inappropriate for nerve block as the intercostal nerves are not found in those tissue planes.

REFERENCES:

1. Zhong T, Ojha M, Bagher S, et al. Transversus abdominis plane block reduces morphine consumption in the early postoperative period following microsurgical abdominal tissue breast reconstruction: a double-blind, placebo-controlled, randomized trial. *Plast Reconstr Surg*. 2014; 134:870-8.

2. Hivelin M, Wyniecki A, Plaud B, et al. Ultrasound-guided bilateral transversus abdominis plane block for postoperative analgesia after breast reconstruction by DIEP flap. *Plast Reconstr Surg*. 2011; 128:44-55.

225. A 27-year-old man is evaluated in the intensive care unit for polytrauma 12 hours after sustaining burns on 10% of the total body surface area over the bilateral lower extremities during an industrial accident. The patient is sedated, intubated, and is being resuscitated appropriately. Examination shows the wounds are waxy and thick, but not circumferential. He has a nondisplaced fracture of the left tibia; physical examination of the left lower extremity shows that the toes are cool and cyanotic, which is markedly different from the right foot. Left lower extremity pulses are intact, but the left calf is much larger and firmer. Which of the following is the most appropriate next step in management of the left lower extremity?

- A) Ankle brachial index
- B) CT angiography
- C) Elevation
- D) Escharotomy
- E) Fasciotomy

The correct response is Option E.

Compartment syndrome consists of increased pressure within enclosed compartments, resulting in decreased blood flow. For extremities, the concern is for muscle ischemia, as decreased perfusion is unable to supply the metabolic demand. The five P's of compartment syndrome (pain, pallor, paresthesia, pulselessness, and paralysis) are a good guideline, but are not entirely helpful in this case. As the patient is intubated, pain, paresthesia, and paralysis are unable to be assessed. Skin pallor is confused by the burn eschar, and pulselessness is an extremely late finding.

Compartment syndrome needs to be diagnosed early for intervention to be effective. High clinical suspicion is mandatory for this patient because of his clinical condition and trauma. Although measurement of intracompartmental pressures can be done, his ongoing fluid resuscitation and current clinical examination would prompt an emergent surgical intervention.

Elevation is not adequate treatment for compartment syndrome.

Escharotomy would be inadequate as all four fascial compartments will need to be released. Although a circumferential eschar can cause compartment syndrome, this patient does not have circumferential eschar and has a tibial fracture, which points to requiring fascial release.

CT angiography and ankle brachial index are good evaluations of flow and perfusion; however, they are not appropriate in the time sequence of this patient.

REFERENCES:

1. Keudell AG, Weaver MJ, Appleton PT, et al. Diagnosis and treatment of acute extremity compartment syndrome. *Lancet*. 2015 386;1299-1310.
2. Moehring JD, Voigtlander JP. Compartment pressure monitoring during intramedullary fixation of tibial fractures. *Orthopedics*. 1995;18:631-35.

226. A 32-year-old man, who is a football player, is brought to the emergency department after being found unconscious and facedown in his home. It is estimated that he was in that position for 6 hours. Physical examination shows swelling of the right forearm and hand. Which of the following physiologic abnormalities is most likely in this patient?

- A) Hyperkalemia, hypercalcemia, metabolic acidosis
- B) Hyperkalemia, hypocalcemia, metabolic acidosis
- C) Hypokalemia, hypercalcemia, metabolic alkalosis
- D) Hypokalemia, hypocalcemia, metabolic acidosis
- E) Hypokalemia, hypocalcemia, metabolic alkalosis

The correct response is Option B.

The physiological abnormalities that result from rhabdomyolysis are caused because of crush injury to the muscle. The crush injury causes pressure or stretching of the muscle and sarcolemmal membrane. As the sarcolemmal membrane is stretched, sodium, calcium (hypocalcemia), and water leak into the sarcoplasm, trapping extracellular fluid inside muscle cells. In addition to the influx of these elements into the cell, the cell releases potassium (hyperkalemia) and other toxic substances such as myoglobin, phosphate, and urate into the circulatory system (metabolic acidosis). The end result of these events is shock, hyperkalemia, hypocalcemia, metabolic acidosis, compartment syndrome, and acute renal failure. Acute renal failure results because of a combination of hypovolemia with subsequent renal vasoconstriction, metabolic acidosis and the influx of nephrotoxic substances such as myoglobin, urate, and phosphate.

REFERENCES:

1. Greaves I, Porter K, Smith JE. Consensus statement on the early management of crush injury and prevention of crush syndrome. *J R Army Med Corps*. 2003 Dec;149(4):255-9.
2. Zimmerman JL, and Shen MC. Rhabdomyolysis. *Chest*. 2014;144(3):1058-1065.

227. Which of the following time frames for onset most accurately reflects the CDC's definition of surgical site infection?

- A) Within 3 days of surgery or within 30 days of prosthetic implant placement
- B) Within 7 days of surgery or within 3 months of prosthetic implant placement
- C) Within 14 days of surgery or within 6 months of prosthetic implant placement
- D) Within 21 days of surgery or within 9 months of prosthetic implant placement
- E) Within 30 days of surgery or within 1 year of prosthetic implant placement

The correct response is Option E.

The CDC defines a surgical site infection as an infection that occurs at the incision site or within the organ or space operated on within 30 days after surgery or within 1 year if a prosthetic implant is placed. Infection requires at least one of the following:

1. Purulent drainage from the surgical site
2. Organisms isolated from an aseptically obtained culture of fluid or tissue at the surgical site
3. Spontaneous dehiscence of a deep incision or deliberate opening of the incision by a surgeon when the patient has at least one of the following signs or symptoms: fever (greater than 100.4°F [38.0°C]), localized pain or tenderness, localized swelling, redness, or heat, unless site is culture-negative
4. An abscess or other evidence of infection involving the incision or operative site that is found on direct examination, during reoperation, or by histopathologic or radiologic examination
5. Diagnosis of a surgical site infection by a surgeon or attending physician

REFERENCES:

1. Mangram AJ, Horan TC, Pearson ML, et al. Guideline for Prevention of Surgical Site Infection. *Infect Control Hosp Epidemiol.* 1999; 20:250-278.
2. Horan TC, Gaynes RP, Martone WJ, et al. CDC Definitions of Nosocomial Surgical Site Infections, 1992: A Modification of CDC Definitions of Surgical Wound Infections. *Infect Control Hosp Epidemiol.* 1992; 10:606-608.

