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- Select the “Start Exam” link and read and acknowledge the honor code statement.
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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 37-year-old woman is scheduled to undergo skin-sparing mastectomy of the left breast with immediate deep inferior epigastric perforator (DIEP) flap reconstruction. Which of the following interventions is most likely to decrease this patient's postoperative narcotic needs?
- A) Application of a preoperative compression garment
 - B) Hypnosis
 - C) Ondansetron therapy
 - D) Oxycodone therapy
 - E) Pregabalin therapy

The correct response is Option E.

Pregabalin (Lyrica) has been shown to decrease narcotic needs after breast surgery. It is a gamma-aminobutyric acid (GABA) analogue and decreases GABA in the brain and acts primarily as an anticonvulsant. It is more potent than gabapentin as an analgesic.

Compression garments would be useful for post-mastectomy lymphedema but would not decrease narcotic needs. Hypnosis might decrease narcotic use slightly, but the effects are negligible. Oxycodone is a narcotic which does not decrease narcotic needs. The use of ondansetron (Zofran) has not been shown to reduce post-operative narcotic requirements.

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2. An otherwise healthy 23-year-old man is brought to the emergency department after a motor vehicle-pedestrian collision causing compartment syndrome, myonecrosis, and need for radical resection of devitalized tissue of the right thigh. He is hemodynamically stable. A photograph taken two days after his first debridement is shown. Which of the following is the most appropriate next step in management?

- A) Bilaminate neodermal reconstruction
- B) Free contralateral anterolateral thigh flap
- C) Negative pressure wound therapy
- D) Skin grafting
- E) Surgical debridement

The correct response is Option E.

Given the obvious devitalized tissue in the associated photograph, the most appropriate next step would be further debridement. This is an often overlooked, but still critical, cornerstone to reconstruction, because without it, complication rates from infection are significantly increased.

Debridement involves the removal of nonviable or contaminated tissue that impedes normal tissue growth. It renews the wound and surrounding tissue to promote normal healing by removing infection, biofilm, and senescent cells.

Different debridement options are available, including mechanical, biologic, technical, and surgical methods. In this acute scenario with an otherwise healthy patient and a large amount of devitalized tissue, surgical debridement is the most appropriate choice.

All other modalities/choices are not appropriate until the wound bed is stabilized. Negative pressure wound therapy may be used in conjunction with debridement, but is not a replacement for it.

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3. A 28-year-old woman comes to the office for evaluation of excessive sweating and odor. She reports that she has a long history of heavy perspiration, mainly from the axillary and groin area. Which of the following glands contributes to her excessive and malodorous sweating?
- A) Apocrine
 - B) Eccrine
 - C) Holocrine
 - D) Merocrine
 - E) Sebaceous

The correct response is Option A.

Apocrine glands are associated with sweat production and when mixed with bacteria produce body odor, which can be malodorous. There are two types of sweat glands, eccrine and apocrine. Eccrine glands are located throughout the body and secrete primarily water and salt. Apocrine glands are located in hair-bearing areas such as the axilla and groin and secrete watery fluid that is higher in protein.

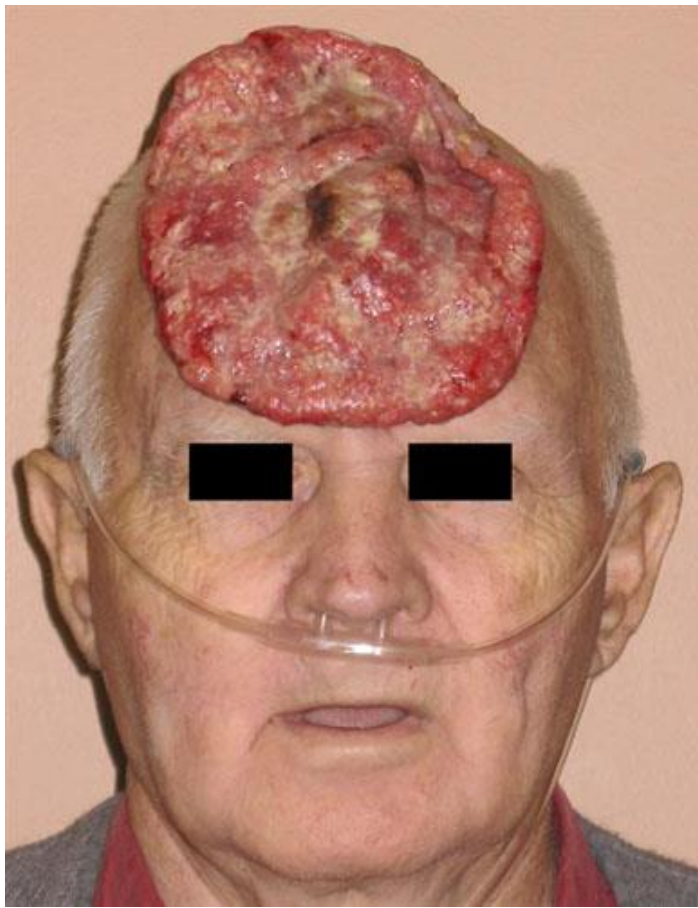
There are three types of exocrine secretion. Merocrine glands secrete via exocytosis and no part of the glands is damaged or lost. Eccrine glands are a type of merocrine gland. Apocrine glands secrete via membrane budding and loss of cytoplasm. The mammary glands are a type of apocrine gland. Finally, holocrine glands secrete via membrane rupture, which destroys the cell. Examples include sebaceous glands, which contain remnants of dead cells, as well as meibomian glands of the eyelids.

Hyperhidrosis describes excessive sweating through the eccrine glands where there is an increase in number and size of these glands. Osmidrosis, or bromhidrosis, involves excess secretion of the apocrine glands combined with bacterial proliferation with corynebacterium. Enzymatic breakdown of the glandular secretions results in the malodor.

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4. A 75-year-old man with a history of renal transplantation presents with a rapidly growing squamous cell carcinoma involving his anterior scalp and forehead. A photograph is shown. Wide excision results in a 20 × 20-cm defect with exposed calvarium. Which of the following flaps is most appropriate for coverage of this wound?

- A) Anterolateral thigh free flap
- B) Gracilis free flap
- C) Lateral arm free flap
- D) Radial forearm free flap
- E) Rectus abdominis free flap

The correct response is Option A.



The anterolateral thigh (ALT) free flap (shown) is the only option listed with the requisite tissue characteristics, size, and pedicle length necessary to repair a defect of this size and location. The ALT flap has rapidly become a first-line option for covering large or irregular head and neck defects. It is an extremely versatile flap with chimeric options allowing for multiple skin paddles, muscle bulk (vastus lateralis) if needed for dead space obliteration, as well as bone (iliac crest) for midface or small mandibular defects. The tissue thickness is well suited for large scalp defects. Flaps as large as 35×25 cm have been described, although defects larger than 10 to 12 cm in width generally require skin grafting the donor site. Pedicle lengths of 12 to 16 cm have been described, which is often long enough to reach the upper neck if necessary.

The radial forearm free flap is an excellent option in many cases, providing a pedicle length up to 18 to 20 cm with maximal dimensions up to 12 × 30 cm. A major criticism of this flap is the poor cosmesis of the donor site and lack of subcutaneous tissue necessary to match the surrounding cutaneous defect. The lateral arm flap based on the radial collateral artery is useful for smaller defects in the head and neck but is limited in this situation by a short pedicle (6 cm) and smaller skin paddle (6 × 12 cm).

Muscle flaps covered with skin grafts have also been described for scalp coverage. When necessary, a latissimus dorsi flap is a great option for near total scalp coverage. With the examples listed here, the gracilis flap is too narrow (5 to 6 cm) with too short a pedicle (medial femoral circumflex, 7 cm). While the pedicle for the rectus free flap (deep inferior epigastric, 8 to 10 cm) might be long enough in this situation, the muscle is not big enough (6 cm wide) to cover the defect.

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5. A 5-year-old male has a cerebrospinal fluid leak and a 3 x 3-cm area of wound dehiscence involving the posterior trunk following tethered cord repair. Which of the following is the most appropriate method to reconstruct the wound?
- A) Gluteal muscle flap and skin advancement flap
 - B) Latissimus muscle turnover flap and skin advancement flap
 - C) Local fascial flap and skin advancement flap
 - D) Skin advancement flap
 - 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.

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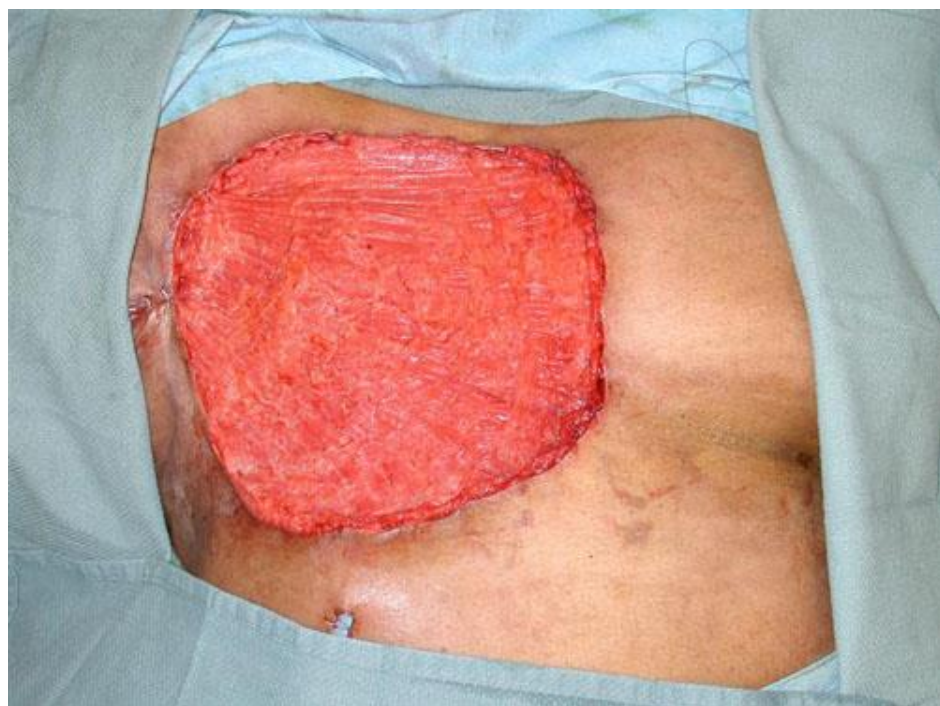
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6. A 19-year-old woman with a medical history significant for Poland syndrome and a BMI of 19 kg/m² undergoes first-stage breast reconstruction with a tissue expander that is complicated by extrusion and infection 40 days after implantation. A photograph is shown. Attempts at implant salvage are made. The presence of which of the following factors is most likely to lead to decreased salvage rates?

- A) BMI of 19 kg/m²
- B) Culture-positive *Staphylococcus* sp
- C) Hemoglobin A_{1c} of 6.5%
- D) Prepectoral placement of the device
- E) Use of acellular dermal matrix

The correct response is Option B.



It has been shown that successful breast device salvage in breast reconstruction is possible if caught early. However, there are associated factors with failure, including culture-positive *Staphylococcus* (epidermidis or aureus), as demonstrated by several studies. Other associated risk factors for failure include obesity, poorly-controlled diabetes, smoking, history of radiation therapy, postoperative seroma, and early contamination of the implant with biofilm formation. Therefore, prompt and aggressive intervention is warranted in these situations where the device is threatened by either infection and/or exposure. This includes both surgical and antimicrobial options.

In a 2017 study, prepectoral and subpectoral placement demonstrated comparable complications. Acellular dermal matrix did not increase failure rates.

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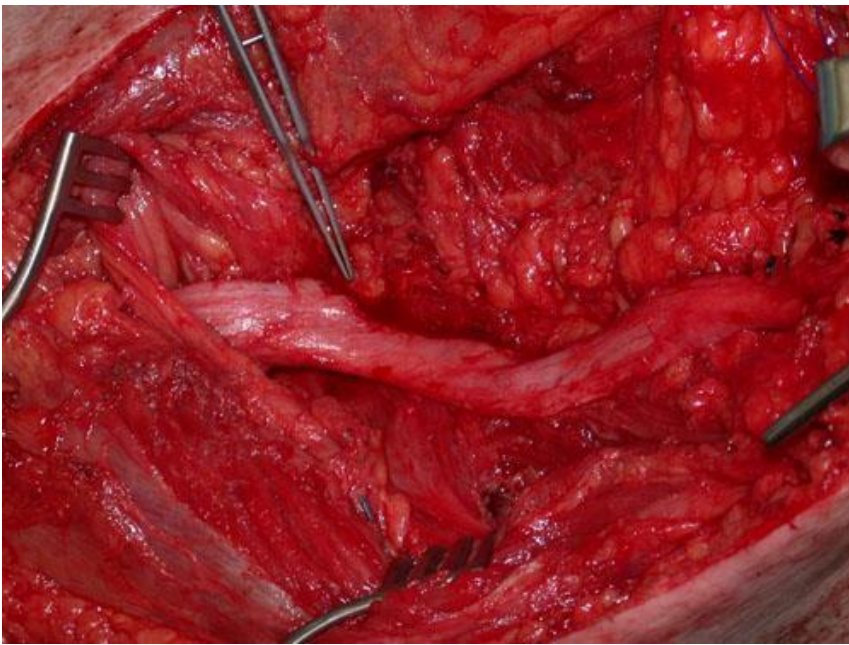
7. A 65-year-old woman comes to the office with swelling of her left upper extremity 18 months after undergoing radiation therapy to her left axilla for breast cancer. Which of the following is the most appropriate test to confirm the diagnosis of lymphedema?
- A) CT scan
 - B) Lymphoscintigraphy
 - C) MRI
 - D) Skin biopsy
 - E) Ultrasonography

The correct response is Option B.

The most appropriate test to confirm the diagnosis of lymphedema is lymphoscintigraphy. Radiation to the axilla causes fibrosis of the axillary lymph nodes, which impairs the proximal drainage of lymph fluid from the extremity, resulting in lymphedema. Lymphoscintigraphy is the gold-standard test to diagnose lymphedema. A radiolabeled protein injected into the hands is taken up by the lymphatic vasculature. Images are obtained as the protein travels proximally to the axillary lymph nodes. Delayed transit of the tracer and/or dermal backflow of tracer into the superficial lymphatics confirms lymphatic dysfunction and lymphedema. The test is 96% sensitive and 100% specific for lymphedema. Ultrasonography, CT scan, and MRI may show subcutaneous fluid, but are not sensitive or specific for lymphedema. Lymphedema cannot be diagnosed using a biopsy; histopathology of lymphedematous tissue only may show non-specific inflammation.

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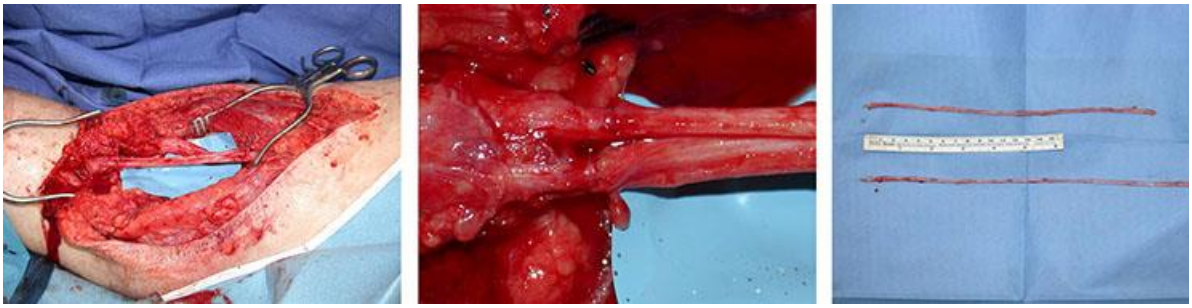
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8. A 40-year-old man is diagnosed with a posterior thigh sarcoma. He undergoes resection of the tumor as well as some of the surrounding muscle. Partial sacrifice of the sciatic nerve is required, leaving a 40% circumferential defect and an 11-cm gap between proximal and distal ends. A photograph is shown. Which of the following is the most appropriate method of nerve reconstruction?

- A) Mobilization and primary coaptation
- B) Polyglycolic acid nerve tube
- C) Processed human allograft conduit
- D) Saphenous vein graft
- E) Sural nerve cable graft

The correct response is Option E.



Fundamentals of nerve repair include coaptation in a tension-free manner. If there is any tension, nerve grafts or conduits are indicated. In this clinical scenario, there is a large nerve gap that precludes tension-free primary coaptation, even with extensive proximal and distal mobilization. Therefore, a nerve graft is indicated. Common choices include sural, lateral, or medial antebrachial cutaneous. For the size and length of the defect and the fact that multiple cable grafts would be needed, the sural is the most appropriate choice.

Nerve conduits such as PGA tubes and processed human allograft conduits serve as scaffolds to promote nerve regeneration, although these are typically used for gaps less than 3 cm. Given the distance involved, a sural nerve graft using a grouped fascicular or epineurial repair is the most appropriate choice, although a gap this large is almost certain to leave permanent deficits. Appropriate levels of expectation must be set with the patient.

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9. A 27-year-old man comes to the emergency department for evaluation after being involved in an altercation earlier in the evening during which he sustained multiple injuries to his right hand. Physical examination shows a deep laceration over his right index and long finger metacarpophalangeal (MCP) joints. There is no evidence of tendon or neurovascular injury. The wound is debrided at bedside, packed with moistened gauze, and placed in a sterile dressing. Prior to discharge, the patient should be provided with prophylactic antibiotic coverage for which of the following microorganisms?
- A) *Eikenella*
 - B) *Flavobacterium*
 - C) *Mycobacterium*
 - D) *Pasteurella*
 - E) *Vibrio*

The correct response is Option A.

It is important to recognize dorsal hand lacerations as a possible site for serious infection, especially in the context of altercations where a “fight bite” might have occurred. In some cases, patients may be apprehensive to admit to the source of their injury, and in these cases, physicians should err on the side of caution and provide antibiotic prophylaxis. The primary bacteria isolated from human bite wounds is *Eikenella*. *Pasteurella* is commonly found in wounds resulting from the bites of dogs, cats, or farm animals. *Flavobacterium* is associated with bites from freshwater fish. *Mycobacterium* can be seen in bites from bears and ferrets. *Vibrio* is associated with shark bite wounds and other marine injuries.

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10. A 21-year-old man comes to the emergency department 10 days after undergoing a septorhinoplasty, with new-onset fever, malaise, throat pain and a painful skin rash. He recently completed a course of amoxicillin and clavulanate potassium (Augmentin). Temperature is 39.1°C (102.4°F), blood pressure is 75/40 mmHg, and heart rate is 140 bpm. Physical examination shows multiple cutaneous blisters involving the face and entire trunk (45% total body surface area [TBSA]). Intraoral examination shows mucosal erythema and erosions. Nasal examination shows nasal septal splints that were placed at the time of surgery. The patient is admitted to the hospital. Biopsy of the skin rash shows full-thickness epidermal necrosis with dermal edema and sparse dermal infiltrates. Which of the following is the most likely diagnosis?
- A) Acute generalized exanthematous pustulosis
 - B) Drug reaction with eosinophilia and systemic symptoms
 - C) Stevens-Johnson syndrome
 - D) Toxic epidermal necrolysis
 - E) Toxic shock syndrome

The correct response is Option D.

Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN) are in the spectrum of the same disease process, characterized by a severe drug-induced immune reaction. The drug or its metabolite acts as a hapten and provides antigenic stimulation for a T-cell-mediated delayed hypersensitivity reaction. The list of offending medications is extensive and includes antibiotics, anticonvulsants and NSAIDs. Onset is within the first 8 weeks of starting the medication, and is characterized by fever, mucositis and a painful generalized vesiculobullous rash. Histology of skin specimens reveals keratinocyte apoptosis, full-thickness necrosis of the epidermis, and minimal dermal inflammation. Mucosal inflammation can involve any mucosal surface. Cutaneous involvement consists of blisters and erosions, with skin separation. Application of shear forces on the skin results in separation of the epidermis (Nikolsky sign). Skin separation of less than 10% of total body surface area is classified as SJS, greater than 30% of total body surface area as TEN, and 10 to 30% of total body surface area as SJS-TEN overlap. Multisystem organ dysfunction can occur. Treatment is supportive, with the best outcomes in patients treated early in a burn center. Intravenous corticosteroids are usually given, although their use is controversial. Mortality is 1 to 5% in SJS and 25 to 40% in TEN. Survivors are often left with skin scarring, mucosal strictures, and ocular complications.

Toxic shock syndrome (TSS) is caused by toxin-producing strains of *Staphylococcus aureus* and *Streptococcus pyogenes*. The toxin acts as a super antigen and causes widespread immune stimulation. Staphylococcal Toxic Shock Syndrome can occur after surgical or traumatic skin break or from colonization of a foreign body. Onset is within 48 hours of surgery and consists of influenza-like symptoms, fevers, and shock. Multisystem organ failure can occur. Skin desquamation usually occurs 2 to 3 weeks later. Treatment consists of source control, antibiotic therapy, and in some cases, immunoglobulins.

Acute generalized exanthematous pustulosis (AGEP) is a T-cell-mediated cutaneous drug reaction. Onset is usually within 48 hours and consists of fever, leukocytosis, and a rash consisting of many small sterile non-follicular pustules distributed predominantly on the trunk and intertriginous areas. Mucous membrane involvement is uncommon and occurs mostly in the lips and buccal mucosa. Internal organ involvement occurs in a minority of cases but can lead to multisystem organ dysfunction. Histology shows intracorneal, sub-corneal, and intraepidermal pustules and a dermal neutrophilic and eosinophilic infiltrate. Treatment is discontinuation of the offending drug, after which the condition quickly resolves. Prognosis is excellent.

Drug reaction with eosinophilia and systemic symptoms (DRESS) is a severe drug reaction of unclear pathogenesis that is characterized by fever, hematological abnormalities (leukocytosis, eosinophilia), and internal organ dysfunction. Onset is typically 2 to 8 weeks after drug exposure. Antiepileptics are most commonly implicated, although a variety of drugs, including antibiotics, can be the causative agent. Cutaneous involvement consists of a morbilliform rash. Mucosal involvement is frequent. Facial edema can be severe. Blood leukocytes are markedly elevated, with 30% of cases having eosinophilia. Multisystem organ dysfunction can occur. Histopathology reveals a perivascular lymphocytic infiltrate in the papillary dermis and dermal edema with extravasated erythrocytes and eosinophils. Treatment consists of cessation of the offending drug, systemic glucocorticoids and supportive care.

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11. A 42-year-old woman with a history of a cesarean delivery from a low-transverse abdominal incision is scheduled to undergo a unilateral deep inferior epigastric perforator (DIEP) flap breast reconstruction. BMI is 28 kg/m² and the distance from nipple to sternal notch is 24 cm per side. This patient's history of cesarean delivery is most likely to have which of the following effects?
- A) Decreased abdominal seroma
 - B) Decreased flap venous congestion
 - C) Increased flap arterial thrombosis
 - D) Increased flap fat necrosis
 - E) No overall effect

The correct response is Option B.

Pfannenstiel incisions are the preferred access for cesarean deliveries. They are not a contraindication for abdominal-based flaps for breast reconstruction because the deep inferior epigastric circulation is not disturbed. However, the superficial epigastric circulation may be divided. The net result appears to be a more robust venous circulation with a protective effect against fat necrosis in the flap. This venous division causes a delay-type phenomenon—during healing increased branches are formed from the superficial epigastric circulation, and there is some evidence of new connections to the venae comitantes of the deep epigastric venous circulation.

There is evidence, however, for an increased rate of abdominal healing problems, including seroma (15% versus 6%), wound healing problems, and fat necrosis in the abdomen. There is no evidence for an effect on the arterial circulation of the flap.

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12. Cancellous bone grafts display which of the following characteristics compared with cortical bone grafts?

- A) Improved osteogenic potential
- B) Increased density with slower resorption
- C) Increased structural support
- D) Low concentrations of osteoblasts and osteocytes
- E) Poor osteoinductive potential

The correct response is Option A.

Cancellous bone grafts have improved osteogenic potential when compared with cortical bone grafts. Despite significant improvements in fracture stabilization, in order to promote adequate bone union, the addition of bone grafts is occasionally necessary. These can be in the form of autografts, allografts, and synthetic bone grafts, and ortho-biologic factors. Osseous autografts can be categorized as vascularized and nonvascularized. Nonvascularized autografts can be further sub-classified as cancellous, cortical, or bone marrow aspirate. In order to choose the optimal type of graft to utilize in a specific clinical scenario, it is important to have an understanding of the properties of specific types of bone grafts as well as differences between categories of available grafts.

Bone autografts are considered the gold standard because of their immunologic compatibility as well as their osteoinductive, osteoconductive, and osteogenic healing properties. The most commonly utilized autologous bone graft is cancellous bone. When compared with cortical bone grafts, cancellous bone grafts have significant concentrations of osteoblasts and osteocytes, thus giving cancellous bone grafts superior osteogenic potential. Cortical bone grafts are dense with significant structural support, which leads to improved stability. This dense structure also leads to slower resorption compared with cancellous bone grafts, but this dense organized structure leads to lower concentrations of osteoblasts and osteocytes thus diminishing the osteogenic potential of cortical bone grafts.

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13. A 51-year-old patient presents for male-to-female gender confirmation surgery. World Professional Association for Transgender Health (WPATH) guidelines have been met, and the patient is deemed a good candidate for penile inversion vaginoplasty. Which of the following is the most likely long-term complication of this procedure?

- A) Neovaginal stenosis
- B) Partial prolapse
- C) Rectovaginal fistula
- D) Urethrovaginal fistula
- E) Urologic dysfunction

The correct response is Option E.

Complications involving urological reconstruction and anastomosis represent the most common adverse events following male to female gender confirmation surgery occurring in nearly 10% of patients. The other complications listed are less common with incidences ranging from 2-4%.

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14. An obese, 43-year-old woman has onset of lymphedema of her right arm 4 months after undergoing modified radical mastectomy with adjuvant radiation therapy. In addition to decongestive therapy, she is fitted for a daytime compression garment. Which of the following factors is most critical to the effectiveness of this modality?

A) Compression should be avoided when cellulitis is present

B) Compression should be constant throughout the limb

C) Compression should be a minimum of 20 mmHg

D) Garments must be worn continuously

E) Garments should be custom fit to the patient

The correct response is Option C.

Compression garments are a necessary adjunct to lymphedema therapy. They come in a variety of pressures. In the US, these are designated by class: 1) 20-30 mm Hg; class II) 30-40 mmHg, class III) 40-50 mmHg; and class IV) >50 mmHg. Generally, more severe cases of lymphedema require higher-class sleeves. Compression garments may be removed while sleeping as long as the extremity is elevated. In addition, compression should be graduated from distal to proximal. Garments can be custom fit or purchased over the counter in standard sizes; there is no evidence that custom garments are better so long as a good fit is achieved. An open wound or infection is not a contraindication to wearing a compression garment.

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15. A 4-year-old girl is evaluated for an axillary skin contracture from a burn. Z-plasty is planned to lengthen the scar in order to improve the contracture. If 45-degree angles are planned, the most likely expected increase in the length of the scar would be which of the following?

- A) 25%
- B) 50%
- C) 75%
- D) 100%
- E) 120%

The correct response is Option B.

The most likely expected increase in scar length is 50%. A Z-plasty is a technique using two triangular flaps which are interdigitated, producing a gain in length of the central limb placed along the line of contracture. The angles of the Z-plasty range from 30 to 90 degrees. The wider the angles, the greater the lengthening. A 30-degree angle is equal to a 25% increase in length, a 45-degree angle is equal to a 50% increase in length, a 75-degree angle is equal to a 100% increase in length, and a 90-degree angle is equal to a 120% increase in length. The most commonly used angle is 60 degrees, giving a 75% increase in length. This angle is optimal because angles less than 60 degrees may not provide enough lengthening, and angles greater than 60 degrees can produce significant tension inhibiting flap transposition.

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16. A 65-year-old woman comes to the office for consultation regarding facial rejuvenation. She is bothered by deepened nasolabial folds and what she describes as a "hollowness" of her cheeks. Which of the following factors is most important in the development of this patient's facial aging?
- A) Atrophy of the periosteal lining and its effects on the facial bones
 - B) Deflation of facial fat compartments and attenuation of facial retaining ligaments
 - C) Increased collagen deposition leading to facial skin changes
 - D) Loss of tone and volume of the underlying mimetic musculature

The correct response is Option B.

A significant factor that leads to the classic signs of facial aging is the loss of volume, or deflation of the fat compartments of the face in conjunction with attenuation and laxity of the anatomical retaining ligaments of the face, which compartmentalize the fat compartments. These two factors in concert lead to the classic appearance associated with facial aging and the associated description of volume loss and descent of the soft tissues of the face.

It is important to note that facial aging is influenced by both environmental, as well as anatomical factors. Controllable environmental factors, such as smoking, excessive alcohol consumption, extremes of BMI, and excessive unprotected sun exposure, can influence and even accelerate the aging process, but even without the presence of these factors, facial aging will occur due to anatomical changes.

Skeletal changes that occur with age influence the way in which the face appears over time. Numerous studies have evaluated changes in the bones of the orbits, mid face, and mandible and their effects on facial appearance. Not only does the bone structure change and influence appearance, but the effects of these skeletal changes also affect the appearance of the overlying skin and soft tissues, thus having a secondary effect. It is the actual change in facial bone shape, not the overlying periosteum, that causes these age-related changes in facial appearance.

Along with changes under the skin, so too does the skin change during the aging process. Chronic photodamage to the skin results in pigmentary changes as well as epidermal thinning. Dermal changes occur, including collagen disruption as well as collagen loss and increased elastin production.

Utilizing MRI, Gosain et al. disproved the once held notion that loss of volume of the underlying mimetic musculature and atrophy of the periosteum led to facial aging—related volume loss.

Pessa and Rohrich have shown that the retaining ligaments of the face help to compartmentalize the fat compartments of the face. As these fat compartments atrophy over time, one notices facial volume loss. In conjunction with this volume loss, as the retaining ligaments become attenuated, this leads to descent of the fat compartments, which leads to the appearance of skin laxity and deepened folds in specific anatomical sites, such as the nasolabial fold, tear trough, and jowl.

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17. A 21-year-old patient comes to the office seeking genital surgery for female-to-male gender confirmation. The patient is an appropriate candidate for phalloplasty with a radial forearm free flap. Which of the following is the most common complication of this technique?
- A) Dissatisfaction with the aesthetic result
 - B) Formation of urethral strictures and fistulas
 - C) Inability to void while standing
 - D) Lack of sensation in the neophallus
 - E) Partial or total flap loss

The correct response is Option B.

The radial forearm free flap is the most commonly used technique for phalloplasty. A neophallus with a length of 7.5 to 14 cm can be reconstructed. The tube-within-a-tube design is commonly employed, in which the flap is tubed to create a neourethra over which the remainder of the flap is tubed to create the bulk of the flap. The clitoris is de-epithelialized and placed under the neophallus. Vascular anastomosis of the radial artery is performed to the inferior epigastric or femoral vessels. The medial and lateral antebrachial cutaneous nerves are coapted to the ilioinguinal nerve and the dorsal nerve of the clitoris or deep pudendal nerve to provide tactile and erogenous sensation.

The goals of phalloplasty are: creation of an aesthetically pleasing neophallus, with tactile and erogenous sensation, the ability to micturate while standing, and the ability to perform penetrative sexual intercourse.

The most common complications of phalloplasty are urologic, with an incidence of approximately 40%. A recent review of radial forearm free flap phalloplasty showed an average rate of fistula formation of 26.58% and strictures of 12.27%. The most common location for fistulas and strictures is at the anastomosis of the fixed urethra and the phallic urethra. Approximately half of these can be managed nonoperatively, with suprapubic catheter placement and endoscopic fistula dilation. Another recent systematic review of radial forearm free flap phalloplasty showed that 69% of patients reported erogenous sensation and 77% reported tactile sensation in their neophallus. Another review showed that standing micturition was achieved in 97.5% of patients and successful penetrative sexual intercourse was reported by 21.1%. The overall rate of

partial flap loss was 5.43% and total flap loss was 1.69%. Overall 70% of patients reported satisfaction with the aesthetic result.

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18. An otherwise healthy 35-year-old man sustains an amputation of the right thumb while using a cutting saw. Assuming appropriate cooling of the amputated part is performed immediately, successful replantation of the digit could be realistically achieved if performed within which of the following maximum time frames?

- A) 2 hours
- B) 4 hours
- C) 6 hours
- D) 12 hours
- E) 24 hours

The correct response is Option E.

The reasonable maximum time frame for replantation of an appropriately cooled and stored digit (referred to as cold ischemia time) is 24 hours. However, the warm ischemia time for digital replantation is 12 hours. These times are further reduced when replanting more proximally amputated limbs, such as an arm or leg, because of the presence of ischemia-sensitive muscle. The recommended maximum cold ischemia time to replantation in these major replants is 12 hours; the warm ischemia time is 6 hours. Despite these recommended time frames, successful replantations performed many hours after the amputations have been reported. In 1986, May et al. reported a successful digit replantation after 39 hours of cold ischemia, the seventh of a seven-finger replant. Then, in 1988, Wei et al. reported successful digital replantations after 84, 86, and 94 hours of cold ischemia. Whenever there is more muscle mass in the replanted limb, ischemia time becomes more critical. In these clinical scenarios, immediate shunting should be considered especially when the ischemia time is nearing the time frames described above.

The other options are incorrect because they are within the ideal maximum time frame.

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19. A 58-year-old man comes to the office with recurrent rectal cancer four years after undergoing low anterior resection with adjuvant radiotherapy. Open abdominoperineal resection is planned. Which of the following closure methods will most reliably reduce the incidence of perineal wound complications?

- A) Gracilis flap closure
- B) Negative pressure wound therapy
- C) Primary closure
- D) Rectus abdominis flap closure
- E) Split-thickness skin grafting

The correct response is Option D.

Several retrospective studies and one randomized trial have shown that when compared to primary closure, the rectus abdominis myocutaneous flap reduces wound healing complications after abdominoperineal resection (APR). Gluteal and gracilis flaps have been used for reconstruction after APR; however, the data supporting their use is not as robust. Split-thickness skin grafting and negative pressure wound therapy are inappropriate for reconstruction of the APR due to the size of the wounds and the risk of evisceration.

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20. An otherwise healthy 30-year-old woman is diagnosed with dermatofibrosarcoma protuberans (DFSP) of the upper back. A wide excision is performed, and a local flap is used to reconstruct her back. On follow-up evaluation, CT scan shows multiple pulmonary metastases. Which of the following is the most appropriate next step in management?
- A) Chemotherapy
 - B) Hormone therapy
 - C) Immunotherapy
 - D) Radiation therapy
 - E) Surgical excision

The correct response is Option A.

The most appropriate next step in management is chemotherapy. Patients with inoperable, recurrent, or metastatic disease may benefit from imatinib which is a tyrosine kinase inhibitor and acts as a molecularly targeted drug. It acts by inhibiting the platelet-derived growth factor receptor tyrosine kinase. Dermatofibrosarcoma protuberans (DFSP) is characterized by chromosomal rearrangements resulting in the production of platelet-derived growth factor B, eventually leading to autocrine growth stimulation of DFSP. Imatinib functions as an inhibitor of platelet-derived growth factor receptors, thus blocking this autocrine stimulation. Therefore, imatinib can be used as an adjuvant therapy for cases in which obtaining sufficient surgical margins is impossible. Neoadjuvant imatinib has also been used for locally advanced primary tumors.

Radiation therapy may improve local control and reduce the risk of recurrence postoperatively in patients with DFSP. There is no described role of it in pulmonary metastases. Resection of the multiple lesions in the lung, and hormonal or immune therapy are not recommended for metastatic DFSP.

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21. A 48-year-old man presents with pain 4 days after he underwent elective surgery of the right hand. The procedure included injection of 1% lidocaine with 1:100,000 epinephrine into the palm. Physical examination shows cold, pale digits, with prolonged capillary refill. Which of the following is the most appropriate management?

- A) Inpatient admission and hourly wound checks for signs of necrosis
- B) Local phentolamine infiltration
- C) Topical nitroglycerin with warm water immersion
- D) Topical terbutaline infiltration
- E) No further management is necessary

The correct response is Option B.

Case reports have been documented of ischemia and subsequent tissue necrosis following elective hand surgery using lidocaine with epinephrine. The vasoconstrictive effect of epinephrine is a result of its stimulation of alpha-adrenergic receptors. Phentolamine, an alpha-adrenergic antagonist, has been used effectively to reverse the vasoconstrictive effect of epinephrine. When used in the hand, phentolamine rescue is carried out by injecting 1 to 2 mg of phentolamine in 1 to 5 mL of saline into the area where epinephrine was used. The reversal of vasoconstriction should result within 1 hour. Digital ischemia following accidental EpiPen injection into the hand has also been reported. The use of topical terbutaline infiltration has been attempted in such cases. In one case series, terbutaline infiltration was found to be effective in reversing vasoconstriction in some, but not all cases. The conclusion reached in the study was that terbutaline should be considered as an alternative when phentolamine is not available. The use of topical nitroglycerin and warm water immersion has not been proven to be an effective method to reverse the alpha-adrenergic effect of epinephrine. If prolonged ischemia is a concern following the use of lidocaine with epinephrine, further management, such as phentolamine rescue, should be considered given that complications such as distal digital amputation have occurred.

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22. A 2-month-old female infant is brought in by her parents for evaluation of a 4-cm, enlarging infantile hemangioma on her left cheek that does not obstruct her vision. Which of the following is the most appropriate management?
- A) Intralesional corticosteroid injection
 - B) Laser ablation
 - C) Oral propranolol therapy
 - D) Surgical excision
 - E) Observation

The correct response is Option C.

Systemic propranolol therapy has quickly become a safe and effective treatment for hemangioma and is well tolerated with few side effects. It is considered the first line medical treatment of infantile hemangiomas at many medical centers. Surgical treatment is generally reserved for lesions that are refractory to medical management which present a functional impairment such as affecting or obstructing vision. Laser ablation and intralesional corticosteroid injection are less effective in several meta-analyses and some randomized controlled trials. Observation is reasonable for small, stable lesions in cosmetically non-sensitive areas.

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23. A 51-year-old male carpenter requires a partial glossectomy for recurrent oral squamous cell carcinoma. He runs for five miles three days a week. He underwent radiation therapy two years previously. Microsurgical transfer of which of the following free flaps is most appropriate for reconstruction?
- A) Deltopectoral flap
 - B) Rectus abdominis flap
 - C) Sural artery perforator flap
 - D) Vastus lateralis flap

The correct response is Option C.

Partial glossectomy defects require a small, thin, pliable flap for optimal reconstruction. The workhorse for glossectomy reconstruction has long been the radial forearm flap (RFF), which often requires a skin graft for donor site closure. However, various reports of donor site morbidity related to the RFF, including delayed healing, decreased grip and pinch strength, and radial nerve sensory problems, make this flap less suitable for a patient whose vocation involves manual labor. The sural artery perforator flap has become increasingly popular as an alternative donor site for very thin, pliable tissue. This flap, which usually arises from perforators from the medial sural artery, results in minimal donor morbidity. Muscle flaps are less desirable for intraoral reconstruction due to the need for an epithelialized surface and the difficulty in achieving skin graft adherence. The rectus abdominis flap is too bulky for partial glossectomy reconstruction. The deltopectoral flap, which arises from the 1st intercostal perforator, is rarely transferred as a free flap. Sacrifice of the vastus lateralis muscle in an avid runner is not recommended.

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24. An otherwise healthy 20-year-old woman develops a keloid on her right earlobe after an ear piercing. Excision and radiation therapy are planned. Which of the following is the ideal time after excision for the initiation of radiation therapy?

- A) 1 day
- B) 7 days
- C) 2 weeks
- D) 4 weeks
- E) 6 weeks

The correct response is Option A.

The ideal time to give radiation therapy in this case is on postoperative day one. Earlobes and the helix of the auricle are common sites for keloid formation, usually after trauma or ear piercing, with an incidence of approximately 2.5%. There are numerous adjuvant therapies (eg, radiation therapy), medical therapies, (eg, intralesional steroids, 5-fluorouracil interferon, and topical silicone), and physical approaches (eg, pressure) that can be used in addition to excision of the keloid to help reduce its recurrence. However, the treatment options for such lesions are still controversial, because there are numerous challenges, and no single best treatment or best combination of treatments has been proved to manage these conditions effectively.

Radiation therapy has long been known to be effective in the early phase of wound healing. More specifically, radiation therapy is sensitive to endothelial vascular buds and decreases proliferation of new fibroblasts. As such, radiation therapy after keloid excision should be performed as soon as possible. Usually, better results are reported when radiation therapy is performed within 1 to 3 days after surgery. The most commonly administered doses are between 10 and 15 Gy over a period of 2 or 3 days.

The other options are incorrect as they are outside the ideal time frame.

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25. A 55-year-old man with an ulcer of the left ischium (stage 4) undergoes debridement, osteotomy, and transfer of a gluteal myocutaneous flap for closure of the wound. Which of the following risk factors is associated with the highest rate of recurrence?
- A) Incontinence
 - B) Obesity
 - C) Paraplegia
 - D) Patient age
 - E) Vitamin deficiency

The correct response is Option C.

In a study out of Johns Hopkins, pressure ulcer patients who underwent reconstruction had a recurrence rate of 82% if they were paraplegic compared with 0% in non-paraplegic patients. Other risk factors for recurrence after repair include factors that predispose patients to prolonged pressure ischemia and/or reduced capacity for tissue repair. These include age greater than 70 years, immobility, poor nutrition, low BMI, anemia, diabetes, end-stage renal disease, cerebrovascular disease, hip fracture within 3 months, and prior pressure ulcer surgery. Although malnutrition is associated with pressure ulcers, micronutrient deficiencies such as vitamin C or zinc are not associated with formation or recurrence. A subsequent Cochrane Database Study showed that nutritional and vitamin supplementation is not associated with improved healing. There is no evidence to show that incontinence is associated with pressure ulcer formation or recurrence.

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26. A 65-year-old man comes to the office with a 2-cm basal cell carcinoma involving the left nasal ala extending across the nasofacial junction onto the cheek. A photograph is shown. Medical history includes previous melanoma. Which of the following is an indication for Mohs micrographic surgery over conventional excision in this patient?

- A) Cancer size
- B) Diagnosis of basal cell carcinoma
- C) History of previous melanoma
- D) Location of the lesion
- E) Patient age

The correct response is Option D.



Mohs micrographic surgical technique has demonstrated cure rates of 99% for primary basal cell carcinomas and up to 95% for recurrent basal cell carcinomas. In this particular patient, the strongest indication for use of the Mohs technique is the anatomical location. The nose is considered a high-risk location in the classically described “H-zone.” This patient underwent Mohs excision with multi-stage forehead flap reconstruction, as shown in the photographs. Patient age, history of previous melanoma, and tumor size 2 cm or less are not standard indications for Mohs excision. Other indications for Mohs technique include the following: Recurrent basal cell/squamous cell carcinomas, Locations prone to recurrence- “H-zone” of the face: periorbital, periauricular, temple, upper lip, nose/nasolabial fold, and chin, Tumors involving critical structures such as the eyelid or lip, Functionally important areas such as the genitals, perianal location, hands, and feet, Tumors arising in sites of previous irradiation therapy, Large tumors (> 2 cm) Lesions with ill-defined tumor margins, Histologic aggressive subtype (morpheiform, basosquamous, perineural, and invasive/poorly differentiated squamous cell carcinoma) Tumors arising in immunosuppressed patients such as transplant recipients or patients with genetic predisposition (basal cell nevus syndrome, xeroderma pigmentosum)

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27. A 50-year-old woman comes to the office 6 weeks after undergoing right mastectomy and immediate placement of a tissue expander. She reports swelling and redness of the right breast. A photograph is shown. Which of the following factors is most predictive of implant salvage failure in this patient?
- A) Culture positive for *Pseudomonas* species
 - B) Elevated body mass index
 - C) Periprosthetic seroma
 - D) Presence of cellulitis
 - E) Previous irradiation

The correct response is Option A.