228. A 50-year-old man comes to the office because of a persistent nonhealing wound 6 months after he underwent open reduction and internal fixation of an open ankle fracture. Examination shows palpable pedal pulse with retained protective sensation of the foot. Which of the following is the most appropriate initial step in management of this patient?

- A) Application of collagenase ointment
- B) Core needle bone culture
- C) Coverage with a free flap
- D) Operative debridement
- E) Referral for hyperbaric oxygen therapy

The correct response is Option D.

The patient is at high risk for fracture nonunion and osteomyelitis. The best next course of management is operative debridement ideally along with the treating orthopedist to make judgments about bone viability and debridement and the risks and benefits of hardware removal. Enzymatic wound debridement would not address the concerns about the deeper wound issues. The role for hyperbaric oxygen in the scenario presented is not well established. Bone cultures at the time of operative debridement should be obtained; but, percutaneous core needle cultures alone would not likely be adequate to obtain best healing. Free flap coverage may be required but is not indicated at this time.

REFERENCES:

1. Anghel EL, DeFazio MV, Barker JC, et al. Current Concepts in Debridement: Science and Strategies. *Plast Reconstr Surg*. 2016 Sep;138(3 Suppl):82S-93S.
2. Cierny G 3rd. Surgical treatment of osteomyelitis. *Plast Reconstr Surg*. 2011 Jan;127 Suppl 1:190S-204S.

229. After successfully completing training at an accredited United States or Canadian training institution, the maximum amount of time a surgeon is allowed to advertise as board eligible while seeking initial certification with the American Board of Plastic Surgery (ABPS) is which of the following?

- A) 1 year
- B) 3 years
- C) 8 years
- D) 10 years
- E) There is no limit

The correct response is Option C.

The American Board of Medical Specialties (ABMS) has held an effective official Board Eligibility Policy since 2012. The policy recognizes physicians' need to advertise with the term "Board Eligible" during their preparatory time for initial board certification, but closes off the potential for abuse through the use of the term indefinitely. This period of time generally varies between ABMS Member Boards as 3 to 7 years following successful completion of accredited training, plus any additional practice time as required by the Member Board for admissibility to their certifying examination. The American Board of Plastic Surgery (ABPS) is one of approximately 24 Member Boards of the ABMS. For the ABPS, the time period is restricted to a maximum of 8 years (7 years plus an additional 1 year allowance to meet the necessary practice requirement to successfully complete both written and oral examinations in plastic surgery).

Exceptions are considered in instances of military deployment, acute illness, or other individual circumstances according to review by the Member Board.

Once certified, diplomates of the ABPS must complete professionalism requirements, self assessment activities, practice improvement activities, and an examination every 10 years as required by the Maintenance of Certification Program in order to maintain their certification status.

REFERENCES:

1. American Board of Medical Specialties. ABMS Board Eligibility Policy. Board Certification 2014; <http://www.abms.org/board-certification/board-eligibility/>. Accessed December 21st, 2016, 2016.

2. American Board of Plastic Surgery. Is Your Plastic Surgeon ABPS Board Certified? ABPS Certification Status: Definitions 2016; <https://www.abplasticsurgery.org/documents/Definitions%20of%20ABPS%20Status.pdf>. Accessed December 21st, 2016, 2016.

230. A 56-year-old woman has been in the intensive care unit since she was struck by a car 2 weeks ago. She sustained multiple facial fractures, severe closed head injury with cerebral contusion, pelvic fractures, and multiple lower extremity fractures. The patient required emergent intubation and has been in a coma since the injury. The patient's current serum sodium concentration is 148 mEq/L, and urinalysis demonstrates dilute urine with low osmolality. Neurogenic diabetes insipidus is suspected. A deficiency in which of the following hormones is most likely the principal cause of this electrolyte imbalance?

- A) Aldosterone
- B) Angiotensin
- C) Cortisol
- D) Renin
- E) Vasopressin

The correct response is Option E.

Neurogenic or central diabetes insipidus is often caused by head trauma resulting in a lack of vasopressin production. Vasopressin is released by the posterior pituitary gland but, unlike other pituitary hormones, is produced in the hypothalamus. Because of this unique relationship, traumatically induced neurogenic diabetes insipidus may occur due to damage to the hypothalamus, pituitary stalk, or posterior pituitary. Vasopressin, also known as antidiuretic hormone (ADH), plays a key role in fluid homeostasis by affecting water retention in the kidneys at the collecting ducts and distal convoluted tubule.

Cortisol is a hormone secreted by the adrenal glands that plays a role in numerous functions including maintaining normal metabolism and regulation of fluid balance. Angiotensin and aldosterone are key hormones of the renin-angiotensin system that is involved in the regulation of plasma sodium concentration and arterial blood pressure. Renin (also known as angiotensinogenase) is an enzyme that converts angiotensinogen to angiotensin. Angiotensin is a peptide hormone that causes vasoconstriction. It is formed by the action of renin on the liver-derived precursor, angiotensinogen, followed by the action of angiotensin-converting enzyme (ACE) to convert angiotensin I to the active form angiotensin II. Aldosterone is a steroid hormone produced by the adrenal glands and released in response to increased angiotensin. It plays a central role in regulation of plasma sodium, extracellular potassium, and arterial blood pressure. Cortisol, renin, angiotensin, and aldosterone deficiencies are not created by neurogenic diabetes insipidus related to head trauma.

REFERENCES:

1. Sterns RH. Disorders of plasma sodium – causes, consequences, and correction. *N Engl J Med.* 2015; 372(1):55-65.

231. A 27-year-old woman is evaluated for jaw pain and new-onset malocclusion with anterior open bite, resulting from a fall from a ladder 6 hours ago. X-ray studies show comminuted bilateral intracapsular mandible fractures. Which of the following is the most appropriate treatment?

- A) Application of an external fixation
- B) Bilateral temporomandibular joint replacements
- C) Maxillomandibular fixation for 2 weeks
- D) Open reduction and internal fixation
- E) Observation with soft diet restriction

The correct response is Option C.