Immediate implant-based reconstruction has become increasingly popular over the past two decades, accounting for over 70% of all reconstructions in the United States. The benefits of immediate reconstruction are numerous, including decreased recovery/number of required procedures and increased patient psychological well-being

and aesthetic outcome. However, the complication (seroma, mastectomy flap necrosis, loss of implant, and infection) rates after implant-based reconstruction remain relatively high. Infection rates in the reported literature range from 2.5 to 24%.

Historically, periprosthetic infection or implant exposure mandated immediate implant removal. However, numerous studies over the past several decades have demonstrated implant salvage rates of 37.3 to 73% depending on the methods employed. Several studies have looked at the predictive factors that increase the risk of a failed salvage attempt. Salvage was typically defined as administration of systemic antibiotics (oral or intravenous), removal of the infected implant, partial/total capsulectomy, pocket curettage, implant pocket irrigation with antibiotic solution, and placement of a new device.

Factors associated with implant salvage failure include an elevated white blood cell count, elevated temperature, deep-seated pocket infection (purulent periprosthetic fluid), and atypical pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas* species. Spear et al. showed that 93.9% of mild implant infections (localized cellulitis) could be salvaged compared with a 30% salvage rate in the severe infection group. Factors such as smoking, chemotherapy, previous irradiation, mastectomy skin necrosis, increased BMI, and use of acellular dermal matrix (ADM) have demonstrated increased rates of implant-related infections, but these factors have not been demonstrated to increase the risk of implant salvage failure.

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28. A 9-year-old boy is undergoing cranioplasty to repair a 5 x 5-cm congenital skull defect. Which of the following is the most appropriate material to reconstruct the cranium?
- A) Costal cartilage graft
 - B) Cranial bone graft
 - C) Fibula bone graft
 - D) Iliac bone graft
 - E) Rib bone graft

The correct response is Option B.

The most appropriate material to reconstruct the cranial defect is bone graft. Autologous bone grafts are preferred for cranioplasty in the pediatric population because the material osseointegrates and grows with the child. Alloplastic implants can become dislodged as the cranium is growing and may restrict brain growth. The preferred autologous donor site for cranioplasty is the cranium because it is in the same operative field, it is associated with the lowest morbidity, and the graft is least likely to resorb. Cranial bone is difficult to split in younger children because a diploic space does not begin to form until approximately 5 years of age. Cranial particulate bone graft can be harvested with a bit and brace at any age because a diploic space is not required. The partial-thickness donor sites reossify and can be used again to harvest additional graft in the future. Iliac and rib donor sites are associated with significant donor site morbidity, graft resorption, and would be less ideal for reconstruction a 5 x 5 cm defect in a 9-year-old. Costal cartilage and fibula are not used as cranioplasty materials.

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29. A 67-year-old woman presents with a 7-mm, irregular, asymmetrical, heterogeneous brown macule that has been enlarging for the past 2 months. An excisional biopsy with 2-mm margins shows melanoma. After tumor thickness, which of the following pathologic features is most indicative of her prognosis?

- A) Clark level
- B) Macule diameter
- C) Mitotic rate
- D) Morpheaform features
- E) Ulceration

The correct response is Option C.

This lesion has all of the clinical features suggestive of melanoma: asymmetry, irregular border, heterogenous color, diameter greater than 6 mm, and evolution. After thickness, mitotic rate is the most important prognostic indicator for melanoma, and has become an important component of T staging. Lesions with >1 mitosis/mm² are associated with significantly reduced survival. Ulceration is also a significant, though less predictive, prognostic indicator. Clark level and lesion diameter are not independent predictors of outcome for melanoma. Morpheaform features are associated with poorer outcomes in basal cell carcinoma.

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30. A 65-year-old man presents with an infection of the sternum following aortic valve repair. After sternal debridement, there is a 10-cm-wide, deep wound from the clavicle to the upper abdomen. Which of the following is the most appropriate flap to reconstruct the wound?
- A) Latissimus dorsi
 - B) Omentum
 - C) Pectoralis major
 - D) Pectoralis minor
 - E) Serratus

The correct response is Option B.

The most appropriate flap to reconstruct the wound is omentum. Because of the large extent of the wound, the only flap listed that can adequately fill the defect and eliminate the dead space is the omentum. Pectoralis major flaps would not adequately fill the defect, particularly the inferior aspect of the wound. Pectoralis minor flaps are not used for sternal reconstruction and would not provide adequate tissue. The latissimus dorsi flap would not be able to fill the large sternal wound. Serratus flaps can be used for posterior chest wounds, but would not be able to reconstruct the large anterior chest wound.

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31. A 68-year-old woman comes to the office for a delayed breast reconstruction. She had right breast cancer and a mastectomy followed by chemotherapy and radiation therapy 1 year ago. BMI is 35 kg/m². Medical history includes well-controlled type 2 diabetes mellitus, a previous cesarean section through a low transverse incision, and an open cholecystectomy through a subcostal incision. The patient requests autologous reconstruction, but the surgeon is not comfortable performing a free flap. Which of the following is the most appropriate method for reconstruction?
- A) Bipedicled transverse rectus abdominis musculocutaneous (TRAM) flap
 - B) Contralateral pedicled TRAM flap
 - C) Ipsilateral pedicled TRAM flap
 - D) Surgical delay procedure followed by contralateral pedicled TRAM flap
 - E) Surgical delay procedure followed by ipsilateral pedicled TRAM flap

The correct response is Option D.

In this obese patient with right breast cancer and a previous subcostal incision, a delay procedure with a contralateral transverse rectus abdominis musculocutaneous (TRAM) flap is the most appropriate method for reconstruction. Although a contralateral TRAM flap can be performed without a delay procedure, it has been shown that the addition of a delay procedure decreases risks of ischemia to the flap. In addition, a delay procedure may also reduce risks of abdominal wall complications. In this patient, the subcostal incision excludes right-sided pedicled flap reconstruction, so an ipsilateral pedicled TRAM would not be the right choice, nor would a bipedicled TRAM flap.

Although there is controversy on which patients should have a delay procedure, the use of this technique has usually been limited to high-risk patients and to those requiring large amounts of tissue. Multiple reports have shown that obese patients undergoing a delay can decrease the risks of tissue related ischemia. In a paper by Wang et al., the delay procedure was performed at least 14 days prior to the reconstruction; however, other studies have shown improvements at 7 days. The procedure described consists of ligation of both deep inferior epigastric arteries and veins bilaterally accessed from an inferior flap incision. This can also be done laparoscopically. Some authors advocate more extensive incisions and elevating portions of the flap; however, there is little data to show that this is effective or necessary.

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32. Which of the following strategies is most effective in improving long-term viability of fat grafts?
- A) Harvest fat from an abdominal donor site
 - B) Harvest fat with a syringe rather than a suction pump
 - C) Inject fat with a low-shear device
 - D) Process fat with telfa gauze rolling technique
 - E) Use tumescent solution without lidocaine

The correct response is Option C.

One of the biggest shortcomings of fat grafting is unpredictable graft survival. Fat grafting can be divided into three major steps: harvest, processing, and injection. Each step has the potential to influence the viability of transplanted fat. Fat donor site does not make a difference in fat graft viability. Lidocaine has been shown to inhibit the growth and metabolism of adipocytes. However, these effects disappear once the lidocaine is removed from the harvested fat and therefore does not affect long-term graft viability. Harvest technique, either with handheld syringe or a suction device, has not been shown to influence graft viability. Although some surgeons avoid centrifugation in an attempt to decrease trauma to fat cells, there is no objective evidence that centrifugation decreases fat cell viability. Trauma to fat cells, during processing or injection, affects fat graft survival. Injection of fat with low-shear devices has been shown to improve fat viability. Similarly, injection with larger cannulas has been shown in a few studies to increase fat survival. Strategies that hold promise in the future to increase fat cell viability include platelet-rich plasma, stem cell enrichment, and scaffolds.

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33. A 68-year-old man is referred for plastic surgery consultation for a chronic, large venous ulcer of the left calf that has been present for more than 4 months. He has been treating it with bacitracin ointment and gauze. Bacterial cultures demonstrate *Staphylococcus* species and normal skin flora. In addition to starting compression therapy, which of the following antimicrobial treatments has been shown to improve venous ulcer healing time?
- A) Intravenous vancomycin
 - B) Oral doxycycline
 - C) Silver alginate dressings
 - D) 0.25% sodium hypochlorite (Dakin's) solution
 - E) Topical neomycin powder

The correct response is Option B.

In general, compression therapy and effective wound care are the mainstays of treatment for venous ulcers. Preventative or prolonged conventional antibiotics have not been shown to help healing in the absence of active infection. Chronic open wounds are often colonized with multiple bacterial species, and patients with venous stasis of the lower extremities often have skin discoloration changes that are visibly similar to the appearance of cellulitis. Antibiotics are often overprescribed in venous stasis ulcer patients and should not be used for skin flora colonization only.

If there is a question of infection because of increased swelling, redness, or wound deterioration, then antibiotic treatment is reasonable. In this case, *S. aureus* grew in the culture in addition to normal skin flora. Among the many antibiotics that are effective against common skin pathogens, including methicillin-susceptible and -resistant *S. aureus*, doxycycline has been shown to improve ulcer healing times at 100 mg twice daily for a minimum of 4 weeks. Doxycycline is a bacteriostatic tetracycline that inhibits protein synthesis in a broad array of bacteria and mycoplasma. It also appears to have been effective against some T-cell inflammatory processes and appears to reduce mixed metalloproteinases and other enzymes that delay healing.

Intravenous vancomycin would be effective therapy for a severe gram-positive bacterial infection, but would not be the first-line treatment in this patient without severe clinical signs of infection such as fever, increased WBC, hypotension increasing tissue necrosis, or ascending erythema. None of the other antimicrobial treatments presented have been shown

to help ulcer healing beyond standard wound care with compression. Topical neomycin powder and silver impregnated dressings have demonstrated antimicrobial properties but have not been shown to speed ulcer healing versus standard dressings. Dakin's solution, or 0.25% sodium hypochlorite, is a useful temporary dressing agent to help debride and disinfect contaminated wounds, but it may inhibit wound healing in clean wounds.

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34. An 18-year-old woman comes to the office because of a large osteosarcoma of the distal shaft of the right femur. A 15-cm bone resection is planned, with a resulting large intercalary segmental defect. The overlying skin and soft-tissue is not involved. The patient is very motivated to proceed with limb preservation. Which of the following is the most appropriate option for reconstruction of this defect?

- A) Bone allograft
- B) Contralateral vascularized fibula free flap
- C) Contralateral vascularized fibula free flap with bone allograft
- D) Ilizarov bone transportation
- E) Ipsilateral pedicled vascularized fibula flap

The correct response is Option C.

In a young patient who desires limb preservation after sarcoma resection, a contralateral vascularized fibula free flap with bone allograft (Capanna technique) is the most appropriate option for a large intercalary segmental defect. This involves placing the fibula flap within an allograft construct and bridging both osteotomy sites. There are advantages to using the allograft with the fibula flap, as a fibula flap alone may have difficulty with weight-bearing and potential fracture. In select cases a double barrel configuration can be used; however, in this patient the defect is too large. An ipsilateral pedicled flap would have difficulty reaching this large defect and would still have issues with fractures from weight-bearing. Ilizarov bone transportation can be performed for smaller defects (4 to 6 cm), but not in a defect this large. Finally, bone allograft alone is an option; however, this has a high rate of nonunion (34% versus 8 to 10%).

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35. A 76-year-old man comes to the office for follow-up after undergoing Mohs resection of a basal cell carcinoma (BCC) of the left central cheek. He smokes a half pack of cigarettes daily and has no intention of quitting. Final margins have been confirmed to be free of residual tumor. The defect is full-thickness skin and measures 2 × 2 cm. Which of the following is the most appropriate treatment option for this patient?

- A) Cervicofacial flap
- B) Direct primary closure
- C) Full-thickness skin grafting
- D) Healing by secondary intention
- E) Rhomboid transposition flap

The correct response is Option B.

Direct primary closure is the best option for this patient. The cheek skin has ample laxity and allows for closure of small- to medium-sized cheek defects. In general, closure should be aligned with the relaxed skin tension lines, and aggressive management of dog ears should be performed. Direct linear closure also allows for simple monitoring for recurrence without any distortion of the anatomy. Secondary intention is better utilized in areas of concavity, like the medial canthus. Full-thickness skin grafting, rhomboid flaps and cervicofacial flaps will have a higher complication rate in an active smoker, while likely providing a lesser aesthetic outcome given the poor orientation of scars.

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36. A 69-year-old woman with breast cancer undergoes bilateral breast reconstruction using free deep inferior epigastric perforator (DIEP) flaps. During surgery, she has onset of hypotension that is unresponsive to standard crystalloid and colloid solutions. The anesthesia team elects to administer norepinephrine to correct her blood pressure. Which of the following flap-related outcomes is most likely?
- A) Flap loss
 - B) Hematoma
 - C) Reoperation
 - D) Wound dehiscence
 - E) No effect

The correct response is Option E.

There are no known increased flap complications with use of vasopressive medications. In fact, one study has shown decreased intraoperative flap complications compared with controls with the use of ephedrine. Traditional dogma is that vasopressors should be avoided during free tissue transfer due to concern that vasoconstriction or thrombosis could occur, resulting in compromised flap perfusion and subsequent flap loss. Most authors argue for standard intravenous fluid replacement or adjustment of anesthetic medications when feasible to first address the hypotension. However, numerous articles have suggested the safety of vasopressive medications in the setting of free tissue transfer. In fact, there are studies correlating excess intravenous fluid administration with increasing complication rates in free transverse rectus abdominis musculocutaneous (TRAM) flaps. As such, vasopressive medications should be considered when standard anti-hypotensive remedies have failed.

The original concern about vasoconstriction of the flap vessels with systemic vasopressor administration and resultant decreased perfusion or thrombosis has largely been disproven. This occurs likely because of sympathetic denervation due to flap transfer, sympathectomy with adventitial removal, and topical use of vasodilators, such as papaverine or nicardipine. Additionally, any vasoconstrictive effect on the flap vessels is more than overcome by increased flap perfusion caused by an elevated blood pressure.

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37. A 78-year-old woman undergoes shave biopsy of a scaly, red, 1-cm plaque-like lesion of the right cheek. Pathologic examination demonstrates actinic keratosis. The patient declines further treatment. Which of the following long-term pathologic outcomes is most likely in this patient?

- A) Basal cell carcinoma
- B) Keratoacanthoma
- C) Melanoma
- D) No malignancy
- E) Squamous cell carcinoma

The correct response is Option D.

Actinic keratosis does have the potential to transform into squamous cell carcinoma, although the estimated rate of malignant growth is no higher than 10%. Actinic keratosis presents as rough, pink plaques, typically in sun-exposed areas. Histologic examination shows atypia of the basal keratinocytes. Most lesions demonstrate p53 tumor suppressor gene mutations. Because of the known malignant transformation potential, local treatment is suggested. Patients with lesions in high-risk areas or who have medical conditions that predispose to cutaneous malignancies should be treated thoroughly and screened closely. These patients include those with lesions on the hands, face, or lips, or those with immunosuppression such as transplant patients or those on chemotherapeutic agents.

Treatment includes various forms of topical destruction: cryotherapy, photodynamic therapy with aminolevulinic acid as a photosensitizer, and topical immunostimulatory creams, such as imiquimod and 5-fluorouracil. Even though most lesions do not progress to carcinoma, the possibility of transformation warrants treatment in most cases.

There is no known association between actinic keratoses and melanoma or basal cell skin cancers. Keratoacanthomas are rapidly-growing precursors or variants of squamous cell carcinoma.

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38. A 52-year-old man sustains an amputation of the index finger of his dominant right hand from a table saw. Physical examination shows a sharp amputation immediately distal to the flexor digitorum superficialis insertion. He does not smoke cigarettes. Which of the following factors is the most appropriate indication to perform a replantation?
- A) Dominant hand
 - B) Index finger amputation
 - C) Level of amputation
 - D) Nonsmoking status
 - E) Patient age

The correct response is Option C.

The most appropriate indication to perform a replantation is the level of the amputation. Replantation of an amputation distal to the flexor digitorum superficialis is attempted because the function of the digit is improved with additional length to a normal proximal interphalangeal joint. An amputation in a child is an indication for replantation (adult age is not). Hand dominance is not a major variable in the determination of whether or not to perform a replantation. Replantation of single digits (including the index finger) at the proximal phalanx or proximal interphalangeal joint in adults often is not performed because the limited motion of the digit can inhibit overall hand function. An exception is any level amputation of the thumb, which is a major indication for replantation because the thumb provides 40 to 50% of hand function. Smoking status is not a major variable for the consideration of replantation.

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39. A 68-year-old man is diagnosed with squamous cell carcinoma of the floor of the mouth with invasion into the tongue and mandible. A radical resection with immediate reconstruction using a vascularized free fibula bone flap is planned. A vascularized bone flap is an ideal choice in this setting due to its ability to promote bony healing through which of the following pathways?
- A) Endochondral ossification
 - B) Osteoblastic rimming
 - C) Osteoconduction
 - D) Osteogenesis
 - E) Osteoinduction

The correct response is Option D.

Free vascularized fibula grafts are the mainstay for mandibular reconstruction in a variety of settings, from traumatic to oncologic. Like most vascularized bone grafts, they primarily heal by osteogenesis, which involves the formation of new bone by osteoblasts from both the flap and recipient site.

In contrast, non-vascularized cortical bone grafts primarily heal by osteoconduction, or creeping substitution. In this process, the bone graft acts as a template for the ingrowth of cells and blood vessels from the recipient bed and ultimately resorbs.

Cancellous bone grafts and demineralized bone matrix heal primarily by osteoinduction. In this process, bone morphogenetic protein directly stimulates mesenchymal cells at the recipient site to differentiate into osteoprogenitor cells.

Bone fractures heal, in part, by endochondral ossification. When a bone is broken, inflammation triggers chondrocytes to form a soft callus consisting of collagen and proteoglycans at the fracture site. Through endochondral ossification, disorganized woven bone replaces the soft callus to form a hard callus which is remodeled over time into highly organized cortical bone.

Osteoblastic rimming is a histologic finding indicating the presence of bony trabeculae rimmed with osteoblasts. It is seen in a variety of bone disorders.

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40. A 55-year-old woman presents for management of upper extremity lymphedema that developed after modified radical mastectomy and external beam radiation therapy for breast cancer. Which of the following findings would make the patient a poor candidate for a vascularized lymph node transfer?
- A) Dermal back flow on lymphoscintigraphy
 - B) Extensive lipomatous changes in the extremity on MRI
 - C) Frequent bouts of cellulitis
 - D) Severe pitting edema
 - E) Short duration of symptoms

The correct response is Option B.

Upper extremity lymphedema has an incidence of 29 to 49% after an axillary lymph node dissection and 5 to 7% after sentinel lymph node biopsy. Surgical treatment options are divided into excisional procedures (excision, liposuction) and physiologic procedures (lymphovenous anastomosis, vascularized lymph node transfer). Although their exact mechanism is unknown, vascularized lymph node transfers are increasing in popularity for surgical management of lymphedema. Commonly used donors for vascularized lymph node transfer are the groin flap, supraclavicular flap, lateral thoracic flap, sub-mental flap and omental flap.

Lymphedema after cancer treatment occurs when the lymphatic drainage system becomes overwhelmed due to impairment in collection pathways from surgical removal of lymph nodes. Lymphatic fluid stasis leads to a proinflammatory state, which over time results in subcutaneous fat deposition. Vascularized lymph node transfers are thus most effective early in the disease process when changes of “lipedema” have not yet occurred. Once there is extensive fatty tissue in the limb, excisional procedures like liposuction or direct excision may be more effective. The finding of pitting edema on physical examination indicates presence of lymphatic fluid in the tissues, thus indicating that physiological procedures may be effective.

Lymphoscintigraphy is the most commonly used imaging modality for evaluating the status of the lymphatic system and is considered by many as the gold standard imaging modality. A radiotracer (technetium-99m) is injected into the subdermal tissue and its movement through lymphatic tissue is imaged sequentially. Impaired lymphatic function is indicated by dermal backflow and blockage of flow of the tracer. Frequency of upper extremity

cellulitis has been shown to decrease after vascularized lymph node transfers, and is not a contraindication for surgery. It can, in fact, be considered an indication for lymph node transfer.

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41. A 58-year-old woman develops full-thickness dermal necrosis in a 4 × 4 × 2-cm area of her lower breast following reduction mammoplasty. After debridement to healthy tissue, she starts daily wound packing with a calcium alginate fiber dressing. The main advantage of calcium alginate versus saline gauze dressings is a decrease in which of the following?
- A) Dressing change frequency
 - B) Healing time
 - C) Keloid scarring
 - D) Treatment cost
 - E) Wound infection rate

The correct response is Option A.

An effective dressing should aid in surface debridement, absorb wound exudate, and maintain a moist healing environment. Normal saline wet-to-dry gauze dressings have been a mainstay of wound management for generations because they are easy to perform, widely available, and inexpensive. They are best changed 2 to 3 times daily to remove exudative material because they can quickly become saturated. Some of the wound healing byproducts, such as metalloproteinases and elastase, can slow down wound healing and result in chronic wounds. By wicking away these potentially harmful agents, more absorptive wound dressings can help simplify care. Alternatives to conventional saline wet-to-dry gauze dressing materials include hydrogels, hydrocolloids, foams, alginates, and negative pressure dressings. They are more expensive than traditional saline-gauze dressings but are typically far more absorptive, allowing for less frequent dressing changes. Daily dressing changes versus two to three times a day are far more convenient for patients and may ultimately save total treatment costs by allowing for fewer nursing visits or allowing for outpatient care. Many studies show no difference in healing times, though some studies suggest a mild benefit in diabetic foot ulcers. Current recommendations call for additional studies, as evidence of faster healing times is lacking. No studies show lower infection or scarring.

Calcium alginates are fibers made of brown seaweed fibers, and they can hold more than ten times their weight in fluid. Some manufacturers claim that they are able to deactivate metalloproteinases and stimulate healing, although in vitro data are lacking. They are a comfortable and effective alternative to saline wet-to-dry dressings, albeit at a higher product cost.

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42. After an uneventful breast reconstruction with an abdominal flap, a healthy 45-year-old woman is started on ketorolac as part of her multi-modality pain control regimen. Inhibition of which of the following is the primary mechanism of action for the increased bleeding time associated with this drug?
- A) Lipoxygenase
 - B) Nitric oxide
 - C) Prostacyclin
 - D) Prostaglandins
 - E) Thromboxane A₂

The correct response is Option E.

The primary mechanism of action for the increased bleeding time associated with the use of ketorolac is the inhibition of thromboxane A₂. Ketorolac is a non-steroidal anti-inflammatory drug (NSAID). Most NSAIDs inhibit the activity of cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2), and thereby the synthesis of thromboxane A₂. This produces a systemic bleeding tendency by impairing thromboxane-dependent platelet aggregation and consequently prolonging the bleeding time. It is thought that inhibition of COX-2 leads to the anti-inflammatory, analgesic, and antipyretic effects through the inhibition of formation of prostaglandins and prostacyclin. Inhibition of lipoxygenase and nitric oxide are not the primary mechanisms associated with NSAID-related platelet inhibition.

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43. A 30-year-old man presents with a large open wound to the right thigh. The proposed treatment plan after debridement and establishing a clean wound is to use negative pressure wound therapy (NPWT). Which of the following is the main direct mechanism for wound healing by this method?

- A) Improvement in tissue auto-debridement
- B) Increase in collagen synthesis
- C) Reduction in wound bacterial load
- D) Removal of interstitial fluid leading to increased blood flow

The correct response is Option D.

Based on the original studies by Moryk, it was hypothesized that the beneficial wound-healing effects of negative pressure wound therapy (NPWT) was a combination of a fluid-based mechanism and a mechanical stress mechanism. The fluid-based mechanism involves the removal of excess interstitial fluid from the wound bed by the vacuum, which results in the interstitial pressure decreasing below the capillary filling pressures, thus allowing “re-opening” of these wound bed capillaries. This leads to improved blood flow within the wound, allowing for granulation tissue formation. The mechanical strain mechanism is created by micro-strain forces created by the vacuum on the cells within the wound. Cellular deformation leads to numerous molecular changes, including activation of the vascular endothelial cell growth factor (VEGF) pathway, which enhance angiogenesis.

Collagen synthesis is not directly affected by NPWT. There is equivocal evidence for whether there is a positive or negative effect of NPWT on wound bacterial loads.

NPWT does not auto-debride wounds. It is important when using NPWT to ensure adequate mechanical debridement of nonviable tissues from the wound bed prior to initiating NPWT.

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44. An otherwise healthy, right-hand–dominant 8-year-old boy is brought to the office for evaluation of a 1-cm wart on the dorsum of the right index finger. The lesion has been present for 3 months and has not been previously treated. His parents request surgical removal. Which of the following is the most effective management of this condition?

- A) Application of duct tape
- B) Cryotherapy
- C) Dinitrochlorobenzene therapy
- D) Salicylic acid therapy
- E) Surgical excision

The correct response is Option D.

In a meta-analysis of various trials, salicylic acid therapy demonstrates better efficacy compared with cryotherapy and dinitrochlorobenzene therapy. Anecdotal descriptions of duct tape therapy are not substantiated in rigorous studies. Surgical excision is not generally indicated as most cases can be managed noninvasively.

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45. A 52-year-old woman with cancer of the right breast undergoes mastectomy and axillary node dissection, complicated by mastectomy flap necrosis requiring skin grafting. She completes adjuvant chemoradiation. One year later, she comes to the office with a fungating mass growing through the skin graft. Imaging demonstrates involvement of the fourth and fifth ribs with an anticipated skeletal defect of 4 × 4 cm. A photograph is shown. Which of the following is the most appropriate treatment for the skeletal reconstruction?

- A) High-density porous polyethylene
- B) Methyl methacrylate with mesh
- C) 2.4-mm Titanium plate
- D) No skeletal reconstruction
- E) Vascularized rib

The correct response is Option D.

The principles of management of this recurrent right breast cancer include radical resection of all involved tissues (including ribs) and reconstruction with well vascularized flaps. In this case, a right latissimus muscle flap and skin graft was used for reconstruction. No alloplastic material was placed or skeletal thoracic cage reconstruction performed. This is common in these types of patients, because excessive fibrosis caused by the radiation to the chest wall prevents loss of respiratory efficiency through paradoxical motion which otherwise occurs in patients who have more than four ribs involved or a defect larger than 5 cm.

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46. A 40-year-old man presents to the emergency department because of the infection shown. Medical history includes type 2 diabetes mellitus, hypertension, kidney transplantation 5 years ago, and a 10 pack-year history of smoking (former smoker). Temperature is 39.7°C (103.5°F) and blood pressure is 80/45 mmHg, white blood cell count is 25,000/ μ L. He is transferred to the surgical intensive care unit for fluid resuscitation and intravenous antibiotics prior to operative debridement in six hours. Which of the following is the strongest risk factor for mortality in this patient?

- A) Age
- B) Delay in operative debridement
- C) History of kidney transplantation
- D) History of smoking
- E) Type 2 diabetes mellitus

The correct response is Option B.

Necrotizing fasciitis is a rapidly progressive soft-tissue infection. Patients usually present with systemic sepsis, fever, high leukocytosis (higher than 25,000), skin findings of edema with blue discoloration, weeping blisters and cellulitis. The more severe cases can present with multisystem organ failure and altered mental status. Polymicrobial infections are most common. Streptococcal species are isolated in more than 60% of polymicrobial infections. Other organisms identified include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas*, *Enterobacter*, *Klebsiella*, *Proteus*, *Bacteroides*, *Clostridium*, and *Peptostreptococcus*.

Multiple studies have reported a mortality rate of approximately 20% from necrotizing fasciitis. Mortality is directly proportional to time of intervention. Delayed surgical debridement has been shown to significantly increase the mortality risk. After diagnostic delay, the most common pitfall in treatment is inadequacy and delay in surgical debridement.

Type 2 diabetes mellitus is incorrect. Comorbid conditions such as diabetes, vascular disease and venous insufficiency are very common in these patients. Diabetes specifically is associated with higher morbidity and mortality. Studies have shown that patients with diabetes have a higher chance of a negative outcome compared to patients without diabetes. However, it has not been shown to be the most severe risk factor associated with mortality.

Smoking is incorrect. Smoking is a risk factor for delayed healing, but there are no studies that show smoking alone to be a risk factor in the progression of necrotizing fasciitis.

After delay of operative debridement, immunosuppression is the second most significant risk factor for mortality. Patients with solid organ transplantation or undergoing treatment for hematologic malignancies are most at risk. Age has been reported as another risk factor of mortality in patients with necrotizing fasciitis. Studies have shown that extremes of age, younger than 1 year or older than 60 years, were associated with mortality, but age is not the strongest risk factor among the others reported.

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47. A 23-year-old woman comes to the office for evaluation of bilateral ear keloids. She reports that the keloids developed after she had her ears pierced 5 years ago. She has not had previous surgery for this problem. Which of the following is the most likely recurrence rate after surgical excision with injection of a corticosteroid?

- A) 5%
- B) 15%
- C) 35%
- D) 50%
- E) 75%

The correct response is Option B.

Earlobe keloid formation after piercing is reported to affect approximately 2.5% of the population. Various adjuvant therapeutic modalities, including radiation therapy, intralesional corticosteroids, interferon, 5-fluorouracil, topical silicone, and pressure devices, are used to decrease recurrence rate after surgical excision. A recent meta-analysis looked at the recurrence rate of keloid formation after surgical excision with the use of radiation therapy and intralesional corticosteroids. Recurrence rate after excision with radiation therapy was found to be 14%. The recurrence rate after excision with intralesional corticosteroids was 15.4%. Although radiation therapy had an overall reduced recurrence rate, it was associated with higher cost and more significant potential complications. Five cases of carcinogenesis after radiation therapy have been reported. The main disadvantage of corticosteroid injections was found in most studies to be the pain of injection. Adjuvant corticosteroid injections in conjunction with surgery were performed preoperatively, intraoperatively, or postoperatively in various studies.

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48. E-cigarettes are similar to traditional cigarettes in that the negative effect of nicotine on wound healing is primarily due to which of the following?
- A) Endothelial cell injury
 - B) Increased inflammatory response
 - C) Increased prostacyclin production
 - D) Peripheral microvascular vasoconstriction
 - E) Platelet aggregation

The correct response is Option D.

Cigarette smoke contains thousands of different chemical substances including chemical toxins and carcinogens in addition to nicotine. While e-cigarettes are believed to have fewer health risks because tar and many other harmful chemicals have been removed, they do deliver vaporized nicotine. Nicotine-induced vasoconstriction in the periphery leads to relative skin ischemia and poor wound healing.

Platelet aggregation is incorrect. Nicotine does not have a direct effect on platelets. In some studies, platelet aggregation appears to be reduced with long-term administration of nicotine. Increased prostacyclin production is incorrect.

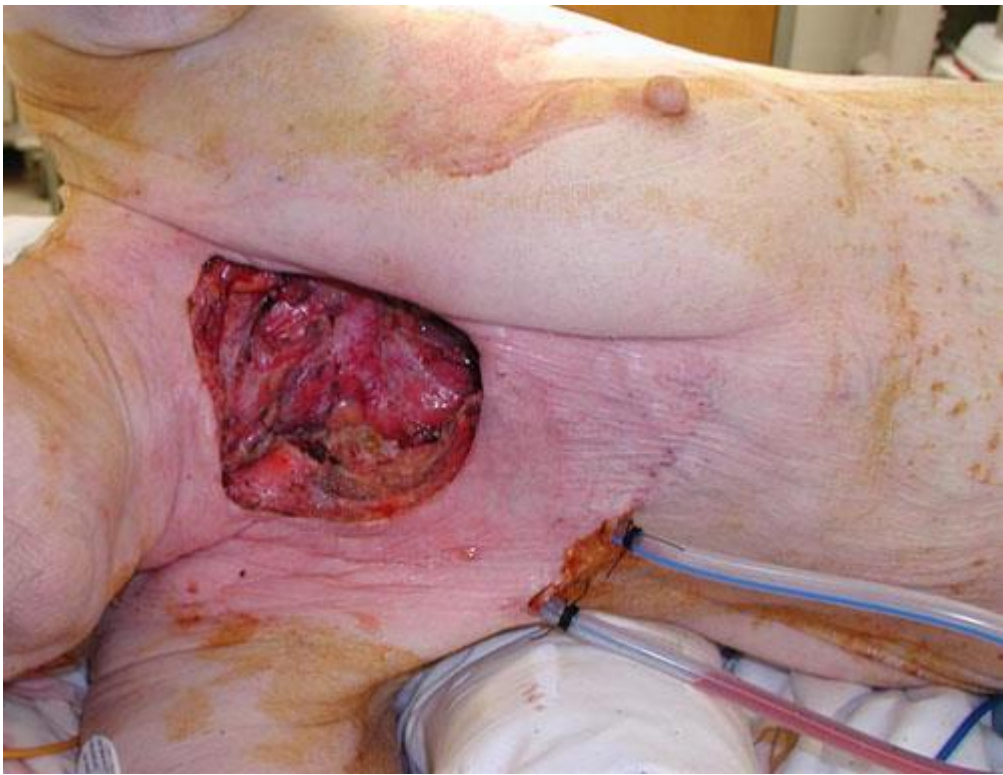
Prostacyclin is a local vasodilator with effects that minimize platelet aggregation.

Nicotine has been shown to inhibit synthesis of prostacyclin. Increased inflammatory response is incorrect. Nicotine causes a diminished inflammatory response by a weakened chemotaxis, reduced migration, impaired bacterial killing by inflammatory cells and a subnormal release of proteolytic enzymes and inhibitors. Endothelial cell injury is incorrect. While nicotine can alter the structural and functional characteristics of vascular smooth muscle and endothelial cells, it does not cause cell injury. Several studies show increased number of endothelial cells in venous blood after nicotine administration in cigarette smokers, but not in non-cigarette smokers, suggesting that other harmful chemicals found in tobacco may contribute to cell injury.

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49. A 75-year-old woman with a history of right mastectomy and irradiation therapy presents with a sarcoma that requires radical resection and partial sternectomy. A photograph is shown. A pedicled flap is planned to repair the defect. Which of the following arteries supplies the most appropriate flap in this situation?

- A) Deep inferior epigastric
- B) Internal mammary
- C) Lateral thoracic
- D) Thoracoacromial
- E) Thoracodorsal

The correct response is Option E.

The most appropriate pedicled flap for this particular defect is a latissimus flap, shown in the photograph, supplied by the thoracodorsal artery. The latissimus flap is a Mathes/Nahai type V flap that can be transferred on its dominant pedicle (thoracodorsal artery) or on

multiple segmental paraspinal perforators. The internal mammary artery terminates as the superior epigastric artery, which would provide blood supply for a superiorly based vertical rectus flap. The rectus flap is a Mathes/Nahai type III flap, with two dominant pedicles. However, this pedicle is not available because of the radical resection and prior irradiation. The lateral thoracic artery is one of two dominant pedicles supplying the serratus anterior muscle (Mathes/Nahai type III). This flap is an option, but it would not provide enough bulk necessary for the defect in this situation. The deep inferior epigastric artery (DIEA) supplies the DIEA perforator flap, which would be an option as a free tissue transfer but not as a pedicle flap for this situation.

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50. A healthy 20-year-old man sustained burns to the neck as a child. He now has a tight band on his neck that is interfering with range of motion. Z-plasty is planned. Compared with W-plasty, which of the following outcomes is unique to Z-plasty?
- A) Break up of a linear scar
 - B) Change in orientation of the scar
 - C) Excision of tissue
 - D) Lengthening of the scar
 - E) Local tissue rearrangement

The correct response is Option D.

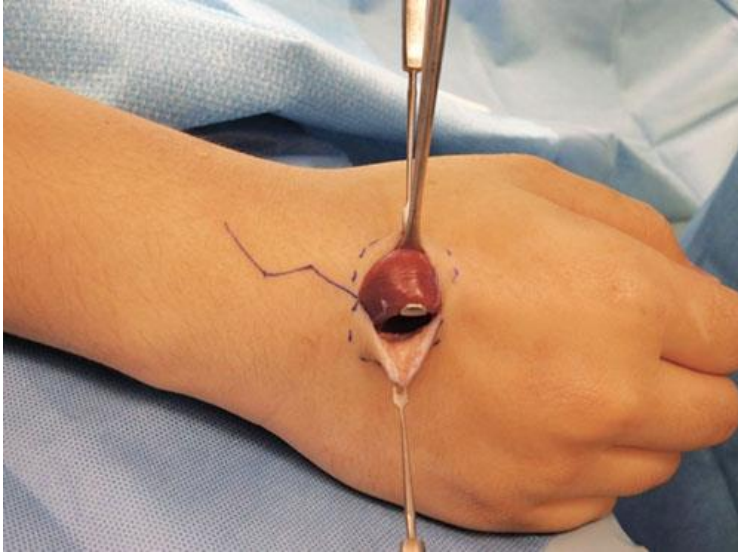
The outcome that is unique to a Z-plasty is lengthening of the scar. A Z-plasty improves the functional and cosmetic appearance of scars. It can elongate a contracted scar or rotate the scar tension line. Technically, it is the transposition of two triangular flaps. The incisions are designed to create a Z shape with the central limb aligned with the part of the scar that needs lengthening or re-aligning.

The traditional 60-degree angle Z-plasty will give a theoretical lengthening of the central limb of 75%. The amount of lengthening gained is proportional to the angles utilized in the formation of the Z-plasty. The underlying principle of the Z-plasty is that it recruits mobile adjacent skin to accomplish the lengthening. Single or multiple Z-plasties can be used. All other options are seen in both Z-plasties and W-plasties.

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Section 2: Hand and Lower Extremity



51. A 15-year-old boy is evaluated because of a 4-month history of a 2.5-cm, soft, well-circumscribed, tender dorsal mass of the right wrist. Examination shows the mass is well defined, does not transilluminate, and softens when the index and long finger are flexed. The image shown is obtained at the time of operative excision. Which of the following is the most likely diagnosis?
- A) Anomalous extensor indicis proprius insertion
 - B) Extensor digitorum brevis manus
 - C) Fibrosarcoma
 - D) Giant cell tumor of tendon sheath
 - E) Multilobulated ganglion cyst

The correct response is Option B.

The extensor digitorum brevis manus (EDBM) is a rare (2 to 3% incidence) anomalous muscle of the hand that may present similarly as a tender dorsal wrist mass distal to the radiocarpal joint about the distal edge of the extensor retinaculum. The clinical presentation can mimic a dorsal wrist ganglion cyst and many cases of EDBM were either initially misdiagnosed as or occurred concurrent with ganglion cyst. There are a number of clinical

features that may aid in differentiating the anomalous EDBM from a dorsal ganglion. The pathologic EDBM more often presents in adults as pain and swelling following physical activity or manual labor. If bilateral, the dominant hand is more commonly symptomatic. Physical examination may show hardening of the mass with resisted index and long finger extension and softening with resting digital flexion as the muscle relaxes. Treatment is guided by symptom severity and patient preference and alternatives include rest and immobilization, surgical release of the fourth compartment alone, or fourth compartment release with complete muscle excision. Ganglion cyst does not appear solid and would transilluminate.

Giant cell tumor of tendon sheath is a common tumor in the hand but rarely grows this large and is yellow, not red, in appearance.

Anomalous insertion of the EIP is a rare source of dorsal wrist pain, but the mass seen here is not consistent with that diagnosis.

Fibrosarcoma is a possibility but that tumor usually invades the skin, is irregular in form, and does not change in firmness with finger flexion and extension.

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52. A 24-year-old man presents with a Gustilo Type IIIB tibial fracture sustained during a motor vehicle collision. Reconstruction with an anterolateral thigh flap is planned. If technically feasible in this patient, how many venous anastomoses should be performed during reconstruction?
- A) One
 - B) Two
 - C) Three
 - D) Four
 - E) Five

The correct response is Option B.

There has been debate for many years about the optimal number of venous anastomoses. One school of thinking argues that fewer anastomoses allow for higher flow in each, while the other school argues that each additional anastomoses adds redundancy.

Recent studies have shown a variable but significant decrease in venous thrombosis and an even higher reduction in flap complications when dual anastomoses are performed. Studies have not reliably evaluated more than two anastomosis. There are situations when two anastomoses are not technically feasible.

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53. A 71-year-old woman elects to undergo surgery for basal thumb osteoarthritis. In addition to carpal tunnel syndrome and presence of pathology at the scaphotrapeziotrapezoid (STT) joint, assessment for which of the following additional concomitant conditions is most appropriate during the operative planning for this patient?
- A) Lunotriquetral dissociation
 - B) Radioscaphoid arthritis
 - C) Scapholunate dissociation
 - D) Thumb interphalangeal arthritis
 - E) Thumb metacarpophalangeal hyperextension

The correct response is Option E.

Operative planning for surgical treatment of basal thumb osteoarthritis requires not only careful history, physical examination, and radiographic examination of the basal thumb joint, but also the scaphotrapeziotrapezoid (STT) joint, the carpal tunnel, and the thumb metacarpophalangeal (MP) joint. Persistent arthritic symptoms following treatment of the basal thumb joint are often due to unrecognized STT arthritis, and many patients will have carpal tunnel syndrome concomitant with basal thumb arthritis; thus, it is important to evaluate for these pathologies to avoid persistent symptoms following surgery. The MP joint must be evaluated for collapse, or hyperextension, particularly with pinch prior to operative treatment. Failure to correct MP hyperextension, particularly that beyond 30 degrees, may lead to persistent pain and progressive collapse of the thumb.

The scapholunate, lunotriquetral, thumb interphalangeal, and radioscaphoid joints are not associated with basal thumb arthritis or its treatment.

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54. A 12-month-old male infant is brought to the office for evaluation of a small right thumb. Physical examination shows instability of the metacarpophalangeal joint and hypoplasia of the first web space. The carpometacarpal joint is stable. The patient has difficulty moving the thumb. Which of the following is the next best step in management?
- A) Free toe transfer
 - B) Metacarpal lengthening
 - C) Opponensplasty
 - D) Pollicization
 - E) Continued observation

The correct response is Option C.

This patient presents with a Blauth Grade 2 or 3A thumb hypoplasia. Surgical management is warranted and includes treatment of the absent or hypoplastic thenar musculature with opponensplasty; release of the first web space; and management of MCP instability.

Pollicization is reserved for Blauth Grade 3B or more severe deficiencies. The distinction between a Blauth 3A and 3b hypoplastic thumb is determined by the stability of the CMC joint.

Blauth classification of Thumb Hypoplasia:

Type	Description	Treatment
I	Minimal hypoplasia with full complement of neurovascular and musculoskeletal elements that are small in size.	No surgical treatment necessary
II	All bones present, but hypoplastic. Instability of ulnar collateral ligament of MCP joint. Thenar hypoplasia.	MCP joint stabilization with opponensplasty; deepening of first web space
IIIA	CMC joint unstable. Poor active motion at MCP and IP joints.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit

IIIB	Deficient CMC joint with absence of trapezium, aplastic proximal first metacarpal head. Absence of active motion at MCP or IP joint.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit
IV	<i>Pouce flottant</i> No muscular or skeletal attachments between thumb and hand; persistent neurovascular structures within hypoplastic thumb.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit
V	Absent thumb.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit

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55. A 45-year-old man who is a cyclist comes to the office because of tingling of the left ring and small fingers. Normal sensibility dorsally is noted. Guyon canal release is planned. Which of the following structures is a border of the Guyon canal?
- A) Capitate
 - B) Dorsal distal radio-ulnar ligament
 - C) Lunate
 - D) Pisohamate ligament
 - E) Volar distal radio-ulnar ligament

The correct response is Option D.