Open reduction and internal fixation of isolated intracapsular fractures of the mandible condyles is not recommended—the fragments are too small to provide reliable hardware fixation. Recommended treatment is a course of closed reduction and maxillomandibular fixation. A period of immobilization with restoration of preinjury occlusion, rather than observation alone, would help relieve pain and restore preinjury bone and soft-tissue relationships. External fixation would offer no benefit in the presence of normal dentition and no other complex injury pattern of the mandible, i.e., segmental loss with accompanying soft-tissue deficit. Replacement of TMJ in this patient is not indicated given her age and degree of injury.

REFERENCES:

1. Morrow BT, Samson TD, Schubert W, Mackay DR. Evidence-based medicine: Mandible fractures. *Plast Reconstr Surg*. 2014 Dec;134(6):1381-90.
2. Wang HD, Susarla SM, Mundinger GS, et al. Which Factors Are Associated with Open Reduction of Adult Mandibular Condylar Injuries? *Plast Reconstr Surg*. 2016 Jun;137(6):1813-21.

232. A surgeon is approached by a charitable organization requesting support for a silent auction fund-raiser. Which of the following services can be donated according to the American Society of Plastic Surgeons (ASPS) code of ethics?

- A) Abdominoplasty
- B) Augmentation mammoplasty
- C) Botulinum toxin A for forehead rejuvenation
- D) Rhytidectomy
- E) Single-site liposuction

The correct response is Option C.

The American Society of Plastic Surgeons (ASPS) has guidelines and policies governing ethical behavior of plastic surgeons. Participation in charitable events is permitted, but must be done in a manner that does not provide implicit understanding of a performance of a procedure for which the patient has not been medically evaluated. Furthermore, an implied or real financial incentive to have a procedure is considered unethical. Botulinum toxin A for forehead rejuvenation is most appropriate. All other options are specific in regards to treatment, for which the patient has ostensibly purchased through the silent auction, but may not be a candidate. Offering free implants also implies that an augmentation mammoplasty is to be done, which is implicitly offering the procedure. No procedures requiring an incision are allowed.

REFERENCES:

1. Code of Ethics of the American Society of Plastic Surgeons. *American Society of Plastic Surgeons*. www.asps.org/documents/governance/asps-code-of-ethics.pdf. Updated October 17, 2016.

233. An otherwise healthy 154-lb (70-kg) woman undergoes a planned facial aesthetic procedure using conscious sedation. The anesthetic plan includes a combination of intravenous 0.25 mg/kg midazolam and 12.5 mg/kg fentanyl. Midway through the procedure, two consecutive noninvasive blood pressure readings taken 5 minutes apart demonstrate a systolic blood pressure of 85 mmHg. Which of the following is the most appropriate next step in management of this patient's hypotension?

- A) Administer flumazenil
- B) Administer naloxone
- C) Administer a vasopressor intravenous bolus (ephedrine or phenylephrine)
- D) Begin cardiopulmonary resuscitation
- E) Increase intravenous fluids

The correct response is Option E.

Conscious sedation is a common anesthetic technique used routinely by plastic surgeons for cosmetic procedures. The patient described is healthy and of average size. The two drugs used in this study are the most commonly used agents for this scenario. The dose chosen is on the low end of normal for both drugs. Increasing the amount of intravenous fluids is the correct answer because in the Marcus et al paper, 20% of the patients who underwent a similar conscious sedation procedure experienced this scenario. One hundred percent of these patients responded appropriately to increased intravenous fluid. Administration of flumazenil to reverse midazolam toxicity is unnecessary as the patient is not experiencing midazolam toxicity. The dosage of midazolam is within the normal range. The patient is not demonstrating any additional signs or symptoms of narcotic (fentanyl) toxicity. The dose is on the low side of normal. Reversal of fentanyl is not indicated. The patient's systolic blood pressure is only mildly low with no other symptoms in an otherwise healthy adult woman. Vasopressors would only be indicated if a fluid challenge was unsuccessful.

REFERENCES:

1. Marcus JR, et al. Optimization of Conscious Sedation in Plastic Surgery. *Plast Reconstr Surg*. 1999;104(5):1338-1345
2. Failey C, Aburto J, La Portilla HG, et al. Office based outpatient plastic surgery utilizing total IV anesthesia. *Aesthetic Surgery Journal*. 2013;33(22):270-274

234. A 77-year-old man undergoes wide local excision of a melanoma on the posterior shoulder. Concomitant sentinel lymph node biopsy is positive for metastasis. Completion axillary lymph node dissection and adjuvant radiation therapy to the axilla are performed. Metastatic workup shows no abnormalities. Postoperatively, the patient develops chronically draining seroma and open wound to the axilla. He is referred for management of the radiation wound after it fails to improve with conservative local wound care. Physical examination shows a 2-cm open wound to the axilla, which tunnels 5 cm into the apex and is surrounded by extensive fibrosis and erythema. Which of the following interventions is most likely to result in a definitive closure?

- A) Administration of 30 hyperbaric oxygen treatments at 2.4 ATA
- B) Application of negative pressure wound therapy
- C) Excision of the wound cavity and full-thickness skin graft reconstruction
- D) Excision of the wound edges and application of acellular dermal matrix
- E) Wide excision of the irradiated soft-tissues and repair with a thoracodorsal artery perforator flap

The correct response is Option E.

Radiation damage produces a hypoxic, hypovascular, and hypocellular environment that can lead to delayed healing and even ulcer formation. Principles of management once a chronic radiation wound has developed include aggressive surgical removal of the entire zone of injury, which is sometimes larger than initially anticipated, and repair with well-vascularized tissue. A thoracodorsal artery perforator flap will provide sufficient healthy and supple soft tissue to cover the entire axilla. The thoracodorsal pedicle should be intact as it is not regularly divided during axillary lymph node dissection.

Negative pressure wound therapy would be contraindicated in this wound because of the potential for exposure of blood vessels in the axilla as well as for sponge retention in the tunneled wound and is, therefore, incorrect.

Excision of the wound edges only may be inadequate treatment of the zone of injury, and it is not the best choice. Furthermore, acellular dermal allograft plays no role, aside from possibly a temporizing measure, in the treatment of radiation ulcers.

Hyperbaric oxygen therapy is indicated for soft tissue radionecrosis. This delivers increased levels of oxygen to the hypoxic, irradiated wound and establishes a steeper oxygen gradient between the wound and surrounding tissues. The cellular response to this gradient stimulates neovascularization and can improve or even heal some wounds. However, with this large, cavitory wound, hyperbaric oxygen therapy, as a single-line treatment, would be unlikely to heal the wound completely.

Excision of the wound cavity and full-thickness skin graft reconstruction is not the best option for two reasons. First, the excision may lead to exposure of neurovascular structures that should not be covered with a skin graft. Second, risk of partial or total loss of a full-thickness skin graft may be unacceptably high in an irradiated wound bed.

REFERENCES:

1. Fujioka M. Surgical reconstruction of radiation injuries. *Adv Wound Care*. 2014; 3:25-27.
2. Jandali S, Mirzabeigi MN, Fosnot J, Low DW. Thoracodorsal artery perforator flaps and muscle-sparing latissimus dorsi myocutaneous flaps for the treatment of axillary hidradenitis. *Ann Plast Surg*. 2012; 69:371-5.

235. A 45-year-old man is brought to the burn unit after sustaining injuries during a house fire. Heart rate is 112 bpm, respiratory rate is 10/min, blood pressure is 113/63 mmHg, and oxygen saturation on room air is 98%. Physical examination shows charring of the face, singed eyebrows, and coarse breath sounds on inspiration. Which of the following is the most appropriate first step in management?

- A) Application of a face mask at 40% oxygen
- B) Bilevel positive airway pressure
- C) Hyperbaric oxygen therapy
- D) Intubation with 100% oxygen delivery
- E) Oxygenation with 6 L nasal cannula

The correct response is Option D.

The patient is at risk for carbon monoxide (CO) toxicity and impending airway collapse. This patient was involved in a house fire and he has signs of lung injury. He should be intubated for airway protection because of his high potential for respiratory collapse. The patient's normal-appearing oxygen saturation is a result of CO poisoning leading to carboxyhemoglobin being mistaken for oxyhemoglobin. Getting a carboxyhemoglobin level will assist in the diagnosis. The treatment for CO toxicity is 100% inhaled oxygen, which will lead to dissociation of the CO molecule from hemoglobin.

Hyperbaric oxygen treatment has been proposed as a potential treatment for CO toxicity, but the data are controversial, and treatment may be inappropriate in a burn patient undergoing resuscitation.

Even though the patient has an oxygen saturation of 98%, it is falsely elevated in CO poisoning.

This patient has stridor and is at risk for airway edema and should be immediately intubated.

Bilevel positive airway pressure does not protect the airway.

REFERENCES:

1. Cancio LC. Airway management and smoke inhalation injury in the burn patient. *Clin Plast Surg*. 2009 Oct;36(4):555-67.

2. Toon MH, Maybauer MO, Greenwood JE, et al. Management of acute smoke inhalation injury. *Crit Care Resusc.* 2010 Mar;12(1):53-61.
3. Mulholland M, Lillemoe K, Doherty G, et al. *Greenfield's Surgery: Scientific Principles and Practice*, 4th Edition. Lippincott Williams & Wilkins; 2005.
4. Tobin MJ. Advances in mechanical ventilation. *N Engl J Med.* 2001 Jun 28;344(26):1986-96.

236. A recent research manuscript is reviewed at a plastic surgery journal club. The article is a case-control study examining the outcomes following peripheral nerve decompression. Which of the following is the level of evidence that this study provides?

- A) Level I
- B) Level II
- C) Level III
- D) Level IV
- E) Level V

The correct response is Option C.

Level I data are defined as high-quality prospective cohort studies with adequate power or systematic review of these studies. Level II evidence represents lesser quality prospective cohorts, retrospective cohort studies, untreated control from an RCT, or systematic review of these studies. Level III evidence is correct and represents case control studies or systematic review of these studies. Level IV evidence is case series studies. Level V evidence is expert opinion, case report, or clinical example; or evidence based on physiology, bench research, or "first principles."

REFERENCES:

1. Burns P, Rohrich R, Chung K. The Levels of Evidence and their role in Evidence-Based Medicine. *Plast Reconstr Surg*. 2011;128(1):305-310.
2. Loiselle F, Mahabir RC, Harrop AR. Levels of evidence in plastic surgery research over 20 years. *Plast Reconstr Surg*. 2008;121:207e

237. An 18-year-old man is brought to the emergency department because of a vertical stab wound to the mid cheek immediately posterior to the level of the lateral canthus. Primary repair is planned within 72 hours. Which of the following is the primary reason to perform the procedure within this time frame?

- A) Anatomical location precludes surgical exploration and repair
- B) Motor end plates will atrophy
- C) Nerve endings will have retracted markedly
- D) Neurotransmitter stores will become irreversibly depleted
- E) Risk of soft-tissue infection of the face increases markedly

The correct response is Option D.

On the face, and posterior to the lateral canthus, the facial nerve should be repaired as early as possible such that identification of the transected nerve stumps is possible. After 72 hours, the neurotransmitter stores required for motor end plate depolarization are irreversibly depleted. As a result, the target muscles no longer respond to stimulation of the distal nerve stump.

Because of marked arborization and cross-innervation of the facial nerve, injuries anterior to an imaginary line drawn from the corner of the eye to the corner of the mouth commonly recover spontaneously. It takes 18 to 24 months for motor end plates to completely atrophy.

REFERENCES:

1. Gordin E, Lee T, Ducic Y, Arnaoutakis D. Facial Nerve Trauma: Evaluation and Considerations in Management. *Craniomaxillofac Trauma Reconstr*. 2015 Mar; 8(1): 1–13.
2. Kadakia S, Helman S, Saman M, Cooch N, Wood-Smith D. Concepts in Neural Coaptation: Using the Facial Nerve as a Paradigm in Understanding Principles Surrounding Nerve Injury and Repair. *J Craniofac Surg*. 2015 Jun;26(4):1304-9.
3. Rovak J, Tung T, Mackinnon S. The Surgical Management of Facial Nerve Injury. *Semin Plast Surg*. 2004 Feb; 18(1): 23–30.

238. During which of the following phases of wound healing is collagen deposition the greatest?

- A) Collagen deposition occurs equally during all phases of wound healing
- B) Collagen deposition does not occur during wound healing
- C) Inflammatory
- D) Proliferative
- E) Remodeling

The correct response is Option D.

The proliferative phase of wound healing occurs in two phases. Fibrin and fibronectin are formed during the initial proliferative period. Around day 3 of wound healing, fibroblasts appear and begin production of collagen. The proliferative phase ends between 2 to 4 weeks of wound healing when collagen accumulation reaches a maximum and collagen remodeling begins, marking the beginning of the remodeling phase of wound healing.