Guyon canal, also known as ulnar canal and ulnar tunnel, allows passage of the ulna nerve and artery into the hand. It is a semi-rigid fibrous longitudinal tunnel, approximately 4 cm in length, beginning at the proximal edge of the transverse carpal ligament and ending at the hypothenar aponeurotic arch. The roof comprises the volar carpal ligament. The medial wall is the pisiform and pisohamate ligament. The lateral wall is the hook of the hamate. The floor is the flexor retinaculum and hypothenar muscles.

The volar and dorsal distal radio-ulnar ligaments are the thicker portions of the triangular fibrocartilage complex (TFCC) and do not contribute to Guyon canal.

The capitate and lunate are part of the floor of the carpal tunnel and also do not contribute to Guyon canal.

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56. A 2-month-old infant is brought to the office for evaluation of bilateral complex syndactyly of the hands and feet. Which of the following is the most likely gene involved?
- A) Engrailed-1 (*EN1*)
 - B) Fibroblast growth factor receptor-2 (*FGFR2*)
 - C) LIM Homeobox transcription factor-1 beta (*LMX1B*)
 - D) Sonic hedgehog (*SHH*)
 - E) Wingless type (*Wnt*)

The correct response is Option B.

This patient presents with complex syndactyly of hands and feet consistent with Apert syndrome. This is an autosomal dominant condition that can be caused by mutation in the fibroblast growth factor receptor-2 gene.

Limb development is controlled by signaling pathways that are located within three different signaling centers. These govern the proximal-distal, anterior-posterior, and dorsal-ventral axes of limb development.

The limb develops in a proximal-distal direction, from shoulder to wrist, which is controlled by the apical ectodermal ridge (AER), a thickened layer of ectoderm over the limb bud. Fibroblast growth factors secreted within the AER signal the underlying mesoderm to differentiate. Disruption of the AER results in truncation of the limb.

Growth in the anterior-posterior (radioulnar) axis is determined by the zone of polarizing activity (ZPA). This is located in the posterior margin of the limb bud. The sonic hedgehog protein (SHH) acts to signal development of the limb into radial and ulnar aspects. Alterations in this pathway can result in mirror duplication.

Dorsal-ventral limb development is signaled by the Wnt signaling pathway, which produces a transcription factor, LMX1B, that induces the development of dorsal structures. Deficiency in LMX1B has been associated with nail-patella syndrome. In the ventral portion of the limb, the Engrailed-1 gene product blocks the Wnt pathway, leading to ventralization.

A variety of other transcription factors encoded by Hox and T-Box genes also govern limb and organ development, and alterations in these can give rise to various developmental differences.

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57. A 35-year-old woman presents with a fixed adduction contracture of the first web space that has not improved with splinting and hand therapy for 4 months. Medical history includes a crush injury with complex laceration to the first web and dorsal hand and index finger five months ago. A photograph is shown. Which of the following is the most appropriate plan for reconstruction of the first web space contracture in this patient?
- A) First dorsal metacarpal artery flap
 - B) Flexor carpi ulnaris flap
 - C) Posterior interosseous artery flap
 - D) Thenar flap
 - E) Split-thickness skin grafting

The correct response is Option C.

Contracture of the first web space may be secondary to cutaneous scarring, skin deficiency, fibrosis of the fascia and thenar muscles, or joint contractures. Mild contractures may be isolated to the skin; however, deeper structures are most likely involved as the contracture

becomes more severe. It is important to understand the mechanism of injury, length of time the contracture has been present, and any prior treatments.

Reconstruction of the first web space involves complete contracture release and resurfacing with adequate vascularized tissue. The dissection should be carried out palmarly and dorsally with release of the palmar fascia and adductor aponeurosis as needed. Intrinsic muscle and joint contractures should be addressed at this time, and a trapeziectomy may be needed to restore carpometacarpal (CMC) motion.

This patient has a severe contracture that likely involves multiple structures given her history of deep lacerations and bony injury. This requires resurfacing with thin, pliable vascularized tissue. In this setting, the posterior interosseous artery (PIA) flap is the best choice. This flap is outside the zone of injury and provides an adequate amount of vascularized tissue for resurfacing of the web space. The PIA runs between the extensor carpi ulnaris and extensor digit quinti and forms an anastomosis with the anterior interosseous artery 2cm proximal to the distal radioulnar joint.

Skin grafting alone, either split-thickness or full-thickness, should be avoided because of the inherent tendency for secondary contracture. Skin grafts may be combined with local flaps such as a 4-flap or 5-flap z-plasty in mild to moderate contractures.

Tissue flaps from the dorsum of the hand such as the first dorsal metacarpal artery fasciocutaneous flap or dorsal hand transposition flap may be good options in some patients with small- to moderate-sized skin deficits. However, this patient sustained trauma to the dorsal hand with dorsal skin lacerations. This makes a random-pattern transposition flap unreliable. The defect in question is also too large to be completely resurfaced with a first dorsal metacarpal artery (FDMA) flap. The flexor carpi ulnaris flap is useful for elbow coverage as a turn-over flap but will not reach the hand.

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58. A 59-year-old man with type 2 diabetes mellitus comes to the office because he has had swelling, pain, and decreased function of the right small finger after he injured it slightly 2 weeks ago. The patient reports similar symptoms of the right thumb, although it sustained no inciting injury. Examination of both digits shows signs and symptoms of pyogenic flexor tenosynovitis. In addition to washing out the respective tendon sheaths, exploration of which of the following additional sites is necessary?
- A) First web space
 - B) Flexor carpi radialis tendon sheath
 - C) Hypothenar compartment
 - D) Ring finger flexor tendon sheath
 - E) Space of Parona

The correct response is Option E.

Infectious flexor tenosynovitis can spread from the tendon sheath of the fifth digit to the flexor tendon sheath of the thumb by way of the space of Parona: the potential space in the volar wrist, deep to the flexor tendons but superficial to the pronator quadratus muscle. In this area, the proximal extent of the tendon sheaths of both the small finger and the thumb are in close proximity. This has been termed the “horseshoe abscess” of the upper extremity.

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59. A 27-year-old woman comes to the office for evaluation of bilateral hand pain. The patient reports worsening pain when she retrieves items from the freezer and says that in the winter she experiences pain in her fingers unless she wears electric, heated gloves and on occasion her fingers will turn white and blue. Medical history includes no personal or family history of joint or skin problems. Physical examination shows the patient's fingers are warm, and wrist pulses are palpable. Which of the following is the most appropriate initial management of this patient's symptoms?
- A) Botulinum toxin type A injection
 - B) Oral nifedipine
 - C) Temperature biofeedback
 - D) Thoracoscopic sympathectomy
 - E) Topical nitroglycerin

The correct response is Option B.

Patients presenting with Raynaud syndrome fall into two classic categories: primary (traditionally referred to as Raynaud disease) and secondary (Raynaud phenomenon, associated with an underlying condition, most commonly involving an autoimmune process). In this woman presenting without an underlying etiology for her vasospastic symptoms, primary treatment should be directed at managing the vasospasm. Although a plethora of interventions have been tried, recent reviews show the calcium-channel blockers, such as nifedipine, to be the optimal first-line intervention.

Temperature biofeedback has shown variable effect in multiple small trials, and, consequently, it is not recommended as a primary intervention for vasospasm.

Topical nitrates can assist with vasodilation in the digits, making them an occasional adjunct treatment for symptoms not completely managed by calcium channel blockers. In isolation, topical nitrates have been ineffective for managing Raynaud syndrome.

Multiple small trials have demonstrated successful relief of pain and digital ulcers in a mixed group of both primary and secondary Raynaud syndrome with injection of botulinum toxin around the digital vessels in the palm. The cost and risk of temporary paralysis to intrinsic muscles, however, renders this a second-line treatment for refractory pain or nonhealing ulcers. Treatment of digital vasospasm is still considered an "off-label" use of botulinum toxin and may not be covered by insurance.

Surgical sympathectomy, either proximally through a thoracoscopic approach or periarterially in the wrist and hand, represents the most aggressive treatment and would typically be reserved for patients with nonhealing wounds or chronic ischemic changes. These procedures are gradually being supplanted by injection of botulinum toxin type A.

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60. A 47-year-old woman comes to the office after sustaining an injury to the left wrist after falling on her outstretched hand. Examination shows pain of the radial aspect of the left wrist and anatomical snuffbox. Scaphoid fracture is suspected. When obtaining posterior-anterior x-ray studies, which of the following is the optimal positioning of the wrist for evaluation of the entire scaphoid?
- A) Wrist in 20 degrees of radial deviation, 20 degrees of wrist extension
 - B) Wrist in 20 degrees of radial deviation, 20 degrees of wrist flexion
 - C) Wrist in 20 degrees of ulnar deviation, 20 degrees of wrist extension
 - D) Wrist in 20 degrees of ulnar deviation, 20 degrees of wrist flexion
 - E) Wrist in neutral radial/ulnar position, neutral flexion/extension

The correct response is Option C.

Scaphoid fractures are the most common carpal fracture and frequently occur after a fall onto an extended and radially deviated wrist. Initial workup often involves plain x-ray studies, which have a sensitivity of approximately 85%. The optimal position of the wrist when imaging scaphoid fractures includes ulnar deviation and wrist extension, which allows for evaluation of the long axis of the scaphoid. CT scan or MRI may be used as additional imaging if plain x-ray studies do not demonstrate a fracture, yet there is high clinical suspicion.

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61. A 52-year-old man presents for evaluation of a claw deformity of the right ring and small fingers. Medical history includes an unrepaired low ulnar nerve injury sustained 30 years ago. Which of the following is the most likely pathophysiology of this patient's deformity?

- A) Unbalanced abductor digit minimi muscle
- B) Unbalanced median and ulnar innervated intrinsic muscles
- C) Weak thenar muscles
- D) Weak ulnar innervated extrinsic flexor muscles
- E) Weak ulnar innervated intrinsic muscles

The correct response is Option E.

Clawing after ulnar nerve injury includes hyperextension of the metacarpophalangeal (MCP) joints and flexion of the interphalangeal (IP) joints. The pathophysiology includes paralysis of the interossei and third and fourth lumbricals. Unopposed long extensors cause the metacarpophalangeal joints to fall into extension while the long flexors pull the proximal interphalangeal joints into flexion. This posture is the classical 'claw hand.'

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62. A 50-year-old woman comes to the emergency department after sustaining an avulsion injury of the right ring finger proximal interphalangeal (PIP) joint. A photograph is shown. Examination shows the central slip is disrupted, and the inside of the PIP joint is visible through the dorsal wound. The patient is able to actively extend the PIP joint. Which of the following anatomical structures allows the patient to extend the PIP joint?

- A) Extrinsic extensor tendon
- B) Interosseous muscle tendon
- C) Lateral conjoined tendon
- D) Oblique retinacular ligament
- E) Sagittal band

The correct response is Option B.



The central slip of the extensor mechanism is the terminal direct extension of the extrinsic extensor tendon (extensor digitorum communis and extensor digiti quinti) and is the primary extensor of the proximal interphalangeal (PIP) joint. Injury to the central slip will normally produce flexion of the PIP joint due to unopposed action of the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) tendons and is called a boutonniere deformity.

The intrinsic extensor mechanism, via the middle band of the interosseous muscles, also inserts on the dorsal base of the middle phalanx and causes extension of the PIP joint. In an open injury, the central slip may be injured without concurrent injury to the interosseous muscle tendon, allowing the patient to still actively extend the PIP joint even in the presence of a disruption of the central slip.

The oblique retinacular ligament connects the flexor tendon sheath volarly to the terminal extensor tendon dorsally. When a patient sustains a laceration to the extensor mechanism over the body of the middle phalanx bone, the oblique retinacular ligament may prevent the occurrence of an extensor lag and a mallet deformity.

The lateral conjoined tendon is formed by the lateral bands of the interosseous muscles and the lateral slips of the extrinsic extensor and produces extension of the distal interphalangeal (DIP) joint.

The sagittal band keeps the extrinsic extensor tendon centralized over the dorsal metacarpophalangeal (MP) joint by connecting to the volar plate. Disruption of the sagittal band on one side of a finger would allow the extrinsic extensor tendon to dislocate and impair its ability to extend the MP joint.

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63. A 24-year-old man is scheduled to undergo reconstruction for avascular necrosis of the proximal pole of the scaphoid with a free osteochondral bone flap. Which of the following arteries is the most commonly encountered vascular pedicle for the medial femoral condyle free bone flap?
- A) Anterior tibial recurrent
 - B) Descending genicular
 - C) Popliteal
 - D) Saphenous
 - E) Superficial femoral

The correct response is Option B.

The medial femoral condyle free bone (corticocancellous) flap has been shown to be an excellent option for treatment of complicated degenerative bone pathology in the wrist, particularly scaphoid avascular necrosis. The Mayo group has also shown improved outcomes for scaphoid nonunion with humpback deformity compared with pedicled flaps from the distal radius. The same group has shown more consistent presence of supply from the medial superior genicular artery, which can be used in cases where the descending genicular artery is insufficient, although the pedicle length of the medial superior genicular artery is generally shorter. More recent anatomic analysis has shown this vessel can supply flaps up to 11 cm in length.

The (superficial) femoral and popliteal arteries are larger, regional vessels, with the superficial femoral artery being the immediate source vessel for the descending genicular artery. The popliteal artery is the source vessel for the medial superior genicular artery. The anterior tibial recurrent artery is distal and lateral, lying over the lateral aspect of the tibial plateau, and does not supply the medial femoral condyle. The saphenous artery has been described as a branch of the superficial femoral supplying the skin paddle overlying the medial femoral condyle but does not supply the bone.

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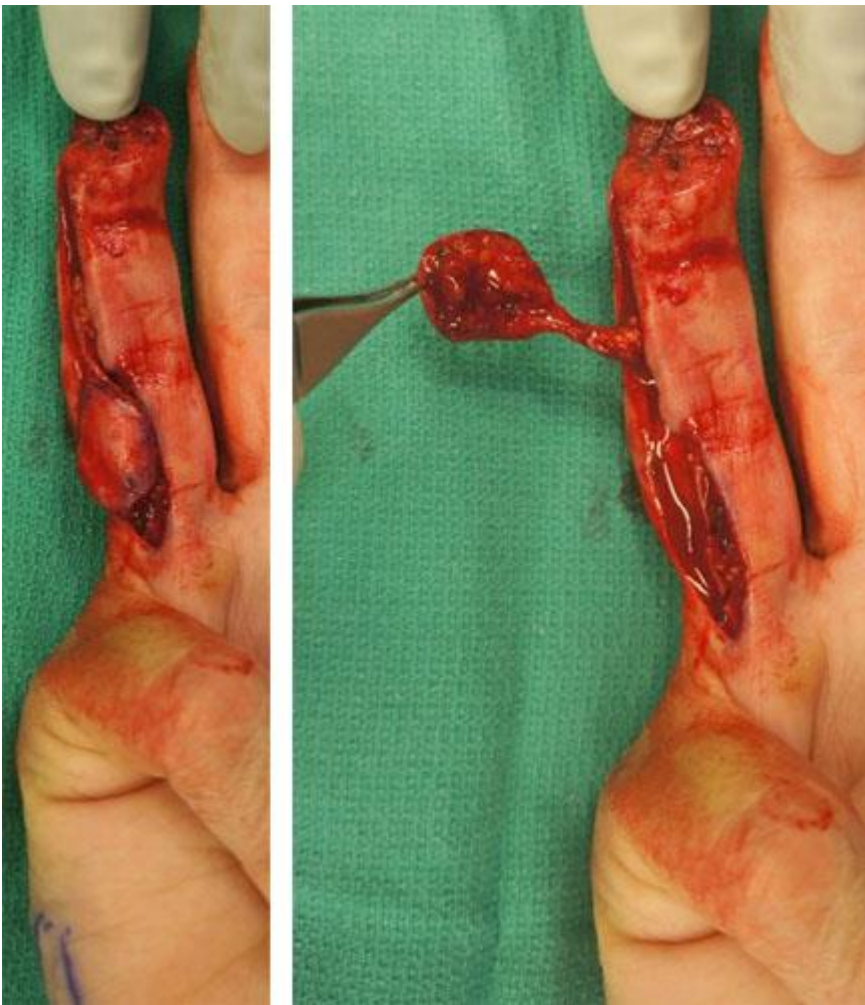
64. Which of the following is the greatest predictive risk factor for birth brachial plexus injury?
- A) Cesarean delivery
 - B) Forceps delivery
 - C) Macrosomia
 - D) Multiple gestation
 - E) Shoulder dystocia

The correct response is Option E.

In multivariate analysis, shoulder dystocia has overwhelmingly been found to be the risk factor most predictive of (most associated with) birth brachial plexus injury. The epidemiological study by Foad showed a 100 times greater risk; another study by DeFrancesco showed an odds ratio of 113.2. While conferring a smaller risk, macrosomia and forceps delivery are far weaker predictive factors, with increases in risk of 14-fold and 9-fold, respectively. Multiple gestation and cesarean delivery are actually protective factors against birth brachial plexus injury.

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65. Which of the following is the arterial supply of the flap for digital tip reconstruction shown?
- A) Distally based from the contralateral digital artery
 - B) Dorsal perforating vessels
 - C) Perineural perforating vessels
 - D) Proximally based from the ipsilateral digital artery

The correct response is Option A.

A reverse homodigital island flap is shown. It is a distally based flap that is useful in the repair of fingertip injuries. Arterial inflow is based upon the contralateral digital artery in the crossing ladder vessels of the palmar digital arch that lie just dorsal to the volar plate at each joint. The flap requires sacrifice of the ipsilateral digital artery and care must be taken to preserve the digital nerve during elevation of the skin paddle. Typically, the donor site is grafted.

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66. Myoelectric prostheses offer which of the following advantages over body-powered prostheses?
- A) Higher durability
 - B) Lower cost
 - C) Lower frequency of adjustment
 - D) More complex motions performed
 - E) Shorter training time

The correct response is Option D.

Body-powered prostheses have been shown to have advantages in durability, training time, frequency of adjustment, maintenance, and feedback; however, they could still benefit from improvements of control. Myoelectric prostheses have been shown to provide greater range of motion including more complex movements involving multiple joints moving at the same time. Currently, evidence is insufficient to conclude that either system provides a significant general advantage. Prosthetic selection should be based on a patient's individual needs and include personal preferences, prosthetic experience, and functional needs.

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67. A 57-year-old woman comes to the office because of burning pain and stiffness of the right hand 8 weeks after closed treatment of a distal radius fracture. The patient reports that she has had difficulty sleeping and continues to have discomfort despite taking narcotics. On physical examination, the hand is shiny, swollen, and warm, and finger range of motion is decreased. There is hypersensitivity to light touch. X-ray studies show good alignment of the fracture. Electrodiagnostic testing shows no abnormalities. Bone scan shows increased periarticular uptake. Which of the following is the most appropriate diagnosis?
- A) Complex regional pain syndrome
 - B) Factitious disorder
 - C) Midpalmar space abscess
 - D) Opioid addiction
 - E) Pain catastrophizing

The correct response is Option A.

The most appropriate diagnosis is reflex sympathetic dystrophy, or complex regional pain syndrome (CRPS) type I. This patient exhibits symptoms consistent with CRPS, which is a form of severe neuropathic pain. The diagnosis of CRPS involves history, physical examination, and diagnostic testing. In addition to pain out of proportion, other features must be present. These can include changes in blood flow, altered temperature perceptions, sudomotor activity, edema, and pigmentation changes. Although no specific test is pathognomonic, triple-phase bone scans are helpful in adding credence to the diagnosis. First- and second-phase bone scans may show asymmetric flow and autonomic dysfunction, while the third phase demonstrates increased periarticular uptake in multiple joints of the affected extremity.

CRPS is divided into two types. Type I occurs without identifiable nerve involvement (also known as reflex sympathetic dystrophy), and Type II has identifiable nerve involvement (causalgia). It is more common in smokers and in women. Pain in CRPS can be either sympathetically mediated or sympathetically independent. This condition is characterized by persistent pain, cold intolerance, autonomic dysfunction, and trophic changes. Patients may show swelling, stiffness, difficulty sleeping, and persistent pain out of proportion to the normal postoperative/post-injury course that may be incompletely relieved by narcotics.

A variety of treatment modalities have been employed in addressing CRPS. These range from therapy modalities such as range of motion, stress loading, and desensitization to pharmacologic interventions with anticonvulsants or antidepressants. Stellate ganglion blocks or autonomic nerve blocks may be helpful in sympathetically mediated pain, and nerve stimulation (either transcutaneous or at the spinal cord level) can also be employed. Often multiple modalities are used concurrently and in sequence. Peripheral nerve decompression may be helpful in resolving symptoms related to CRPS type II.

Factitious disorder can occur when there is potential for secondary gain, but would not present with physiological symptoms.

Although opioid addiction can be a source of pain complaints in an attempt to acquire additional narcotics, the patient exhibits physiological changes that are unable to be mimicked.

Pain catastrophizing is a maladaptive behavioral response to pain that can be a risk factor for prolonged pain after trauma.

A midpalmar space abscess would be unlikely after a closed distal radius fracture. It would also not be likely to have trophic skin changes or changes in a bone scan as seen in this patient.

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68. A 30-year-old man with a history of radius and ulna midshaft fractures underwent fasciotomies for acute compartment syndrome of the nondominant left volar forearm with immediate return of normal perfusion 4 months ago. He is now pain-free with normal sensation but has persistent stiffness and weakness of the fingers, despite appropriate splinting and physiotherapy. His compartments are soft, and there are no joint contractures. He has full motion and normal strength, except the fingers and thumb can fully extend only with the wrist flexed, and finger and thumb flexion have MRC grade 4/5 strength. Which of the following is the most appropriate next step in management?
- A) Dynamic splinting
 - B) Flexor tendon transfers
 - C) Intrinsic releases
 - D) Selective muscle origin slide
 - E) Strengthening physiotherapy

The correct response is Option D.

The patient is presenting with evidence of Volkmann ischemic contracture of his deep volar forearm compartment musculature, specifically flexor digitorum profundus and flexor pollicis longus. Flexor digitorum superficialis could be minimally involved, but the wrist flexors are spared. Mild median nerve involvement with full recovery and sparing of the ulnar nerve would support this diagnosis. The patient has already undergone appropriate physiotherapy. With persistent findings at 4 months, the most appropriate treatment is surgical exploration, debridement of necrotic muscle, with either selective muscle origin slide or tendon lengthening of preserved but contracted muscle.

Although continued dynamic physiotherapy could potentially provide further improvement in this patient's muscle tightness, strengthening physiotherapy will not address the problem adequately. Dynamic splinting could complement physiotherapy and be helpful but has likely provided most of its benefit in the 4 months after initial surgery. Intrinsic releases would be indicated in intrinsic muscle contractures; however, this patient has involvement of the extrinsic flexors, not the intrinsic muscles. Finally, flexor tendon transfers would be indicated for more severe cases of Volkmann contractures, where there is no muscle function remaining. This patient's examination suggests adequate muscle function remains.

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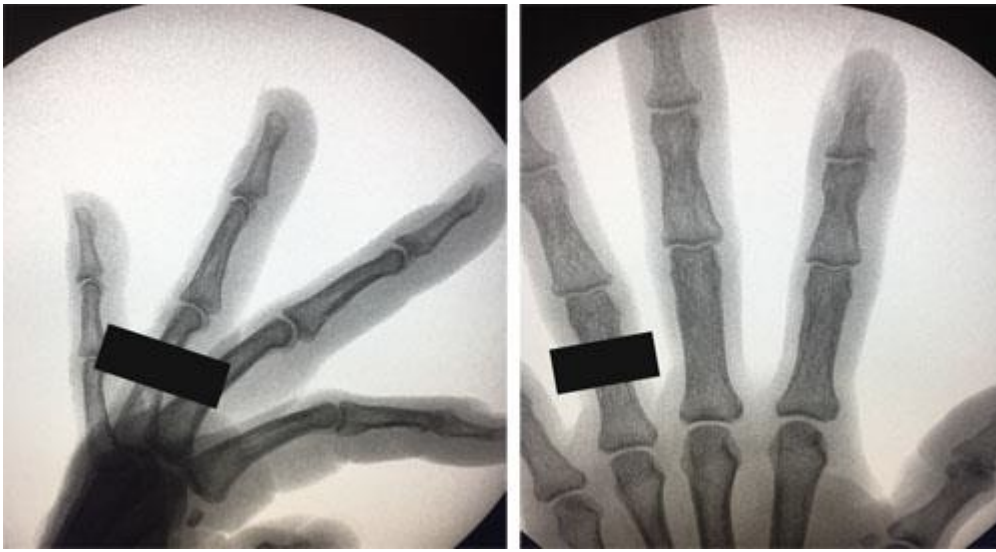
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69. A 62-year-old woman presents because of a 6-month history of a painless mass near the nail fold of the left index finger. The patient reports that clear thick drainage leaks intermittently from the nail fold. She is concerned about the appearance of the nail. A photograph is shown. On evaluation of this patient, which of the following additional studies in her workup is most appropriate?

- A) Blood work
- B) Culture of a drainage specimen from the nail fold
- C) Diagnostic x-ray study of the finger
- D) Incisional biopsy of the mass
- E) MRI of the finger

The correct response is Option C.



This is a mucous cyst based on history and examination. Mucous cysts are cysts that arise from the distal interphalangeal joints. They are frequently associated with dorsal osteophytes secondary to osteoarthritis and x-ray studies are useful to establish the severity of osteophytes. X-ray views usually demonstrate osteophytes in proximity to the cyst. The cyst can decompress and clear viscous fluid can be seen. Pressure on the germinal matrix from an enlarging mucous cyst can cause nail grooving, which this patient demonstrates.

These masses are benign and do not require treatment. Aspiration and corticosteroid injection can be considered for nonsurgical treatment. The osteophyte is thought to be an inciting cause of the mucous cyst in these patients and should be removed when surgically treating these patients hence the utility of x-rays in evaluation of the patient. The cyst and stalk are traditionally removed as well.

MRI is unnecessary as clinical examination should be sufficient to establish the diagnosis.

Blood work and culture would be unable to establish a diagnosis.

Culture is sometimes necessary if there are signs of infection but there are no concerning signs or symptoms in this patient. Biopsy is helpful when clinical diagnosis is suspect, but unnecessary with this benign mass.

X-ray studies of this patient's left hand (anteroposterior and lateral) are shown.

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70. A 40-year-old man comes to the office because of an 8-month history of intermittent ischemic change to the right ring finger. The patient reports intermittent coolness, pallor, pain, and cold sensitivity. Angiogram demonstrates a tortuous ulnar artery at the wrist and faint radial digital artery runoff into the right ring finger. Digital brachial index (DBI) of the ring finger is 0.9. Which of the following is the most appropriate first step in management?
- A) Botulinum toxin type A injection
 - B) Excision and vein grafting of the ulnar artery
 - C) Ligation of the thrombosed ulnar artery segment
 - D) Thrombectomy and heparin drip
 - E) Trial of acetylsalicylic acid and nifedipine

The correct response is Option E.

This patient presents with hypothenar hammer syndrome. The gold standard for establishing the diagnosis is angiography. Aortic arch and upper extremity arteriography is the study of choice. In hypothenar hammer syndrome, the pathognomonic angiographic features can include tortuosity of the ulnar artery with a corkscrew appearance, aneurysm formation, occlusion of the ulnar artery segment overlying the hook of the hamate, occluded digital arteries in the ulnar artery distribution, and demonstration of intraluminal emboli at sites of digital obstruction.

Treatment depends largely on the severity of the ischemia. The therapeutic strategy is controversial because there are limited studies on this problem. For most patients with milder or transient/intermittent symptoms, nonsurgical treatment will be sufficient, particularly in the setting of vasospasm with adequate collateral circulation. Conservative nonoperative care may include smoking cessation, avoidance of further trauma (may require change of occupation), padded protective gloves, cold avoidance, calcium channel blockers (nifedipine, diltiazem), antiplatelet agents or anticoagulation, local care of fingers with necrosis, and pentoxifylline to reduce blood viscosity.

More severe symptoms (persistent ischemia, soft tissue loss/gangrene, ulnar nerve symptoms) or symptoms refractory to nonoperative management require consideration of surgical intervention. Surgical options in this setting include arterial ligation (assuming an intact radial/palmar arch), resection of thrombosed arterial segment or aneurysm with end-to-end anastomosis, or resection and vascular reconstruction with vein or artery graft. Some

argue that best outcomes are seen in those treated with surgical resection and reconstruction. The benefits of surgical treatment include removal of the source of embolism, removal of the painful mass, relief of ulnar nerve compression, and creation of a local periarterial sympathectomy. As this patient has mild and intermittent symptoms without evidence of soft-tissue loss or gangrene or any evidence of ulnar nerve irritation, a trial medical management is indicated. Botulinum toxin type A is indicated for vasospasm secondary to Raynaud syndrome or disease and would not be part of the medical management algorithm.

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71. An 86-year-old farmer is brought to the emergency department because of a large dorsal wound of his nondominant left hand sustained when his hand was caught in a flail mower. After debridement is performed, examination shows normal volar structures, including nerve and tendon function, and loss of dorsal skin and tendons. Medical history includes myocardial infarction 1 month ago. An x-ray study and photograph are shown. Which of the following is the most appropriate method of reconstruction for this patient?

- A) Bilaminate neodermis (Integra) and skin grafting with delayed bone grafting
- B) External fixator and posterior interosseous artery flap
- C) Finger fillet flaps of index and middle finger
- D) Free anterior lateral thigh flap with secondary bone grafting
- E) Pedicle radial forearm flap with secondary bone grafting

The correct response is Option C.



When caring for patients with mangling hand injuries, it is imperative to consider all aspects of the patient's history and future goals. This patient would be at risk for cardiac complications if a longer procedure such as a free flap were chosen. The amount of bone loss in the index and middle metacarpals is also problematic and would most likely require multiple procedures. Just placing an external fixation and covering the wound with a local flap is also possible but will require several procedures. Bone grafting while receiving bilaminate neodermis (Integra) and skin grafts is not recommended because of the lack of subcutaneous tissue and poor blood supply. The most expeditious method of covering this patient's wounds in one procedure is finger fillet flaps of the injured digits. Finger fillet flaps can cover a large area for reconstruction as shown.

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72. A 32-year-old man presents following a motor vehicle collision in which he sustained a dorsal perilunate dislocation of the nondominant left hand. He was treated with open reduction and internal fixation including ligament repair with suture anchors and Kirschner-wires two days after the injury. Which of the following is the expected long-term outcome for this patient?
- A) Chronic pain and grip strength less than 50% of the normal side
 - B) Evidence of moderate post-traumatic arthritis and 80% of grip strength compared to the opposite side
 - C) Normal x-ray appearance with greater than 80% of motion compared with the opposite side
 - D) Normal x-ray appearance with poor wrist motion and poor grip strength
 - E) Severe post-traumatic arthritis requiring total wrist fusion

The correct response is Option B.

Peri-lunate dislocations (PLD) and peri-lunate fracture dislocations (PLFD) are considered complex, high-energy injuries with potentially difficult recovery for many patients. In terms of outcomes research, long-term data are considered to be follow-up greater than 10 years. The long-term data are retrospective but consistent across many studies.

The treatment of choice for PLD and PLFD is open reduction and internal fixation. Studies looking at closed reduction and casting or percutaneous pin fixation have shown inferior outcomes, and open treatment is recommended by most authors.

All studies agree that there will be the presence of moderate or even severe post-traumatic arthritic changes on x-ray in most patients (50 to 100%), which can be various degrees of SLAC, SNAC, or avascular necrosis. However, the data also show that the presence of radiographic arthritis does not necessarily correlate with functional outcomes. On average, patients will achieve 65 to 70% of wrist flexion-extension arc and 80% grip strength compared with the unaffected side.

Although some patients may develop severe complications of a PLD or PLFD such as advanced SLAC or SNAC or ulnar translation of the carpus, it is a rare finding. Most studies show outcomes in the good and fair range according to the Mayo wrist score and other outcome measures. Patients with the most severe arthritis usually do correspond to the

worst symptoms and may require salvage procedures such as proximal row carpectomy or limited wrist fusion.

Persistent, chronic pain is a rare finding with long-term outcomes of perilunate injuries. Pain with heavy activity only is the most commonly reported outcome, although many patients are largely pain free.

Patients can have near normal looking x-rays after PLD or PLFD; however, this is rare. One would not expect >80% of wrist motion after an injury of this magnitude even with normal x-rays. Also, patients with minimal arthritic changes tend to show better functional outcomes.

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73. A 17-year-old boy comes to the office because of ongoing pain of the right hand after he punched a wall 5 days ago. Physical examination demonstrates tenderness of the fifth carpometacarpal joint. Posteroanterior, oblique, and lateral x-ray studies taken at an urgent care facility were read as negative by the radiologist. Which of the following additional radiographic views is most likely to help confirm this patient's diagnosis?
- A) Anteroposterior with 30 degrees of pronation from full supination
 - B) Carpal tunnel view with wrist in full extension
 - C) Clenched fist lateral in neutral forearm position
 - D) Lateral with 15 degrees of supination from neutral forearm position
 - E) Posteroanterior with 45 degrees of supination from full pronation

The correct response is Option A.

Injuries to the fifth carpometacarpal joint, including subluxation, dislocation, and fracture-dislocation, are often missed with standard two-view and three-view hand images. Two views have been suggested to help detect this subtle injury:

1. Anteroposterior view with forearm pronated 30 degrees from full supination. This view shows more clearly the profile of the articulation between the hamate and fifth metacarpal base. (This is similar to the “reverse oblique” view, which is typically done in 45 degrees of pronation and might also be useful.)
2. Lateral with 30 degrees of pronation. This view is especially helpful for detecting subluxation of the metacarpal dorsally off of the hamate. In some cases, CT scan may be warranted if plain films are inconclusive.

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74. A 60-year-old woman with rheumatoid arthritis (RA) comes to the office because of the sudden inability to extend the right thumb. The patient reports no pain or swelling before the loss of extension. She notes her RA symptoms have been well controlled for over 10 years with low-dose prednisone and methotrexate. Physical examination shows strong flexion of the right thumb at the interphalangeal joint. The patient is unable to extend the thumb interphalangeal joint against resistance and is unable to lift the thumb off the tabletop when the palm is held flat. Full passive mobility of the thumb is noted. Rupture of which of the following tendons is most likely upon surgical exploration?
- A) Abductor pollicis brevis at the metacarpophalangeal joint
 - B) Abductor pollicis longus at the carpometacarpal joint
 - C) Extensor pollicis brevis at the metacarpophalangeal joint
 - D) Extensor pollicis longus at the wrist
 - E) Flexor pollicis longus near the scaphoid

The correct response is Option D.

One of the more common tendon ruptures in rheumatoid arthritis (RA) is the extensor pollicis longus (EPL) at the level of the wrist. Although spontaneous ruptures with no other known pathology occur, the most common etiologies for rupture center around mechanical or vascular changes in the EPL within the third extensor compartment as the tendon bends around Lister's tubercle. This appears to be related in part to the proximity of the tendon to an injury (in distal radius fractures) and to the "watershed" zone of perfusion of the EPL at Lister tubercle. In this patient with RA, the rupture is likely a combination of ischemia and direct inflammatory synovial infiltration of the tendon within the third compartment.

Other tendon ruptures may occur in the setting of RA, the common ruptures being the extensor digitorum communis and extensor digiti minimi on the dorsal wrist and the flexor pollicis longus (Mannerfelt lesion) on the volar wrist. The presence of strong flexion of the thumb at the interphalangeal joint rules out flexor pollicis longus (FPL) rupture.

Rupture of the extensor pollicis brevis (EPB) would not result in obvious loss of function as the motion would be compensated for by an intact EPL.

Neither abductor rupture would result in loss of interphalangeal joint extension or retropulsion (lifting the thumb off the table with the palm held flat on the surface).

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75. A 45-year-old woman who underwent Achilles tendon repair through a posterior midline incision 3 weeks ago develops a postoperative wound infection and subsequent skin necrosis. Physical examination shows a 3 x 3-cm wound directly overlying the Achilles tendon in the absence of peritenon. A fasciocutaneous propeller flap from the medial leg is designed to cover this defect. The septal perforators to this flap run between which of the following structures?

- A) Flexor hallucis longus and gastrocnemius
- B) Gastrocnemius and soleus
- C) Peroneus longus and peroneus brevis
- D) Soleus and flexor digitorum longus
- E) Tibialis anterior and extensor digitorum longus

The correct response is Option D.

This defect may be reconstructed with a posterior tibial artery perforator propeller flap. These vessels emerge between the flexor digitorum longus and the soleus muscle. In one anatomic study, there were three clusters of perforators: 4 to 9 cm, 13 to 18 cm, and 21 to 26 cm from the intermalleolar line. The peroneal artery perforators often arise through the posterior peroneal septum, and the anterior tibial artery perforators are often found between the extensor digitorum longus and the peroneus longus or between the tibialis anterior and the extensor digitorum longus.

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76. A 23-year-old man is brought to the emergency department because of a laceration of all extensor tendons at Zone VII of the right upper extremity. Which of the following tendons has the most distal muscle belly when attempting to reappose the tendon ends?

- A) Extensor carpi radialis longus
- B) Extensor carpi ulnaris
- C) Extensor digitorum communis to long finger
- D) Extensor indicis proprius
- E) Extensor pollicis longus

The correct response is Option D.

Zone 7 extensor tendon injuries are those over the dorsal wrist. The extensor indicis proprius tendon typically has the most distal muscle belly and this fact can frequently be used to uniquely identify this tendon. Extensor tendon zones are useful for describing the locations of injuries:

1. Distal interphalangeal (DIP)
2. Central slip to DIP
3. Proximal interphalangeal (PIP)
4. Metacarpophalangeal (MCP) to PIP
5. MCP
6. Carpometacarpal (CMC) to MCP
7. Wrist and proximal

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77. An 11-year-old boy is brought to the office with an acute injury of the left small finger. A lateral x-ray study is shown. Which of the following is the most appropriate description of this patient's injury?
- A) Displaced Salter Harris fracture of the middle phalanx
 - B) Displaced Salter Harris fracture of the proximal phalanx
 - C) Nondisplaced Salter Harris fracture of the distal phalanx
 - D) Nondisplaced Salter Harris fracture of the middle phalanx
 - E) Nondisplaced Salter Harris fracture of the proximal phalanx

The correct response is Option A.

This is a displaced growth plate fracture of the small finger middle phalanx. There is a 90% displacement of the metaphysis relative to epiphysis. Although there is no obvious involvement of the metaphysis and, thus, the injury could be interpreted as a Salter Harris I fracture, minor concurrent involvement of some portion of the metaphysis (making it technically a Salter Harris II fracture) cannot be excluded and is quite common. The proximal and distal phalanges of the small finger are not injured.

The mnemonic "SALTER" may be used to recall Salter–Harris fracture types:

Type I: S (Slipped). The fracture occurs through the cartilage of the growth plate (physis) with an incidence of 5-7%.

Type II: A (Above). The fracture occurs above the physis, through the metaphysis. This is the most common type, occurring in 75% of patients.

Type III: L (Lower). The fracture occurs below the physis into the epiphysis. This occurs in 7-10%.

Type IV: TE (Through Everything). The fracture occurs through everything which includes the metaphysis, physis, and epiphysis. This type occurs in 10%.

Type V: R (Rammed or crushed). The growth plate (physis) has been crushed. This occurs in <1%.

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78. A 23-year-old man who works in an office undergoes evaluation of the left nondominant wrist after sustaining an injury from a fall 2 days ago. CT scan shows a nondisplaced distal scaphoid tubercle fracture. Examination reveals no other abnormalities. Which of the following is the most appropriate next step in management?

- A) Autologous bone grafting and internal fixation plus immobilization for 3 to 6 months
- B) Cast immobilization for 6 to 8 weeks
- C) Compression screw fixation plus immobilization for 6 to 12 weeks
- D) Physical therapy for 6 weeks
- E) Observation until the wrist is nontender

The correct response is Option B.

Nondisplaced scaphoid fractures may not be apparent on plain radiographs and are better visualized on CT scan. Although the treatment options for nondisplaced scaphoid wrist fractures may include immobilization alone or surgical fixation, nondisplaced distal pole and tubercle fractures are felt to be more stable and can be treated with immobilization alone for 6 to 12 weeks. In addition, these fractures often have small fragments that are not as amenable to compression screw fixation.

Observation and physical therapy allow mobilization of the wrist and are not recommended because of the potential for delayed healing or nonunion.

Compression screw fixation is not generally necessary and is sometimes not possible for tubercle fractures, but it is a common treatment for scaphoid wrist fractures.

Autologous bone grafting and internal fixation is generally reserved for scaphoid nonunions.

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79. When considering dislocations of the thumb carpometacarpal (CMC) joint, which of the following is most correct regarding which vector of dislocation would occur with injury to the stabilizing ligament?

Injured Ligament	Vector of Dislocation
A) Dorsal intercarpal	radial
B) Dorsoradial	dorsal
C) Intermetacarpal	ulnar
D) Radiocarpal	dorsal

The correct response is Option B.

The CMCJ is very important for hand function and plays a key role in pinch and grasp. The increased range of motion inherent to the thumb CMCJ is attributed to the anatomy of the joint. The biconcave saddle shaped articular surface of the CMCJ also provides some inherent stability. Motion allowed by the joint includes flexion, extension, adduction, abduction, circumduction. Stabilizing ligaments and joint capsule further reinforce the joint, thus thumb CMCJ dislocations are rare injuries. These injuries account for less than 1% of hand injuries.

There are five major stabilizing ligaments to the CMCJ: anterior (volar) oblique, ulnar collateral, intermetacarpal, dorsoradial, and dorsal (posterior) oblique. These ligaments are critical stabilizers during motion. The volar oblique ligament and dorsoradial ligaments are considered to be the most important resistive forces in dislocation in cadaver studies. Reports of traumatic thumb CMCJ dislocation have been in a dorsal vector. The volar oblique ligament was originally thought to be the critical resistive ligament; however, recent literature has supported the dorsal complex (includes the dorsoradial and posterior oblique ligaments) are the most critical for restraint of the joint, thus are injured in dorsal dislocations. Timely recognition is important for these injuries as immediate reduction and casting or splinting for 4 to 6 weeks may be adequate to prevent recurrence. However, these injuries are often missed on radiologic examination or may be persistently unstable. Closed reduction and Kirschner wire fixation may be adequate for treatment in persistently unstable injuries. Some authors advocate for open reduction and ligament reconstruction. Delayed treatment especially beyond three weeks will likely require open reduction and ligament reconstruction. These injuries are often missed on x-ray examination as they can be subtle especially in the setting of more obvious trauma. Inadequate treatment puts these patients at increased risk for subsequent posttraumatic osteoarthritis given the joint malalignment.

The radiocarpal and dorsal intercarpal ligaments are wrist stabilizer not thumb CMCJ stabilizers.

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80. A 26-year-old man comes to the office 4 weeks after injuring his left shoulder while snowboarding. Physical examination shows limited abduction and forward flexion of the shoulder to 30 degrees. No additional abnormalities are noted. From which of the following areas of the brachial plexus does the affected nerve most likely arise?
- A) Lateral cord
 - B) Lower trunk
 - C) Medial cord
 - D) Posterior cord

The correct response is Option D.

The axillary nerve (ventral rami of C5 and C6) arises from the posterior cord of the brachial plexus, giving off muscular branches to teres minor and deltoid. It also innervates the shoulder joint and the skin over the deltoid. Its close proximity to the inferior shoulder capsule as it courses on the anteroinferior border of the subscapularis and then through the quadrangular space, puts it at risk for injury.