Inflammatory phase is dominated by white blood cells. There is an influx of polymorphonuclear leukocytes (PMNs), macrophages, and lymphocytes. PMNs are not essential to wound healing, but macrophages are essential. Sterile incisions normally heal without PMNs.

Type III collagen is converted to type I in the remodeling phase. In this phase there are increased collagen cross-linking and increased tensile strength.

Collagen deposition does not occur during wound healing is incorrect. It occurs during all phases of wound healing.

Collagen deposition occurs equally during all phases of wounding healing is incorrect because collagen deposition is heaviest during the proliferative phase. Fibroblasts differentiate from resting mesenchymal cells in connective tissue. They are chemoattracted to the site, divide and produce components of ECM and their primary function is to synthesize collagen during that phase.

REFERENCES:

1. Janis JE, Harrison B. Wound Healing: Part I. Basic Science. *Plast Reconstr Surg*. 2014 Feb;133(2):199e-207e.

2. Janis JE, Harrison B. Wound Healing: Part II. Clinical Applications. *Plast Reconstr Surg*. 2014 Mar;133(3):383e-392e.
3. Glat P, Longaker M. Wound healing. In: Grabb W, Aston SJ, Smith JW. *Grabb and Smiths Plastic Surgery*, 5th ed. Lippincott-Raven, Philadelphia;1997.

239. A 19-year-old man is undergoing open reduction and internal fixation of multiple facial fractures when the nasal endotracheal tube is accidentally disconnected from the breathing circuit. The surgeon, who is performing electrocauterization, witnesses an unexpected flash in the operative field. The surgeon immediately stops the procedure and alerts the anesthesiologist. Smoke and a burning odor coming out of the patient's airway are noted. Which of the following is the most appropriate next step in management?

- A) Decrease the flow of airway gases by half
- B) Immediately remove the endotracheal tube
- C) Pack the oral and nasal cavities with sponges
- D) Perform emergency bronchoscopy
- E) Reconnect the endotracheal tube

The correct response is Option B.

This surgical team is confronted with a fire in the operating room, involving the airway. The most appropriate next step is immediate removal of the endotracheal tube, without waiting.

The incidence of operating room fires in the United States is estimated to be around 600 cases per year. Fire requires the presence of three components: fuel, an oxidizer, and an ignition source. Common fuels in the operating room include alcohol-containing prepping agents, drapes and bandages, gowns and other personal protection equipment, petroleum jelly, etc. Ignition sources include the electrocauterization lasers, fiberoptic light sources, and defibrillators. The two most common oxidizing agents in the operating room are oxygen and nitrous oxide.

Early warning signs of fire include unexpected flash, flame, smoke or heat, unusual sounds (e.g., a “pop,” “snap,” or “foomp”) or odors, unexpected movement of drapes, discoloration of drapes or breathing circuit, and unexpected patient movement or complaint. The surgical procedure should be immediately halted so the team can evaluate whether fire is indeed present.

In cases of airway fire, the ASA practice advisory recommends immediate (without waiting) removal of the tracheal tube, interruption of flow of all airway gases, removal of all sponges or any other flammable materials from airway, and pouring of saline into the airway. Once the fire is extinguished, subsequent steps consist of re-establishing ventilation, avoiding oxidizer-enriched atmosphere if clinically appropriate, examining of the

endotracheal tube for possible fragments left behind in the patient's airway, and considering bronchoscopy.

REFERENCES:

1. Apfelbaum JL, Caplan RA, Barker SJ, et al. Practice advisory for the prevention and management of operating room fires: an updated report by the American Society of Anesthesiologists Task Force on Operating Room Fires. *Anesthesiology*. 2013;118:271-290.
2. Rinder CS. Fire safety in the operating room. *Curr Opin Anaesthesiol*. 2008;21:790-795.
3. Hart SR, Yajnik A, Ashford J, et al. Operating room fire safety. *Ochsner J*. 2011;11:37-42.



240. A 60-year-old man is transferred to the surgical intensive care unit (SICU) following ventral hernia repair. Medical history includes coronary artery disease. Shortly after arrival in the SICU, the 12-lead ECG shown is obtained. This finding is most consistent with which of the following cardiac dysrhythmias?

- A) Atrial fibrillation
- B) Atrial flutter
- C) First-degree AV block
- D) Multifocal atrial tachycardia
- E) Second-degree AV block

The correct response is Option E.

Cardiac dysrhythmias in the postoperative setting are extremely common, occurring 9% of the time in non-cardiac surgery patients without a history of cardiac disease to over 40% in cardiac surgery patients. In the surgical intensive care unit (SICU) setting, cardiac dysrhythmias may have several causes including hypoxia, cardiac ischemia, catecholamine excess, routine medications, and electrolyte abnormalities. It is important to be able to identify the characteristic electrocardiographic features of common dysrhythmias.

The PR interval is a measure of the conduction time through the AV node and bundle of His. When the PR interval is prolonged, the patient has a first-degree AV block. Second degree AV block occurs with intermittent failure of the conduction of the impulse to the ventricles. Progressive prolongation of the PR interval until a failure of conduction (“dropped” QRS complex) occurs is second degree AV block (Wenckebach block).

Multifocal atrial tachycardia is thought to be caused by abnormal automaticity. It demonstrates an irregular rate and rhythm, characterized by the presence of three or more

morphologically different P waves on EKG with increased rates of 110 to 140 beats per minute.

Atrial fibrillation is one of the most common dysrhythmias encountered in an ICU setting. It is associated with dilation of the left atrium due to fluid shifts or structural heart disease. Echocardiographically, it is characterized by normal complex tachycardia without P waves.

Atrial flutter is associated with atrial enlargement and is caused by a reentrant circuit within atrial tissue. Increased atrial rates of 250 to 350 beats per minute are common, and not all of the atrial beats pass to the ventricle, typically in a 2:1 ratio. The EKG has a characteristic “sawtooth” flutter wave.

REFERENCES:

1. Asensio and Trunkey. *Current Therapy of Trauma and Surgical Critical Care*, 2nd edition. Atlanta: Elsevier Health Sciences, 2015.
2. Hollenberg SM, Dellinger RP. Non cardiac surgery: postoperative arrhythmias. *Crit Care Med*. 2000 Oct; 28.
3. Heintz KM, Hollenberg SM. Perioperative cardiac issues: postoperative arrhythmias. *Surg Clin North Am*. 2005 Dec;85(6):1103-14, viii.

241. A 52-year-old woman is undergoing Stage II alloplastic breast reconstruction. The surgeon opens the breast pocket by excising the mastectomy scar, divides the muscle and expander capsule, removes the tissue expanders bilaterally, places silicone high-profile implants, and closes the 7-cm incision in layers. The surgeon then performs fat grafting for correction of medial hollowness. Which of the following is the most appropriate CPT coding for this procedure?

	CPT Code	Description
A)	19380	Revision of reconstructed breast
B)	11970, 19370, 20926, 13102	Replacement of tissue expander with permanent prosthesis, Capsulotomy, Fat grafting, Complex repair
C)	11970, 20926, 13102	Replacement of tissue expander with permanent prosthesis, Fat grafting, Complex repair
D)	11970, 20926	Replacement of tissue expander with permanent prosthesis, Fat grafting
E)	11970, 19370	Replacement of tissue expander with permanent prosthesis, Capsulotomy

- A)
- B)
- C)
- D)
- E)

The correct response is Option D.

This patient’s procedure should be coded as replacement of tissue expander with permanent prosthesis (11970) and fat grafting (20926). Excising the mastectomy scar, often performed prior to closure, is bundled in 11970. In this scenario, periprosthetic capsulotomy is not a separate code because the capsule was incised as the approach to the implant. The revision of reconstructed breast code (19380) should only be used in a patient who is undergoing the revision of a preexisting reconstruction and not a patient undergoing Stage II alloplastic reconstruction.

REFERENCES:

1. CPT: 2017 Standard Edition. American Medical Association, Edition 1, 2017.

2. Janevicius R. CPT Corner: Breast Reconstruction Coding Continues to Evolve.
Plastic Surgery News. December 12 2012.

242. Compared with the code team, which of the following is a typical criterion for calling the Rapid Response Team (RRT)?

- A) Absence of respiratory effort
- B) No recordable blood pressure
- C) No recordable pulse
- D) Rapid heart rate
- E) Unresponsiveness

The correct response is Option D.

The Rapid Response Team (RRT) was conceptualized to intervene in the care of a greater number of hospitalized patients at an earlier stage of clinical deterioration. The goal of the RRT is to act acutely to prevent catastrophic adverse events.

The RRT would typically be called for hypotension, rapid heart rate, respiratory distress, and altered consciousness. While the traditional code team would treat cardiac arrest, respiratory arrest, and airway obstruction, the RRT would assess and manage sepsis, pulmonary edema, arrhythmia and respiratory failure.

Typically, hospital mortality in patients treated is 70 to 90% for the traditional code team, while it is 0 to 20% for the RRT.

REFERENCES:

1. Jones D, DeVita M, Bellomo R. Rapid-Response Teams. *N Engl J Med*. 2011; 365:139-146.
2. Leach LS, Mayo AM. Rapid response teams: qualitative analysis of their effectiveness. *Am J Crit Care*. 2013 May;22(3):198-210.

243. A 6-month-old infant is brought to the office because of abnormal head tilt and limited range of motion of the neck. Physical examination shows a 3-cm firm mass on the right side of the neck above the clavicle. Which of the following physical findings is most likely associated with this condition?

- A) Flexion of the head toward the left shoulder
- B) Flexion of the neck toward the left shoulder
- C) Limited lateral flexion toward the left shoulder
- D) Limited lateral flexion toward the right shoulder
- E) Rotation of the head to the right shoulder

The correct response is Option C.

Torticollis is a congenital neck deformity involving shortening of the sternocleidomastoid muscle. The symptoms are head tilt and limited range of motion in the neck, and there is usually a firm mass in the body of the sternocleidomastoid muscle. The majority of the symptoms resolve in the first year of life. Occasionally, large portions of the muscle may become fibrotic, necessitating surgical release.

On physical examination, findings include flexion of the head and neck toward the ipsilateral shoulder, rotation of the head and neck to the contralateral shoulder, and a lack of lateral flexion toward the contralateral shoulder. In the case of right-sided torticollis, the findings would be:

- Flexion of the head and neck toward the right shoulder
- Rotation of the head and neck toward the left shoulder
- Limited lateral flexion toward the left shoulder

REFERENCES:

1. Seo SJ, Yim SY, Lee IJ, et al. Is craniofacial asymmetry progressive in untreated congenital muscular torticollis? *Plast Reconstr Surg*. 2013 Aug;132(2):407-13.
2. Kim HJ, Ahn HS, Yim SY. Effectiveness of Surgical Treatment for Neglected Congenital Muscular Torticollis: A Systematic Review and Meta-Analysis. *Plast Reconstr Surg*. 2015 Jul;136(1):67e-77e.

3. Lim KS, Shim JS, Lee YS. Is sternocleidomastoid muscle release effective in adults with neglected congenital muscular torticollis? *Clin Orthop Relat Res.* 2014 Apr;472(4):1271-8.

244. As of January 1, 2018, surgeons enrolled in Centers for Medicare & Medicaid Services (CMS) Electronic Health Record (EHR) Meaningful Use incentive programs are subject to which of the following payments?

- A) No payments, enrollment is mandatory
- B) 1% Penalty adjustments below existing Medicare/Medicaid reimbursements
- C) Tax credits commensurate with level of participation
- D) 1 To 3% positive adjustments above existing Medicare/Medicaid reimbursements
- E) Up to \$44,000 to offset EHR initiation costs

The correct response is Option B.

The concept of “meaningful use” of electronic health records was introduced by the Health Information Technology for Economic and Clinical Health (HITECH) Act. The HITECH Act was one of many measures enacted by the American Reinvestment and Recovery Act of 2009 to modernize the United States’ infrastructure. The Centers for Medicare & Medicaid Services (CMS) and the Office of the National Coordinator for Health Information Technology (ONC) subsequently published a series of specific rules for health care providers under Electronic Health Record (EHR) Incentive Programs to support the concept of meaningful utilization of electronic health records espoused by HITECH. Both Medicare and Medicaid have related but independent criteria for demonstrating meaningful use through their respective EHR Incentive Programs.

In general, “meaningful use” is defined by the use of certified EHR technology in a meaningful manner (eg, electronic prescribing); ensuring that the certified EHR technology is connected in a manner that provides for the electronic exchange of health information to improve the quality of care; and that in using certified EHR technology, the provider must submit to the Secretary of Health & Human Services (HHS) information on quality of care and other measures.