The axillary nerve is most commonly injured during orthopedic surgeries such as shoulder arthroscopy, and open reduction and internal fixation (ORIF) of the proximal humerus, in which case, it is most commonly the result of closed traction injury. It can also be seen in the setting of an anterior glenohumeral joint dislocation or proximal humerus fracture, or as the result of a direct blow to the superior aspect of the shoulder. The majority of nerve injuries are temporary neurapraxias, which typically resolve within 6 to 12 months of injury; however, permanent nerve deficit can occur, requiring surgical intervention in the form of decompression, or reconstruction with nerve graft or nerve transfer from the radial nerve.

The lateral cord receives contribution from C5, C6, and C7 roots, and contributes to the musculocutaneous and median nerves. The medial cord receives contribution from C8 and T1 roots, and contributes to the median and ulnar nerves. There are no superior or anterior cords within the brachial plexus.

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81. A 40-year-old man employed as a construction worker comes to the office because of a 3-month history of median nerve sensory distribution deficit. Diagnostic evaluation shows a mass located in the medial cord of the brachial plexus. Histology of the mass shows a malignant peripheral nerve sheath tumor. Metastasis is most likely found in which of the following organ systems?

- A) Brain
- B) Colon
- C) Liver
- D) Lung
- E) Spine

The correct response is Option D.

For malignant peripheral nerve sheath tumors, metastasis occurs in about 39% of patients, most commonly affecting the lung. Malignant peripheral nerve sheath tumors commonly present as a soft-tissue mass arising from a large peripheral nerve such as the sciatic nerve or brachial plexus. There is usually motor and sensory deficit of the affected nerve. Demographics for solitary neurofibromas are 30 to 55 years, and neurofibromatosis are 20 to 40 years. Malignant peripheral nerve sheath tumors are sarcomas. They originate from peripheral nerves or from the nerve sheath, such as Schwann cells, perineural cells, or fibroblasts. Wide surgical excision is the mainstay of treatment, including the affected nerve. Radiation therapy is an integral part of treatment. Chemotherapy is usually not used except in larger, higher grade tumors.

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82. A 36-year-old man comes to the office because of a 2-week history of pain of the right wrist after a fall on his outstretched hand. X-ray studies are shown. If this injury is left untreated, which of the following joint surfaces is most likely to develop arthritis first?

- A) Capitulum
- B) Lunotriquetral
- C) Radiolunate
- D) Radioscaphoid
- E) Scaphocapitate

The correct response is Option D.

The most likely joint surface to develop arthritis is the radioscaphoid joint. This patient shows evidence of scapholunate ligament tear. There is evidence of widening of the scapholunate interval and increase in the scapholunate angle.

The scapholunate angle is calculated by measuring the angle between a line drawn perpendicular to the distal surface of the lunate and along the axis of the scaphoid on the lateral view. The normal scapholunate angle varies from 30 to 60 degrees. A tear in the scapholunate ligament results in volar flexion of the scaphoid bone and dorsiflexion of the lunate, with a resultant increase in the angle.

If a scapholunate ligament tear is left untreated, a degenerative pattern of changes result. This is known as scapholunate advanced collapse (SLAC) wrist. Over time there is separation of the scaphoid and lunate bones and descent of the capitate into the intervening space.

With scapholunate ligament tears, arthritis occurs in a predictable sequence. This initially begins in the radioscaphoid joint, followed by the scaphocapitate joint and the capitoulunate joint. The radiolunate joint is typically spared until advanced stages. The lunotriquetral ligament is intact and arthritis does not occur in this area with SLAC wrist.

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83. A 27-year-old woman sustains a Grade IIIB degloving injury of the left lower extremity in a motor vehicle collision. Latissimus dorsi free flap placement is planned. Which of the following is the most likely outcome in this patient in terms of donor site morbidity?
- A) Decreased seroma formation but increased hematoma formation
 - B) Inability to maintain sitting-up position when back is not supported
 - C) Initial decreased shoulder range of motion that improves by one year
 - D) Permanent loss of external rotation of the shoulder and inability to reach forward

The correct response is Option C.

Most studies that demonstrate shoulder weakness and loss of motion show that the loss of function is greatest in the early postoperative period and returns to baseline, or close to baseline, at 1 year or more after surgery.

All studies comparing types of latissimus flaps demonstrate less morbidity with perforator or muscle-sparing flaps as compared to traditional or extended latissimus dorsi (LD) flaps. Lower functional morbidity is observed with more native muscle preserved as is other flaps. This assumes that the muscular branches of the motor nerve to the latissimus are spared.

A recent meta-analysis does show higher functional impairment than expected after latissimus flap transfer. The number of patients who required a change in occupation was less than 10%. This was likely because of difficulty with activities such as ladder climbing, painting overhead, and sustained reach overhead.

The function of the latissimus dorsi muscle is shoulder adduction, extension and internal rotation. Other muscles of the rotator cuff perform similar functions and will assist in compensation for the loss of the latissimus. Patients who do develop weakness report it in activities involving shoulder adduction and internal rotation. Paradoxically, limitations in range of motion are mostly in shoulder flexion and abduction possibly related to tight skin closure and internal scarring.

Donor site seroma formation is particularly problematic, with published rates ranging from 3.9 to 79%.

Core muscles such as rectus abdominis, external oblique, gluteus maximus, medius, and minimus, and erector spinae all contribute to rotation, balance, and stabilization during sitting and standing.

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84. The Jones transfer for radial nerve palsy, specifically flexor carpi ulnaris to extensor digitorum communis III-V, is most likely to have which of the following significant disadvantages?
- A) Difficulty of dissection
 - B) Inappropriate excursion of donor tendon
 - C) Indirect line of pull requiring pulley creation
 - D) Poor synergy
 - E) Unacceptable postoperative rupture rate

The correct response is Option B.

Although the Jones transfers were practiced for years, there were significant disadvantages that led to them falling out of favor. Among the disadvantages are loss of flexor carpi ulnaris (FCU) as an important ulnar wrist stabilizer and weakness in flexion/ulnar deviation, which is a very important wrist motion. Additionally, the short excursion of FCU is inadequate to fully extend the fingers when transferred to extensor digitorum communis (EDC).

Subsequent modifications to the Jones technique by Boyes and others found better alternatives to the use of FCU. Standard Boyes transfers are:

- PT to ECRL and ECRB
- FCR to EPL and ABL
- FDS-III to EDC (via interosseous membrane)
- FDS-IV to EPL and EIP (via interosseous membrane)

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85. A 35-year-old man comes to the office for evaluation of a previous amputation of the dominant thumb. Medical history includes factor V Leiden mutation. The patient states that he does not want any microsurgical flap reconstruction. X-ray study shows amputation at the metacarpal base level. Which of the following reconstruction methods is most appropriate for the best aesthetic and functional outcome in this patient?
- A) Metacarpal distraction
 - B) Osteoplastic reconstruction with iliac bone and radial forearm flap coverage
 - C) Pollicization of the index finger
 - D) Silicone prosthesis
 - E) Web space deepening with Z-plasty

The correct response is Option C.

The thumb is considered to account for at least 40% of hand function. Essential characteristics to provide optimal function of the thumb include mobility, opposition, sensation, stability, strength, and normal shape. Metacarpal distraction can provide a strong, stable, and sensate thumb but is not very aesthetically pleasing as it will be larger than a normal thumb and lack a nail. Osteoplastic reconstruction and flap coverage provides a stable post but no mobility and poor sensation with the same visual concerns. Web space deepening with Z-plasty can provide a very functional stable thumb with more distal amputations but would not provide sufficient length in this patient. Silicone prostheses provide excellent cosmetic digits but are not functional. The most appropriate reconstruction in this patient without a toe transfer would be an index pollicization.

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86. A 65-year-old woman comes to the office because she is unable to actively extend the left ring and small fingers. Medical history includes rheumatoid arthritis and no marked trauma. On physical examination, the ring and small fingers are held in 45 degrees of flexion with ulnar deviation at the metacarpophalangeal (MCP) joints. Mild swelling around the MCP joints of all fingers and a prominent ulnar head are noted. The patient is able to maintain extension when her fingers are passively extended. X-ray studies show moderate to severe wrist arthritis but minimal arthritic changes of the finger joints. Which of the following best explains the physical examination findings in this patient?
- A) Extensor tendon rupture of the ring and small fingers at the ulnar head
 - B) Incomplete radial nerve palsy
 - C) Severe ulnar neuropathy at the elbow
 - D) Ulnar subluxation of the extensor mechanism at the MCP joint
 - E) Volar subluxation of the MCP joint

The correct response is Option D.

Rheumatoid arthritis (RA) is an autoimmune inflammatory polyarthritis. Immune complex deposition results in inflammation and synovial hypertrophy, joint destruction, and weakening of the ligamentous support structures. This results in a predictable pattern of deformities seen in the hand and wrist related to the inflammatory synovitis.

The wrist is the most commonly affected joint in the upper extremity in RA. Collapse of the carpal height on the radial aspect of the wrist from attenuation of the scapholunate ligament results in weakening of the ulnar collateral ligaments of the wrist, ulnar subluxation and supination of the carpus, and radial deviation of the metacarpals. Along with synovitis of the metacarpophalangeal (MCP) joints, this contributes to the characteristic ulnar drift of the fingers seen in RA.

The loss of active finger extension in rheumatoid patients is because of one of three causes. Attenuation of the radial sagittal band of the MCP joint from inflammation and ulnarly directed forces from pinch and grip may result in ulnar subluxation of the extensor mechanism. The extensor tendons will slide into the valley between the metacarpal heads and the extensor tendon will place a flexion force on the MCP joint. In this case, passive extension of the fingers will centralize the extensor and the patient will be able to maintain the fingers actively in an extended position. This is the critical physical exam maneuver to diagnose this issue and the key to the patient in this question.

Patients with synovitis of the distal radioulnar joint and dorsal subluxation of the ulnar head (caput ulna) may present with spontaneous rupture of the extensor tendons. This occurs in a predictable sequence beginning with the extensor digiti quinti and progressing radially across the hand. Intact junctura may make this difficult to diagnose initially, but these patients will not be able to extend the small finger with the adjacent digits flexed. These patients will not be able to actively maintain finger extension even if the fingers are passively extended.

Finally, volar subluxation or dislocation of the MCP joints from synovitis can be a cause of ulnar drift and loss of digit extension. This may or may not be passively correctable. This can be distinguished easily from extensor tendon subluxation by x-ray evaluation of the hand. Joint malalignment is easily seen on standard x-rays but is not present in this patient. It is important to understand the cause of the deformity because the treatment for each is different.

Radial neuropathy in RA is very rare and would not likely be isolated to extension of the ring and small fingers only. One would expect more global posterior interosseous nerve (PIN) palsy, which is not present in this case.

Severe ulnar neuropathy would result in intrinsic weakness and possibly clawing of the ulnar digits. This would present with hyperextension of the MCP joints and flexion of the interphalangeal joints.

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87. An 18-year-old man presents for follow-up evaluation 8 weeks after he sustained a penetrating injury to the posterior medial right elbow and a complete transection of the ulnar nerve in the cubital tunnel. At this time, which of the following are the most likely Sunderland/Mackinnon injury grade and electromyogram/nerve conduction findings in this patient?

Electromyography/Nerve Conduction Findings

Injury Grade	Sharp Waves	Fibrillations	Amplitude of Compound Motor Axon Potential
A) Grade I	Absent	Present	Decreased
B) Grade I	Present	Present	Normal
C) Grade V	Absent	Absent	Normal
D) Grade V	Present	Present	Decreased
E) Grade VI	Present	Present	Normal

The correct response is Option D.

Nerve injuries are graded using the Sunderland/Mackinnon classification. Grade I injuries involve neurapraxia and are expected to recover completely; grades II to IV injuries involve increasing disruption of the perineurium and endoneurium (with expectation for a variable degree of spontaneous recovery); grade V injuries represent neurotmesis, or complete transection of the nerve. Grade VI injuries represent combined injuries in which more than one grade of injury exists within the same segment of damaged nerve. After a complete nerve transection and progression of Wallerian degeneration, patients develop fibrillations and sharp waves and progressive decrease in the compound motor action potential.

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88. A 51-year-old woman is scheduled to undergo needle aponeurotomy for Dupuytren disease of the small finger. A photograph is shown. The addition of lipografting after needle aponeurotomy is most likely to decrease the rate and severity of recurrence in this patient by which of the following mechanisms?

- A) Decreasing the proximity of residual cord tissue to the skin
- B) Increasing the density of myofibroblast cell-to-cell contact
- C) Increasing the density of the residual cord tissue
- D) Inhibiting myofibroblast proliferation
- E) Providing stem cells to promote collagen production

The correct response is Option D.

Fat grafting (also called lipofilling) has shown promise as a means to improve outcomes after percutaneous needle aponeurotomy for Dupuytren disease. It is believed to work by several mechanisms:

1. Reducing the density of cell-to-cell myofibroblast contact
2. Inhibiting myofibroblast proliferation via adipose-derived stem cells
3. Acting as an interposed tissue graft
4. Providing passing over the cords to replace native subdermal fat displaced by the nodules and cords

A randomized prospective trial by Kan and colleagues showed that aponeurotomy with lipofilling showed equivalent results at one year out from treatment with a much faster recovery compared with limited fasciectomy.

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89. A 44-year-old woman comes to the office because of a 3-month history of a painful subungual area of bluish discoloration. The patient reports severe pain when localized pressure is applied to the area, and cold water testing elicits severe pain. Which of the following is the most likely diagnosis?
- A) Glomus tumor
 - B) Hemangioma
 - C) Hematoma
 - D) Melanoma
 - E) Pyogenic granuloma

The correct response is Option A.

Glomus tumors comprise approximately 1 to 5% of soft-tissue tumors of the hand. The majority are subungual. Presentation is typically a raised blue or pink nodule that can discolor or deform the nail. Love's pin test is performed by applying pressure to the area with a pinhead, causing exquisite pain. Diagnosis can be aided with plain film x-ray and MRI. Treatment includes complete surgical excision. Hematoma, hemangioma, and pyogenic granuloma would less likely present with point tenderness and positive cold water test.

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90. Which of the following techniques is most commonly used for reconstruction of a Blauth IIIB thumb hypoplasia in the United States?

- A) Great toe to thumb transfer
- B) Index pollicization
- C) Metacarpophalangeal (MCP) joint stabilization with opponensplasty
- D) Second toe to thumb transfer
- E) Toe wrap around transfer

The correct response is Option B.

Blauth classification of Thumb Hypoplasia:

Type	Description	Treatment
I	Minimal hypoplasia with full complement of neurovascular and musculoskeletal elements that are small in size.	No surgical treatment necessary
II	All bones present, but hypoplastic. Instability of ulnar collateral ligament of MCP joint. Thenar hypoplasia.	MCP joint stabilization with opponensplasty; deepening of first web space
IIIA	CMC joint unstable. Poor active motion at MCP and IP joints.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit

IIIB	Deficient CMC joint with absence of trapezium, aplastic proximal first metacarpal head. Absence of active motion at MCP or IP joint.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit
IV	<i>Pouce flottant</i> No muscular or skeletal attachments between thumb and hand; persistent neurovascular structures within hypoplastic thumb.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit
V	Absent thumb.	Amputation of hypoplastic thumb followed by pollicization of the radialmost digit

The most severe forms of thumb hypoplasia (types IIIB, IV, and V) require amputation of the existing thumb and reconstruction, most commonly by index pollicization.

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91. A 67-year-old man comes to the office because of nerve deficit of the left lower extremity which occurred after undergoing a femoral-distal bypass 5 days ago. Physical examination shows numbness of the plantar surface of the foot and weakness in plantarflexion. Which of the following nerves is most likely injured in this patient?
- A) Femoral
 - B) Obturator
 - C) Peroneal
 - D) Sural
 - E) Tibial

The correct response is Option E.

This patient appears to demonstrate symptoms of a tibial nerve injury. The tibial nerve is a branch of the sciatic nerve. It travels through the popliteal fossa and gives off branches to gastrocnemius, soleus, plantaris, and popliteus muscles. The tibial nerve travels in proximity to the posterior tibial artery. In the leg, it gives off branches to the flexor digitorum longus, tibialis posterior, and flexor hallucis longus. Distally in the foot, it branches to give rise to the medial and lateral plantar nerves, which provide sensation to the plantar surface of the foot. Injury to the tibial nerve results in deficits of plantarflexion, as well as anesthesia to the plantar surface of the foot.

The femoral nerve innervates muscles of the anterior thigh, including the quadriceps group, iliacus, and sartorius. Injury to the femoral nerve results in weakness of leg extension.

The obturator nerve provides innervation to the medial thigh muscles (adductor group), including adductor brevis, longus, and magnus, as well as the gracilis and obturator externus. The cutaneous branch provides sensation of the medial thigh. Injury to the obturator nerve results in weakness in thigh adduction, and sensory deficits in the medial thigh.

The peroneal nerve is divided into superficial and deep branches at the area of the fibular neck. The superficial peroneal nerve supplies the lateral compartment of the leg, giving motor branches to peroneus longus and brevis, as well as sensory contributions to the lateral aspect of the leg. Injury to the superficial peroneal nerve results in anesthesia of the lateral aspect of the leg and weakness in eversion and plantarflexion of the foot. The deep peroneal nerve travels in the anterior compartment of the leg, and gives branches to the tibialis

anterior, extensor hallucis longus, and extensor digitorum longus and brevis, as well as peroneus tertius. The sensory distribution of the deep peroneal nerve is in the area of the first web space. Injury to the deep peroneal nerve causes weakness in dorsiflexion of the foot.

The sural nerve travels on the posterior aspect of the leg between the lateral malleolus and calcaneus. It provides sensation to the lateral aspect of the foot, and does not have a motor component. It is commonly sampled in nerve biopsy and used as a source of nerve graft. Injury or sacrifice of the sural nerve would result in numbness of the lateral foot.

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92. A 50-year-old woman comes to the emergency department because of a stab wound to the right forearm. A photograph is shown. She is taken to the operating room and general anesthesia is administered. Which of the following is the most appropriate examination, in this intubated patient, to assess for tendinous injuries to the fingers?

- A) Passively extend the fingers
- B) Passively extend the wrist
- C) Passively flex the fingers
- D) Passively flex the wrist
- E) Place hand in cold water

The correct response is Option D.



This patient has sustained a dorsal mid forearm laceration. Common injuries within this location include injuries to the musculotendinous units of the extensors to the wrist, fingers, and thumb. Additionally, the radial sensory nerve and dorsal branch of the ulnar nerve could be injured depending on the location and vector of the object that caused the injury. Passive flexion as demonstrated in the photograph demonstrates the effect of tenodesis. With passive wrist flexion, intact digital extensors should be put under tension and bring the metacarpophalangeal joints into extension. However, in this patient the long and ring fingers do not extend with wrist flexion.

In an uninjured hand, when the wrist is passively flexed the fingers and thumb will extend. With wrist extension, the fingers are brought into flexion and the thumb is brought toward the small finger.

Bringing the wrist into extension would help with a volar wound as it would help establish injuries to digital flexors.

Putting the hand in cold water is a better test for sensory nerve injury as loss of wrinkling will be demonstrated.

Passive flexion or extension of the fingers will not reliably demonstrate which specific tendons are injured in this patient.

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93. An 8-year-old girl is brought to the office because of severe, worsening pain as well as finger swelling and numbness three days after she underwent cast placement for a fracture of the left forearm. After removal of the cast, her pain continues and is worsened by passive wrist motion. Which of the following is the most appropriate next step in assessment of this patient's condition?

- A) Angiography
- B) CT scan
- C) Duplex ultrasound
- D) Electromyography
- E) Manometry

The correct response is Option E.

The most appropriate next test is manometry. The patient is exhibiting signs of compartment syndrome after swelling due to fracture under a tight restrictive cast. Signs and symptoms of compartment syndrome include pain with passive stretch, increased pressure on palpation, paresthesia, paralysis, pallor, and pulselessness.

Early recognition and treatment are necessary to prevent permanent damage. The pressure within the muscles increases, preventing blood flow to the area and capillary exchange of nutrients. Fasciotomy is recommended if compartment pressure exceeds 30 mmHg, or if the difference between intracompartmental pressure and diastolic blood pressure is less than 30 mmHg. Without treatment, ischemic necrosis to the muscles can result, leading to Volkmann ischemic contracture and causing permanent disability. Scarring and shortening of the muscles can occur, with resultant contracted intrinsic minus appearance of the hand.

Compartment pressures can be measured by handheld manometer (Stryker pen), or needle manometer method (Whitesides) with an arterial line setup. Operative fasciotomy is indicated to release the compartment pressures and prevent tissue loss and muscle necrosis in cases of compartment syndrome. Loss of pulse typically occurs later in the spectrum of findings.

Angiography would be useful in evaluating vasculature and blood flow. Typically pain with passive stretch does not occur in cases of arterial insufficiency.

Duplex ultrasound can evaluate the presence of deep venous thrombosis, which can be a source of pain and swelling. This can occur through compression of the antecubital region, but in this case, the symptomatology would prompt measurement of compartment pressures and urgent fasciotomy.

Electromyography can be used to evaluate nerve function but would not be the next appropriate measure.

CT scan can provide detailed imaging but would not be indicated in this situation and would delay treatment.

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94. A 21-year-old man undergoes reconstruction with a free flap. Photographs are shown. This procedure places the patient at risk for claw toe with loss of active flexion of the great toe. The muscle responsible for this functional loss is located in which of the following compartments in the lower leg?

- A) Anterior
- B) Deep posterior
- C) Lateral
- D) Superficial posterior

The correct response is Option B.

Claw toe or loss of active flexion of the great toe interphalangeal joint can result from harvest of the flexor hallucis longus for free fibula flaps. The flexor hallucis longus is present within the deep posterior compartment of the lower leg and should be resuspended

to the interosseus membrane and posterior tibial muscles as needed to maintain proper tension. Physical therapy is initiated after adequate wound healing to maintain the mobility of the great toe and ankle. The deep posterior compartment musculature is composed of the tibialis posterior, the flexor digitorum longus, the flexor hallucis longus, and the popliteus.

The superficial posterior compartment musculature is composed of the gastrocnemius, soleus, and plantaris.

The anterior compartment musculature is composed of the tibialis anterior, the extensor digitorum longus, extensor hallucis longus, and the peroneus tertius.

The lateral compartment musculature is composed of the peroneus longus and brevis muscles.

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95. A 54-year-old woman sustains an open fracture of the right ankle in a motorcycle collision. Flap coverage of the associated distal-third leg wound is planned. Which of the following is the most significant advantage of using a fasciocutaneous flap instead of a muscle flap?
- A) Better fill of dead space
 - B) Higher flap survival rate
 - C) Improved clearance of osteomyelitis
 - D) Less donor site morbidity
 - E) Quicker dissection

The correct response is Option D.

Muscle flaps were “workhorses” for lower extremity reconstruction for years, but harvest of muscle always leaves some donor site functional morbidity because of loss of the muscle function. Survival rates, speed of dissection, and treatment of osteomyelitis are not significantly different between the flap types. Muscle flaps tend to fill dead space easier than fasciocutaneous flaps.

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96. A 24-year-old man presents for reconstruction of an open tibial fracture. Examination of the middle third of the leg demonstrates circumferential loss of skin with exposure of the tibial fracture site. The patient's foot is pink and warm and the toes demonstrate 3-second capillary refill. Preoperative duplex ultrasound imaging shows that there is no flow of the peroneal and anterior tibial arteries distal to the injury site. Which of the following is the most appropriate Gustilo classification for this injury?

- A) I
- B) II
- C) IIIA
- D) IIIB
- E) IIIC

The correct response is Option D.

Although there are defined vascular injuries in this patient, this wound falls within the Gustilo IIIB category as there is an open fracture with soft tissue defect and a perfused foot through the posterior tibial artery. Gustilo IIIC injuries include a vascular injury requiring repair, which is not the case in this patient.

For review:

Gustilo Classification of Open Fractures	
I	Open fracture with wound <1cm
II	Open fracture with wound >1cm without extensive soft tissue damage
IIIA	High energy; wound >1cm; adequate soft tissue coverage
IIIB	High energy; wound >1cm; inadequate soft tissue coverage with periosteal stripping and bone exposure
IIIC	High energy; wound >1cm; vascular injury requiring repair

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97. A 55-year-old Caucasian man comes to the office for evaluation of a pigmented streak of the left thumb and index fingernails. Medical history includes a minor crush injury to the thumb one year ago that required no treatment. Examination shows a 4-mm-wide pigmented streak in both digits that extends from the eponychial fold to the tip of the sterile matrix. The patient reports that the pigmented areas have become darker over time. Which of the following clinical features is most consistent with a benign lesion?

- A) Age greater than 50 years
- B) Change in color over time
- C) Involvement of more than one digit
- D) Pigmentation involving the periungual skin
- E) Width greater than 3 mm

The correct response is Option C.

Subungual melanoma is a relatively rare melanoma subtype accounting for 0.7 to 3.5% of all melanomas. Because of the location, appearance, and unique anatomy of the nail unit, subungual melanomas are often diagnosed late in more advanced stages than typical cutaneous melanoma. There is disagreement as to whether subungual melanomas behave more aggressively than cutaneous melanomas of comparable depth. In addition, it can be difficult to distinguish subungual melanomas from benign melanonychia.

Characteristics that are concerning for subungual melanoma are: age 50 to 70, longitudinal band greater than 3 mm or irregular border, change of lesion size or coloration, extension onto periungual skin (Hutchinson sign), personal or family history of melanoma, and single finger involvement.

Benign melanonychia is more common in dark-skinned patients. The differential diagnosis of subungual pigmentation includes subungual hematoma, onychomycosis, and Addison disease among others.

In this case, multiple digit involvement is the clue that the lesions are benign. All other characteristics could be consistent with malignant melanoma. If there is concern for subungual melanoma, a full-thickness biopsy of the pigmented area should be performed.

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98. A 42-year-old man presents with an open tibia fracture sustained during a motor vehicle collision 4 hours ago. Physical examination shows a 3-cm puncture wound at the fracture site, no dirt or debris in the wound, and no exposed bone. X-ray studies show a transverse fracture of the tibia and fibula without comminution. Which of the following is the appropriate initial antibiotic coverage?
- A) First generation cephalosporin
 - B) First generation cephalosporin, aminoglycoside, and penicillin
 - C) First generation cephalosporin and aminoglycoside
 - D) Third generation cephalosporin
 - E) Third generation cephalosporin, aminoglycoside, and penicillin

The correct response is Option A.

The Gustillo-Anderson classification system is used to grade open fractures based on the extent of bone and soft tissue injury, and the extent and nature of wound contamination. Aggressive debridement, administration of prophylactic antibiotics, application negative pressure dressing while the wound is open, and early definitive wound coverage (less than 5 days) reduces the infection risk. The open fracture described is a grade II injury and a first-generation cephalosporin alone provides appropriate antibiotic coverage. A concurrent vascular or neural injury or gross contamination could escalate this into a grade III injury, but there is no mention of these factors in the clinical scenario described.

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99. A 55-year-old woman is brought to the emergency department after sustaining mutilating injury to the hand during a motor vehicle collision. Examination shows the hand is unsalvageable. Disarticulation of the wrist is planned. Compared with transradial amputation, which of the following is the most likely benefit of this approach?

- A) Better accommodation of a myoelectric unit
- B) Better forearm pronation and supination
- C) Decreased risk of neuroma formation
- D) Decreased risk of prosthetic abandonment
- E) More stable soft-tissue envelope

The correct response is Option B.

The choice of wrist disarticulation compared with transradial amputation is a controversial one. The primary benefit of the wrist level disarticulation is preservation of the distal radioulnar joint and consequential improvement in forearm rotation. Preservation of the metaphyseal flare of the radius may aid in prosthetic fit; however, the additional length associated with functional units such as myoelectrics may result in a limb length discrepancy. The prominence of the distal radius and ulna may predispose to pressure-related wound issues associated with prosthetic wear. Patients with wrist level disarticulation are more likely to abandon their prosthesis compared with transradial amputees.

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100. Congenital constriction band syndrome is responsible for which of the following percentages of all congenital upper limb defects?

- A) 6%
- B) 12%
- C) 18%
- D) 24%
- E) 30%

The correct response is Option B.

Constriction band syndrome and amniotic band sequence are the terms applied to a wide range of congenital anomalies, most typically limb and digital amputations and constriction rings which occur in association with fibrous bands. These classic syndromic birth defects represent disruptions and do not occur along the known lines of embryologic development. It has been proposed that the birth defects are caused by the action of the fibrous amniotic bands in association with a rupture of the amnion at early stage of pregnancy, which was later referred to as the “extrinsic theory.” In this theory, low amniotic fluid level plays a major role in the development of constriction rings. This has become the more widely accepted theory. However, many cases are associated with birth defects not readily explained by the mechanism of fibrous strings entangling body parts and causing disruption of fetal structures. A subset of cases manifests with cleft lip and palate (CLP), congenital heart defect, and renal anomalies. There are also case reports of children presenting with polydactyly, supernumerary nipples, and skin tags suggesting a genetic origin.

Based on a study on 419 upper limb defects and 171 lower limb defects occurring among 753,342 births in Finland during 1993 to 2005, constriction band syndrome comprises approximately 12% of all congenital upper limb defects and 14% of lower limb defects. Other skeletal and non-skeletal anomalies were present in 30% of the affected children, suggesting a possible genetic etiology.

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Section 3: Craniomaxillofacial



101. An 8-year-old boy is brought to the office with a congenital abnormality of the ear. A photograph is shown. When the ear is pulled on traction, the upper pole cartilage becomes visible under the skin. This abnormality is most likely caused by which of the following?
- A) Anomaly of the intrinsic postauricular muscles
 - B) Effacement of the scaphofossa
 - C) Formation of a third antihelical crus
 - D) Hemifacial microsomia
 - E) Intrauterine pressure

The correct response is Option A.

This patient has cryptotia of the ear. It is also known as pocket ear. The upper part of the ear is adherent and the cartilage is buried under the skin in a pocket. Other deformities may be present, such as a missing upper sulcus, underdeveloped scapha, and antihelical crura.

It is caused by an anomaly of the intrinsic oblique and transverse auricular muscles.

Surgical treatment requires release from the pocket and resurfacing of the post- and retroauricular defects. In some cases otoplasty may be required for normalization. A number of techniques are described.

Intrauterine pressure may cause ear deformities, which may spontaneously resolve or are amenable to neonatal molding techniques. It does not cause cryptotia.

Stahl ear is associated with formation of a third antihelical crus.

Hemifacial microsomia is associated with microtia. Microtia is sometimes the only manifestation of hemifacial microsomia, but subtle clinical findings are often present, such as mild facial nerve weakness or soft tissue hypoplasia on the involved side.

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102. A 6-month-old female infant presents with a wide, tall forehead, low-set ears, and supraorbital rim retrusion. CT scan demonstrates bicoronal synostosis. Genetic testing is positive for *TWIST* mutation. Which of the following additional findings is/are characteristic of this patient's disorder?
- A) Cervical spine anomalies
 - B) Complete cartilaginous tracheal rings
 - C) Eyelid ptosis
 - D) Gastroschisis
 - E) Thumb duplication

The correct response is Option C.

The patient described has Saethre-Chotzen syndrome as confirmed by bilateral coronal synostosis, low-set ears, and mutations of the *TWIST* gene. In addition to these findings, patients with Saethre-Chotzen syndrome often have eyelid ptosis, which is a distinguishing feature from other forms of syndromic craniosynostosis. It is important to recognize ptosis in infants and young children in order to maintain adequate visual pathway development. Thumb duplication is not found in patients with Saethre-Chotzen syndrome. Tracheal anomalies are associated with Pfeiffer syndrome. Cervical spine anomalies can be found in both Apert and Pfeiffer syndromes. Gastroschisis is not associated with syndromic craniosynostosis.

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103. Which of the following disorders is most likely to be successfully treated with botulinum toxin type A?

- A) Bruxism
- B) Cervical paroxysmal dyskinesia
- C) Hemifacial dyskinesia
- D) Tardive dyskinesia
- E) Vertical maxillary excess

The correct response is Option C.

Botulinum toxin type A has good evidence demonstrating efficacy for the treatment of blepharospasms, hemifacial dyskinesia, cervical dystonia, post-stroke upper limb spasticity (not from paroxysmal dyskinesia—see below).

Bruxism is clenching/grinding of teeth and jaw and can occur either awake or asleep. Treatment includes splint therapy and pharmacotherapy. There have been published reports using botulinum toxin type A. However, while the amplitude of muscle contraction was decreased, it did not decrease the rhythm or number of bruxism episodes. At this time, there is no evidence that it is an effective treatment.

Tardive dyskinesia develops as a result of adverse effect of anti-psychotic medication. Botulinum toxin type A, which consists of VMAT2 (vesicular monoamine transporter 2) inhibitor such as deutetrabenazine or valbenazine, is not indicated in its treatment.

Paroxysmal dyskinesia is considered an immune-related movement disorder. It mainly affects the limbs but can also affect cervical muscles. Treatment includes systemic antibiotics, corticosteroids, and immune therapy such as rituximab. Botulinum toxin type A is not indicated.

Vertical maxillary excess is not treated with botulinum toxin type A.

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104. A 6-year-old boy with microtia is evaluated for single-staged alloplastic reconstruction. In addition to the prosthesis itself, discussing with the parents soft-tissue reconstruction should focus on tissues dependent on which of the following vasculature?

- A) Facial
- B) Occipital
- C) Submental
- D) Superficial temporal
- E) Supraorbital

The correct response is Option D.

Although alloplastic reconstruction can be successfully performed in a single stage, 3D printed, and still allow for atresia repair, there is still a soft-tissue component that needs to be addressed. In general, the superficial temporal/temporoparietal fascia flap is the work-horse flap and is based on the superficial temporal vasculature. This requires incisions into the hair-bearing scalp; alopecia and irregular parting of the hair are possible negative outcomes. Additional skin grafting must also be discussed. The other vasculature listed is not directly important for this type of surgery.

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105. An 8-year-old boy with congenital right facial hemiparesis is seen in consultation for possible facial reanimation. MRI shows absence of a right facial nerve trunk. A two-stage cross-facial nerve grafting procedure is planned. A sural nerve graft coapted to a buccal branch of the facial nerve with 10-0 nylon is planned. Which of the following factors will have the greatest influence on the outcome of this procedure?
- A) Advanced patient age
 - B) Donor nerve axon density
 - C) Duration of hemiparesis
 - D) Length of obturator nerve pedicle
 - E) Method of nerve coaptation

The correct response is Option B.

While reanimation techniques have been proposed to restore function in nearly every part of the face, the most well-studied and reliable are for restoration of the smile. There are two primary operations to restore a dynamic smile: the two-staged cross-facial nerve graft and the single-stage transfer using nerve to the masseteric branch of the trigeminal nerve. Both utilize free muscles transfer and the gracilis muscle has become the gold standard donor for most surgeons. This muscle is favored largely because it boasts excellent muscle contraction characteristics with limited bulkiness, but it also boasts an anatomically consistent vascular pedicle, a long donor nerve (obturator), and no functional impact from its harvest. The two-stage procedure is well described and utilizes a nerve graft(s), usually sural, coapted to branches of the buccal or zygomatic branches of the facial nerve at or just distal to the anterior edge of the parotid gland. Although various factors can influence the outcome of this procedure, several recent studies highlight the importance of donor nerve (i.e., buccal or zygomatic branches) axonal density. While the results of two-stage facial reanimation in older patients (i.e., adults, especially older adults) are typically inferior to pediatric patients, there is no evidence that age is a major factor in children under 10 years of age. Unlike a patient with acquired or traumatic facial nerve injury, the duration of paralysis has no bearing in this patient with a paralysis secondary to facial nerve agenesis since the muscles of facial animation on the right side would be absent or fibrotic as well. The length of the obturator nerve and method of nerve coaptation would have no effect on the outcome.

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106. A 47-year-old Caucasian man comes to the office regarding a painful enlarging mass at the base of the tongue. He does not smoke cigarettes. The lesion measures 4.5 cm. A biopsy of the lesion is performed and shows (+) p16 staining, nonkeratinized squamous cell carcinoma. Further imaging and workup demonstrate an ipsilateral solitary lymph node measuring 2.3 cm. No distal metastatic disease is found. Which of the following best describes the stage of his disease?

- A) Stage 1
- B) Stage 2
- C) Stage 3
- D) Stage 4

The correct response is Option B.

Table 3. AJCC (8th Edition) Prognostic Stage Groups for HPV-Associated (p16+) OPSCC (Pathologic)			
T Category	N Category	M Category	Stage Group
T0,T1, or T2	N0, N1	M0	I
T0,T1, or T2	N2	M0	II
T3 or T4	N0, N1	M0	II
T3 or T4	N2	M0	III
Any T	Any N	M1	IV

AJCC = American Joint Committee on Cancer; HPV = human papillomavirus; OPSCC = oropharyngeal squamous cell carcinoma.

The correct answer is Stage 2. Previously, this patient would have been Stage 3. The American Joint Committee on Cancer (AJCC) revised its staging system for squamous cell cancers that stain p16 positive. These lesions are related to the human papillomavirus

(HPV) and have been found to be less virulent tongue base or oropharyngeal cancers. Recent studies have demonstrated that 5 year survival difference for patients with Stage 4 disease as <50% for HPV-negative patients and >70% for HPV-positive patients, thus prompting the AJCC to study and revise the staging system for HPV-positive oropharyngeal cancers. These lesions tend to be more sensitive to radiation therapy and chemoradiation and a better prognosis overall. Patients with HPV-related squamous cell cancers tend to be younger, male, and Caucasian. HPV-related squamous cell cancers now represent the majority of newly diagnosed oropharyngeal carcinomas in the United States. This new staging system for HPV (+) related cancers went into effect 1/1/2017.

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107. A 65-year-old woman has a 1.25-cm defect of the alar rim after undergoing Mohs micrographic surgery for basal cell carcinoma. There is a skin and cartilage defect. Which of the following is the most appropriate method for reconstruction?

- A) Composite grafting
- B) Full-thickness skin grafting
- C) Healing by secondary intention
- D) Primary closure
- E) Use of an alar advancement rotation flap

The correct response is Option A.

In this case, the patient has a defect of the alar rim. Healing by secondary intention or direct closure can only be used in cases with a defect of less than 0.25 cm and not near the rim.

A full-thickness skin graft would not be adequate to reconstruct the three-dimensional nature of the defect and does not address the cartilage loss.

An alar advancement flap could be used in smaller defects (less than 1 cm) but is unlikely to work in a defect of this size.

In alar rim defects of 1 to 1.5 cm, composite grafts, nasolabial flaps, or other local flaps may be considered. Forehead flaps in combination with cartilage grafts could be used for large defects (1.5 cm or greater).

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108. A 22-year-old man is evaluated because of a painless, firm, unilateral enlarging mass of the body of the mandible. He denies trauma to the area and he has excellent oral hygiene. His dentist performed fine needle biopsy that showed multinucleated giant cells. CT scan shows a radiolucent bone lesion with an expanded cortex. Which of the following is the most appropriate next step in management?

- A) Incisional biopsy
- B) Partial mandibulectomy with free margins
- C) Radiation therapy
- D) Resection and curettage
- E) Sclerotherapy

The correct response is Option D.

This patient has an aneurysmal bone cyst (ABC). These lesions may be related to giant cell granulomas. These lesions are most common in the long bones with 1.9% of them being reported in the mandible.

The correct answer is resection and curettage. In a study of 120 ABC cases, resection and curettage was reported to have a 91.8% success rate (recurrence occurred in 11 out of 120 cases). Incomplete resection is hypothesized to be a cause of recurrence. Recurrence was not related to histopathologic parameters.

Pathologically, these lesions are a pseudocyst comprised of multinucleated giant cells, woven trabecular bone with caverns, and sinusoids lacking endothelium. Recurrence can be treated with repeat excision curettage, open packing, or block resection. These lesions are quite vascular and typically bleed until resected, so expeditious removal is recommended (transfusion with packed red blood cells has been reported in the literature).

Incisional biopsy would be diagnostic but is not recommended for these lesions given their vascularity and the surgeon's inability to control the bleeding.

Sclerotherapy is recommended for vascular malformations such as arteriovenous malformations, venous malformations, or lymphatic malformations. This lesion would not be responsive to this type of therapy.

Partial mandibulectomy with free margins is the preferred treatment for lesions like ameloblastomas. Given the efficacy of excision and curettage, mandibulectomy is not the recommended first line treatment for this diagnosis. It can be employed in recurrences (although as stated above, less aggressive interventions are typically employed first).

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109. A 35-year-old woman, gravida 1, para 2, with a history of bilateral cleft lip and palate comes to the office to discuss her risk for having a child with clefting. She reports that one of her twin children had a unilateral cleft lip and palate, and the other child did not have clefting but did have indentations of the lower lip. She reports no other history of clefting in her family, her husband, or her husband's family. The likelihood that her next child will have a cleft lip and/or palate is closest to which of the following percentages?

- A) 2.5%
- B) 4%
- C) 10%
- D) 17%
- E) 50%

The correct response is Option E.

The diagnosis for this patient is Van der Woude syndrome. Van der Woude syndrome is the most common syndrome associated with cleft lip with or without cleft palate. It is inherited in an autosomal dominant manner with incomplete penetrance, thus clinical presentation for patients with Van der Woude syndrome is variable. This patient has a de novo mutation, since no other family members reported clefting. Morphology for these patients can range from lip pits to bilateral complete cleft lip and palate. Van der Woude syndrome is most commonly related to mutations in interferon regulatory factor 6 (IRF6). Since this is an autosomal dominant condition, the best estimate for this woman's next child to be affected is 50%.

The other percentages are all reported in the literature and are related to non-syndromic clefting and familial patterns. If there is one affected sibling with an isolated cleft lip, the risk factor is 2.5%. If there is one affected sibling with a unilateral cleft lip and palate, the risk factor is 4.2%. If there are two affected siblings, the risk factor is 10%. If parental cleft and sibling clefting are present, the risk factor has been reported at 17%.

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110. A 44-year-old woman has a malignancy of the nasopharynx. She does not smoke cigarettes or drink alcohol. Which of the following viruses is the most common cause of this patient's malignancy?
- A) Epstein-Barr virus (EBV)
 - B) Herpes simplex virus (HSV)
 - C) Human immunodeficiency virus (HIV)
 - D) Human papillomavirus (HPV)
 - E) Human T-lymphotrophic virus-1 (HTLV-1)

The correct response is Option A.

There is ongoing investigation into the pathogenesis of infectious agents in cancer formation. Although increasing attention is focused on the relationship between HPV and head and neck cancers, HPV strains 16 and 18 are associated with the oropharynx, not nasopharynx location. In contrast, the Epstein-Barr virus (EBV) is associated specifically with nasopharyngeal cancers as well as Burkitt lymphoma. The other viruses listed are not routinely associated with head and neck cancers.

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- 2. Mallen-St Clair J, Alani M, Wang MB, Srivatsan ES. Human papillomavirus in oropharyngeal cancer: The changing face of disease. *Biochim Biophys Acta*. 2016 Dec; 1866(2): 141-150.



111. A 9-year-old boy is brought to the office for evaluation of a nodule on the neck that appeared 1 week ago. The nodule measures 2 cm and is slightly to the right of midline. A photograph is shown. The lesion is slightly tender. Which of the following is the most appropriate management of this lesion?
- A) Excision of lesion with any tract and a section of hyoid bone
 - B) Excision of lesion with any tract and a section of thyroid cartilage
 - C) Excision of lesion with any tract only
 - D) Fine-needle aspiration with cytology
 - E) Intralesional sclerotherapy under image guidance

The correct response is Option A.

Thyroglossal duct cysts are neck lesions that usually present during childhood, often after a localized inflammation or infection. They are usually neck lesions near the midline. Some may move with swallowing if they are close to the base of the tongue, but not all exhibit this finding. The congenital thyroglossal duct is the remnant of the descent of the developing thyroid gland, and it runs from the foramen cecum of the base of the tongue, down to the thyroid. Imaging is typically by ultrasound, but other modalities, including radioisotope scans to rule out ectopic thyroid tissue or confirm the location of the normal thyroid gland, have been suggested to avoid excising ectopic thyroid gland.

The Sistrunk procedure shows less recurrence and is a complete excision, including any associated tract, and about a 1-cm section of hyoid bone. Although proposed in 1928, this is still the most commonly recommended approach for thyroglossal duct cysts.

Fine-needle aspiration is appropriate for thyroid nodules, which are unlikely to present in an acute manner in this population.

Sclerotherapy is used for vascular anomalies and likely would have presented earlier on in childhood.

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3. Li WY, Reinisch JF. Cysts, pits, and tumors. *Plast Reconstr Surg*. 2009 Jul;124(1 Suppl):106e-116e.

112. Which of the following best describes the main difference between the Nagata and Brent techniques of ear reconstruction for microtia?
- A) Nagata is performed at 5 years of age, while Brent is only performed around 12 years of age
 - B) Nagata is performed in two stages, while Brent is performed in three or more
 - C) Nagata uses a microvascular omental flap, while Brent only uses local tissue
 - D) Nagata uses a porous polyethylene framework, while Brent uses autologous cartilage
 - E) Nagata uses local tissue for framework reconstruction, while Brent uses autologous cartilage and iliac crest bone

The correct response is Option B.

The primary advantage of the Nagata technique is that it typically uses fewer stages than the Brent technique. The principle difference between the two approaches lies in how the lobule and the tragus are reconstructed. In the traditional Brent sequence, lobule creation/elevation and tragal reconstruction are separate stages, while in the Nagata approach, these are created/elevated during the same stage as framework implantation.

Although microvascular techniques may be added as adjunct procedures to a particular approach, they are typically used as a salvage method for a secondary reconstruction if there is framework exposure or loss in either technique.

The Nagata and Brent techniques use autologous rib cartilage for framework reconstruction. Neither technique routinely uses iliac crest bone. The Reinisch technique is a more recently described approach to microtia ear reconstruction and uses a porous polyethylene implant, but the Brent and Nagata techniques have typically used autologous costal cartilage for the framework.

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2. Baluch N, Nagata S, et al. Auricular Reconstruction for Microtia: A Review of Available Methods. *Plast Surg (Oakv)*. 2014 Spring; 22(1): 39-43.

113. A 65-year-old man develops a hemorrhagic stroke requiring decompressive craniotomy. The bone is found to be unusable and a customized polyetheretherketone prosthesis is planned. Which of the following is the most common complication of using this material?

- A) Cerebrospinal fluid leak
- B) Contour deformity
- C) Dehiscence
- D) Hematoma
- E) Infection

The correct response is Option E.

Reports on using polyetheretherketone (PEEK) as an alloplast for cranial reconstruction vary in terms of outcomes and complications. The larger studies conclude that it is a reliable material compared with other alloplastic alternatives and has the advantage of being custom made for a variety of craniofacial defects. However, infection remains the most common complication, and choosing this material should be weighed against the risk for microorganism seeding through, wound dehiscence, hematogenous spread, or indolent colonization of the wound bed.

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3. Jonkergouw J, van de Vijfeijken SE, Nout E, et al. Outcome in patient-specific PEEK cranioplasty: A two-center cohort study of 40 implants. *J Craniomaxillofac Surg*. 2016 Sep;44(9):1266-72.

114. A 5-year-old girl is evaluated because of acute onset of unilateral facial paralysis including inability to close the left eyelid, lack of smiling, and inability to lift the ipsilateral brow. Which of the following is the most likely cause of this patient's paralysis?
- A) Acute otitis media
 - B) Bell palsy
 - C) Cerebrovascular accident
 - D) Neoplasm
 - E) Trauma

The correct response is Option A.

The major cause of acute facial nerve paralysis in children is infection, with the majority being a complication of acute otitis media.

Trauma is not an uncommon cause, and in the neonatal period is usually from a traumatic delivery. In older children, sports or motor vehicle collisions are common traumatic causes. Both populations overall have an excellent prognosis for recovery unless penetrating trauma has occurred, which necessitates surgical repair. Bell palsy is a diagnosis of exclusion when no other causes are found and is less common in children. Tumors rarely cause facial nerve weakness in children. Congenital facial nerve paralysis is present since birth and would not present acutely. Cerebrovascular accident is a rare cause in children.

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3. Karalok ZS, Taskin BD, Ozturk Z, et al. Childhood peripheral facial palsy. *Childs Nerv Syst*. 2018 Feb 9. (Epub ahead of print)

115. A 4-year-old boy is referred to the clinic for evaluation. Medical history includes a cardiac defect requiring surgery, submucous cleft palate, hypernasality, and developmental delay. His parents report that he undergoes cardiology follow-up annually. Further testing is most likely to detect an abnormality that will require consultation with which of the following specialties?

- A) Endocrinology
- B) Gastroenterology
- C) Immunology
- D) Nephrology
- E) Psychiatry

The correct response is Option C.

The patient described has 22q11.2 deletion syndrome (formerly known as velocardiofacial syndrome or DiGeorge syndrome). This syndrome is the most common chromosomal deletion error in fetuses, with a prevalence of 1 in 3000 to 6000 live births. 22q11.2 Deletion syndrome is a common cause of hypernasality. Children with congenital heart defects and hypernasality should be worked up for 22q11.2 deletion syndrome. Either a FISH probe or microarray can detect the chromosomal deletion that occurs in the LCR22A–LCR22D region of the chromosome.

Children with 22q11.2 deletion syndrome can present with a myriad of clinical manifestations. The most common clinical manifestation is a congenital cardiac defect, particularly of the outflow tracts (e.g., tetralogy of Fallot). Congenital cardiac disease remains the primary cause of mortality in this patient population.

Hypernasality is another common finding within this patient population, occurring in approximately 65% of patients with 22q11.2 deletion syndrome. Classic workup for this involves imaging of the velopharyngeal mechanism (either nasopharyngoscopy or video fluoroscopy) and imaging of the posterior pharyngeal pharynx with MRI and evaluation of aberrant/medialization of the internal carotid arteries.

Immunologic abnormalities are the most common of the group. A referral to immunology should be initiated in all patients with 22q11.2 deletion syndrome since up to 75% of this patient population can have thymic hypoplasia and diminished T cell production. Children

with 22q11.2 deletion syndrome can have chronic infections and poor responses to vaccinations.

Gastrointestinal conditions such as poor feeding, gastroesophageal reflux, and vomiting or constipation occur in approximately 30% of patients with 22q11.2 deletion syndrome. More concerning GI conditions such as malrotation or tracheoesophageal fistula have been found in patients with this syndrome.

Hypocalcemia secondary to hypoparathyroidism can present as tetany, seizures, or feeding issues. Hypocalcemia presents in approximately 50 to 65% of patients with 22q11.2 deletion syndrome. Thyroid function can also be abnormal with hypothyroidism possible.

Nephrology consultation should be considered if abdominal ultrasonography shows renal agenesis, duplication of the collecting system, or cystic kidney disease. About 33% of patients with 22q11.2 deletion syndrome have some abnormality related to the genitourinary system.

Patients with 22q11.2 deletion syndrome are at increased risk for psychiatric disorders such as attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder, and anxiety (particularly when they progress into adulthood). The rate of schizophrenia is increased in this patient population compared with unaffected individuals.

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2. McDonald-McGinn DM, Sullivan KE. Chromosome 22q11.2 deletion syndrome (DiGeorge syndrome/velocardiofacial syndrome). *Medicine* (Baltimore). 2011 Jan;90(1):1-18.
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116. A 32-year-old man comes to the emergency department after being hit in the right eye. Examination shows enophthalmos, hyphema, and numbness over the cheek. There is no diplopia. CT scan shows a large orbital floor fracture with herniation of contents into the maxillary sinus. Which of the following findings requires urgent management?

- A) Cheek numbness
- B) Enophthalmos
- C) Hyphema
- D) Maxillary sinusitis
- E) Orbital floor fracture

The correct response is Option C.

Hyphema is marked by presence of blood in the anterior chamber and is an emergent concern. It can lead to permanent damage to the vision. All the other options are urgent concerns but can be addressed after the hyphema is treated.

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2. Kim HS, Jeong EC. Orbital Floor Fracture. *Arch Craniofac Surg*. 2016 Sep; 17(3):111-118.

117. A 40-year-old woman undergoes surgery for a right parotid tumor observed to be invading the facial nerve. During surgery, a segment of facial nerve is resected, resulting in a 5-cm gap from the main trunk to the distal branches. Which of the following is the most appropriate treatment for this patient?
- A) Cable nerve graft repair
 - B) Cross-facial nerve grafting
 - C) Masseteric nerve to facial nerve transfer
 - D) Reconstruction with an innervated gracilis muscle free flap
 - E) Temporalis tendon transfer

The correct response is Option A.

When a facial nerve has been divided or resected, the best outcomes for regaining function are usually obtained from direct repair or cable nerve grafting. Facial motor nerve recovery is observed even in cancer patients who have preoperative weakness and who receive postoperative radiation therapy.

When this is not possible, for example, when the nerve has been resected very proximally, up to the intracranial portion of the nerve, cross-facial nerve grafting between redundant branches of the normal contralateral nerve and the distal facial nerve stumps of the paralyzed side can produce excellent results with spontaneous symmetrical facial movement. In a patient with long-standing facial paralysis, cable nerve grafting or cross-facial nerve grafting will not be successful because the motor endplates of the distal facial nerve have degenerated. Performing a nerve transfer from a donor nerve, such as the masseteric (V), spinal accessory (XI), or hypoglossal (XII) nerves can provide facial tone and symmetry at rest, and, in some cases, volitional movement with training. When nerve repair or nerve transfers from the contralateral face or donor nerves are not feasible, innervated free muscle flap transfers can restore facial movement to the lower face. Muscles commonly used for facial reanimation include the gracilis, pectoralis minor, serratus anterior, and latissimus dorsi, due to their thinness, good excursion, and low donor site morbidity. In addition to a microvascular anastomosis, an epineural nerve repair is performed either to a cross-facial nerve graft or a donor cranial nerve such as the masseteric nerve. In patients who are not candidates for free muscle transfer or who refuse it, temporalis tendon slings can be used to suspend the face, usually at the oral commissure, to improve facial symmetry and function.

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1. Green B, Rahimi S, Brennan PA. Salivary gland malignancies –an update on current management for oral healthcare practitioners. *Oral Disease*. 2016 June;22:735-739.
2. Seethala RR. Salivary gland tumors: current concepts and controversies. *Surg Pathol Clin*. 2017 Mar;10(1):155-176.

118. A 45-year-old male fitness instructor has squamous cell carcinoma of the oral cavity requiring reconstruction with a soft-tissue free flap. The patient is very concerned about maintaining all muscular function at the flap donor site. To address the patient's concern, which of the following fasciocutaneous flaps should be used for reconstruction to minimize muscular donor site morbidity?
- A) Anterolateral thigh flap
 - B) Deep inferior epigastric artery perforator flap
 - C) Medial sural artery perforator flap
 - D) Parascapular flap
 - E) Profunda artery perforator flap

The correct response is Option D.

The benefit of perforator flaps over traditional musculocutaneous flaps is the ability to preserve muscle at the donor site. Depending on perforator anatomy, it can either traverse between surrounding myofascial units requiring no muscle sacrifice, or alternatively pass through the muscle substance requiring division of a small amount of muscle to liberate the flap. The anterolateral thigh (ALT) or deep inferior epigastric artery perforator (DIEP) flaps have variable perforator anatomy containing either septal or muscular perforators, or both within the same flap. The profunda and medial sural artery perforator flaps have vessels that pierce the adductor magnus and gastrocnemius muscles, respectively. Of the options listed, only the parascapular flap consistently has a septal perforator located between the teres major, teres minor, and the triceps.

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- 2. Wei and Mardini. *Flaps and Reconstructive Surgery*. 1st ed. Philadelphia, PA: Elsevier Health Sciences; 2009: 326.

119. Which of the following is the prevalence of middle ear effusion in patients with isolated cleft palate?

- A) 10%
- B) 30%
- C) 50%
- D) 70%
- E) 90%

The correct response is Option E.

Over 90% of patients have chronic infection of the middle ear prior to repair. As a result of this fact, 100% of patients with cleft palate should be screened for hearing loss and for fluid in the middle ear due to eustachian 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. However, what is clear, is that the cleft patient population is at risk for chronic infection of the middle ear. Unfortunately, if this condition is unrecognized, elements of preventable hearing loss will occur.

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3. Paradise JL, Bluestone CD, Felder H. The universality of otitis media in 50 infants with cleft palate. *Pediatrics*. 1969 Jul;44(1):35-42.

120. A 65-year-old man who wears glasses sustained a massive injury to the left side of the face causing a ruptured globe with total loss of the upper and lower eyelids. Which of the following is the best aesthetic option to recommend?

- A) Eye patch
- B) Hemifacial prosthesis
- C) Ocular prosthesis
- D) Orbital prosthesis

The correct response is Option D.

In this case the patient has had severe orbital trauma with loss of lids and globe. Natural-looking and functional total-lid reconstruction is challenging. Lids would be needed to support an ocular prosthesis. An orbital prosthesis would likely provide this patient a comfortable and aesthetically satisfactory prosthesis. Eyeglasses can help mask the seam of the prosthesis. The hemifacial prosthesis is larger than necessary for this patient and has unnatural seams. An eye patch would not improve symmetry or be reconstructive.

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121. In a patient undergoing reconstructive cranioplasty, an increased rate of complications is most likely if which of the following is present?

- A) Frontal location
- B) Occipital location
- C) Parietal location
- D) Sphenoidal location
- E) Temporal location

The correct response is Option A.

Early decompressive craniectomy is a life-saving maneuver for certain traumatic brain injuries and can be performed far forward in the theater of war. Patients treated with decompressive craniectomy for combat injuries are a unique understudied population. Outcome of treatment of this patient cohort has been previously reported using a standardized cranial defect treatment protocol using custom alloplast implants. Two subgroups of patients (large endocranial dead space and frontal orbital bar injuries) were identified as often having higher rates of complications than other cranial reconstruction cohorts.

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122. Patients with which of the following conditions have the highest incidence of accessory auricle?

- A) Apert syndrome
- B) Goldenhar syndrome
- C) Treacher Collins syndrome
- D) VACTERL association
- E) Van der Woude syndrome

The correct response is Option B.

In a recent review of the literature about congenital accessory auricle, patients with Goldenhar syndrome were found to have an accessory auricle reported 100% of the time.

Of the options listed, VACTERL (Vertebral, Anal, Cardiac, Tracheal, Esophageal, Renal, and Limb association) has the lowest association with an accessory auricle at 16%. Patients with VACTERL typically are found to have vertebral defects, anal atresia, cardiac anomalies, tracheoesophageal fistula, renal anomalies, and limb differences.

Patients with Treacher Collins syndrome are found to have an accessory auricle present 30 to 40% of the time. These patients often have mandibular hypoplasia, zygomatic hypoplasia, external ear anomalies, conductive hearing loss, eyelid colobomas, cleft palate, and dental anomalies. It is associated with several different genes, including TCOF1, POLR1C, and POLR1D.

Patients with Apert syndrome and Van Der Woude syndromes do not typically have accessory auricles.

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3. Amirhassankhami S, Lloyd MS. Accessory Auricles: Systematic Review of Definition Associated Conditions, and Recommendations for Clinical Practice. *J Craniofac Surg*. 2017 Dec 12.

123. A 45-year-old man presents with a rapidly growing, painful mass of the left cheek. He has facial weakness on the left side. CT scan shows a left parotid tumor encasing the facial nerve; there are no abnormal lymph nodes. Which of the following is the most appropriate surgical treatment for this lesion?
- A) Enucleation
 - B) Partial parotidectomy
 - C) Radical parotidectomy
 - D) Superficial parotidectomy
 - E) Total parotidectomy sparing the facial nerve

The correct response is Option C.

Although most (80%) of parotid tumors are benign, the parotid gland is the most common location for a salivary gland malignancy. Pain, paresthesia, and facial paralysis are signs of neural invasion and are usually associated with malignant tumors. Rapid growth, bony fixation, skin ulceration, and palpable nodal enlargement are also associated with malignancies.

Parotidectomy is removal of part or all of the parotid gland. While not true “lobes,” the facial nerve anatomically divides the parotid gland into superficial and deep portions. A superficial parotidectomy involves removal of the parotid gland superficial to the plane of the facial nerve and is appropriate for benign and malignant tumors confined to this portion of the gland. A less than complete superficial parotidectomy that still removes the entire tumor with a negative margin is referred to as a partial parotidectomy. A total parotidectomy involves removal of both the superficial and deep lobes. The facial nerve is carefully dissected and spared if it is not involved. Enucleation, which involves simple removal of the mass, is not indicated for malignant tumors and felt to be controversial for benign tumors, with many surgeons advocating against it. For those that consider enucleation, resection should include the capsule of the tumor, and it should be reserved for benign superficial tumors less than 4 cm in diameter.

A radical parotidectomy is indicated in this case of a malignant lesion invading the facial nerve. This procedure involves total parotidectomy with facial nerve sacrifice. If adjacent structures such as the skin, mandible, or temporal bone are involved, an extended radical parotidectomy may be indicated. In the clinically and radiographically node-negative neck,

the decision to perform a neck dissection or treat the neck with adjuvant radiation versus observation usually depends on histologic factors and/or tumor subtype and grade.

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2. Seethala RR. Salivary gland tumors: current concepts and controversies. *Surg Pathol Clin*. 2017 Mar;10(1):155-176.

124. A 63-year-old woman underwent an uncomplicated right superficial parotidectomy for a benign salivary gland tumor. At her 12-month follow-up visit, she reports abnormal sweating of the right cheek when eating, especially sour foods. Which of the following details from this patient's history is most likely to have increased her risk for this complication?

- A) Female gender
- B) Prior parotid surgery
- C) Prior radiation therapy
- D) Tumor pathology
- E) Tumor size greater than 4 cm

The correct response is Option E.

Frey syndrome, or gustatory sweating, is an uncommon complication of parotid and preauricular surgery. It is important to be able to counsel patients on their surgical risk for such complications. Of the answer choices, only tumor size has been shown to be associated with increased risk for developing Frey syndrome. One recent large-scale study found twice as high a risk for developing symptomatic Frey syndrome with tumors larger than 4 cm. Larger tumors, the authors concluded, required greater plane of dissection and more disruption of parasympathetic nerve fibers, leading to a greater chance of aberrant innervation. History of radiation, malignancy, prior surgery, and gender had no association with developing Frey syndrome.

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125. A newborn has a pretragal cystic mass with a sinus tract visible in the external auditory meatus. Which of the following is the most likely diagnosis?

- A) Dermoid cyst
- B) First branchial cleft cyst
- C) Second branchial cleft cyst
- D) Third branchial cleft cyst
- E) Vascular cystic lesion

The correct response is Option B.

The first branchial cleft develops into the external auditory canal. The second, third, and fourth branchial clefts merge to form the sinus of His, which will normally become involuted. When a branchial cleft is not properly involuted, a branchial cleft cyst forms. Occasionally, both the branchial pouch and branchial cleft fail to become involuted, and a complete fistula forms between the pharynx and skin.

First branchial cleft cysts are divided into type I and type II. Type I cysts are located near the external auditory canal. Most commonly, they are inferior and posterior to the tragus (base of the ear), but they may also be in the parotid gland. Type II cysts appear at the angle of the mandible and may involve the submandibular gland.

The second branchial cleft accounts for 95% of branchial anomalies, and they are most frequently identified along the anterior border of the upper third of the sternocleidomastoid muscle and adjacent to the muscle. However, these cysts may present anywhere along the course of a second branchial fistula, which proceeds from the skin of the lateral neck, between the internal and external carotid arteries, and into the palatine tonsil. Therefore, a second branchial cleft cyst is part of the differential diagnosis of a parapharyngeal mass.

Third branchial cleft cysts are rare. A third branchial fistula extends from the same skin location as a second branchial fistula (recall that the clefts merge during development); however, a third branchial fistula courses posterior to the carotid arteries and pierces the thyrohyoid membrane to enter the larynx, terminating on the lateral aspect of the pyriform sinus. Third branchial cleft cysts occur anywhere along that course (eg, inside the larynx), but they are characteristically located deep to the sternocleidomastoid muscle.

Congenital dermoid cysts of the face typically occur at the lateral orbit overlying the ZF suture, and vascular cyst lesions can be located anywhere on the face but do not present with sinus tracts into the EAC.

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2. D'Souza AR, Uppal HS, De R, Zeitoun H. Updating concepts of first branchial cleft defects: a literature review. *Int J Pediatr Otorhinolaryngol*. 2002 Feb 1;62(2):103-9.

126. A 66-year-old man sustains an isolated complete amputation of the right ear from an injury at work. First responders were able to recover the part, which they wrapped in a wet towel and placed on ice. An attempt is made for microvascular reanastomosis, but no vein can be identified to establish adequate outflow. Which of the following approaches will most likely yield the best long-term aesthetic outcome?
- A) Dermabrasion of the epidermis of the amputated part, burial in a subcutaneous pocket, and staged elevation of the ear
 - B) Disposal of the amputated part with delayed costal cartilage reconstruction
 - C) Microvascular replantation without venous anastomosis followed by postoperative leech therapy
 - D) Removal of the skin of the amputated part followed by temporoparietal flap coverage
 - E) Replantation of the ear without microvascular anastomoses followed by postoperative hyperbaric oxygen therapy for 3 weeks

The correct response is Option C.

Microvascular replantation has demonstrated superiority over the other treatment options mentioned, even when venous outflow cannot be established. Indeed, a recent systematic review demonstrated no significant difference in salvage rate, transfusion rate, or postoperative appearance between cases where venous outflow was established and where it was not. Dermabrasion and subcutaneous burial (Mladick technique) was the most common method prior to the microvascular era, but has been shown to lead to inferior results compared with microsurgical approaches. The other techniques are useful as salvage procedures or in special cases where microvascular surgery is contraindicated.

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2. Norman ZI, Cracchiolo JR, Allen SH, Soliman AM. Auricular reconstruction after human bite amputation using the Baudet technique. *Ann Otol Rhinol Laryngol*. 2015 Jan;124(1):45-8.
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127. A 28-year-old man is brought to the emergency department after sustaining injury during a motor vehicle collision. Cranialization of the frontal sinus is planned. Which of the following best describes the components of cranialization?

- A) Removal of the anterior table, reconstruction of the posterior table with a titanium plate, and closure of the dura
- B) Removal of the posterior table, sinus mucosa, and closure of the sinonasal tract
- C) Repair of both the posterior and anterior tables with bioabsorbable plates, and obliteration of the frontal sinus
- D) Repair of the anterior table and obliteration of the frontal sinus
- E) Repair of the posterior table with bioabsorbable plates, removal of the sinus mucosa, and closure of the dura

The correct response is Option B.

Cranialization involves removal of the posterior table (not repair), closure of the dura, sinonasal tract, and obliteration of the sinus mucosa. Management of the anterior table is as indicated.

Surgical repair of the anterior table is indicated if there is nasofrontal duct involvement, or, in the absence of nasofrontal duct involvement (such as a minimally displaced anterior table), patient desire for a better aesthetic outcome. If there is nasofrontal duct involvement, the nasofrontal duct and frontal sinus can be obliterated (repair of the anterior table and obliteration of the frontal sinus).

Bioabsorbable or titanium plates can be used to fixate the fractured anterior table. It is not used for the posterior table.

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128. A 6-year-old girl is referred for velopharyngeal dysfunction and on physical examination is found to have a submucous cleft and bifid uvula. Which of the following additional clinical findings is most likely to support the diagnosis of 22q11.2 deletion syndrome?
- A) Hypocalcemia
 - B) Hypothyroidism
 - C) Microtia
 - D) Overjet
 - E) Retinal detachment

The correct response is Option A.

22q11.2 Deletion syndrome (also referred to as DiGeorge syndrome, velocardiofacial syndrome, and CATCH-22) is a congenital disorder caused by the deletion of a segment of chromosome 22. Symptoms of this syndrome often include anomalous carotid arteries and conotruncal cardiac abnormalities such as truncus arteriosus and tetralogy of Fallot. The prevalence of atrial septal defect (ASD) has been reported to be 12% in patients with velocardiofacial syndrome. Other symptoms and findings include absent or hypoplastic thymus, developmental delay, cleft palate, and hypocalcemia related to hypoparathyroidism. Patients with velocardiofacial syndrome also have abnormal facial features including a broad nasal root, low-set ears, retrognathia, elongated face or maxillary excess, and epicanthal folds. Overjet and retinal detachment are not associated with velocardiofacial syndrome. Hypothyroidism is not as common as hypocalcemia in this patient population.

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- 1. Yoo D, Kim HJ, Cho KH, et al. Delayed diagnosis of 22q11 deletion syndrome due to late onset hypocalcemia in an 11 year old girl with imperforate anus. 2017. *Ann Pediatr Endocrinol Metab*; 22:133-138.
- 2. Cancrini C, Puliafito P, Digilio MC, et al. Clinical features and follow-up in patients with 22q11.2 deletion syndrome. *J Pediatr*. 2014 Jun;164(6):1475-80.e2.

129. A 35-year-old woman is referred for evaluation of jaw pain. She reports a history of clicking and popping in her jaw particularly when chewing gum. She denies any history of trauma. Physical examination shows class I occlusion with a midline chin point. She has normal intra-oral opening. Which of the following diagnostic imaging techniques will provide the best sensitivity and specificity to evaluate her temporomandibular joint?

- A) Arthrography
- B) CT scan
- C) Dynamic MRI
- D) Fluoroscopy
- E) Ultrasonography

The correct response is Option C.

This patient has subluxation of the disc causing her popping and subsequent pain. The study ordered must evaluate her for internal derangement of the disc related to the joint.

All of the listed imaging techniques have been used to evaluate temporomandibular joint (TMJ) disease. MRI is considered the gold standard for evaluation of the TMJ, particularly when evaluating the joint-disc relationship.

X-ray studies are indicated in the presence of trauma and would not provide the appropriate detail to determine the causes of this patient’s problems. CT scans are more sensitive and specific than conventional x-ray studies at determining bony abnormalities.

CT scan has a definite role in evaluation of patients with TMJ problems. CT scan should be enlisted when diagnosing bony abnormalities. It is useful in the diagnosis of ankylosis, osseous changes (e.g., idiopathic condylar resorption, or condylar hypoplasia seen in congenital anomalies such as Treacher Collins syndrome), or traumatic deformities. CT scan does not determine the location of the disc, so it would not be the appropriate imaging technique for this patient.

Arthrography is an invasive procedure and would not be performed for initial diagnosis. It can be combined with MRI to evaluate for adhesions or perforations.

Given its low cost and availability, ultrasonography of the TMJ has received increased attention in diagnosing internal derangement of the disc. Recent studies have reported a

sensitivity of 65.8% and a specificity of 80.4% when compared with MRI. Ultrasonography was reported to be accurate in diagnosing normal disc position and the presence of abnormal disc-joint relationships but was less effective in evaluating disc displacement with or without reduction of the disc. Ultrasonography-guided arthrocentesis has been employed to decrease patient discomfort and multiple attempts to enter the joint space.

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130. A 23-year-old woman seeks improvement in the appearance of her smile. A Le Fort I osteotomy is planned for correction of maxillary excess. Which of the following arteries is at increased risk for injury during this procedure?

- A) Ascending pharyngeal artery
- B) Descending palatine artery
- C) Infraorbital artery
- D) Posterior superior alveolar artery
- E) Sphenopalatine artery

The correct response is Option B.

The blood supply to the maxilla before Le Fort I osteotomy is from the descending palatine, infraorbital, and posterior superior alveolar arteries, which are branches of the internal maxillary artery off the external carotid artery. When performing a Le Fort I osteotomy, the descending palatine artery runs vertically in the posterior maxilla and is at risk of injury.

After Le Fort I osteotomy, the blood supply to the maxilla is from the ascending palatine artery, which is a branch of the facial artery, off the external carotid artery and the palatine branch of the ascending pharyngeal artery, off the external carotid artery.

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2. Bauer RE, Ochs MW. Maxillary Orthognathic Surgery. *Oral Maxillofac Surgery Clin North Am*. 2014; 26(40):523-37.

131. A 3-month-old infant with 22q11.2 deletion syndrome is evaluated for an isolated cleft of the soft palate (Veau I). A Furlow palatoplasty is planned at age 9 months. Compared with nonsyndromic patients with the same cleft type, this patient will have a higher postoperative risk for which of the following?
- A) Air embolus
 - B) Palatal fistula
 - C) Respiratory failure
 - D) Velopharyngeal insufficiency
 - E) Wound dehiscence

The correct response is Option D.

Velocardiofacial syndrome (VCF syndrome), also termed 22q11.2 deletion syndrome, is characterized by overt or submucous clefting of the palate, hypotonia, cardiac anomalies, hypocalcemia due to hypoparathyroidism, immune deficiencies, and variable learning disabilities. There should be strong clinical suspicion in any child with cardiac anomalies and a cleft palate, and most patients have a distinct facial appearance (ie, elongated face with a wide nose, small ears, and lower facial muscle tone). The diagnosis can be confirmed in 95% of patients by testing a blood sample using fluorescence in situ hybridization (FISH) for a deletion in chromosome 22q11.2. Repeated studies have demonstrated worse speech outcomes in this patient population following any cleft repair compared with nonsyndromic cleft patient and most other cleft syndromes. This difference has been largely attributed to decreased oropharyngeal tone and/or muscle coordination, but other influences, such as learning differences, may have a role. The risk for persistent velopharyngeal insufficiency following repair of cleft palate is considerably higher in this group than non-VCF syndrome patients undergoing the same repair. The risk for palatal fistula and wound dehiscence is not higher in VCFS; postoperative respiratory compromise can be seen in VCFS patients with concurrent Robin sequence, but this is not discussed in the clinical vignette. Lastly, air embolism is a complication that is not associated with cleft repair in any patient population.

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132. Which of the following anatomic landmarks should be used during percutaneous injection of neurotoxin to treat benign masseteric hypertrophy?

- A) Between the earlobe-to-oral commissure line and the inferior border of the mandible
- B) Between the maxillary and mandibular occlusal planes
- C) Between the tragus-to-infraorbital rim line and the cervicomental line
- D) Between the tragus-to-mid upper lip line and the root of the helix to subnasale line
- E) Between the zygomatic arch-to-mid upper lip line and the Frankfort horizontal

The correct response is Option A.

Benign masseteric hypertrophy can be treated by botulinum toxin type A or other neurotoxins. The masseter originates from the body of the zygoma, and inserts into the inferior border of the mandible, and therefore the inferior limit is the inferior border of the mandible. Below the transverse line from the earlobe to the corner of the mouth is a safe zone, as there are no important anatomic structures inferior to this line, and yet the majority of the masseter muscle hypertrophy will be in this region. The other choices contain other anatomic landmarks that are not related to neurotoxin injection for benign masseter hypertrophy.

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133. A 30-year-old man sustains significant mid face injuries following a motor vehicle collision, and has a large laceration in the vicinity of the medial canthal region. Canalicular injury is confirmed intra-operatively. Which of the following is the most appropriate method for repairing this patient's canalicular injury?

- A) Delayed dacryocystorhinostomy
- B) Direct microsurgical suture repair
- C) Healing by secondary intention
- D) Immediate dacryocystorhinostomy
- E) Placement of silicone canalicular stents

The correct response is Option E.

When canalicular injury is suspected, the lacrimal system should be investigated for patency. Typically, this involves performing a Jones I and II test to determine if fluorescein navigates from the lower lid fornix into the nose. If canalicular interruption is suspected and identified, the proximal and distal stumps of the canaliculus are joined by placing a silicone stent and leaving this in place for 3 to 6 months to allow for healing.

Direct microsurgical suturing is not preferred because of the high likelihood of cicatricial obstruction.

Dacryocystorhinostomy is generally reserved as a “salvage” procedure for patients who have lacrimal obstruction after being treated with a stent. Healing by secondary intention is incorrect since it would likely result in canalicular obstruction.

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134. A 40-year-old man and his 80-year-old father are assaulted. They both have facial fractures. The older victim is more likely to have which of the following?
- A) Decreased chance of noncraniofacial injuries
 - B) Higher mortality
 - C) Less severe injuries
 - D) Mandibular body fracture
 - E) Shorter hospital stay

The correct response is Option B.

In recent years many publications focused on craniofacial injury in the elderly as not only the mode of trauma differs compared with the younger population, but also the associated injuries and morbidities. In general, most related comorbidities in patients older than 60 to 65 (depending on the study) versus those younger are worse, including: longer hospital stays, need for assistance upon discharge, more severe injuries, likely to have noncraniofacial injuries like limb and spine fractures, and, of greatest concern, a much higher death rate. In a recent article though, Mundinger et al, showed that panfacial and mandible fractures were more common in the nongeriatric population, whereas mid face, orbital, and condylar fractures were more common in those older than 60 years of age.

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135. Which of the following is true about cleft lip with or without palate when compared with cleft palate only?

- A) Cleft lip/palate does not have a nasal deformity
- B) Cleft lip/palate has a lower overall birth incidence than cleft palate only
- C) Cleft lip/palate has a slight female predominance
- D) Cleft lip/palate incidence is similar among different ethnicities
- E) Cleft lip/palate is less likely to be associated with a syndrome

The correct response is Option E.

Cleft lip with or without palate (CLP) has different epidemiologic characteristics and presentation, compared with isolated cleft palate only (CPO). CLP has a higher incidence (1 in 700, versus 1 in 1500), higher male predominance (M:F 2:1, versus F:M 3:2), incidence varies by ethnicity (Asian:Caucasian:African 4:2:1, versus no ethnicity difference), and less syndromic association (15% versus 50%). Cleft lip is always associated with some degree of cleft nose deformity, whereas CPO does not involve the nose. Therefore the correct response is that cleft lip/palate is less likely to be associated with a syndrome.

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136. Which of the following structures contributes to the formation of the tragus?

- A) First branchial arch
- B) First branchial cleft
- C) Second branchial arch
- D) Second branchial cleft

The correct response is Option A.

The first branchial arch contributes to the formation of the tragus and anterior helix.

The first branchial cleft is incorrect. It gives rise to the external auditory canal.

The second branchial arch is incorrect. It contributes to the formation of the majority of the external ear – the antitragus, remainder of the helix, antihelix, and crura all arise from the second branchial arch.

The second branchial cleft is incorrect. It is typically obliterated during development, but may persist in the form of a second branchial cleft cyst.

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137. A 30-year-old woman with a 4-year history of epistaxis requiring intraoffice and intraoperative cauterizations is admitted to the emergency department with blood loss greater than 500 mL. Imaging does not show any tumors, and her nosebleed is controlled with packing. Embolization is planned. Which of the following arteries is most appropriate for an on-target, curative approach?

A) Ascending pharyngeal

B) Ethmoidal

C) External carotid

D) Facial

E) Sphenopalatine

The correct response is Option E.

The nasal cavity has blood supply by both the internal and external carotid arterial systems. Understanding the anatomy of these systems and their specific downstream branches that participate in epistaxis is key in planning treatment for this pathology. Although there are direct or indirect vascular contributions from the choices, only the anterior and posterior ethmoidal and sphenopalatine arteries are major direct contributors. Because the anterior and posterior ethmoidal arteries are part of the ophthalmic artery system, which ends at the retina, these are not appropriate for embolization. However, the sphenopalatine artery is appropriate, and either embolization or direct ligation (endoscopic) has shown to be effective approaches in the treatment of even refractory epistaxis.

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138. A 2-month-old infant is evaluated for a congenital ear deformity. Which of the following physical findings is most likely to result in failure of nonoperative molding?

- A) Constricted ear deformity
- B) Cryptotia
- C) Prominent ear deformity
- D) Stahl ear deformity

The correct response is Option A.

Effective nonoperative molding can be carried out until about 1 to 2 months of age. Failure is related to both the pliability of the cartilage and parental and patient compliance. Deformities like a constricted ear deformity that involve significant skin shortage or sharp crimping of the cartilage are more likely to fail conservative management. Stahl ear (third crus), cryptotia (buried upper pole of ear), and prominent ear deformity (effaced antihelical fold with an increased scapha-conchal angle) respond well to molding if started early enough.

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2. Brown FE, Colen LB, Addante RR, Graham JM Jr. Correction of congenital auricular deformities by splinting in the neonatal period. *Pediatrics*. 1986 Sep;78(3):406-11.
3. Yotsuyanagi T. Nonsurgical correction of congenital auricular deformities in children older than early neonates. *Plast Reconstr Surg*. 2004;114:190-1.

139. A 35-year-old woman has minimally displaced bilateral subcondylar fractures of the mandible without loss of posterior vertical height, but she reports subjective malocclusion. Which of the following is the most appropriate management of this patient?
- A) Advise the patient to eat a soft diet for 6 weeks
 - B) Application of a gunning splint for 8 weeks
 - C) Maxillomandibular fixation (MMF) for 4 to 6 weeks
 - D) MMF for 1 week
 - E) MMF for 8 to 10 weeks

The correct response is Option C.

Closed reduction has historically been the standard treatment option for subcondylar fractures of the mandible. Its widespread use is attributed to the idea that closed reduction results in fewer complications with similar functional and aesthetic outcomes compared with open reduction and internal fixation (ORIF). For instance, complications such as facial nerve damage and excessive scarring are significantly decreased due to the noninvasive nature of this approach. However, as highlighted by the ongoing debate, a consensus regarding outcomes between open and closed reduction is not evident in the literature. In short, some studies conclude that both approaches produce roughly similar results, while others have associated an array of unfavorable outcomes with closed reduction. These include facial asymmetry, deviation upon mouth opening, skeletal malocclusion, and chronic pain of the temporomandibular joint (TMJ). The fact that many of these parameters lack standardization in time course of treatment further obscures the debate. Larger studies with consistent parameters are needed to reassess outcomes with the surgical techniques and technology present today. However, it is unlikely that a large enough trial will deliver granular evidence to conclusively quell this debate.

Another controversial point regarding closed reduction is the length of time a patient should spend in maxillomandibular fixation (MMF). Many surgeons choose to apply fixation for a very short period (ie, 2 weeks) to avoid ankylosis of the TMJ secondary to forced immobilization during MMF. While the etiology of ankylosis is not completely understood, it is hypothesized that trauma leading to intracapsular hematoma results in fibrosis and excessive bone formation, ultimately causing hypomobility of the affected side.

Given the current hypothesis, ankylosis of the TMJ is likely a manifestation of direct injury within the joint capsule or condylar head itself. It is imperative to point out that as a result, there should be a decreased risk for ankylosis in subcondylar fractures compared with fractures of the condylar head. Therefore, the position of the fracture line relative to the joint capsule should be closely examined, and a longer period of MMF should be employed if there is no involvement of the condylar head, disc, or capsule. A longer period of MMF results in better union of the fractured segments with no increase in the incidence of ankylosis. In a nondisplaced fracture or minimally displaced fracture with a functional occlusion, 4 to 6 weeks of MMF followed by 2 to 3 weeks of guiding elastics is recommended. The same treatment applies in the case of nondisplaced bilateral fractures. However, this scenario is less common because the force parameters to cause the bilateral fractures are often greater and tend to displace the fracture fragments significantly, necessitating ORIF.

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140. A 15-year-old girl is brought to the office for follow-up evaluation 5 months after sustaining facial injuries from being bitten by a dog. She has an abnormal facial nerve examination and cannot generate a smile on the right side. Prior exploration during anesthesia showed missing segments of the facial nerve. Which of the following is the most appropriate management at this time?
- A) Babysitter procedure
 - B) Cross-facial nerve grafting
 - C) Dynamic reanimation with gracilis free flap
 - D) Interpositional nerve grafting
 - E) Primary nerve repair

The correct response is Option D.

The critical components of facial nerve reconstruction are the cause of the injury, timing of the injury, and age of the patient. These generally dictate the management options.

In this case we have a young patient with a traumatic injury that occurred 5 months ago. The goal is reconstruction of the facial nerve with enough time for nerve regeneration prior to loss of the motor end plates of the muscle. This can usually be done if nerve regeneration is anticipated to occur within 18 months of the initial injury.

With a history of missing segments of facial nerve, it is unlikely that primary repair of the facial nerve branches will be feasible.

The proximal facial nerve is available for reconstruction, making cross-facial nerve grafting unnecessary. Without the addition of nerve grafts, a cross-facial nerve graft alone would not restore facial reanimation.

Since the timing of the injury is only 5 months, reconstruction with nerve grafts should be attempted prior to the use of facial reanimation with a gracilis free flap. It could be used in the event that nerve grafting fails.

The babysitter procedure is a procedure that is intended to send strong motor fibers quickly to denervated facial muscles while waiting for cross-facial nerve grafts or dynamic reanimation procedures to complete nerve regeneration and healing. The babysitter

procedure preserves muscle bulk while waiting for the cross-facial nerve graft or other mode of reanimation to enable coordinated animation.

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141. An 8-year-old girl with a history of complete cleft lip and palate repaired as an infant presents for management of her alveolar cleft. During the preoperative visit, options for management of the bony defect are discussed. Which of the following is the primary disadvantage of secondary bone grafting using iliac crest cancellous bone rather than using demineralized bone matrix?

- A) Cost
- B) Donor site morbidity
- C) Failure rate
- D) Impact on mid face growth
- E) Surgical procedure duration

The correct response is Option B.

The primary disadvantage of iliac crest bone grafting is postoperative pain in the donor site, as there is no donor site morbidity with demineralized bone matrix (DBM). Cost for the increased operating room time for the iliac crest bone graft cancels out the increased cost for DBM. Primary artery bypass grafting is associated with a negative impact on mid face growth that is not seen with secondary bone graft regardless of the material used in the defect. An iliac crest bone graft increases operating room duration but not enough to cause any significant morbidity. Failure rates of DBM and iliac crest bone grafting for alveolar defects are equivalent.

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142. A 51-year-old woman is scheduled to undergo a lower lip reduction. Blockade of the mental nerve is planned for anesthesia. The most appropriate site for injection of the mental foramen blockade is the mucosa below which of the following teeth?

- A) Canine
- B) Central incisor
- C) Lateral incisor
- D) Second bicuspid
- E) Second molar

The correct response is Option D.

The mental nerve foramen is located near the second bicuspid or first molar along the border of the mandible. This nerve will give sensation to the lower lip. The other answers are too distal or mesial for the mental nerve foramen.

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143. A 20-year-old man desires correction of a depressed, retracted, post-tracheostomy scar. Which of the following is the best recommendation for improving the scar?
- A) Perform autologous fat grafting and laser resurfacing
 - B) Reconstruction tracheal ring and detach adhesions
 - C) Scar excision and interposition of acellular dermal matrix
 - D) Scar excision and reapproximation of strap muscles
 - E) Scar revision

The correct response is Option D.

After decannulation, the tracheostomy site heals by secondary intention. Often the patient is left with a soft, small asymptomatic scar. On occasion, the scar is painful and the skin has adhesions to tissue deep to the strap muscles. This may lead to pulling and retraction with swallowing as well as a scar that is not aesthetically pleasing to the patient. The depressed retracted tracheostomy scar requires reapproximation of platysma and approximation of the sternothyroid and sternohyoid for correction. Fat grafting is unlikely to address retraction or fully correct the depression. Laser resurfacing and fat grafting will have minimal improvement of retraction. Several studies support use of cadaver materials or fascia to support the coverage of the strap muscles when tissue is missing or heavily damaged. The tracheal ring does not need to be reconstructed for routine tracheostomy scar revision. Care must be taken when working around the trachea. Communication with anesthesia about oxygen content and fire risk is important for surgical safety.