While maximum EHR benefits through the Medicare Incentive Program initially totaled up to \$44,000 if specific criteria were met over 5 consecutive years, participants must have begun meeting incentive program criteria by 2014, and the last year these incentive payments were paid was 2016.

Participation for both Medicare and Medicaid EHR Incentive Programs is currently completely “voluntary.” However, since 2015, failure to participate in the incentive programs including attestation to your meaningful use of certified EHR technology on a

yearly basis has resulted in a penalty in the form of negative adjustments to Medicare/Medicaid reimbursement rates of at least 1% from CMS. On its own, EHR Meaningful Use “incentive program” has transformed into a euphemism for a de facto penalty program.

REFERENCES:

1. EHR Incentive Programs 2013. Health IT.gov. <https://www.healthit.gov/providers-professionals/ehr-incentive-programs>. Accessed December 21st, 2016.
2. Meaningful Use. HITECH Answers. <http://www.hitechanswers.net/ehr-adoption-2/meaningful-use/>. Accessed December 21st, 2016.
3. Meaningful Use. United States Center for Disease Control and Prevention. <https://www.cdc.gov/ehrmeaningfuluse/introduction.html>. Accessed December 21st, 2016.

245. A 75-year-old woman is evaluated after undergoing bilateral autologous breast reconstruction with deep inferior epigastric artery perforator (DIEP) flaps 2 days ago. The patient had been recovering well until this morning, when she developed acute respiratory insufficiency with hypoxia, tachycardia, and tachypnea. Pulmonary embolism is suspected, and pulmonary CT angiography has been ordered. Baseline creatinine level is 1.1 mg/dL. Which of the following steps should be taken to prevent contrast-induced nephropathy in this patient?

- A) Hydration with hydroxyethyl starch (colloid)
- B) Hydration with 0.9% saline
- C) No preventive measures are needed
- D) Pretreatment with the antioxidant *N*-acetylcysteine
- E) Pretreatment with 0.9% saline and diphenhydramine

The correct response is Option B.

Although the risk of contrast-induced nephropathy (CIN) is overall relatively low, geriatric patients are at higher risk for this complication secondary to their high prevalence of risk factors for renal dysfunction. In this patient population, even normal laboratory creatinine concentrations are not always indicative of normal glomerular filtration rate (GFR), and every effort should be made to prevent the development of CIN. Important prophylactic strategies to avoid this adverse effect include optimization of fluids and avoidance of dehydration, use of non-ionic contrast media, and avoiding repeated exposure to contrast at close intervals.

This geriatric patient should be well hydrated prior to undergoing exposure to this high-contrast study. Minimizing fluid and performing no intervention will increase the patient's risk of developing CIN even with a normal creatinine concentration. Antioxidants such as *N*-acetylcysteine, vasodilators such as dopamine, and colloid solutions such as Hespan have not proven to be beneficial in preventing renal dysfunction. Pretreatment with 0.9% saline and diphenhydramine is used in patients who have allergies to the contrast dye to minimize the allergic reaction and plays no role in preventing CIN.

REFERENCES:

1. Merten GJ, Burgess P, Gray LV. Management of acute renal failure in the elderly patient. *Drugs and Aging*. 2008; 25(6): 455-476.

2. Weibe N, Tonellie M, et al. Prophylaxis strategies for contrast-induced nephropathy. *JAMA*. 2006; 295(23):2765-2779.

246. A 40-year-old man with a history of seizure disorder presents with jaw pain and malocclusion 12 hours after he was punched in the face during a brawl. X-ray studies show a displaced left angle fracture and right parasymphyseal fracture. He smokes one pack of cigarettes daily. Open reduction and internal fixation of the fractures is planned. Which of the following factors in this patient's clinical presentation places him at greatest risk for postoperative wound infection?

- A) History of seizures
- B) History of tobacco use
- C) Patient age
- D) Patient gender
- E) Surgery delayed until 5 days after injury

The correct response is Option B.

Although early treatment of mandible fractures would help relieve pain, delay of treatment in multiple series has not been directly correlated with an increased wound infection rate. In a recent review, tobacco use has been associated with a sixfold increase in wound infection compared with nonsmokers. Although the incidence of complications after mandible fractures is lower in children, in the adult population, patient age and gender do correlate with an increased complication rate. Factors that have correlated with a higher complication rate include the number of mandible fractures present and incision location, intraoral and combined intraoral, and combined intraoral and extraoral incisions were associated with higher infection rates than only extraoral incisions.

REFERENCES:

1. Odom EB, Snyder-Warwick AK. Mandible Fracture Complications and Infection: The Influence of Demographics and Modifiable Factors. *Plast Reconstr Surg*. 2016 Aug;138(2):282e-9e.
2. Morrow BT, Samson TD, Schubert W, Mackay DR. Evidence-based medicine: Mandible fractures. *Plast Reconstr Surg*. 2014 Dec;134(6):1381-90.

247. Which of the following factors is most likely to lead to a patient undergoing breast reconstruction after mastectomy?

- A) *BRCA1/BRCA2* status
- B) Insurance coverage through Medicaid
- C) Living close to a reconstructive surgeon
- D) Patient age
- E) Residence in the southeastern United States

The correct response is Option C.

Several large population-based studies in different regions of the United States show that provision of breast reconstruction is not uniform among all mastectomy patients. The two biggest factors are geographic distance from reconstructive surgeons and insurance status. Patients who live farther away from providers of reconstruction and those uninsured or with Medicaid have a much lower incidence of reconstruction compared to the overall cohorts. Most studies also show *BRCA* positive and younger patients tend to have a higher incidence of bilateral reconstruction.

REFERENCES:

1. Roughton MC, Diegidio P, Zhou L, et al. Distance to a Plastic Surgeon and Type of Insurance Plan Are Independently Predictive of Postmastectomy Breast Reconstruction. *Plast Reconstr Surg*. 2016 Aug;138(2):203e-11e.
2. Alborno CR, Cohen WA, Razdan SN, et al. The Impact of Travel Distance on Breast Reconstruction in the United States. *Plast Reconstr Surg*. 2016 Jan;137(1):12-8.