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144. An 18-month-old child is brought to the office after undergoing fronto-orbital advancement for metopic craniosynostosis. Which of the following is the earliest age the surgeon can order the x-ray studies and expect to be able to see frontal sinus development?

- A) 1 year
- B) 2 years
- C) 4 years
- D) 6 years
- E) 10 years

The correct response is Option D.

Frontal sinus development is associated with specific age-related periods of growth of the skull. The frontal sinus is absent at birth and during the initial phase of growth of the skull. The sinus is visible only in x-ray studies at the end of the first period of skull growth. This is the time when the endocranial table of the skull ceases to grow and conforms to the general shape of the brain. This is not seen on x-ray studies until 6 years of age or 72 months.

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145. A female infant is born with severe Treacher Collins syndrome and bilateral Pruzansky III mandible (absence of condyle). Tracheostomy is performed for respiratory distress. Which of the following surgeries is most likely to allow decannulation?
- A) Alloplastic condylar reconstruction
 - B) Bilateral sagittal split osteotomy
 - C) Costochondral rib grafts
 - D) Mandibular distraction
 - E) Tongue-lip adhesion

The correct response is Option C.

Patients with Treacher Collins syndrome may have a varied presentation. The mandible hypoplasia may be mild or severe. In this case the patient has no temporomandibular fossa or condyles. Tongue-lip adhesion and mandibular distraction are used in severe Pierre Robin sequence. Because of the absence of condyles and temporal mandibular joints, distraction, and sagittal split osteotomy are not the best options. A costochondral graft will provide better airway support and can also be distracted in the future.

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146. Which of the following best describes the normative percentage of the lower third of the face from subnasal to menton when compared to the upper face and mid face?

- A) 10%
- B) 20%
- C) 30%
- D) 40%
- E) 50%

The correct response is Option C.

The face may be divided into horizontal thirds. The upper third extends from the hairline to the glabella, the middle third from the glabella to the subnasale and the lower third from the subnasale to the menton. These facial thirds are rarely equal. If proportions are to be used in orthodontic/orthognathic surgical planning, they should be used only as general guidelines alongside other well-established treatment planning methods.

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2. Farkas LG, Hreczko TA, Kolar JC, Munro IR. Vertical and horizontal proportions of the face in young adult North American Caucasians: revision of neoclassical canons. *Plast Reconstr Surg*. 1985 Mar;75(3):328-38.



147. A 19-year-old woman undergoes excision of squamous cell carcinoma of the right auricle that results in a 2.5-cm defect of the mid-helix. A photograph is shown. Which of the following is the most appropriate method of reconstruction?

- A) Auricular prosthesis retained by osseointegrated implants
- B) Porous polyethylene implant covered by temporoparietal fascia flap and skin graft
- C) Postauricular flap and conchal cartilage graft
- D) Retroauricular revolving door flap
- E) Wedge closure

The correct response is Option C.

A number of local flaps have been used to reconstruct the helix. One of the most reliable ways to reconstruct the middle third of the helix is to use a postauricular flap as described by Dieffenbach. This flap is supplied by the posterior auricular artery and vein. Wrapping the flap around a conchal cartilage graft prevents late cicatricial deformity. This flap pins the ear back and requires dividing the base of the flap in a second stage several weeks later to return the ear to a normal position. A full-thickness skin graft is used to cover the donor site defect. The Antia-Buch chondrocutaneous advancement flap may also be used for helical rim defects, but tends to result in a cupped and noticeably smaller ear for longer defects such as this.

The retroauricular “revolving door” or “flip-flop” flap is also based on postauricular skin, but it is an island flap used to reconstruct conchal bowl and occasionally antihelical defects. Wedge closure can be used for defects up to about one third of the helical rim but would result in an ear asymmetry, making the auricle noticeably smaller in this defect. A porous polyethylene implant covered by temporoparietal fascia flap and skin graft, as well as an implant retained auricular prosthesis, are options for near total and total auricular defects. They would be difficult to fixate to the remaining ear for small helical defects.

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148. Which of the following statements is correct about Tessier clefts No. 3, No. 4, and No. 5?

- A) Tessier No. 3 involves the alveolar ridge, while Tessier No. 5 does not
- B) Tessier No. 3 is medial to the infraorbital nerve, while Tessier No. 4 is lateral
- C) Tessier No. 3 only affects the oral region, while Tessier No. 4 only affects the orbital region
- D) Tessier No. 4 involves the piriform aperture, while Tessier No. 5 does not
- E) Tessier No. 4 is medial to the infraorbital nerve, while Tessier No. 5 is lateral

The correct response is Option E.

Tessier No. 3 and No. 4 are medial to the infraorbital nerve, but Tessier No. 5 is lateral.

Tessier No. 3 involves clefts of the nose, orbit, and lip (naso-oral-ocular cleft), whereas Tessier No. 4 involves the lip and orbit (oral-ocular cleft), and the nose is uninvolved.

Tessier No. 5 involves oral, cheek (maxillary sinus), and orbital cleft and is the rarest.

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149. A 55-year-old Taiwanese man with a history of Epstein-Barr virus is being treated for nasopharyngeal carcinoma. Which of the following levels of cervical lymph nodes drain this tumor first and are usually the first nodes to become clinically positive?

- A) Level I
- B) Level III
- C) Level IV
- D) Level V
- E) Level VI

The correct response is Option D.

Nasopharyngeal carcinoma is the most common head and neck malignancy associated with Epstein-Barr virus infection. Nasopharyngeal carcinomas arise from the mucous epithelium of the nasopharynx and are more common in Africa and East Asia than the United States. Nasopharyngeal carcinomas are most commonly treated with radiation therapy and chemotherapy, while surgery is reserved for recurrent disease or unusual cancers. Patients with nasopharyngeal carcinoma can present with bilateral lymphadenopathy of Level V cervical lymph nodes. Carcinomas of the oropharynx and oral cavity usually drain to Levels I to IV cervical nodes and thyroid malignancies usually drain to Level VI nodes.

Level Ia lymph nodes include those in the submental triangle (made up of the anterior bellies of the digastric muscle and the hyoid bone), while Level Ib lymph nodes are those located in the submandibular triangle (made up of the mandible and anterior and posterior bellies of the digastric muscle).

Level II lymph nodes are referred to as "upper jugular" nodes and are those lymph nodes within the area made up of the lateral border of the sternohyoid muscle anteriorly, the posterior border of the sternocleidomastoid muscle (SCM) posteriorly, the skull base superiorly, and the hyoid bone inferiorly.

Level III nodes are referred to as "middle jugular" nodes and are contained within the area made up of the lateral border of the sternohyoid muscle anteriorly, the posterior border of the SCM muscle posteriorly, the hyoid bone superiorly, and the cricothyroid notch inferiorly.

Level IV nodes are referred to as the "lower jugular" group and are those within the area made up of the lateral border of the sternohyoid muscle anteriorly, the posterior border of the SCM muscle posteriorly, the cricothyroid notch superiorly, and the clavicle inferiorly.

Level V nodes are those contained within the posterior triangle of the neck, with the posterior border of the SCM muscle anteriorly, the anterior border of the trapezius posteriorly, and the clavicle inferiorly.

Level VI nodes are those contained within the anterior compartment of the neck with the carotid sheath laterally, the hyoid bone superiorly, and the suprasternal notch inferiorly.

Level VII nodes are referred to as "upper mediastinal" nodes and are those nodes contained within the area made up of the carotid arteries laterally, the suprasternal notch superiorly, and the aortic arch inferiorly.

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150. Which of the following is the most common cause of scaphocephaly without craniosynostosis?

- A) Fibromatosis colli
- B) Hereditary dolichocephaly
- C) Ocular torticollis
- D) Prematurity
- E) Ventriculoperitoneal shunt

The correct response is Option D.

Positional plagiocephaly is very common since the American Academy of Pediatrics began the 'back to sleep' campaign to decrease sudden infant death syndrome in 1992. Occipital flattening is the most common type seen. Positional plagiocephaly risk factors include prematurity, intrauterine position, congenital muscular torticollis, plural birth, motor delays, and hypotonia. Ventriculoperitoneal (VP) shunts may induce a secondary craniosynostosis if over-shunting occurs. Scaphocephaly head shape without craniosynostosis is noted in the premature babies in the NICU due to positioning and tone. This corrects with growth, increased tone, and repositioning. Presence of a VP shunt does not lead to the head shape of scaphocephaly without craniosynostosis but may be seen in children after intraventricular hemorrhage in the NICU. Scaphocephaly without craniosynostosis does occur in older infants and children but is not known to be a hereditary condition. Both ocular torticollis and congenital muscular torticollis can cause a head tilt and are associated with deformational plagiocephaly. Fibromatosis colli is seen with severe muscular torticollis and is associated with plagiocephaly.

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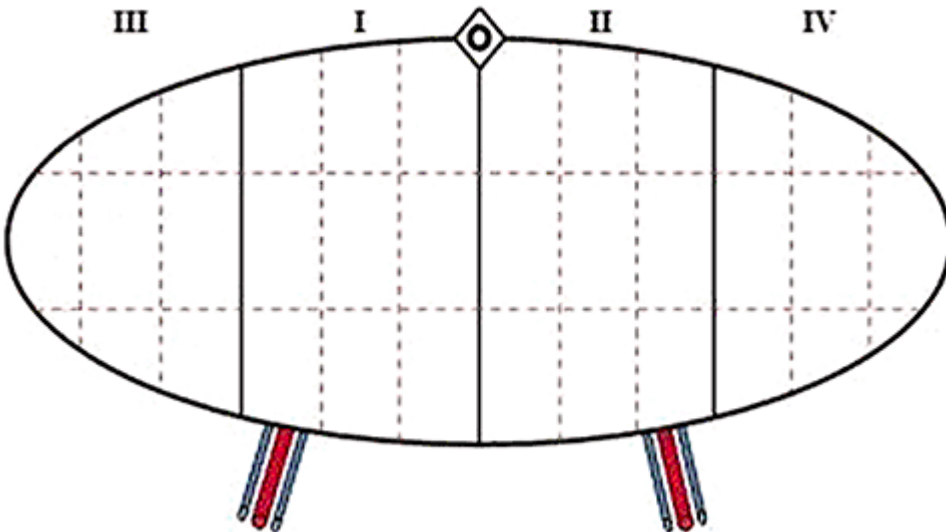
Section 4: Breast and Cosmetic

151. A 52-year-old woman undergoes autologous breast reconstruction with unilateral deep inferior epigastric perforator (DIEP) flaps. According to the Hartrampf model of perfusion zones, if the lateral row perforator vessels are used, in which chronological order will the flap zones be perfused?

- A) I – II – III – IV
- B) I – III – II – IV
- C) II – I – III – IV
- D) II – I – IV – III
- E) IV – III – II – I

The correct response is Option B.

In medial perforator-based flaps, the zones are perfused in the order I – II – III – IV (A) as shown in the image. In lateral perforator-based flaps, however, the zones are perfused in the order I – III – II – IV (B).



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152. A 55-year-old man is scheduled for a rhytidectomy with an extended superficial musculoaponeurotic system (SMAS) flap and neck lift. In order to avoid injury to the great auricular nerve, which of the following best describes the most likely course of the main branch of the great auricular nerve?
- A) Exits the deep neck at the anterior border of the sternocleidomastoid muscle
 - B) Exits the stylomastoid foramen and emerges through the Lore fascia
 - C) Lies parallel and posterior to the external jugular vein
 - D) Lies superficial to the platysma muscle at the anterior border of the sternocleidomastoid muscle
 - E) Perforates the sternocleidomastoid muscle 6.5 cm inferior to the external auditory meatus

The correct response is Option C.

The great auricular nerve (GAN) is the most commonly injured named nerve during a rhytidectomy. Multiple studies have estimated the incidence at 6%. The course and avoidance of injury to this nerve is important in minimizing the risks for painful neuroma, allodynia, and permanent numbness. The GAN is a purely sensory nerve that arises from the C2 and C3 spinal roots and then fuses into the main trunk of the GAN. It exits the deep neck along the posterior border of the sternocleidomastoid muscle (SCM) and then travels parallel and posterior to the external jugular vein (EJV). It usually bifurcates into anterior and posterior branches. There are anomalous courses that can occur in rare cases.

Guidelines in avoiding injury of the GAN include the following:

1. Raising the platysma at the anterior border of the SCM will protect the nerve from injury.
2. To avoid suture injury to the nerve, platysma/superficial musculoaponeurotic system suspension sutures should be placed posterior to a vertical line drawn from McKinney's point to a point 1.5 cm posterior to the insertion of the lobule.

The GAN does not perforate the SCM, but lies on top of it. McKinney's point is located along the midwidth of the SCM approximately 6.5 cm inferior to the external auditory meatus. This represents where the GAN usually exits from beneath the SCM fascia and becomes more superficial and is increasingly susceptible to injury.

At the sternocleidomastoid muscle, the GAN lies deep to the platysma muscle and is a safe location to begin elevation of a platysma flap.

The facial nerve exits the stylomastoid foramen, not the GAN.

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153. Chemical peel neutralization using 1% sodium bicarbonate would be recommended with which of the following peeling agents?

- A) Glycolic acid
- B) Jessner solution
- C) Phenol-croton oil
- D) Salicylic acid
- E) Trichloroacetic acid (TCA)

The correct response is Option A.

The requirement for neutralization is specific to each peel and must be thoroughly understood before application. For instance, the trichloroacetic acid peel approach is a dynamic process that depends largely on clinical judgment and experience to assess the extent of frosting relative to peel depth in an effort to optimize results and minimize complications. Furthermore, peel neutralization is typically carried out with a basic solution such as 1% sodium bicarbonate, and is generally required only for specific acids, such as glycolic acid, whereas phenol-croton oil peels and Jessner solution cannot be neutralized. Salicylic acid does not need to be neutralized. TCA penetrates deep to the dermal-epidermal junction and is counteracted by dilution with saline. TCA cannot be neutralized at the end of treatment because it has penetrated too deeply.

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154. A 14-year-old girl comes to the office with a history of rapid significant increase in the size of her breasts with puberty. She wears a size 32H brassiere. The size of her breasts negatively affects her activities of daily living. Physical examination shows BMI is 21 kg/m², and both breasts are enlarged with minimal asymmetry. Histology of the breasts is most likely to demonstrate a proliferation of which of the following types of tissue?

- A) Adipose
- B) Ductal
- C) Lobular
- D) Muscle
- E) Stromal

The correct response is Option E.

The patient is presenting with juvenile (virginal) hypertrophy of the breast. In this patient, the growth of the breast is due to the hypertrophy of the stromal component of the breast tissue. In this case, the patient has a normal range BMI, decreasing the chances that the size of the breast is related to her weight.

The histology of the breast will demonstrate a predominance of stromal tissue. This is the connective tissue of the breasts, which includes the fibroblasts and fat. As noted, fatty tissue will be present in the breast; however, it is not a predominant component in true juvenile massive breast enlargement as compared with breast enlargement in the obese adolescent. Ducts will be present but not predominating, lobules will be absent or poorly formed, and muscle development is unrelated to breast size.

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155. A patient who had massive weight loss comes to the office to discuss reconstruction. The surgeon determines that the patient would benefit from a lower body lift. Advancement of the flaps in this procedure will be best achieved by undermining which of the following zones of adherence?

- A) Distal posterior thigh
- B) Gluteal crease
- C) Inferolateral iliotibial tract
- D) Lateral gluteal depression
- E) Mid medial thigh

The correct response is Option D.

Continuous or discontinuous release of the lateral gluteal depression would be the most effective in allowing the advancement of the flaps in a lower body lift. Though the gluteal crease is in proximity of the flaps, release here would undesirably blunt this crease. The other choices are not in proximity and their release would have little effect on advancing the flaps.

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156. The dominant blood supply to the nipple-areola complex comes from which of the following arteries?

- A) Anterior lateral intercostal
- B) Internal mammary
- C) Lateral thoracic
- D) Superior epigastric
- E) Thoracoacromial

The correct response is Option B.

Although the internal mammary artery, anterior intercostal arteries, lateral thoracic arteries, and thoracoacromial artery all supply the nipple-areola complex (NAC), the internal mammary artery provides the most consistent contribution, which has been confirmed in multiple cadaver studies as well as in vivo MRI studies. The superior epigastric artery arising from the internal mammary artery supplies the anterior abdominal wall.

Indeed, some authors have suggested that the decreased incidence of NAC necrosis with an inframammary fold incision when compared with a periareolar incision may be due to the preservation of the blood supply to the NAC using the former incision. The design of pedicles for reduction mammoplasty, similarly, has been historically informed by the blood supply to the NAC.

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157. A 54-year-old woman undergoes a rhytidectomy with a SMAsectomy (superficial musculoaponeurotic system). The drains are removed on postoperative day 2. Several days later, significant fluid collection is noted on the right side, and the fluid is aspirated and appears clear. The fluid collection continues to recur, and analysis shows extremely high amylase levels. On examination, the parotid duct is intact. A bland diet is suggested, and a scopolamine patch is applied. Which of the following additional treatments is most likely to help improve this patient's condition?

- A) Anti-inflammatory medication
- B) Botulinum toxin type A injections
- C) Direct surgical repair of the injury
- D) Nerve grafting of the injury
- E) Surgical evacuation of the fluid

The correct response is Option B.

This patient has a salivary leak secondary to direct injury to the parotid gland, either from dissection or a suture being placed through the gland. Although typically self-limiting, these injuries can be frustrating to treat and upsetting to the patient. Treatment is directed at minimizing salivary secretions as much as possible by multimodal therapy while spontaneous healing is allowed to occur. Surgical treatment is not indicated and may cause further damage, thus exacerbating the situation. Spontaneous resolution is the general rule, although it may take several weeks and even months. Common treatment modalities to minimize salivary secretions include regular percutaneous drainage of the collection or placement of a temporary drain. In addition, compression is useful and should be maintained as much as tolerated. Antihistamines and scopolamine patches are used to slow down and minimize salivary production. A bland diet and avoiding sour, spicy, or acidic foods also helps to minimize excessive secretions. Recently, botulinum toxin type A injections directly into the gland have been used successfully to minimize salivary secretions.

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158. A 27-year-old woman comes to the office with concerns about aesthetic deformity of the neck. Despite appropriate lifestyle modifications and BMI less than 25 kg/m², the patient has an obtuse cervicomenal angle caused by accumulation of preplatysmal adipose tissue. The patient opts for nonsurgical management of the submental fullness by undergoing treatment with deoxycholic acid (DCA). Which of the following best describes the mechanism of action of this agent?

- A) Disruption of cellular membrane
- B) Injury to endoplasmic reticulum
- C) Irreversible binding to cellular mitochondrion
- D) Protein binding of Golgi apparatus
- E) Targeted injury to cell nucleus

The correct response is Option A.

Deoxycholic acid (DCA) disrupts adipocyte cell membranes when injected subcutaneously into fat, inducing an inflammatory response to clear cellular debris and liberated lipids from the injection site. DCA is a nonspecific cytolytic agent that injures tissue by injuring the cellular membrane of cells that come into contact with the naturally found substance. ATX-101 was FDA approved in the United States and Canada in 2015 for treatment of patients diagnosed with moderate to severe amounts of fat accumulating in the submental fat pad. The treatment is a series/protocol of up to six treatments in patients requesting nonsurgical management of submental fullness. Patients are selected based on candidacy and their desire to avoid surgery. A youthful patient with mild to no skin laxity, minimal post-platysmal fat, mild to no digastric muscle hypertrophy, and minimally enlarged submandibular glands is a good candidate for the treatment.

Mitochondria, responsible for energy metabolism within the cell, act as signaling organelles. Mitochondrial dysfunction may lead to cell death and oxidative stress and may disturb calcium metabolism. The nucleus is the control center of the eukaryotic cell. The sequestering of genetic material within the nucleus of the eukaryotic cell provides the nucleus with a powerful mechanism for the regulation of gene expression and other cellular processes through selective translocation of proteins between the nucleus and cytoplasm. There are various drugs that act on DNA to prevent its replication and to decrease or inhibit transcription of a variety of important genes. However, a therapeutic molecule, even if delivered inside the target cell, often fails to reach its subcellular target. The Golgi apparatus (GA) is the central organelle of the cell secretory pathway and interacts with the

endoplasmic reticulum (ER). The GA carries out posttranslational modification of newly synthesized proteins by employing various enzymes for phosphorylation, acylation, glycosylation, methylation, and sulfation. The ER is a network of folded membrane-enclosed tubules and sacs (cisternae) that extend from the nuclear membrane throughout the cytoplasm. Its primary function is to facilitate the folding of secretory and membrane proteins. Additionally, it is involved in calcium storage and signaling, and has been shown to play a role in apoptosis regulation against disturbances in calcium homeostasis, ischemia, hypoxia, exposure to free radicals, oxidative stress, elevated protein synthesis, and gene mutations. Several different types of drugs target these organelles, but these cellular components are not the target of deoxycholic acid.

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159. A 64-year-old woman who is postmenopausal asks why she has not been prescribed hormone replacement therapy with estrogen and progestin like her mother was. Supplementation with these hormones is associated with an increased risk for which of the following?

- A) Coronary artery disease
- B) Diabetes
- C) Endometrial cancer
- D) Invasive breast cancer
- E) Osteoporosis

The correct response is Option D.

Hormone replacement therapy has fallen out of favor because of a risk profile that is believed to exceed the potential benefits. Combined estrogen and progestin supplementation is thought to be associated with an increased risk for invasive breast cancer but may decrease the risk for diabetes and osteoporosis. It is thought to not impact the risk for coronary artery disease or endometrial cancer.

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160. To avoid damage to the medial antebrachial cutaneous nerve during brachioplasty, which of the following veins is most important to mark?

- A) Axillary vein
- B) Basilic vein
- C) Brachial vein
- D) Cephalic vein
- E) Innominate vein

The correct response is Option B.

Care is used to avoid damage to the medial antebrachial cutaneous nerve of the forearm in the distal third of the medial arm. The nerve divides into anterior and posterior branches around the basilica vein. The other veins, axillary, cephalic, and brachial are incorrect.

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161. A 25-year-old man who underwent septorhinoplasty 6 weeks ago is evaluated because of clear nasal discharge. He notes that the drainage worsens when he bends forward or strains, and the discharge tastes salty. Physical examination shows a small amount of watery drainage from the right nostril. Examination with a nasal speculum shows no other abnormalities. Which of the following is the most appropriate next step in management?

- A) MRI of the skull base
- B) Testing of fluid for beta-2 transferrin
- C) Testing of fluid for glucose
- D) Trial of a corticosteroid nasal spray
- E) Trial of an oral antihistamine

The correct response is Option B.

The patient in question presents with a history that is suggestive of cerebrospinal fluid (CSF) leak following septoplasty. Patients with such a leak typically have unilateral clear nasal discharge that tastes salty or metallic. Straining, Valsalva maneuver, or leaning forward typically make the drainage worse.

Commonly, rocking or twisting forces applied during the septoplasty cause a traumatic injury to the cribriform plate, with a resultant CSF leak. The injury is more common (2:1) on the right side and is more common in men.

Beta-2 transferrin testing on the CSF fluid is very specific for the injury. This protein is only found in CSF, but the test is not available in all centers. Testing the fluid for glucose is not specific and has a high false-positive rate. MRI of the skull base is not particularly helpful for CSF leaks. High-resolution CT is preferred.

Steroid nasal spray and antihistamines are not used in the management of CSF rhinorrhea.

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162. A 56-year-old man is evaluated because of gynecomastia. Physical examination shows mild, diffuse breast enlargement with no visible inframammary fold or ptosis. Which of the following is the most appropriate surgical correction of this patient's condition?

- A) En bloc resection of skin and breast tissue with free nipple grafting
- B) Open excision of breast tissue with mastopexy
- C) Subcutaneous mastectomy with nipple preservation
- D) Suction-assisted lipectomy
- E) Superior periareolar excision with skin excision

The correct response is Option D.

The treatment of gynecomastia is based on the degree of breast enlargement and the extent of ptosis that is noted on examination. Grade 1 gynecomastia is minimal breast hypertrophy without ptosis. Grade II gynecomastia is moderate hypertrophy without ptosis. Grade III gynecomastia is severe hypertrophy with moderate ptosis. Grade IV gynecomastia is severe hypertrophy with severe ptosis. The treatment of mild to moderate gynecomastia without ptosis is suction-assisted lipectomy. Direct periareolar excision with skin excision and subcutaneous mastectomy are not indicated for gynecomastia without ptosis. Mastopexy and free nipple grafting techniques are indicated for gynecomastia with severe ptosis.

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163. A 68-year-old woman wants improvement of the appearance of her upper eyelids. She wears contact lenses daily without need for lubricating eye drops. When compared with the left eyelid, the right upper eyelid has a more elevated lid crease and the marginal reflex distance-1 (MRD-1) is 1.5 mm. The MRD-1 for the left eyelid is 3.0 mm. Levator excursion is 12 mm bilaterally. Which of the following eye tests is the most appropriate next step in this patient's evaluation for surgery?

- A) Phenylephrine test
- B) Schirmer test
- C) Tear breakup time
- D) Visual acuity test
- E) Visual field test

The correct response is Option A.

The patient presents with unilateral ptosis of the right eyelid. The elevated lid crease suggests levator aponeurosis attenuation or dehiscence as the mechanism for ptosis. This is known as senile ptosis and is the most common etiology. The challenge in these patients is to determine whether the contralateral eye is also ptotic and requires surgery. This phenomenon is explained by Hering's law (equal and simultaneous innervation of both levator palpebrae muscles). When one eye has ptosis, the brain signals both eyelids to raise. The less ptotic contralateral eye can look normal. The problem occurs when only the more ptotic eye is surgically repaired. The impulse to raise the eyelids is decreased and the contralateral eyelid now descends and appears ptotic. Evaluation demands a way to determine whether contralateral ptosis repair is required. Phenylephrine eye drops put into the more ptotic eye stimulate the Müller muscle to raise the eyelid. In turn, the afferent signals to raise the eyelids decrease. If the contralateral eyelid then falls over the next 10 to 15 minutes, the phenylephrine test is positive and suggests the need for bilateral ptosis repair. Other tests include patching the ptotic eye to decrease the afferent signals or manually raising the ptotic eyelid.

Marginal reflex distance-1 (MRD-1) is the distance in millimeters from the light reflex on the patient's cornea to the level of the upper eyelid margin with the patient in primary gaze. Normal MRD-1 values are greater than 2.5 mm. Most of the population has MRD-1 values of 4 to 5 mm. The following tests are appropriate for evaluation of blepharoplasty patients, but they are not the most important next step in surgical planning for this patient with unilateral ptosis. Schirmer test evaluates tear production, and tear breakup time measures

how quickly the tears evaporate. These tests are appropriate; however, dry eyes are unlikely in this patient because she is able to wear contact lenses without symptoms. Visual field tests are more important for insurance documentation than surgical planning. Visual acuity is for baseline information, not surgical planning.

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164. A 46-year-old woman who is 5 ft 7 in (170 cm) tall and weighs 135 lbs (61 kg) is evaluated one year following bilateral nipple-sparing mastectomy and immediate reconstruction with placement of 350-mL smooth, round silicone gel implants beneath the pectoralis major muscle. Since the surgery, she has experienced hyperdynamic deformity of her breasts. On physical examination, the breast reconstruction appears natural, and there is significant movement of the breasts when the patient flexes her chest. Which of the following is the most appropriate management for this patient?
- A) Inject botulinum toxin into the pectoralis major muscle
 - B) Inject triamcinolone-40 into the areas of tenderness using ultrasound guidance
 - C) Move the implants to the prepectoral plane and cover them fully with acellular dermal matrix
 - D) Perform a breast MRI to assess for rupture of the implants
 - E) Refer the patient to a physical therapist for range of motion, massage, and ultrasound treatments

The correct response is Option C.

This patient is experiencing significant movement because her implants were placed beneath the pectoralis major muscles. While reconstruction options are limited in this otherwise healthy and very thin patient who is not a good candidate for fat grafting or pedicled or free tissue transfer, placing implants over the pectoralis major muscles and covering the implants fully with acellular dermal matrix would be the most appropriate method of reconstructing her breasts and addressing her concerns.

Physical therapy and muscle relaxants are unlikely to produce long-term improvement. An MRI would likely be nondiagnostic, and even if her implants were ruptured, change to a prepectoral plane is still indicated. Botulinum toxin type A is likely not as effective for long-term significant improvement as reoperation. Triamcinolone would not be effective for hyperdynamic deformity.

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2. Ter Louw RP, Nahabedian MY. Prepectoral Breast Reconstruction. *Plast Reconstr Surg.* 2017 Nov;140(5S):51S-59S.

165. A 26-year-old woman is evaluated because she has difficulty breathing out of her right nostril. Physical examination shows the nasal septum is deviated to the right. The nasal dorsum is straight, and the nasal tip is slightly underprojected. A septoplasty is planned. Which of the following incisions is most appropriate for accessing the septum?

- A) Intercartilaginous
- B) Killian
- C) Marginal
- D) Rim
- E) Weir

The correct response is Option B.

A Killian incision is made 1-2 cm posterior to the caudal edge of the septum and provides access to the septum for a septoplasty. It is the most appropriate of the choices listed. While the Killian incision does not provide access to the caudal septal angle, it preserves tip support. The transfixion incision, which obtains access to the septum by incising both sides of the membranous septum at its junction with the caudal septum, is sometimes used. Both provide access to the septum, but the transfixion incision disrupts the septal ligaments, which can deproject the nasal tip inversely. When nasal tip deprojection is desired, the transfixion incision is used, and when the nasal tip is slightly under projected, a Killian incision can be considered.

The Weir incision is made at the alar base. The marginal incision is made at the caudal aspect of the lower lateral cartilage, and the rim incision is made at the rim. Though often grouped together, these incisions are distinct. The intercartilaginous incision is made between the upper lateral and lower lateral cartilages. These incisions are not used for septoplasty.

The septum can also be accessed through a transcolumellar approach, which is an open approach.

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166. The capsules from patients with breast implant–associated anaplastic large-cell lymphoma (ALCL) have significant presence of which of the following bacteria?
- A) *Escherichia coli*
 - B) *Ralstonia pickettii*
 - C) *Staphylococcus aureus*
 - D) *Pseudomonas aeruginosa*
 - E) *Serratia marcescens*

The correct response is Option B.

Most concerning in the past two decades is the incidence of breast implant–associated anaplastic large-cell lymphoma (ALCL). This entity was first diagnosed and associated with breast implants in 1997, and is almost only associated with a history of textured implants and/or tissue expanders. The most common presentation of these patients is late seroma, with some patients presenting with mass, tumor erosion, or lymph node metastasis. A recent review of the world literature on this entity include the following: (1) 173 cases were documented, (2) no cases were found in patients with documented smooth devices only (although this remains controversial, as the data in many cases are incomplete), (3) there may be an associated genetic predisposition as suggested for cutaneous T-cell lymphoma, and (4) the cause is likely multifactorial.

Bacterial biofilm is thought to be an inciting factor for the development of both breast-implant related ALCL and Non-Tumor related capsule contractures. The capsules from patients with tumor had significant presence of Gram-negative bacteria (*Ralstonia* species) compared to nontumor capsules (*Staphylococcus* species). Such data may support the bacterial induction model, as there are also other types of implant-associated lymphomas.

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167. A 12-year-old girl is evaluated for correction of congenital left unilateral upper eyelid ptosis. She demonstrates moderate left levator muscle function of 8 mm. Which of the following methods is most appropriate for correction of this child's blepharoptosis?
- A) Fasanella-Servat procedure with removal of the tarsus, conjunctiva, and Müller muscle
 - B) Frontalis muscle flap advancement
 - C) Frontalis suspension procedure with autogenous fascia lata
 - D) Müller muscle-conjunctival resection
 - E) Resection and advancement of the levator aponeurosis

The correct response is Option E.

The most appropriate method for correction of this child's congenital ptosis is resection and advancement of the levator aponeurosis. This technique is appropriate in patients with greater than 5 mm of levator function. This child has 8 mm of levator function and is therefore a candidate for levator resection and advancement.

Frontalis suspension procedures are reserved for patients with poor levator function or congenital Marcus Gunn jaw-winking syndrome.

The Fasanella-Servat procedure is for correction of minimal ptosis and may alter eyelid contour.

The Müller muscle-conjunctival resection surgery is recommended for patients with fairly good levator function and does not allow for intraoperative adjustment of eyelid height. This child has unilateral blepharoptosis, and achievement of symmetry with the opposite eyelid is crucial.

The frontalis muscle flap is recommended for use in patients with severe ptosis with levator function of less than 4 mm.

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168. A 7-day-old infant is brought to the office for evaluation of widened conchal-mastoid angle and an absent antihelical fold of the left ear. There is a history of maternal hepatitis and oligohydramnios. Which of the following is the most appropriate initial step in management?
- A) Immediate initiation of rigid ear molding system
 - B) Otolaryngology consultation for inner ear evaluation
 - C) Reassurance that the deformity will correct itself
 - D) Reevaluation in 6 weeks
 - E) Surgical repair at 5 years of age

The correct response is Option A.

This infant has a "prominent/cup ear," the most common type of ear deformity, which is characterized by a widened conchal-mastoid angle and an absent antihelical fold.

The traditional approach on ear deformities has been observation, but studies have concluded that only approximately 30% will self-correct. Ear molding techniques provide tremendous benefit to the lives of many children whose misshapen ears do not self-correct. This is possible because the higher postpartum circulating maternal estrogen will increase the amount of hyaluronic acid, a key component of the ear cartilage, and will cause a temporary malleability to the infant's ear cartilage. Timing is important. Waiting more than 6 weeks will cause the loss of the window of opportunity to reshape the ear as the maternal estrogen is decreased. A rigid ear molding system applies a combination of anterior and posterior forces to selectively shape and expand the targeted areas (i.e., helical rim, scapha, antihelix, superior crus, concha, and lobule).

Molding in the neonatal period corrects the auricular deformities long before the onset of peer teasing and bullying. It also decreases the need for surgical correction and the associated pain and costs of surgical corrections. The results may exceed what can be achieved with the surgical alternative. Surgery is required for deformities that cannot be corrected with ear molding and is usually performed after the age of 6 years.

Since there is no inner ear pathology associated with "prominent/cup deformity," otolaryngology consultation is not needed.

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3. Byrd HS, Langevin CJ, Ghidoni LA. Ear molding in newborn infants with auricular deformities. *Plast Reconstr Surg*. 2010 Oct;126(4):1191-200.

169. A 53-year-old woman is evaluated because of horizontal rhytides at the root of the nose and between her eyebrows. Treatment will most specifically target which of the following muscles?

- A) Corrugator supercilii
- B) Depressor septi nasi
- C) Frontalis
- D) Orbicularis oculi
- E) Procerus

The correct response is Option E.

The procerus stretches from the nasal bones to the dermis of the glabella, and contraction promotes horizontal rhytides in the glabellar region. The corrugator supercilii is more likely to promote vertical rhytides in the glabella. The orbicularis oculi serves as a sphincter around the eye and may also contribute to vertical glabellar rhytides. The frontalis is responsible for the horizontal forehead rhytides above the eyebrows. The depressor septi nasi does not impact forehead wrinkles.

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170. A healthy 40-year-old woman who weighs 126 lb (57 kg) undergoes tumescent liposuction of the hips and abdomen in an accredited ambulatory surgery facility. Three liters of tumescent fluid (each liter containing 300 mg of lidocaine and 1 mg of epinephrine) are infiltrated, and a total of 2500 mL of lipoaspirate is removed. The procedure is uneventful, and the patient is sent home the same day. After 24 hours, she reports feeling dizzy and light-headed when ambulating. She has a moderate amount of pain at the operative sites and is taking acetaminophen as directed with some relief. Which of the following is the most appropriate next step in management?

- A) Chest x-ray study
- B) Complete blood count
- C) CT angiogram
- D) Infusion of a 20% lipid emulsion intravenously
- E) Reassurance that the patient's symptoms are normal

The correct response is Option B.

The patient underwent a significant amount of liposuction and may be experiencing symptoms due to blood loss anemia. Traditionally, blood loss from tumescent liposuction has been calculated as a percentage of the lipoaspirate, but some studies show this number may underestimate true blood loss. In light of the patient's symptoms, the most appropriate next step would be to instruct her to obtain laboratory studies at the local hospital or emergency room. Offering reassurance would be inappropriate if the patient has a drop in her hemoglobin and is symptomatic. Dizziness and light-headedness can be early signs of lidocaine toxicity; however, she received a lidocaine dose within the accepted limit of 2000 mg (35 mg/kg), and her symptoms are presenting beyond the time frame of peak plasma absorption, which occurs around 12 hours. Intralipid infusion is not indicated for this patient. A chest x-ray study or CT angiogram may be appropriate if she is short of breath and penetration of the chest cavity, pneumothorax, pulmonary edema, or pulmonary embolism are suspected.

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171. Which of the following arteries provides the blood supply to the superomedial pedicle in reduction mammoplasty procedures?

- A) Internal mammary
- B) Lateral third intercostal
- C) Posterior fourth intercostal
- D) Thoracoacromial
- E) Thoracodorsal

The correct response is Option A.

The superomedial pedicle used in some reduction mammoplasty cases is supplied by arterial blood flow from the ipsilateral internal mammary artery and its intercostal branches. The other arteries are incorrect.

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172. A 35-year-old woman comes to the office for treatment of glabellar rhytides with botulinum toxin type A. A total of 20 units is used for the treatment, with 10 units injected into the region of each corrugator muscle. Ten days later, the patient returns to the office because of ptosis of the left upper eyelid. To help decrease the eyelid ptosis, an alpha-adrenergic agonist eye drop can be used to stimulate which of the following muscles?

- A) Dilator pupillae
- B) Frontalis
- C) Levator palpebrae superioris
- D) Müller
- E) Orbicularis oculi

The correct response is Option D.

Eyelid ptosis is the result of an inadvertent effect of the botulinum toxin upon the levator palpebrae superioris muscle. This can occur during treatment of the glabellar region if the injection is performed within/below the orbital rim.

The ptosis that results from the weakening of the levator palpebrae superioris can be countered by the use of alpha-adrenergic eyedrops such as apraclonidine (Iopidine) or phenylephrine. These eyedrops will stimulate the Müller muscle, which is an accessory eyelid elevator that is located deep to the levator palpebrae superioris between the levator muscle and the conjunctiva of the upper eyelid. This can help improve the ptosis but not likely adequately resolve the problem until the effect of botulinum toxin type A has worn off.

The levator, frontalis, and orbicularis will not be affected by the use of the eyedrops. The iris will dilate because of the effects of the eyedrops. This however, will have no effect on the ptotic position of the eyelid.

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173. A 35-year-old woman comes to the office for correction of an irregularity of the nasal dorsum following rhinoplasty performed 1 year ago. The patient wants nonsurgical treatment. Hyaluronic acid filler (0.6 mL) is injected into the upper third of the nasal dorsum. Immediately after injection, the patient reports partial loss of vision and pain in the right eye. Which of the following is the most appropriate next step?
- A) Application of apraclonidine eye drops
 - B) Intravenous infusion of tissue plasminogen activator
 - C) Nasal subcutaneous injection of hyaluronidase
 - D) Percutaneous lateral canthotomy
 - E) Retrobulbar injection of hyaluronidase

The correct response is Option E.

This patient has symptoms of an intravascular injection of hyaluronic acid (HA) causing occlusion of the central retinal artery. This complication is extremely rare; however, when it occurs, treatment must be immediately instituted because the retinal circulation needs to be restored quickly (within 60 to 90 minutes) for possible reversal of symptoms.

The first line of treatment is to bathe the retinal circulation with hyaluronidase. This is achieved with a retrobulbar injection. Using a 25-gauge needle or cannula, enter the orbit along the orbital floor between the inferior and lateral rectus muscles. Advance the needle along the orbital for at least 1 inch beyond the orbital rim and inject 2 to 4 mL of undiluted hyaluronidase. Hyaluronidase adjacent to an occluded vessel can dissolve an HA embolus.

The likely mechanism of vascular occlusion is an intra-arterial injection of filler under pressure. In this case, the filler would have entered the dorsal nasal artery and traveled retrograde to the ophthalmic artery. Once the injection pressure is released, the filler would then flow antegrade into the central retinal artery which is the terminal branch of the ophthalmic artery.

Tissue plasminogen activator would be indicated for hematologic thrombosis or blood clot embolism, not HA embolus.

Subcutaneous injection of hyaluronidase is indicated for treatment for filler-related vascular compromise secondary to extravascular compression. The goal is to dissipate the

extravascular compression of the artery. However, in patients with symptoms of vision loss, the likely diagnosis is a HA embolus and therefore the first injection should be retrobulbar.

Lateral canthotomy is indicated for decompression or a retrobulbar hemorrhage.

Reassurance is not a reasonable treatment option as this is an emergency. Apraclonidine is a sympathomimetic eye drop use to stimulate Müller muscle and improve botulinum toxin type A–related ptosis.

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174. A 32-year-old woman is evaluated for rhinoplasty. In the course of evaluation, the Cottle maneuver is performed. This test is most likely performed to evaluate which of the following?

- A) Collapse of the external nostrils
- B) Hypertrophy of the inferior turbinate
- C) Patency of the internal nasal valves
- D) Presence of septal perforation
- E) Septal mucosal thickening

The correct response is Option C.

Nasal airway obstruction is a common symptom among patients presenting for rhinoplasty. Evaluation of the nasal airway should be performed in all patients presenting for rhinoplasty. The key structures that affect nasal airflow include the external and internal nasal valves, the inferior turbinates, and the nasal septum. The patient should be examined for collapse of the external nasal valves on deep inspiration, and a Cottle maneuver should be performed to evaluate patency of the internal nasal valves. Internal nasal examination is aided with the use of a nasal speculum. Oxymetazoline nasal spray facilitates mucosal constriction if mucosal edema is present. Narrowing or collapse of the internal valves with inspiration should be noted, along with inferior turbinate hypertrophy, which typically occurs on the side opposite septal deviation.

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175. A 47-year-old woman who underwent bilateral augmentation mammoplasty with silicone implants to treat mammary hypoplasia 17 years ago is evaluated because of worsening pain, firmness, and distortion of her breasts. Which of the following diagnostic evaluations is most sensitive for evaluating this patient's silicone breast implants?

- A) Breast thermography
- B) CT scan
- C) Mammography
- D) MRI
- E) Ultrasonography

The correct response is Option D.

MRI scan would be the most sensitive and specific method for detection of silent rupture of a silicone breast implant in this patient. Classic MRI findings indicating rupture include the linguini sign or the teardrop sign. Current FDA recommendations are to obtain MRI screening for silent rupture three years after placement of silicone implants and every two years after that.

CT scanning can show findings similar to those seen with MRI, but CT involves ionizing radiation, which can be harmful. CT has not been proven to be as sensitive as MRI in evaluating silicone breast implant rupture.

Ultrasonography is a less costly method of implant evaluation but this method is highly operator-dependent. In asymptomatic women, a subsequent MRI scan is generally needed to confirm a positive ultrasound screen.

Mammography is indicated for screening for breast cancer but not for implant rupture.

Breast thermography utilizes digital infrared imaging to evaluate metabolic activity and vascular circulation of the breast to look for suspicious signs of breast cancer. It is not effective in the evaluation of silicone breast implant rupture.

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176. A 42-year-old woman comes to the office for consultation on nonsurgical options for treatment of prominent nasolabial folds. The consultation covers injectable filler options. Compared with other types of injectable fillers, hyaluronic acid is distinguished by which of the following characteristics?

- A) Can be enzymatically reversed
- B) Cannot be combined with lidocaine
- C) Contains methylmethacrylate
- D) Is indicated for subperiosteal placement
- E) Is radiopaque on x-ray study

The correct response is Option A.

Hyaluronic acid (HA) fillers are among several agents currently available in the United States. HA is a naturally occurring polysaccharide derived from bacterial fermentation that exhibits no species or tissue specificity. Therefore, serial retreatment is unlikely to induce allergic reactions. Other types of filler products include finely ground methylmethacrylate, calcium hydroxyapatite and poly-L-lactic acid. Although complications may arise with any type of filler, intravascular injection/embolization can occur, and it requires urgent management to preclude tissue necrosis or, in the case of retinal artery occlusion, vision loss. Only HA can be dissolved with an injection of an enzyme, hyaluronidase. It is not radiopaque as is calcium hydroxyapatite. It may appear gray (Tyndall effect) if placed too near the surface. While certain formulations of HA can be injected into the subcutaneous plane, neither it nor any of the others are approved for injection into the subperiosteal plane. Lidocaine is mixed into many HA products to diminish injection site pain. More than 1 mL can be injected per patient in the same setting. Operator technique is most important to maximize safety when using any type of filler. Minor complications of fillers include hypersensitivity, acute infection, malposition of filler, and inflammatory nodules or granulomas.

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177. A 34-year-old woman with a history of grade I breast ptosis who is 6 years status post-augmentation mammoplasty with subglandular gel-filled implants returns to the clinic. Physical examination shows normal-appearing breasts, but there is mild firmness on palpation. Which of the following Baker grades best describes these findings?

- A) Grade I
- B) Grade II
- C) Grade III
- D) Grade IV

The correct response is Option B.

Many classification systems have been used to evaluate the severity of breast capsular contracture, which occurs when the peri-implant capsule undergoes fibrotic change. The most widely employed assessment tool remains the Baker grading system, which takes into account patient signs and symptoms. According to the Baker classification, only the highest degrees of contractures (grades III and IV) require surgical treatment. The descriptors for each grade are listed here:

Grade I: the breast is soft and appears normal in size and shape

Grade II: the breast is a little firm and appears normal

Grade III: the breast is firm and appears abnormal

Grade IV: the breast is firm, appears abnormal, and is painful

Studies note decreased relative risk for Baker grade III to IV capsular contracture in patients who undergo primary breast augmentation through an inframammary fold incision, subpectoral pocket placement, and textured implants. There is an increased relative risk for capsular contracture when patients undergo a periareolar or axillary incision and subglandular placement of smooth implants.

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178. A 45-year-old woman who is obese is considering unilateral mastectomy and reconstruction of the left breast because of invasive ductal carcinoma. Which of the following patient characteristics is associated with the lowest risk for complications from a nipple-sparing mastectomy?

- A) BMI of 41 kg/m²
- B) Grade III ptosis of the breast
- C) Nipple retraction
- D) Tumor distance from nipple of 5 cm
- E) Tumor size of 6 cm

The correct response is Option D.

Nipple-sparing mastectomy is increasing in popularity. To decrease the risk for surgical complications as well as oncologic complications, smaller tumors located further from the nipple in patients without morbid obesity or severe ptosis are considered better candidates for treatment with nipple-sparing mastectomy. Clinical involvement of the nipple, including retraction, would suggest that nipple-sparing mastectomy should not be performed.

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179. A 36-year-old woman is evaluated because of spontaneous galactorrhea 6 days after undergoing augmentation mammoplasty. Which of the following factors most likely contributed to this outcome?

- A) Inframammary placement of the incision
- B) Subglandular versus dual-plane position of the device
- C) Surgical interruption of the intercostal nerves
- D) Use of silicone versus saline breast implants

The correct response is Option C.

Although no one knows exactly what leads to postoperative galactorrhea, it is observed to occur more often in parous women and theorized to occur due to a combination of factors which simulate suckling or change in the innervation of the chest wall and nipple-areola complex. This would include increased tissue pressure related to the implant placement and interruption of intercostal nerves. No relationship has been identified between incision placement (peri-areolar, inframammary, transaxillary, or even peri-thelial) and postoperative galactorrhea. Similarly no relationship has been identified between device positioning (dual-plane, subglandular, and submuscular) and postoperative galactorrhea. Again, no relationship has been observed in implant type, saline versus silicone, and postoperative galactorrhea.

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180. Which of the following is associated with the transconjunctival blepharoplasty with the skin pinch technique, when compared with transcutaneous blepharoplasty with a skin-muscle flap?
- A) Decreased incidence of scleral show
 - B) Easier access to the lateral fat compartment
 - C) Easier access when performing retinacular suture canthopexy
 - D) Increased incidence of middle lamellar scarring
 - E) Ineffective resection of lower eyelid skin

The correct response is Option A.

Transconjunctival blepharoplasty with the skin pinch technique has a low rate of scleral show, compared with rates seen in studies of the transcutaneous blepharoplasty using a skin-muscle flap. However, because it uses a transconjunctival approach to the fat compartments of the lower eyelid, access is not improved but can be challenging, particularly for the lateral fat pad. This is considered a disadvantage of the transconjunctival method. Skin resection is believed to be more thorough with the skin pinch method than with the classical skin-muscle flap. The incidence of middle lamellar scarring with the technique is believed to be less, since the orbicularis oculi muscle is not violated. Performance of canthopexy is not changed by the selection of this technique.

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181. A 45-year-old woman is undergoing abdominal and flank liposuction. When the superwet liposuction technique is used, estimated blood loss is closest to which of the following percentages of the lipoaspirate?
- A) 0.1%
 - B) 1%
 - C) 15%
 - D) 30%
 - E) 50%

The correct response is Option B.

The best estimate of blood loss during either superwet or tumescent technique liposuction is 1% of the lipoaspirate. There may, however, be differences in true blood loss based on interstitial extravasation. Techniques that employ smaller ratios of tumescent solution infusion generally lead to higher levels of blood loss, as high as 20 to 40% of the lipoaspirate.

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182. A 55-year-old woman is evaluated for facial rejuvenation. She is concerned about brow ptosis and dynamic frown lines. Physical examination shows brow ptosis, dynamic and static frown lines, a long forehead, and thick hair. Which of the following is the best approach for brow lift surgery for this patient?

- A) Endoscopic
- B) Endotemporal
- C) Pretrichial
- D) Transcoronal
- E) Transpalpebral

The correct response is Option C.

The pretrichial incision is the appropriate approach to perform a brow lift and to address a long forehead. Of the options listed, the pretrichial incision alone can specifically address a long forehead.

An endotemporal approach is useful for patients with thin hair or lateral ptosis, and endoscopic and transpalpebral approaches are useful for a brow lift but cannot address a long forehead. A transcoronal incision is most useful in a patient with a short forehead and deep rhytides.

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183. Which of the following is the most likely chronic effect of post-mastectomy radiation therapy?
- A) Desquamation
 - B) Dyspigmentation
 - C) Edema
 - D) Erythema
 - E) Ulceration

The correct response is Option B.

Radiation therapy induces tissue injury that can be categorized as acute or chronic. The spectrum of acute injury includes erythema, edema, desquamation, hyperpigmentation, and ulceration, ranging from mild to severe. Acute radiation dermatitis occurs in upward of 85% of treated patients. Chronic injury involves skin atrophy, dryness, telangiectasia, dyspigmentation, and dyschromia. In the breast, it leads to chronic fibrosis of the skin and subcutaneous tissues. This fibrosis and surrounding injury can lead to pain and restricted movement of the arm. The chronic changes from radiation can take months to years to fully manifest.

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184. A 74-year-old woman comes to the office to discuss blepharoplasty. She has bilateral dermatochalasis and right lid ptosis secondary to levator dehiscence. She does not have dry eyes and states that her vision is much improved after recent corneal refractive surgery. Which of the following is the minimum amount of time after her corneal refractive surgery that this patient should wait before undergoing blepharoplasty?
- A) 3 Months
 - B) 6 Months
 - C) 9 Months
 - D) 12 Months
 - E) None; this patient is not a candidate for blepharoplasty

The correct response is Option B.

The current accepted time frame between corneal refractive surgery and blepharoplasty is a minimum of 6 months. Early post-corneal refractive surgery puts the patient at risk for worsening dry eyes and/or keratopathy.

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185. When a cephalic trim is performed during primary rhinoplasty, which of the following is the minimum width of caudal lower lateral cartilage that should be left behind?

- A) 4 mm
- B) 6 mm
- C) 8 mm
- D) 10 mm
- E) 12 mm

The correct response is Option B.

The nasal tip represents a complex nasal tripod. The paired lower lateral cartilages work synergistically to provide the main structural support for the nasal tip. Tip refinement is of course common in rhinoplasty, and a cephalic trim of excess lower lateral cartilage is a classic maneuver utilized in primary rhinoplasty. The cephalic trim acts to decrease vertical height of the lateral crura and to debulk to tip. It is crucial that enough cartilage be left behind when removing excess lower lateral cartilage from the cephalic portion. Classically, 6 mm (5 to 7 mm) of rim strip is the accepted standard of how much should be left behind at minimum to prevent stability compromise of the lower lateral cartilages. Resection in excess of this can weaken the lateral crus and cause retraction, notching, and/or external valve dysfunction.

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186. A 28-year-old woman with history of lipodystrophy of the abdomen and waist plans to undergo suction-assisted lipectomy while receiving general anesthesia. The surgeon anticipates 1.5 L of lipoaspirate. With a superwet technique, how much fluid is the patient most likely to receive in the form of subcutaneous tissue infiltration?
- A) 0 mL
 - B) 375 mL
 - C) 750 mL
 - D) 1500 mL
 - E) 3000 mL

The correct response is Option D.

Originally, liposuction was performed without wetting solutions, but this technique was associated with reported estimated blood loss of up to 45% of aspirate. Infiltrating wetting solutions with a base of normal saline or Ringer's lactate with additives epinephrine and lidocaine prior to suctioning improves hemostasis and pain control. The current options for wetting solutions are dry, wet, superwet, and tumescent. The dry technique is rarely used and no wetting solution is infused. The wet technique employs injecting a standard 200 to 300 mL per anatomic area to be treated, irrespective of the anticipated lipoaspirate. The superwet technique is predicated on a 1:1 ratio of instilling 1 mL of solution per 1 mL of aspirate. True tumescent infiltration involves infiltration at a ratio of 2 to 3:1 of wetting solution per mL of expected lipoaspirate.

0 mL is a dry technique, 375 mL is a wet technique, 750 mL does not fall into any category, and 3000 mL is tumescent technique.

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187. A 35-year-old woman who is morbidly obese comes to the plastic surgery clinic to discuss body contouring. She is counseled that losing weight before undergoing contouring may be beneficial. Which of the following methods of weight loss is most likely to increase this patient's risk for surgical complications during body contouring?

- A) Exercise
- B) Gastric band/sleeve
- C) Gastric bypass
- D) Liposuction
- E) Low-carbohydrate diet

The correct response is Option C.

Multiple studies have demonstrated that results from body contouring after massive weight loss depend somewhat on the method of weight loss. Weight loss via gastric bypass has been shown to be associated with higher rates of surgical complications following body contouring than other weight loss methods.

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188. A 40-year-old woman comes to the office for consultation on an augmentation mastopexy 2 years after giving birth to her second child. She is back to her pre-pregnancy weight. Physical examination shows involutional changes contributing to a deflated appearance of the breasts. This appearance is most likely due to a histologic decrease in which of the following?

- A) Area composed of stromal matrix
- B) Number of differentiated lobules
- C) Thickness of dermis
- D) Thickness of pectoralis muscle
- E) Volume of adipose tissue

The correct response is Option B.

Postpartum involutional changes can manifest clinically as breasts that appear deflated, commonly due to a loss of volume and skin that has been stretched. On a histologic level, these clinical manifestations occur due to a decrease in the number and area of differentiated lobules that were enlarged and specialized for milk production. As this occurs, it is hypothesized that the lobular area is then replaced by stromal matrix and eventually fat. Involutional changes do not refer to changes in the dermis, pectoralis muscle or chest wall structures.

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189. A 48-year-old woman with moderate neck skin laxity, little submental fat, moderate cheek laxity, and moderate jowling undergoes short scar rhytidectomy using the two-suture minimal access cranial suspension technique. At completion of skin closure, a vertical fold of excess skin on the lateral neck is visible near the earlobe. Which of the following is the best method to address the vertical fold of skin?
- A) Extend the rhytidectomy incision postauricularly, with excision of excess skin
 - B) Place a third purse-string superficial musculoaponeurotic system (SMAS) plication suture
 - C) Re-rotate the cheek flap superiorly
 - D) Use a subsideburn wedge excision
 - E) Observe only

The correct response is Option A.

One of the potential drawbacks of the short scar rhytidectomy is in patients with significant skin excess. When a postauricular incision is not made, as in the classic minimal access cranial suspension technique, a vertical fold of excess skin may result in the lateral neck area, inferior to the earlobe, in patients who have moderate to severe neck laxity. This is best treated by extending the incision posteriorly in the traditional postauricular direction, elevating a postauricular skin flap, and excising the excess.

Reopening the incision and rotating the flap will accentuate closure difficulties in the visible temporal area and will not address the horizontal neck skin excess. The third purse-string suture, described in the extended MACS lift, is used for mid face correction and does not help the skin excess. A subsideburn wedge excision, while a useful technique for vertical elevation of the cheek flap, does not provide the correct vector of pull for this problem. Observation only is not recommended, as the dog ear tends to persist and not resolve.

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190. A 45-year-old man is evaluated for a body lift after undergoing bariatric surgery and subsequent 100-lb weight loss. Which of the following characteristics would make this patient an inappropriate candidate?
- A) BMI of 30 kg/m²
 - B) History of deep venous thromboembolism
 - C) Protein intake of 25 g daily
 - D) Transverse abdominal scar
 - E) Type 2 diabetes

The correct response is Option C.

Achieving satisfactory outcomes while minimizing morbidity requires careful assessment of the patient's comorbidities, nutritional deficiencies, and psychological issues. A history of venous thromboembolism is not a contraindication for body contouring procedures but requires evaluation of the patient by a hematologist and postoperative thromboembolism prophylaxis. Type 2 diabetes is not a contraindication for a circumferential body lift. BMI is a predictor of complications following body contouring procedures. Higher BMI (BMI >35) is associated with increased complication rates.

Nutritional status in the postbariatric patient is important to achieving successful outcomes for the body lift patient. Deficiencies in calcium, vitamin B12, folate and thiamine should be corrected prior to surgery. Protein deficiencies have been shown to significantly lower healing rates among massive weight loss patients. Studies have indicated that a minimum of 60 to 100 g daily of protein is necessary to prevent malnutrition and avoid delayed wound healing in such patients. Daily protein intake of 25 g or less would produce severe malnutrition and be a contraindication for surgery.

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191. A 26-year-old healthy woman comes to the office for consultation because she has constant pain 1 year after undergoing augmentation mammoplasty by another surgeon. She reports that he "botched" her surgery and that she is considering taking legal action against him. On physical examination, the breasts are quite firm and mildly tender. The relatively immobile subglandular implants are high on the chest wall. There are no overlying skin changes. Which of the following is the most appropriate response by the surgeon in this scenario?
- A) Decline to establish care
 - B) Follow-up visit in one year
 - C) Perform a diagnostic intercostal nerve block
 - D) Prescribe a course of oral corticosteroids
 - E) Recommend surgical intervention

The correct response is Option E.

This patient has developed Baker grade IV capsular contracture as evidenced by hard, painful breast implants that are malpositioned. This is a known complication of augmentation mammoplasty, and the patient should be informed that it is treatable with another surgery. It would be reassuring to the patient to hear that it is a known post-operative complication that happens not uncommonly, and that it is unlikely the other surgeon directly did anything to cause this. Thoughtful analysis and contextualization are helpful in high-tension consultations such as these.

Providing the patient with a malpractice attorney's contact information may be what she thinks she wants, but diffusing the situation is best for all involved. Dismissing the patient's concerns outright without diagnosing her and suggesting a course of treatment would not be helpful. The new surgeon may even take it a step further by offering to speak with her previous surgeon to discuss the patient's concerns and the findings seen during consultation. The patient may refuse to allow this, and she may have lost faith in her other surgeon, but at least offering to speak with the other surgeon is prudent and may restore the relationship between this patient and her surgeon. A pain management specialist and physical therapy may help somewhat with symptoms, but her problem ultimately requires and should respond well to a surgical solution.

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192. A 30-year-old woman wants improvement of the bulbous tip of her nose. Open rhinoplasty and thinning of the tip is planned. Intraoperative examination shows the cause of the bulbous tip is widely convex lower lateral cartilages that are thick and relatively inflexible. The domal width is greater than 6 mm. The angle of divergence is normal. Which of the following surgical maneuvers is most likely to correct the deformity?

- A) Alar rim grafting
- B) Cephalic trimming of the lower lateral cartilage
- C) Crural spanning sutures
- D) Lateral crural strut grafting
- E) Subdomal spreader grafting

The correct response is Option D.

A bulbous/boxy tip can be caused by a convex lower lateral cartilage with a wide domal width (less than 4 mm), widened angle of divergence (less than 30 degrees), or a combination of both. This patient's deformity is a widely convex lower lateral cartilage. The best choice is a lateral crural strut graft. This graft is usually harvested from the septum and sutured to the undersurface of the lower lateral cartilage. These grafts are strong and can reshape a thick inflexible lower lateral cartilage. Crural spanning sutures can straighten the convexity of these cartilages if the cartilages are flexible; however, in this patient it would unlikely be successful.

Transgenu sutures are often needed to further refine the domal width; however, in very boxy tips, a lateral crural strut graft would also be needed for a better result. Cephalic trim of the lower lateral cartilage is often performed to narrow the cartilage. This maneuver would not correct the deformity. When performing the cephalic trim, it is important to leave at least 6 mm of cartilage for support. An alar rim graft is a strip of cartilage placed in a subcutaneous pocket along the alar rim. This graft is placed caudal to the lower lateral cartilage. It can strengthen a buckled rim but would not straighten a stiff convex lower lateral. Subdomal spreader grafts are used to correct a pinched tip deformity.

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193. A 58-year-old woman is evaluated for seroma six weeks after undergoing a lower body lift following massive weight loss. The surgery was uneventful, and the drain had been removed. Repeated aspirations of the seroma were done without success. The surgeon is considering injection of a sclerosant agent into the seroma space. Which of the following agents is most likely to be used?

- A) Doxorubicin
- B) Doxycycline
- C) Erythromycin
- D) Gentamycin

The correct response is Option B.

Seroma presents as a common postoperative management problem in plastic surgery, particularly in body contouring for massive weight loss. The combination of potential injury to a rich lymphatic supply, possible excision of lymphoid tissue, and extensive subcutaneous dissection in adjacent areas, combined with shear forces and motion are the substrates to seroma formation. The most widely used treatment strategies for effusions include percutaneous aspiration, drainage, and injection of sclerosant agents through chest tubes. Doxycycline and bleomycin are the most common sclerosant agents used.

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194. A 53-year-old woman who underwent periareolar mastopexy 13 years ago comes to the office to request reoperation of her now DD-cup–sized breasts. She wants improvement in the appearance of her breasts with greater projection and a decrease in her brassiere size to a B cup. Physical examination of the breasts shows flattened nipple-areola complexes that are 72 mm in diameter surrounded by circumferential hypertrophic surgical scars. The breasts are wide and bottomed out with a 14-cm distance between the inferior areolar border and the inframammary fold. Which of the following is the most appropriate technique to achieve the desired result?
- A) Liposuction of the breasts with autologous fat transfer to the retroareolar region
 - B) Liposuction of the breasts with placement of breast implants
 - C) Liposuction of the lower poles of the breasts with excision of the hypertrophic areolar scars
 - D) Periareolar mastopexy with open excision of excess breast tissue
 - E) Wise pattern mastopexy with open reduction of excess breast tissue

The correct response is Option E.

The most appropriate technique to achieve this patient's desired result of improved appearance of her breasts with increased projection and significantly decreased cup size is a secondary Wise pattern mastopexy with open reduction of her excess breast tissue. This technique will allow reduction in the diameter of the areola, give increased breast projection, and decrease the chance for recurrence of widened hypertrophic periareolar scarring.

Liposuction of the lower pole of the breast and periareolar scar revision could modestly decrease breast volume and possibly improve scar quality, but they would be ineffective at improving breast shape and projection, and in decreasing the areolar dimensions and excessive length of the lower pole of the breast.

Periareolar mastopexy with open reduction of excess breast tissue will not increase central breast projection or adequately address the excessive length of the inferior areolar to inframammary crease distance.

Liposuction of the breasts with placement of breast implants could improve central breast projection. This approach, however, would not provide the significant decrease in breast

volume of three cup sizes which this patient desires, and would not improve the patient's periareolar scars or the bottoming out of the lower poles of the breasts.

Liposuction of the breasts with fat grafting to the retro-areolar areas could increase central breast projection and decrease brassiere cup size, but it does not treat the hypertrophic areolar scarring or the abnormal lower pole dimensions of the breasts.

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195. A healthy 62-year-old woman presents 1 week after undergoing uneventful rhytidectomy because her smile is now asymmetric. On physical examination, the left lower lip does not depress on smiling. Which of the following is the most appropriate management of this complication?
- A) Evaluate the patient for a cerebrovascular accident
 - B) Explore the left cheek and neck for entrapment of the marginal mandibular nerve
 - C) Perform a nerve conduction study to assess the marginal mandibular nerve
 - D) Refer the patient to a physical therapist who specializes in facial reanimation training
 - E) Reassure the patient that her smile should return to normal within 3 to 6 months

The correct response is Option E.

Injury to the marginal mandibular nerve can result in inability to depress the affected side of the lower lip. Nerve dysfunction may be attributable to traction, cautery, sutures, or surgical division. Spontaneous recovery is usually noted within 3 to 4 months. Usually, careful reassurance and close follow-up are necessary.

Physical therapy would offer little benefit. A nerve conduction study also is likely to provide little additional information and no benefit especially one week after surgery. Without concern for intraoperative division of the nerve, surgical exploration should be delayed for several months to allow for nerve recovery.

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196. A 39-year-old woman comes to the office with a 6-month history of progressive firmness and superior fullness of the left breast. History includes bilateral augmentation mammoplasty with textured saline implants placed in a submuscular dual-plane pocket 15 years ago. On physical examination, the left breast appears larger and firmer with more upper pole fullness in comparison with the right breast. Which of the following is the most appropriate next step?

- A) Capsulectomy and pocket change
- B) Mammography
- C) 3-Month trial of montelukast (Singulair)
- D) MRI
- E) Ultrasonography

The correct response is Option E.

Breast implant patients who present with late-onset enlargement of one of their breasts require evaluation for breast implant-associated anaplastic large cell lymphoma (BIA-ALCL). This disease usually presents with spontaneous onset of peri-prosthetic fluid. A late-onset seroma is usually accepted as occurring 1 year after surgery; however, they have presented as early as 4 months. It is often difficult to determine if late-onset firmness of the implant is secondary to fluid, capsular contracture, or both.

The initial workup should begin with an ultrasound to evaluate for peri-prosthetic fluid or capsular mass. If fluid is present, it should be sent for cytology, flow cytometry with immunohistochemistry looking for expression of T-cell CD30 cell surface protein.

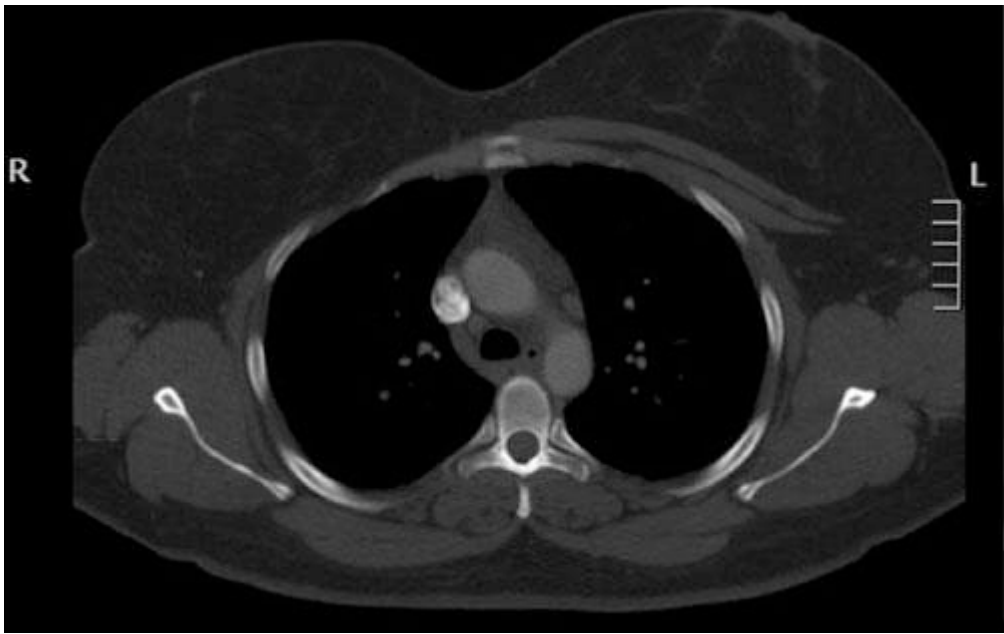
BIA-ALCL is overwhelmingly associated with textured implants. It is important to remember that BIA-ALCL is extremely rare and that most patients presenting with a late seroma will not have lymphoma, but will have peri-prosthetic fluid from the textured surface pulling away from the capsule and forming a double capsule. The treatment for localized BIA-ALCL is bilateral total capsulectomy and explantation. Treatment for the more likely double capsule or capsule contracture is capsulectomy and pocket change; however, surgery is not indicated until the diagnosis is made.

Montelukast is a leukotriene antagonist that can inhibit the inflammatory cascade thought to be involved with capsular contracture. It seems to be more useful in patients with capsular contracture less than grade III. There is no consensus on its use or effectiveness.

The sensitivity and specificity of ultrasound for detecting a seroma has been equal or better than MRI or 3D mammography. After diagnosis of ALCL, MRI and PET scanning may be indicated. If the implants were silicone gel, MRI would be indicated to evaluate for implant rupture; however, ultrasound would still be recommended for seroma evaluation and aspiration.

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3. Huang CK, Handel N. Effects of Singulair (Montelukast) Treatment for Capsular Contracture. *Aesthet Surg J*. 2010 May-Jun;30(3):404-8.
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197. The postoperative CT scan shown is obtained to evaluate a wound dehiscence in a patient who underwent left-sided unilateral reduction mammoplasty for asymmetry six weeks ago. Which of the following upper extremity deformities is most likely to be found in this patient?

- A) Contralateral radial club hand
- B) Contralateral “pouce flottant” thumb
- C) Ipsilateral brachysyndactyly
- D) Ipsilateral radial head subluxation
- E) Ipsilateral type IV Wassel preaxial polydactyly

The correct response is Option C.

Assessment of the chest CT shows right-sided absence of the pectoralis major and minor muscles and breast hypoplasia. The patient suffers from Poland syndrome, which is a congenital disorder of unknown etiology with the prevailing theory being hypoplasia of the subclavian artery or its branches during the sixth week of embryogenesis. Variability exists in physical findings with the most common being: anterior axillary fold and pectoralis major sternal head absence, breast gland thinning, rib and cartilage hypoplasia, and

ipsilateral brachysyndactyly. After local wound care and antibiotic therapy, the patient had resolution of her symptoms.

A type IV Wassel preaxial polydactyly is the most common congenital thumb duplication but is not associated with Poland syndrome. Radial club hand is more common than ulnar club hand, but has no association with Poland syndrome. Both are congenital hand deformities, but unrelated to the pathological condition mentioned. Radial head subluxation is also known as “nursemaid's elbow.” Nursemaid's elbow is a common injury of early childhood. It is sometimes referred to as "pulled elbow" because it occurs when a child's elbow is pulled and partially dislocates. There is no connection between Poland syndrome and increased incidence of radial head subluxation. Type IV Manske modification of the Blauth classification thumbs (the “pouce flottant” thumb) have rudimentary elements and are attached to the hand by a small skin bridge. These thumb anomalies are not associated with Poland syndrome.

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198. An otherwise healthy 25-year-old woman is evaluated and scheduled for augmentation mammoplasty with silicone gel implants. Which of the following is most accurate regarding breast implant-associated anaplastic large cell lymphoma (BIA-ALCL)?
- A) All late breast implant-associated seromas should be evaluated
 - B) BIA-ALCL is most often associated with an aggressive clinical course
 - C) BIA-ALCL is most often associated with smooth implants
 - D) It is not necessary to include BIA-ALCL in a standard breast augmentation/reconstruction consent
 - E) Knowledge about BIA-ALCL's cause is based on strong evidence-based studies

The correct response is Option A.

Due to the potential critical relevance of breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) and its tendency to present as a late seroma, correct diagnostic pathways should be carried out on all late breast implant-associated seromas to include cytologic examination and, if indicated further, fine-needle aspiration, flow cytometry, and immunohistochemistry for CD30. BIA-ALCL is a critical outcome in implant-associated breast augmentation/reconstruction. It is most commonly confined to peri-implant seroma fluid and follows a nonaggressive course amenable to implant and capsule removal, although there are aggressive variants. Discussion about this condition should be part of the consenting process for all breast implant cases. Finally, to this point evidence on cause is based on very low-evidence studies. ALCL is most often associated with textured implants.

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199. A 46-year-old woman seeks to improve her facial appearance with soft-tissue fillers. Her rejuvenation plan includes administration of a highly cross-linked hyaluronic acid injectable filler to the mid face to restore volume loss. To properly add volume to and rejuvenate this area, the filler should be injected into which of the following soft-tissue layers?
- A) Intradermal
 - B) Preperiosteal
 - C) Subdermal
 - D) Subperiosteal
 - E) Throughout multiple layers of soft tissue from deep to superficial

The correct response is Option B.

Restoration of mid face volume loss is a highly effective maneuver that can be performed utilizing fat grafting or off-the-shelf injectable fillers. The most commonly used hyaluronic acid-based injectable fillers utilized for mid face rejuvenation and volume restoration include those that are highly cross-linked, thus increasing the stability, density, cohesivity, and longevity of the filler. The process of cross-linking hyaluronic acid results in larger, more stable molecules that have biocompatibility and viscoelastic properties similar to those of fat. Ideally, these highly dense fillers should be placed at the preperiosteal level to optimize results and minimize potential complications, such as intravascular placement of filler or visible lumps.

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200. A 55-year-old woman who underwent augmentation mammoplasty with retro-pectoral smooth saline implants 18 years ago comes to the office because she is dissatisfied with her breast shape. Physical examination shows glandular ptosis hanging off the implants. She has Grade I capsules. Which of the following is the most appropriate procedure to correct this patient's deformity?

- A) Implant exchange alone
- B) Implant exchange with capsulectomy
- C) Implant exchange with mastopexy
- D) Implant exchange with suture plication of the expanded inferior pocket
- E) Site change to subglandular placement

The correct response is Option C.

The described patient has a “snoopy nose deformity” or “waterfall breast deformity,” with the ptotic breast hanging off of the implant. There is no pocket expansion. The implants have stayed in their original position while the native breast tissue has become ptotic with time and gravity. This is not superior malposition due to capsular contracture; both breasts are soft. Correction of this problem is best performed with an appropriately chosen form of mastopexy. In this case, replacement of the implants would also be performed because of their age.

Implant exchange alone would not correct the ptotic breast. Capsulectomy is not indicated, since the breasts are soft, and no capsule is noted clinically. Similarly, suture plication of the pocket is not required, since the inframammary fold is in the correct position, and no second fold is seen. Site change would not correct the patient’s grade III ptosis, but it may be used to correct this problem in cases without significant ptosis.

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Section 5: Core Surgical Principles

201. A 10-year-old boy undergoes surgical repair of microtia of the right ear. During cartilage rib harvest, the right thorax is damaged with visualization of the lung. After repair of the pleura, Valsalva maneuver is performed with no evidence of an air leak. An intraoperative chest x-ray is negative for pneumothorax. Several minutes later in the PACU, the patient becomes hypotensive and tachypneic, and his oxygen saturation decreases to the mid-80s, despite use of a non-rebreather mask. Which of the following is the most appropriate next step in management?

- A) Draw arterial blood gas
- B) Intubation
- C) Needle decompression of the right chest
- D) Open the chest incision
- E) Portable chest x-ray study

The correct response is Option C.

The patient shows all the signs of tension pneumothorax, and although the precise etiology is unclear, the patient requires decompression. Intubation will not help relieve the tension and pressure, with decreased venous return jeopardizing hemodynamic stability.

Immediate chest x-ray is inappropriate because of the time required.

Opening the chest incision is not a good option because it requires surgical equipment, general anesthesia, and cannot be completed in a timely fashion.

Needle decompression at the second intercostal is the standard of care to decompress a tension pneumothorax. After oxygen saturation and hemodynamics are stabilized, definitive treatment of pneumothorax can be pursued. This would include placement of chest tube to low suction and serial chest x-ray to monitor the progress of the lung inflation.

Arterial blood gas will not help make the diagnosis and potentially will delay the appropriate intervention.

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202. Which of the following procedures has the greatest risk of potential venothromboembolism (VTE)?

- A) Abdominoplasty
- B) Bilateral reduction mammoplasty
- C) Implant-based calf augmentation
- D) Liposuction of the trunk

The correct response is Option A.

There is level II evidence provided by Winocour et al in 2017 by querying the Cosmetassure database of more than 129,000 patients that body procedures such as lower body lift and abdominoplasty have higher risk than breast, liposuction, or facial procedures. More specific level II evidence about abdominoplasty and venothromboembolism (VTE) was published in 2018 Keyes et al. after querying the Internet Based Quality Assurance Program database, that BMI greater than 25 kg/m2 and age greater than 40 were independent predictors of VTE risk. Most of the patients in this study who had VTE had pre-operative Caprini scores of 2 to 8, which would not typically make these patients recipients of chemoprophylaxis against VTE.

Although operating in the area of the calf muscles seems like a good source of potential VTE, there is no reference to calf implants in these large database studies, and a PubMed search of VTE and calf implants returns no literature.

For a generalized summary of risk stratification, consult the Pannucci et al. article.

REFERENCES:

1. Pannucci CJ, Swistun L, MacDonald JK, et al. Individualized Venous Thromboembolism Risk Stratification Using the 2005 Caprini Score to Identify the Benefits and Harms of Chemoprophylaxis in Surgical Patients: A Meta-analysis. *Ann Surg.* 2017 Jun;265(6):1094-1103.
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203. A 36-year-old health-care worker sustains a needle-stick injury from a hepatitis C–seropositive patient. Immediate testing for anti-HCV antibodies and confirmatory immunoassays for HCV-RNA are performed. Initial follow-up testing after exposure should be performed at which of the following time periods?

- A) 1 week
- B) 3 weeks
- C) 6 weeks
- D) 12 weeks
- E) 24 weeks

The correct response is Option C.

It is recommended that follow-up retesting be done at 6 weeks, 3 months, and 6 months in known HCV exposure cases. Tests at 1 or 3 weeks would possibly lead to false negative results. There is no advantage in waiting beyond 6 weeks.

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2. Pappas N, Lee DH. Hepatitis C and the Hand Surgeon: What You Should Know. *Journal of Hand Surgery*. *J Hand Surg Am*. 2012 Aug;37(8):1711-3; quiz 1714.

204. A newborn male infant who is born at 36 weeks' gestation via cesarean delivery has a large defect of the anterior abdominal wall. Examination shows matted bowel loops coming through the defect lateral to the umbilical cord. No other abnormalities are noted. Which of the following associated findings is/are most likely?
- A) Abnormal karyotype
 - B) Constriction rings with limb and digital amputations
 - C) Elevated maternal serum alpha fetoprotein (MSAFP)
 - D) Hypoglycemia, macrosomia, and macroglossia
 - E) Translucent membrane covering bowel

The correct response is Option C.

Omphalocele (OC) and gastroschisis (GS) represent the two most common congenital abdominal wall defects, with a prevalence of approximately 3 to 4 per 10,000 live births/fetal deaths/stillbirths/pregnancy terminations each. Precise pathoetiologies are unclear, but developmental pathways and characteristics at the time of birth are notably distinct. OC is characteristically a midline partial-thickness abdominal wall defect covered by a membrane of amnion and peritoneum occurring within the umbilical ring and containing abdominal contents. GS is characteristically a full-thickness, paraumbilical abdominal wall defect associated with eviscerated bowel.

Both OC and GS are associated with elevated maternal serum alpha fetoprotein (MSAFP). For comparison, MSAFP values average twice that recorded in pregnancies with open spina bifida, and similar to values recorded with anencephaly. An elevated MSAFP is an indication for thorough ultrasound examination of the fetus for anatomical abnormalities.

Multiple chromosomal abnormalities have been associated with at least 60% OC cases, including trisomy -18, -13, -21, Turner syndrome, and triploidy. By contrast, GS is associated with abnormal karyotype in about 1% of cases, usually in the setting of other congenital abnormalities.

The definite treatment of both OC and GS is surgical once optimal resuscitation is achieved. Primary closure is associated with better survival rates if it can be achieved without compromise of intestinal blood flow or other hemodynamic or respiratory embarrassment. Large defects are frequently managed with temporary abdominal silos

which are gradually reduced over the course of days to weeks in a form of visceral tissue expansion followed by delayed abdominal wall closure. The long-term outcome in isolated cases of OC and GS are generally good, although they can be associated with gut motility impairment, gastroesophageal reflux, ventral hernias, and late obstructive episodes.

Constriction rings with limb and digital amputations are found in amniotic band sequence but are not characteristic of OC or GS. GS is not characteristically associated with hypoglycemia, macrosomia, or macroglossia.

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205. Hyperbaric oxygen therapy (HBOT) is most appropriate for a patient with which of the following conditions?
- A) Acute osteomyelitis of the tibia
 - B) Anaerobic necrotizing soft-tissue infection
 - C) Chemical burn because of lye exposure
 - D) Stevens-Johnson syndrome
 - E) Wagner grade 2 diabetic foot ulcer

The correct response is Option B.

Hyperbaric oxygen therapy (HBOT) is an accepted adjunct to surgical debridement, appropriate antibiotic therapy, and indicated critical care measures for necrotizing soft-tissue infections such as necrotizing fasciitis and Fournier gangrene. The increased oxygen delivery of HBOT improves leukocyte function and can enhance penetration of certain antibiotics such as aminoglycosides. The clinical effects include slowing of the progress of the infection and decreased risk of both amputation and mortality.

There is not adequate evidence to justify HBOT in diabetic foot ulcers (DFUs) with Wagner grade 2 (extension to bone, tendon, or capsule) or less. However, there is moderate evidence to suggest benefit in DFUs with Wagner grade 3 (deep ulcer with osteomyelitis or abscess) or greater.

HBOT may be indicated in the treatment of chronic osteomyelitis but not in the acute setting. It plays no role in the treatment of Stevens Johnson syndrome, and may be beneficial in acute thermal burns but is not indicated for chemical burns.

The complete list of approved indications for HBOT, as determined by the Undersea and Hyperbaric Medical Society and the U.S. Food and Drug Administration, includes the following:

1. Air or gas embolism
2. Carbon monoxide poisoning
3. Clostridial myositis and myonecrosis (gas gangrene)
4. Crush injury, compartment syndrome, and other acute traumatic ischemias
5. Decompression sickness
6. Arterial insufficiency

7. Severe anemia
8. Intracranial abscess
9. Necrotizing soft-tissue infections
10. Refractory osteomyelitis
11. Delayed radiation injury (soft tissue and bony necrosis)
12. Compromised grafts and flaps
13. Acute thermal burn injury
14. Idiopathic sudden sensorineural hearing loss

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206. A 28-year-old postpartum woman comes to the office for evaluation of breast asymmetry with pain and enlargement of the right breast for 2 months. Medical history includes augmentation mammoplasty 4 years ago. She denies fever or chills. She was previously breast-feeding but stopped this 1 month ago. Physical examination shows the right breast is significantly larger than the left breast. A well-healed peri-areolar incision is present and no evidence of infection is noted. Ultrasound shows a complex cyst, which yields 150 cc of milky fluid. A drain is placed. The most appropriate next step is administration of which of the following medications?
- A) Bromocriptine
 - B) Cephalexin
 - C) Fluconazole
 - D) Prolactin
 - E) Trimethoprim-sulfamethoxazole

The correct response is Option A.

This postpartum patient is presenting with a symptomatic galactocele after breast-feeding. Galactoceles are benign breast cysts containing milk. They typically occur in women of childbearing age in the setting of active lactation, recent pregnancy, or the use of hormonal medications such as oral contraceptives. The galactocele is thought to occur from ductal obstruction. Although the presence of a breast implant and the respective pocket placement is unknown to have an effect on the development of galactoceles, there is some thought that peri-areolar incisions may contribute to the ductal obstruction. There are, however, documented cases of post-augmentation galactocele without peri-areolar incisions.

Treatment for a galactocele is typically medical with the initiation of oral bromocriptine. Bromocriptine is a dopamine receptor agonist and causes inhibition of prolactin secretion, which is the primary hormone responsible for milk production. Dosage is titrated to effect. Incision and drainage of the cyst, particularly in the setting of implants, is often performed as well to rule out the possibility of infection.

Cephalexin and trimethoprim-sulfamethoxazole are antibiotics and are not indicated in this case because there is no active infection. Fluconazole is indicated for the treatment of fungal infections. Prolactin would actually stimulate milk production and would worsen the patient's symptoms.

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1. Rosique RG, Rosique MJ, Peretti JP. Postaugmentation Galactoceles Without Periareolar Incision and 8 Years after Pregnancy. *Plast Reconstr Surg Glob Open*. 2016; 4(3): e644.
2. Tung A, Carr N. Postaugmentation Galactocoele: A Case Report and Review of the Literature. *Ann Plast Surg*. 2011; 67(6): 668-670.

207. A 70-year-old man is in the recovery room after undergoing radial forearm free flap reconstruction for squamous cell carcinoma of the tongue. He has a 30-pack year history of smoking. The patient is ventilated with a tracheostomy tube. Two days postoperatively, sedation is turned off for an hour with the goal of weaning the patient off mechanical ventilation. He becomes agitated and delirious. Which of the following drugs should be avoided in this patient during the postoperative period?

- A) Albuterol
- B) Diphenhydramine
- C) Neostigmine
- D) Propranolol
- E) Varenicline

The correct response is Option B.

Postoperative delirium is an acute brain dysfunction that is characterized by changes in levels of consciousness, inattention, and disorganized thinking. There are two types of delirium. Delirium can manifest with hyperactive signs (agitation, restlessness), or hypoactive signs (lethargy, inattentiveness). It is very common in hospitalized patients, with 60 to 80% of mechanically ventilated patients and 20 to 50% of patients with a lower severity of illness developing delirium at some point during their hospitalization.

For patients at risk of postoperative delirium, benzodiazepines and antihistamines should be avoided, as these medications could exacerbate the symptoms.

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3. Moskowitz EE, Overbey DM, Jones TS, et al. Post-operative delirium is associated with increased 5-year mortality. *Am J Surg.* 214(6):1036-1038, December 2017.

208. A 52-year-old woman comes to the office after undergoing uncomplicated rhytidectomy 1 week ago. The patient reports that she cannot feel her left earlobe. Damage to a sensory nerve is suspected. The affected nerve was most likely injured intraoperatively in which of the following locations?
- A) Along a line from the external auditory canal to the lateral edge of the inferior orbit
 - B) At the anterior border of the sternocleidomastoid muscle
 - C) Half the distance from mastoid process to the clavicular origin of the sternocleidomastoid muscle
 - D) One centimeter caudal to the external jugular vein as it crosses the sternocleidomastoid muscle
 - E) One-third the distance from external auditory canal to the clavicular origin of the sternocleidomastoid muscle

The correct response is Option E.