248. An 84-year-old man comes to the office accompanied by his son-in-law for evaluation of an ulcer of the ischium. Physical examination of the patient shows not only a Stage IV ulcer of the right ischium, but also multiple bruises of the extremities including circumferential upper extremity ecchymoses. The son-in-law claims the patient sustained a fall, but the patient is silent and avoids eye contact when questioned. Because of the unusual physical findings and questionable history, elder abuse is suspected. Which of the following is the most appropriate response in this situation?

- A) Proceed with excision and flap reconstruction of the ulcer since there is no definite proof of elder abuse
- B) Pull the son-in-law aside and ask him in private about the suspected elder abuse
- C) Referral to a wound care center
- D) Report the suspected elder abuse to adult protective services
- E) Report the suspicion of elder abuse only with the patient's permission

The correct response is Option D.

Although elder abuse may be relatively rare in consultation, plastic surgeons must be aware that it is treated similarly to child abuse. The healthcare provider has a responsibility to report the suspected offense even if the patient denies the abuse if the physician has any reason to suspect that the elder abuse may be occurring. Elderly patients may be just as vulnerable as children to abuse and are often overlooked because of the fact that they frequently are competent adults. Similar to children, geriatric patients may be reluctant to report the abuse for fear of repercussions such as withholding of care. Breaching patient confidentiality rights is acceptable if the interests of the vulnerable patient are best served by reporting the incident in good faith and can be made without fear of liability to the provider. In these cases, delays in reporting may result in additional harm to the elderly person.

REFERENCES:

1. <https://www.acponline.org/clinical-information/ethics-and-professionalism/acp-ethics-manual-sixth-edition-a-comprehensive-medical-ethics-resource/acp-ethics-manual-sixth-edition>



249. A 65-year-old woman comes to the office because she is concerned about the appearance of her lower eyelid. A photograph is shown. Which of the following maneuvers is most critical to improve her periorbital appearance?

- A) Botulinum toxin type A injections in the "crow's feet" area
- B) Fat injection limited to the lower eyelid
- C) Orbital malar ligament release and fat repositioning
- D) Skin resection and lateral canthopexy
- E) Skin resurfacing using a phenol-croton oil peel

The correct response is Option C.

The primary factor contributing to the patient's concern is the relationship of the orbital malar ligament, orbital septum and retroseptal orbital fat. Release of the orbital malar ligament and fat repositioning offers the best option for improvement. The retroseptal fat compartments appear to be full so that fat injection alone would risk creating unwanted prominent fullness in the area. Skin resection should be conservative after fat repositioning to avoid lower lid malposition. Phenol-croton oil peeling is an effective treatment for aging

changes but would not correct the anatomical relationships that underlie this patient's chief concern. Botulinum toxin type A injections would not adequately address this patient's concerns.

REFERENCES:

1. Hashem AM, Couto RA, Waltzman JT, et al. Evidence-Based Medicine: A Graded Approach to Lower Lid Blepharoplasty. *Plast Reconstr Surg*. 2017 Jan;139(1):139e-150e.
2. Drolet BC, Sullivan PK. Evidence-based medicine: Blepharoplasty. *Plast Reconstr Surg*. 2014 May;133(5):1195-205.

250. In consultation with a plastic surgeon, a patient who has undergone massive weight loss decides to proceed with a medically necessary panniculectomy under Medicare. The procedure is complicated by a wound dehiscence, prompting numerous additional encounters for acute pain management, intensive outpatient wound care, staged suture removal, and eventual scar revision performed in a minor procedure room. In addition to the primary panniculectomy procedure, it is most appropriate for the plastic surgeon to bill for which of the following?

- A) Acute pain management, including modification of indwelling infusion catheter
- B) Initial consultation
- C) Outpatient wound care, including cost of dressings
- D) Scar revision
- E) Staged suture removal

The correct response is Option B.

The Centers for Medicare & Medicaid Services (CMS) have outlined a detailed description of what is included in the “global surgical package” when reimbursing health care providers for services rendered. Most third-party commercial insurance companies tend to follow these same rules. The global surgical package is a single payment for all care associated with a surgical procedure. In practice, this means that certain services which are incidental to the main procedure, and/or considered an integral component of the main procedure, are not separately billable to the primary surgical procedure.

Panniculectomy would qualify as a major surgical procedure, which includes 1 day of preoperative care, care on the day of surgery, and the 90 days following it for a total of 92 days in the global surgical package.

Medicare includes the following services in the global surgical payment package for major surgery when they are provided in addition to surgery:

- Preoperative visits after the decision is made to operate, including second consultation for preoperative consent, photos, and markings
- Post-surgical pain management by the surgeon
- All additional medical and surgical services required by the surgeon during the post-operative period for routine care and for care arising because of complications, with exception of care requiring additional trip to operating room. Treatment for postoperative complications such as wounds and scar management are not separately

billable when performed outside an operating room, including those performed in minor treatment rooms, recovery rooms, or in an intensive care unit (unless the patient's condition was so critical there would be insufficient time for transportation to an operating room)

- Supplies and services such as dressing changes, local incisional care, removal of operative packs, removal of cutaneous sutures and staples, drains, casts, and splints, and removal of urinary catheters

Services not included in global surgical payment that can be billed and paid for separately include:

- The initial evaluation of problem by surgeon to determine need for major surgery. (Note this is not true for minor surgical procedures, eg, endoscopies, which are always included in the global surgical package)
- Visits unrelated to diagnosis for which surgical procedure is performed, unless visits occur due to complication of surgery
- Clearly distinct surgical procedures that occur during the post-operative period which are not re-operations or treatments for complications

REFERENCES:

1. Centers for Medicare & Medicaid Services, United States Department of Health and Human Services. Global Surgery Fact Sheet. Medicare Learning Network 2015; <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/GlobalSurgery-ICN907166.pdf>. Accessed December 21st, 2016, 2016.
2. Wilcox A, American Medical Association. What Is the Global Surgical Package? Find A Code 2016; <https://www.findacode.com/articles/what-is-the-global-surgical-package.html>. Accessed December 21st, 2016, 2016.

Thank you for your participation.

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244	(A)	(B)	(C)	(D)	(E)
245	(A)	(B)	(C)	(D)	(E)
246	(A)	(B)	(C)	(D)	(E)
247	(A)	(B)	(C)	(D)	(E)
248	(A)	(B)	(C)	(D)	(E)
249	(A)	(B)	(C)	(D)	(E)
250	(A)	(B)	(C)	(D)	(E)