The great auricular nerve (GAN) is the most commonly injured nerve in rhytidectomy. The GAN complication rate is approximately 6.5%. GAN injury can result in pure anesthesia, partial parasthesia, as well as painful neuromas in the distribution of the nerve. Permanent complete numbness has been reported in up to 5% of patients. This may cause difficulty wearing earrings, using the telephone, shaving, or combing one's hair. Although not as catastrophic as a facial nerve injury, this complication can present as a functional impairment and nuisance to the patient and surgeon alike.

It is critical to be aware of this nerve when embarking upon rhytidectomy in order to prevent iatrogenic injury. Once the GAN emerges onto the anterior surface of the sternocleidomastoid muscle, it resides in a superficial plane and is vulnerable to injury during elevation of facial flaps. The GAN is found at its most superficial location approximately one third the distance from the external auditory canal to the clavicular origin of the sternocleidomastoid (SCM). A similar distance ratio exists from the mastoid process to the clavicular origin of the SCM. It also lies approximately one centimeter cranial to the external jugular vein on the anterior surface of the sternocleidomastoid muscle. With these anatomical landmarks, the surgeon can accurately predict the location of the GAN at its most vulnerable site and reliably proceed with flap dissection in the lateral neck during rhytidectomy procedures.

Frankfort's line is a cephalometric measurement that runs from the external auditory canal to the lateral edge of the inferior orbit and would be too cranial a location to find the GAN.

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1. Murphy R, Dziegielewski P, O'Connell D, et al. The great auricular nerve: an anatomic and surgical study. *J Otolaryngol Head Neck Surg*. 2012 Apr;41 Suppl 1:S75-7.
2. Ozturk CN, Ozturk C, Huettner F, et al. A Failsafe Method to Avoid Injury to the Great Auricular Nerve. *Aesthet Surg J*. 2014 Jan 1;34(1):16-21.
3. Rohrich RJ, Taylor NS, Ahmad J, et al. Great auricular nerve injury, the “subauricular band” phenomenon, and the periauricular adipose compartments. *Plast Reconstr Surg*. 2011;127(2):835-843.

209. A 75-year-old woman with type 1 diabetes mellitus undergoes closure of a sternotomy wound using pectoralis major muscle flaps. On postoperative day 2, her plasma creatinine level has increased to 2.2 from 1.1 mg/dL preoperatively. The patient is hemodynamically stable in the ICU, and her central venous pressure is within normal range. An intravenous infusion of normal saline is initiated. Which of the following is the most appropriate next step in management?

- A) Administration of a diuretic
- B) Discontinuation of enteral nutrition and initiation of parenteral nutrition
- C) Discontinuation of protein intake
- D) Infusion of low-dose ($<2.5 \mu\text{g/kg/min}$) dopamine intravenously
- E) Plasma glucose control protocol

The correct response is Option E.

This patient has acute kidney injury (AKI) after a surgical procedure. International practice guidelines recommend insulin therapy for targeted glucose control in critically ill patients. Although the Kidney Disease – Improving Global Outcomes (KDIGO) task force recommended a plasma glucose target of 110 to 149 mg/dL, the latest recommendation by the Surviving Sepsis Campaign is for an upper blood glucose level not higher than 180 mg/dL.

Other recommendations for prevention and treatment of AKI by the 2012 KDIGO Clinical Practice Guideline included: Isotonic crystalloids rather than colloids (albumin or starches) as initial management for expansion of intravascular volume in patients at risk for or with AKI; Avoiding restriction of protein intake with the aim of preventing or delaying initiation of renal replacement therapy (RRT); Administration of 0.8 to 1.0 g/kg/d of protein in non-catabolic AKI patients without need for dialysis; 1.0 to 1.5 g/kg/d in patients with AKI on RRT; and up to a maximum of 1.7 g/kg/d in patients on continuous renal replacement therapy (CRRT) and in hypercatabolic patients; Providing nutrition preferentially via the enteral route in patients with AKI; Not using diuretics to prevent AKI; Not using diuretics to treat AKI, except in the management of volume overload; Not using low-dose dopamine to prevent or treat AKI

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3. Rhodes A, Evans LE, Alhazzani W, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. *Crit Care Med*. 2017; 45(3):486-552.

210. A 79-year-old woman undergoes excision and elective neck dissection of a 2.5-cm invasive squamous cell carcinoma of the right lateral surface tongue. She has no history of head and neck cancer, and there is no radiologic or clinical evidence of nodal or metastatic disease. Wide excision with adequate margins and ipsilateral modified radical neck dissection is performed. Elective neck dissection is most likely to result in which of the following outcomes in this patient?
- A) Decreased local recurrence
 - B) Fewer postoperative complications
 - C) Increased incidence of distant metastasis
 - D) Increased nodal relapse
 - E) Increased overall survival

The correct response is Option E.

This patient will have increased overall survival compared with a patient who does not have elective neck dissection. The patient described has Stage II (T2 N0 M0) oral cancer (larger than 2 cm but not larger than 4 cm, has not spread to lymph nodes with no metastatic disease). There has been much debate regarding management of the neck in patients with early-stage oral cancers. The two primary options include elective neck dissection (ie, at the time of the primary tumor resection) versus therapeutic neck dissection in the case of nodal relapse. In a prospective, randomized, controlled trial study of patients with T1 or T2 node-negative oral squamous cell carcinoma, patients received either elective neck dissection at the time of primary tumor resection or therapeutic neck dissection after nodal relapse. At 3 years, patients who underwent elective neck dissection had a higher rate of survival compared with the therapeutic surgery group (69.5 vs. 45.9%, $P<0.001$).

Patients who undergo elective neck dissection at the time of primary tumor resection have an increased number of postoperative complications and decreased nodal recurrence. Distant metastasis was the same between the two groups.

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211. A 43-year-old woman who is *BRCA*-positive is scheduled to undergo bilateral mastectomy. Tissue expander–based reconstruction is planned. Which of the following is the optimal duration of antibiotic prophylaxis for this patient?
- A) No preoperative antibiotic
 - B) One preoperative antibiotic dose and another dose during skin closure
 - C) One preoperative antibiotic dose, followed by 24 hours of treatment while in the hospital
 - D) One preoperative antibiotic dose, followed by 24 hours of treatment while in the hospital and then discharge on oral antibiotics until drains are removed
 - E) One preoperative antibiotic dose, followed by 24 hours of treatment while in the hospital and then maintenance on oral antibiotics until tissue expanders are exchanged

The correct response is Option C.

The overall complication rate in breast reconstructive surgery is as high as 60%. Infection rates can exceed 20%, much higher than in clean elective surgery. The CDC guidelines suggest only 24 hours of peri-operative antibiotics beginning thirty minutes prior to skin incision. However, not all plastic surgeons agree with this. A 2013 meta-analysis found when comparing combined patient cohorts receiving no antibiotics, antibiotics for less than 24 hours, and antibiotics for greater than 24 hours, the average infection rates were 14.4, 5.8, and 5.8%, respectively. This demonstrated that the administration of antibiotics made a difference, however duration beyond 24 hours did not.

A study was published in 2013 evaluating the difference in surgical site infection between two different prophylactic antibiotic durations (24 hours and until drain removal). In this prospective, randomized, controlled non-inferiority trial, 24 hours of antibiotics is equivalent to extended oral antibiotics for surgical-site infection in tissue expander immediate breast reconstruction patients.

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3. Phillips BT, Fourman MS, Bishawi M, et al. Are Prophylactic Postoperative Antibiotics Necessary for Immediate Breast Reconstruction? Results of a Prospective Randomized Clinical Trial. *J Am Coll Surg*. 2016 Jun;222(6):1116-24.

212. A 67-year-old man undergoes ventral hernia repair and abdominal wall reconstruction with component separation. On postoperative day 5, the patient develops a cough; temperature is 39.0°C (102.2°F). Chest x-ray study shows right middle lobe pneumonia. Antibiotic therapy is promptly initiated. Despite adequate fluid resuscitation, the patient becomes hypotensive (mean arterial pressure < 65 mmHg). Which of the following blood tests is most appropriate to establish the suspected diagnosis of septic shock?

- A) Albumin
- B) C-reactive protein
- C) Lactate
- D) Plasminogen
- E) White blood cell count

The correct response is Option C.

Obtaining a serum lactate level is the most appropriate next step for the diagnosis of septic shock in this scenario. Patients with septic shock can be clinically identified by having both of two criteria:

- 1) Vasopressor requirement to maintain a mean arterial pressure of 65 mmHg or greater and
- 2) Serum lactate level greater than 2 mmol/L (>18 mg/dL) in the absence of hypovolemia.

In 1991, a consensus task force developed initial definitions that focused on the prevailing view at the time that sepsis resulted from a host's systemic inflammatory response syndrome (SIRS) to infection. SIRS was defined by the presence of two or more of four criteria, including body temperature, heart rate, respiratory rate, and white blood cell count. Despite their known limitations, these definitions remained mainly unchanged for almost three decades. In 2016, the Society of Critical Care Medicine and the European Society of Intensive Care Medicine sponsored a task force to review the definition of sepsis and its management guidelines (Sepsis-3).

Sepsis is now defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection. This organ dysfunction can be represented by an increase in the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score of two points or more. Another measure called quick SOFA (qSOFA), although less robust, may be more practical

for providers diagnosing sepsis in the non-ICU setting. qSOFA incorporates altered mentation (GCS <15), systolic blood pressure of 100 mmHg or less, and respiratory rate of 22/min or greater.

Septic shock is a subset of sepsis with profound circulatory and cellular/metabolic dysfunction, associated with a higher risk of hospital mortality than with sepsis alone (40% versus 10%, respectively).

The term “severe sepsis,” previously defined as sepsis complicated by organ dysfunction, has been incorporated into the current definition of sepsis and abandoned.

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213. Which of the following patients is eligible to be an organ donor?

- A) 30-year-old HIV-positive patient
- B) 10-year-old whose family does not want to donate
- C) 42-year-old with a diagnosis of Creutzfeldt-Jakob disease
- D) 49-year-old with a recent diagnosis of stage IV melanoma

The correct response is Option A.

Minors are neither eligible for nor able to receive organ donation without the consent of a parent or guardian.

Creutzfeldt-Jakob disease or any other prion disease is a contraindication for organ donation of any kind.

Metastatic cancer is a contraindication for organ donation.

HIV status is no longer a contraindication to donate or receive an organ, provided the donor and recipient are both HIV positive.

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2. Malani PN. New law allows organ transplants from deceased HIV-infected donors to HIV-infected recipients. *JAMA*. 2013; 310:2492.

214. A 24-year-old woman presents to the surgical oncologist because of a mass in the right breast. Examination of the specimen obtained on core biopsy shows invasive ductal carcinoma. Genetic testing is positive for the *BRCA1* gene mutation. Which of the following statements about this patient's diagnosis is correct?
- A) Male patients who develop breast cancer are more likely to have a *BRCA1* mutation
 - B) Mode of inheritance is X-linked
 - C) Patient's cancer staining is more likely to be estrogen- and progesterone-positive, and HER2-negative
 - D) Patients with *BRCA1* mutation are at increased risk of medullary carcinoma
 - E) The risk of developing breast cancer is slightly lower for *BRCA1* mutation than for *BRCA2* by age 70

The correct response is Option D.

BRCA mutations have an autosomal dominant mode of inheritance.

Mutations within *BRCA1* and *BRCA2* are highly penetrant. Studies of large breast cancer families propose that the risk of developing breast cancer by age 70 is 87% for *BRCA1* carriers and 84% for *BRCA2* carriers.

BRCA1 tumors are characteristically high-grade invasive ductal carcinomas that are predominately triple-negative.

Male breast cancer is responsible for approximately 1% of all breast cancer cases. Although the risk of male breast cancer is elevated for carriers of mutations in both genes, it is most noticeable with *BRCA2*.

Tumors identified in carriers of *BRCA1* mutations also show an increased incidence of medullary carcinoma compared with controls and *BRCA2* carriers.

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215. Which of the following mechanisms is most likely to inhibit normal wound healing in a patient who smokes cigarettes?
- A) DNA strand breaks and helical cross-linking
 - B) Increased cosubstrate for enzymes involved in collagen production
 - C) Increased platelet aggregation
 - D) Increased tissue oxygen delivery
 - E) Nicotine-induced vasodilation

The correct response is Option C.

The detrimental effects of smoking on wound healing are due primarily to nicotine, carbon monoxide, and hydrogen cyanide. One of the effects of nicotine is increased platelet aggregation due to enhanced adhesiveness of the platelets themselves. This leads to thrombus formation and decreased oxygen delivery. Nicotine does not produce vasodilation, but rather vasoconstriction. Both of these effects can lead to local tissue ischemia, which inhibits the normal wound healing process.

One of the major mechanisms by which ionizing radiation inhibits wound healing is production of DNA strand breaks and helical cross-linking, but smoking is not significantly involved.

Vitamin C is the vitamin which plays the greatest role in wound healing. It is required as a cosubstrate for hydroxylase enzymes, which are involved in the production of collagen. Vitamin C deficiency has long been known to inhibit wound healing (scurvy). However, supplemental vitamin C in the nondeficient patient has not been shown conclusively to produce any beneficial wound-healing effects.

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1. Janis JE, Harrison B. Wound Healing: Part I. Basic Science. *Plast Reconstr Surg.* 2016 Sep; 138(3 Suppl):9S-17S.
2. Silverstein P. Smoking and wound healing. *Am J Med.* 1992;93(1A):22S-24S.

216. An otherwise healthy 52-year-old woman comes to the office for consultation for bilateral mastopexy. Her last mammogram 2 years ago was negative. Physical examination shows a palpable breast mass in the upper outer quadrant of the right breast that the patient has not noticed previously. Which of the following is the most appropriate next step in management?
- A) Core needle biopsy
 - B) Diagnostic mammogram with ultrasound
 - C) Fine-needle aspiration biopsy
 - D) Mastopexy with open biopsy
 - E) Screening mammogram

The correct response is Option B.

The first step in the management of a newly found palpable breast mass is x-ray imaging to further characterize the tumor. The type of imaging required typically depends on the age of the patient at presentation. In females less than 30 years of age, ultrasound is typically the first (and possibly only) test ordered as the breast tissue is typically denser and mammography is not as effective. In women greater than 30 years of age, mammogram is usually the first test ordered. Mammography can evaluate both breasts for other incidental findings as well as further characterize the mass. Unless the results of the initial mammogram are definitive of a benign etiology of the mass, then an ultrasound is typically necessary as well. Ultrasound can distinguish cystic from solid masses and will help delineate the shape, borders, and acoustic properties of the mass. When the mass is suspicious, biopsy is guided by ultrasonography but this is typically not the initial treatment.

Mammography can be used for both screening and diagnosis. Screening mammography consists of two routine views, craniocaudal and mediolateral oblique, and is appropriate for asymptomatic patients. Diagnostic mammography incorporates additional views (e.g. tangential or spot compression views) in order to better delineate the area of concern. The current patient has a new finding of palpable mass on exam and requires a diagnostic mammogram for proper evaluation and management.

Given the patient's age and presentation with newly palpable mass, x-ray imaging prior to any surgery is warranted to rule out malignancy. Proceeding with surgery that would rearrange the breast tissue may compromise the oncologic management of a possible breast

cancer with incomplete excision and inability to obtain reliable margins that would require a completion mastectomy instead of the option for breast-conserving therapy.

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217. A newborn male is brought to the tertiary multidisciplinary referral center for evaluation of anorectal malformation, tracheoesophageal fistula and absent right thumb. Which of the following associated VACTERL diagnoses is the best predictor of inpatient mortality?

- A) Aniridia with brain stem hypoplasia
- B) Anomalies of spine or vertebrae
- C) Cardiac disease
- D) Renal or urinary anomaly
- E) Tracheal stenosis with stridor

The correct response is Option C.

Anomalies of the spine or vertebrae (V), anorectal malformations (A), congenital cardiac anomalies (C), esophageal atresia/tracheoesophageal fistula (TE), renal and urinary abnormalities (R), and limb lesions (L) frequently co-occur and are recognized as VACTERL anomalies. VACTERL association is typically diagnosed in the presence of at least three characteristic features in the absence of evidence for an overlapping condition, and is estimated to occur in approximately 1 in every 10,000 to 40,000 live births. The presence of either anorectal malformation or esophageal atresia alone generally triggers a workup for associated VACTERL diagnoses because of their significant impact on morbidity and mortality. For example, in a large cohort of children undergoing surgical repair of anorectal malformations, Lautz et al. found associated VACTERL diagnoses including congenital heart disease in 40.4%, renal or internal urinary disease in 34.7%, spinal or vertebral anomalies in 31.4%, esophageal atresia/tracheoesophageal fistula in 7%, and limb defects in 5.6%. The most common limb defects in VACTERL association include poorly developed or missing thumbs, or underdeveloped forearms and hands, polydactyly, syndactyly, and reduction deformities of the lower limb.

Independent predictors of mortality in any patient with VACTERL association include congenital heart disease (greatest for those who require cardiac surgery than those with a diagnosis but no operation), birthweight < 2 kg, and black race. Of note, the association between cardiac disease and higher mortality has been reproduced in several studies.

Aniridia, brain stem hypoplasia, and tracheal stenosis with stridor are not primary characteristics of VACTERL association.

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2. Olgun H, Karacan M, Caner I, Oral A, Ceviz N. Congenital cardiac malformations in neonates with apparently isolated gastrointestinal malformations. *Pediatr Int*. 2009;51(2):260-262.
3. Totonelli G, Catania VD, Morini F, et al. VACTERL association in anorectal malformation: effect on the outcome. *Pediatr Surg Int*. 2015;31(9):805-808.

218. A 33-year-old transfeminine (male-to-female) patient with gender dysphoria presents for consultation regarding bilateral breast enlargement with silicone implants. Which of the following is the most appropriate CPT code for this procedure?
- A) 19324-50: mammoplasty, augmentation; without prosthetic implant
 - B) 19325-50: mammoplasty, augmentation; with prosthetic implant
 - C) 19342-50: delayed insertion of prosthesis in breast reconstruction
 - D) 19357-50: immediate insertion of a tissue expander
 - E) 19366-50: breast reconstruction with other technique

The correct response is Option B.

Breast surgery for treatment of gender dysphoria is a recognized therapeutic option, which is covered by the Centers for Medicaid and Medicare Services, military health maintenance organizations, and most private payers. Because breast reconstruction with implants is a defined, covered benefit for women with breast cancer, as mandated by federal legislation, the US judicial system has ruled that this procedure should also be available to transgender women who desire breast reconstruction. Because this benefit is available for some women, this benefit should be available for all women, including transgender women. Withholding a medically necessary procedure for treatment of gender dysphoria would represent a form of gender discrimination.

The CPT code recognized by both private and public health insurance companies is 19325-50 for bilateral augmentation mammoplasty with prosthetic implant. Even though this code is most often used in the aesthetic setting, the procedure is considered to be reconstructive in transgender women with gender dysphoria.

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https://www.cms.gov/medicare/coverage/determinationProcess/downloads/Kalra_comment_01022016.pdf.

219. A 51-year-old farmer is brought to the emergency department after sustaining extensive burns in a fertilizer explosion. Examination shows white phosphorus embedded in his burn wounds. In addition to burn resuscitation and examination of the wounds under ultraviolet light, application of which of the following is the most appropriate next step in management?
- A) Calcium gluconate
 - B) Mafenide (Sulfamylon)
 - C) Mineral oil
 - D) Polyethylene glycol
 - E) Saline irrigation

The correct response is Option E.

White phosphorus is sustained in both military and civilian circumstances. It is commonly found in fireworks, fertilizers, and pesticide. It is extremely volatile and can ignite spontaneously upon exposure to air. Additionally, phosphoric acids form during combustion and further injure tissues.

Treatment mainstays include:

- 1. Immediate debridement of visible debris
- 2. Copious irrigation
- 3. Keep the area wet and covered with saline-soaked gauze
- 4. Cardiac monitoring and electrolyte evaluation.

Profound hypocalcemia, hyperphosphatemia, and sudden death have been associated with this injury.

Calcium gluconate gel is used in the management of hydrofluoric acid burns. Polyethylene glycol is used in the management of phenol and cresol burns. Mineral oil is used to isolate potassium, sodium, and magnesium from water, with which they react explosively. Mafenide (Sulfamylon) has no role in the immediate management of white phosphorus burns.

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220. In a randomized, blinded, placebo controlled trial, 84% of patients in the migraine surgery vs. 58% of patients in the sham surgery group had greater than 50% reduction in migraine symptoms ($p < 0.05$). Which of the following is indicated by a p value of <0.05 ?
- A) The observed difference is likely due to sampling variation (accept null hypothesis)
 - B) The observed difference is likely due to sampling variation (reject null hypothesis)
 - C) The observed difference is not likely due to sampling variation (accept null hypothesis)
 - D) The observed difference is not likely due to sampling variation (reject null hypothesis)
 - E) Cannot make a determination regarding the null hypothesis

The correct response is Option D.

The p value is defined as the probability of getting a difference at least as large as that observed if the null hypothesis is true. The larger the p value, the more likely the observed difference is due to sampling error (and therefore one accepts the null hypothesis of no difference). The smaller the p value, the more likely the observed difference is not due to sampling error (and therefore one rejects the null hypothesis of no difference).

In patients who suffer from moderate to severe migraine headaches from a single or predominant trigger site, 84% of patients that underwent surgical decompression of that trigger point experienced reduction in migraine symptoms by more than 50%, compared to 58% of those who underwent sham surgery.

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221. Which of the following forms of communication is compliant with the Health Insurance Portability and Accountability Act (HIPAA)?

- A) E-mailing the confidential information using an encrypted patient portal server
- B) Leaving protected information on the patient's voicemail
- C) Placing a sealed folder with patient records under the attending physician's office door
- D) Texting medical information to a password protected smart phone
- E) Transferring the patient records via a non-encrypted flash drive

The correct response is Option A.

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is United States legislation that provides data privacy and security provisions for safeguarding medical information. Unauthorized release of any confidential or identifying information, which can be linked to an individual patient, is considered a violation of the law, with penalties ranging from fines to incarceration. The secure, private transmission of Protected Health Information (PHI) is allowed between two treating health-care professionals, provided that the communication is confidential and not at significant risk of breach or theft. Transmission of PHI via social media, e-mail, and other electronic methods must be done through a combination of safeguards that involves encryption. Although the legal understanding of how to communicate PHI continues to evolve, these devices must meet institutional requirements for security.

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222. An 81-year-old man with peripheral vascular disease undergoes coverage of exposed vascular prosthesis in the groin with a rectus femoris muscle flap. On postoperative day 2, the patient has sudden onset of chest tightness and becomes unresponsive, with no palpable pulse. CPR is promptly initiated. The defibrillator monitor shows ventricular fibrillation. Which of the following is the most appropriate next step after shock delivery (electrical defibrillation)?

- A) Capnometry
- B) Chest compressions for 2 minutes
- C) Endotracheal intubation
- D) Intravenous administration of adenosine
- E) Pulse/rhythm check

The correct response is Option B.

According to current Advanced Cardiac Life Support (ACLS) guidelines, CPR should be resumed immediately after shock delivery, without pausing for a rhythm or pulse check. It should begin with chest compressions and continue for 2 minutes, after which the rhythm should be checked and the cycle (shock/CPR 2 min/check) repeated if there is no return of spontaneous circulation (ROSC).

Increasing emphasis has been placed on the importance of continuous “high-quality” chest compression (5 cm sternal depression, 100 to 120/min), to maximize tissue perfusion and probability of ROSC. A 30:2 compression:ventilation rate is recommended in the absence of an endotracheal or supraglottic airway. Otherwise, 10 breaths per minute should be delivered with continuous chest compressions.

There are no studies directly addressing the timing of advanced airway placement and outcome during resuscitation from cardiac arrest. Although insertion of an endotracheal tube during ongoing chest compressions is possible, in most instances intubation is associated with interruption of compressions for many seconds. Particularly, patients with witnessed cardiac arrest from ventricular fibrillation or pulseless ventricular tachycardia may benefit from a few uninterrupted cycles of CPR prior to placement of an advanced airway.

Adenosine is not indicated in the treatment of adult cardiac arrest.

Capnometry/capnography requires placement of an endotracheal tube.

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223. A 64-year old woman comes to the office because of a nonhealing radiated scalp wound. Medical history includes resection of invasive basal cell carcinoma of the scalp, reconstruction with a scalp rotation flap, and high-dose postoperative radiation therapy (60 Gy) 10 years ago. Clinical examination shows a full-thickness wound consisting of erythematous, ulcerated, and necrotic skin, and exposed, foul-smelling skull at the base of the wound. Which of the following is the most appropriate next step in management of this patient?
- A) Biopsy of the wound
 - B) Craniectomy with free flap reconstruction
 - C) MRI
 - D) Resection of involved scalp with split-thickness skin grafting
 - E) Vacuum-assisted closure (VAC)

The correct response is Option A.

The first step in managing this patient is biopsy of the wound to rule out cancer recurrence. Although the diagnosis is most likely osteoradionecrosis of the skull, one would not proceed with the next steps of management until recurrence of cancer is ruled out. In this patient, the management sequence would include a biopsy to rule out cancer recurrence, followed by CT scan to delineate the extent of the skull involvement. MRI would not delineate the extent of the bony involvement.

The rates of osteoradionecrosis occurrence vary in the literature (from 1.8 to 37%). Although the rate and severity of osteoradionecrosis are most consistently associated with doses of radiation exceeding 50 Gy, there are reports of osteoradionecrosis in patients who received doses as low as 30 Gy.

This patient would require extensive craniectomy by a neurosurgeon to debride the wound of necrotic bone and, in most cases, reconstruction with free tissue transfer. Vacuum-assisted closure would not be a viable option for this patient, nor would resection of the scalp with split-thickness skin grafting.

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2. Huang WB, Wong STS, Chan JYW. Role of surgery in the treatment of osteoradionecrosis and its complications after radiotherapy for nasopharyngeal carcinoma. *Head Neck*. 2017 Oct 9.

224. A 12-year-old boy is brought to the office for evaluation of an obvious anterior open bite sustained when he fell from his bicycle. Imaging shows a displaced fracture of the right mandibular condyle with intra-articular extension. Which of the following is the most appropriate treatment?
- A) Application of an external fixator
 - B) Delayed sagittal split osteotomy
 - C) Maxillomandibular fixation with arch bars
 - D) Open reduction and internal fixation
 - E) Soft diet and observation

The correct response is Option C.

Condylar fractures in children can predispose to facial growth disturbance and temporomandibular joint dysfunction. A condylar fracture with an associated parasymphyseal fracture and an open bite should be treated with arch bars and a period of intermaxillary fixation in a 12-year-old, if possible. Open reduction and plating of the mandible is generally avoided in this age group to avoid injury to tooth buds. It has been demonstrated that arch bars can be used safely and effectively for the injury pattern described during the period of mixed dentition. Delayed sagittal split osteotomy is not indicated in a patient with a normal premorbid occlusion.

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2. Naran S, Keating J, Natali M, et al. The safe and efficacious use of arch bars in patients during primary and mixed dentition: a challenge to conventional teaching. *Plast Reconstr Surg*. 2014 Feb;133(2):364-6.

225. A 69-year-old man is brought to the emergency department because of acute onset of excruciating pain of the left forearm and a pale, pulseless, cool left hand. Medical history includes atrial fibrillation and steroid-dependent chronic obstructive pulmonary disease (COPD). Physical examination and hand-held Doppler interrogation are consistent with acute arterial blockage in the left ulnar artery. In addition to aspirin, which of the following therapeutic interventions should be administered promptly while assessing the patient's ability to withstand surgery?
- A) Apixaban
 - B) Clopidogrel
 - C) Heparin
 - D) Recombinant tPA
 - E) Verapamil

The correct response is Option C.

Iannuzzi and colleagues have summarized the treatment for acute arterial thrombosis of the hand. Prevention of further damage should be the first line of treatment while completing work-up of the patient. They recommend that heparin and aspirin should be administered to prevent propagation of further arterial occlusion. While the idea of reducing vasospasm in the surrounding vessels is appealing, Iannuzzi's review of the literature is inconclusive of any benefit for tissue salvage outcomes. The article is also useful for comparison of the various imaging modalities for definitive diagnosis and approach to treatment.

In their meta-analysis for the Cochrane library, Berridge et al. surveyed the literature and came to the conclusion that distal limb salvage was similar at 30 days, 6 months, and 1 year with either surgical extraction of clot or thrombolysis by direct delivery of the agent to the artery in question. Bleeding and distal embolization were more common after use of thrombolytic agents at 30 days.

Robertson et al, also in meta-analysis for the Cochrane library, found some differences favoring tissue plasminogen activator (tPA) in initial vessel patency, but there were no differences in limb salvage outcomes with intra-arterial delivery of tPA or urokinase. In the streptokinase vs tPA studies, there were increased bleeding complications noted with streptokinase.

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3. Berridge DC, Kessel DO, Robertson I. Surgery versus thrombolysis for initial management of acute limb ischaemia. *Cochrane Database Syst Rev*. 2013 Jun 6;(6):CD002784.

226. A 59-year-old woman presents with an infected sternal nonunion after coronary artery bypass grafting 4 weeks ago. After debridement of the wound, five sternal plates and bilateral pectoralis flaps are placed. Postoperatively, the patient becomes hypotensive, tachycardic, and confused. Jugular distention is noted. Oxygen saturation is 100% on nasal cannula. Which of the following is the most appropriate initial step in management?
- A) Auscultation
 - B) Chest x-ray
 - C) ECG
 - D) Ultrasonography of the heart
 - E) Return the patient to the operating room

The correct response is Option A.

On auscultation a muffled heart sound and pericardial friction rub is heard and would direct the clinician to decompress tamponade.

Patient is demonstrating Beck's triad and has reason for possible cardiac tamponade.

Immediate chest x-ray can be ordered to help rule out pneumothorax, but with normal oxygenation, the chance of a pneumothorax is lower on the differential, and there are other better initial diagnostic and therapeutic steps.

ECG can help support the diagnosis of pericardial effusion, but this is not diagnostic and is only used as an adjunct.

Ultrasonography of the heart can confirm the existence of pericardial effusion, as well as allow needle drainage for immediate treatment. However, this would be performed after auscultation.

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227. A 47-year-old woman underwent fat grafting of the buttock for buttock augmentation one year ago. The patient requests a second similar procedure to further increase the volume of her buttock. Her sister has a history of Factor V Leiden. The patient reports a 2-month history of numbness of the right lower extremity after her first procedure. Which of the following presents the lowest risk of postoperative embolus formation in this patient?

- A) Family history of Factor V Leiden
- B) Performing the procedure for the second time
- C) Personal or family history of deep vein thrombosis or pulmonary embolus
- D) Presence of lower extremity varicosities
- E) Sciatic nerve compression symptoms

The correct response is Option B.

While performing fat transfer to the buttock, the following measures should be followed in order to stay safe and decrease the risk of a fat embolus: using a larger bore blunt cannula (≥ 4 mm); using a continual motion; remaining primarily in the subcutaneous or superficial muscle throughout and only in the subcutaneous plane in the triangle of danger; and avoiding filling to excessively high recipient-site pressure.

Having personal or family history of deep vein thrombosis or pulmonary embolus, presence of lower extremity varicosities that increases the risk of vein violation, sciatic nerve compression symptoms that usually indicate the presence of large varicose veins around the nerve, hematologic disorders, and use of anticoagulants or herbal medications increases the patient's risk of a postoperative pulmonary embolus or deep vein thrombosis.

Performing the procedure for the second time does not increase the patient's risk unless the above measures are not followed.

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228. Compared with standard wound dressings, postoperative negative pressure wound therapy is most likely to produce which of the following outcomes?
- A) Better delayed primary fascial closure rates for salvage laparotomy
 - B) Better split-thickness skin graft incorporation
 - C) Increased inflammatory response
 - D) Increased postoperative dressing changes
 - E) Increased risk of infection

The correct response is Option B.

Multiple studies have shown the benefits of negative pressure wound therapy (NPWT) when used in conjunction with skin grafts, both as a bolster over a skin graft as well as wound bed preparation.

NPWT has been shown to decrease the risk of infection in complex and traumatic wounds in some studies, while others have shown no difference in infection rates in complex wounds when the patient has multiple comorbidities or when used to cover uncomplicated incisions for elective orthopedic operations. However, there is no evidence to suggest NPWT increases infection risk compared with standard wound dressings.

NPWT reduces both inflammatory response and edema formation.

When used for damage control laparotomy and abdominal compartment syndrome, studies have failed to show any benefit of NPWT over standard dressings. Furthermore, at least one study has suggested an increased rate of enteric fistula formation is associated with NPWT.

NPWT has been shown to decrease both the number of postoperative dressing changes and the number of additional operative interventions in complicated diabetic wounds.

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229. A 54-year-old woman with a history of augmentation mammoplasty with textured silicone implants has histologic confirmation of breast implant–associated anaplastic large cell lymphoma (BIA-ALCL). MRI and PET scans show no associated masses, with activity localized to the periprosthetic seroma. Which of the following is the most appropriate next step in management of this patient?
- A) Anterior capsulectomy with removal of the implants bilaterally
 - B) Complete capsulectomy with removal of the implant on the affected side
 - C) Partial capsulectomy with replacement of the implant
 - D) Removal of the textured implant and replacement with a smooth implant
 - E) Sealing of the seroma cavity with fibrin glue

The correct response is Option B.

Breast implant–associated anaplastic large cell lymphoma (BIA-ALCL) is a rare peripheral T-cell lymphoma that has been increasingly recognized as a serious, albeit uncommon, complication associated with the use of textured breast implants. Since the initial case report in 1996, there have been continually increasing reported cases of this rare malignancy and according to the most recent data available, the lifetime risk of association between breast implants and BIA-ALCL is between 1 in 1000 to 1 in 30,000 with the ASPS recognizing nearly 200 cases in the US and nearly 500 cases worldwide.

BIA-ALCL patients typically present with a spontaneously occurring periprosthetic fluid collection or capsule-associated mass approximately 10 years following implantation of the breast implant. To date, all cases have had some association with a textured device. Initial workup includes ultrasound for evaluation of a periprosthetic fluid collection or mass. Periprosthetic fluid collections should undergo fine-needle aspiration in the clinic or ultrasound-guided aspiration by interventional radiology if there is concern for trauma to the implant while masses require tissue biopsy. Specimens should be sent for cytology with immunohistochemistry and flow cytometry for T-cell markers, specifically CD30 cell surface protein. A recent systematic review revealed that 66% of BIA-ALCL patients presented with isolated late-onset seroma while only 8% presented with an isolated new breast mass.

National Comprehensive Cancer Network (NCCN) guidelines for treatment of BIA-ALCL recommend complete removal of the lymphoma (fluid and/or mass), complete capsulectomy, and removal of the implant. More advanced disease may require

chemotherapy, radiotherapy, and/or lymph node dissection. Although some surgeons advocate removal of the contralateral breast implant as approximately 4.6% of cases have demonstrated incidental lymphoma in the contralateral breast, this recommendation is controversial. The official NCCN guidelines for treatment only recommend consideration of contralateral breast implant removal but this is not mandated.

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2. Leberfinger AN, Behar BJ, Williams NC, et al. Breast Implant-Associated Anaplastic Large Cell Lymphoma: A Systematic Review. *JAMA Surg*. 2017;152(12): 1161-1168.

230. A 12-year-old boy is referred to a multidisciplinary sarcoma treatment center because of a deep localized rhabdomyosarcoma of the right thigh. After neoadjuvant radiotherapy, radical resection with curative intent, including a 20-cm segmental intercalary resection of involved distal femoral diaphysis, is performed. Skin and major neurovascular structures will be spared. Postoperative chemotherapy is planned. Which of the following is the most appropriate method for management of the bony defect in this patient?
- A) Distraction osteogenesis
 - B) Free fibula transfer with femoral allograft (Capanna technique)
 - C) Induced membrane (Masquelet) technique
 - D) Lower extremity rotationplasty (Van Ness procedure)
 - E) Pedicled medial femoral condyle flap

The correct response is Option B.

Rhabdomyosarcomas represent the most common soft-tissue sarcoma of childhood and are responsible for approximately half of all soft-tissue sarcomas in this age group. They are thought to originate from immature cells that are destined to form striated skeletal muscle, although they can arise anywhere in the body. With modern multimodal management, the cure rates for localized disease are generally greater than 70% overall. The primary goal of local tumor control in extremity rhabdomyosarcoma is limb-sparing complete resection where possible.

Vascularized bone grafting represents the gold standard for reconstructing segmental bone loss greater than 6 cm associated with a compromised local soft-tissue environment that occurs with radiotherapy and chemotherapy. For large weight-bearing intercalary reconstruction, significant literature supports the combination of a large structural allograft combined with vascularized fibula as described by Capanna in 1980. With this combination, the neoosteogenic properties of the free fibula are supplemented by the immediate structural support of the bulk allograft and provide a durable single-stage biological reconstruction.

Distraction osteogenesis is a technique of de novo bone formation that capitalizes on normal bone healing with gradual, surgically controlled distraction of adjacent osteotomy defects and has the advantage of simultaneously expanding surrounding soft-tissue envelopes. The technique requires viable bone in proximity to one another following a latency phase and is

useful in limb lengthening and craniofacial procedures but has limited utility in long segmental tumor reconstruction.

The induced membrane technique proposed by Masquelet is a two-step procedure where a segment of bone loss is first filled with an acrylic spacer and later replaced by cancellous bone graft in the so-called self-induced reactive “periosteal” membrane. The technique requires two stages and is less favored in the setting of planned radiation or chemotherapy where experience has shown that vascularized flaps or supplemented vascularized allografts are beneficial.

The medial femoral condyle flap has been used for small osteoperiosteal, corticoperiosteal, and osteocartilaginous flaps based off either the articular descending genicular or superomedial genicular arteries. It would be insufficient in size for a 20-cm-long bone defect.

The Van Ness rotationplasty is a type of autograft where functional limb below the knee is used to reconstruct more proximal defects. It can be a useful “spare part” reconstructive option in composite proximal extremity resections by repurposing a functional ankle joint more proximally in a rotated configuration for preserved gait advantage at the repurposed knee. A rotationplasty would not be indicated for intercalary resections sparing joint and metaphysis.

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2. Dasgupta R, Rodeberg DA. Update on rhabdomyosarcoma. *Semin Pediatr Surg*. 2012;21(1):68-78.
3. Pappo AS, Dirksen U. Rhabdomyosarcoma, Ewing Sarcoma, and Other Round Cell Sarcomas. *J Clin Oncol*. 2018;36(2):168-179.

231. A 48-year-old woman undergoes excision of a 3-cm recurrent keloid of the presternal chest. Immediate reconstruction with a collagen-glycosaminoglycan scaffold dermal regeneration template is performed, followed by thin (0.008-in) epidermal autografting 21 days later. After it has healed completely, punch biopsy is performed. The absence of which of the following histologic features is most likely to indicate regenerated skin in this patient?
- A) Capillary loops at the dermal-epidermal junction
 - B) Elastic fibers
 - C) Hair follicles
 - D) Neovascularization
 - E) Rete ridges

The correct response is Option C.

Regenerated skin is clearly quite different histologically from scar and, in fact, shares many characteristics with normal physiologic skin. Regenerated skin shows mechanical competence, vascularization, and heat and cold sensitivity. Furthermore, the dermal-epidermal junction shows formation of rete ridges and capillary loops. Regenerated skin displays elastic fibers and increased collagen fiber density in the reticular dermis, and it often exhibits nerve fiber regeneration as well. Regenerated skin, even when resurfaced with a split-thickness skin graft, however, does not have the dermal appendages such as hair follicles and sweat glands, that are present throughout normal skin.

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1. Yannas IV, Orgill DP, Burke JF. Template for skin regeneration. *Plast Reconstr Surg.* 2011 Jan; 127(1 Suppl):60S-70S.
2. Moiemmen N, et al. Long-term clinical and histological analysis of integra dermal regeneration template. *Plast Reconstr Surg.* 2011 Mar; 127(3):1149-54.

232. An 80-year-old man sustains an extravasation injury to the dorsum of the arm secondary to administration of a dopamine infusion. Which of the following findings is an indication for a surgical intervention in this patient?
- A) Blanching of the skin
 - B) Blistering
 - C) Erythema
 - D) Induration
 - E) Persistent pain

The correct response is Option E.

The indications for surgery in an extravasation injury include full-thickness skin necrosis, chronic ulceration, and persistent pain. Whereas blistering indicates a partial-thickness skin loss, it is alone not an indication for surgery. Erythema, induration, and poor capillary refill (blanching) are signs of extravasation injury but are not indications for an operative intervention.

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2. Scuderi N, Onesti MG. Antitumor agents: Extravasation, management, and surgical treatment. *Ann Plast Surg*. 1994 Jan;32(1):39-44.

233. A 45-year-old woman undergoes abdominoplasty in an ambulatory surgery center. After induction of general anesthesia, the patient's end tidal carbon dioxide level increases, her heart rate increases to 160 bpm, and her arms become rigid. Which of the following are the physiologic abnormalities associated with this condition?
- A) Hyperkalemia, hyperphosphatemia, metabolic acidosis
 - B) Hyperkalemia, hyperphosphatemia, metabolic alkalosis
 - C) Hyperkalemia, hypophosphatemia, metabolic acidosis
 - D) Hypokalemia, hyperphosphatemia, metabolic acidosis
 - E) Hypokalemia, hyperphosphatemia, metabolic alkalosis

The correct response is Option A.

Malignant hyperthermia is an inherited myopathy that is autosomal dominant with variable penetrance. Anesthetic agents that trigger malignant hyperthermia include halothane, enflurane, isoflurane, desflurane, sevoflurane, and succinylcholine. These agents trigger an earlier calcium release into the skeletal muscle, resulting in an abnormal buildup of calcium in the myoplasm. This flood of calcium causes the muscle to remain in a contracted state, producing high levels of lactic acid, carbon dioxide, phosphate, and heat. The resulting physiologic changes are metabolic acidosis, hypercapnia, hyperphosphatemia, and fever in a patient experiencing malignant hyperthermia. The treatment of malignant hyperthermia is discontinuation of volatile agents and succinylcholine, dantrolene, treatment of hyperkalemia and metabolic acidosis, and transfer to an acute care hospital.

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234. Administration of prophylactic antibiotics is most appropriate for which of the following surgical procedures?
- A) Abdominoplasty
 - B) Blepharoplasty
 - C) Brachioplasty
 - D) Mastopexy
 - E) Rhytidectomy

The correct response is Option D.

The ASPS recently published the first consensus statement/guidelines for antibiotic prophylaxis in plastic surgery which is based on comprehensive systematic review of the available evidence.

Systemic antibiotic prophylaxis is recommended for clean-contaminated, contaminated, or dirty plastic surgery of the head and neck, orthognathic/mandibular, septoplasty/rhinoplasty, hand and upper limb, and skin. Antibiotic prophylaxis is also recommended to reduce surgical-site infection for clean plastic surgery of the breast. Antibiotic prophylaxis is not recommended to reduce surgical-site infection in clean surgical cases of the head and neck, orthognathic/mandibular area, hand and upper limb, skin, and abdominoplasty.

With the exception of cosmetic breast surgery, clean operations have not been shown to benefit from routine antibiotic prophylaxis. Clean-contaminated and contaminated plastic surgical procedures do benefit from the use of antibiotic prophylaxis. The duration of antibiotic use should generally be limited to a single preoperative dose because studies have generally showed no benefit for longer term antibiotic prophylaxis.

As far as choosing the antibiotic, it should have activity against the most frequently encountered microorganisms in postoperative surgical-site infections. Cefazolin as a single dose preoperatively is the most commonly recommended agent and would be considered appropriate in most cases. In the event of allergy or intolerance, clindamycin or vancomycin may be appropriate alternatives.

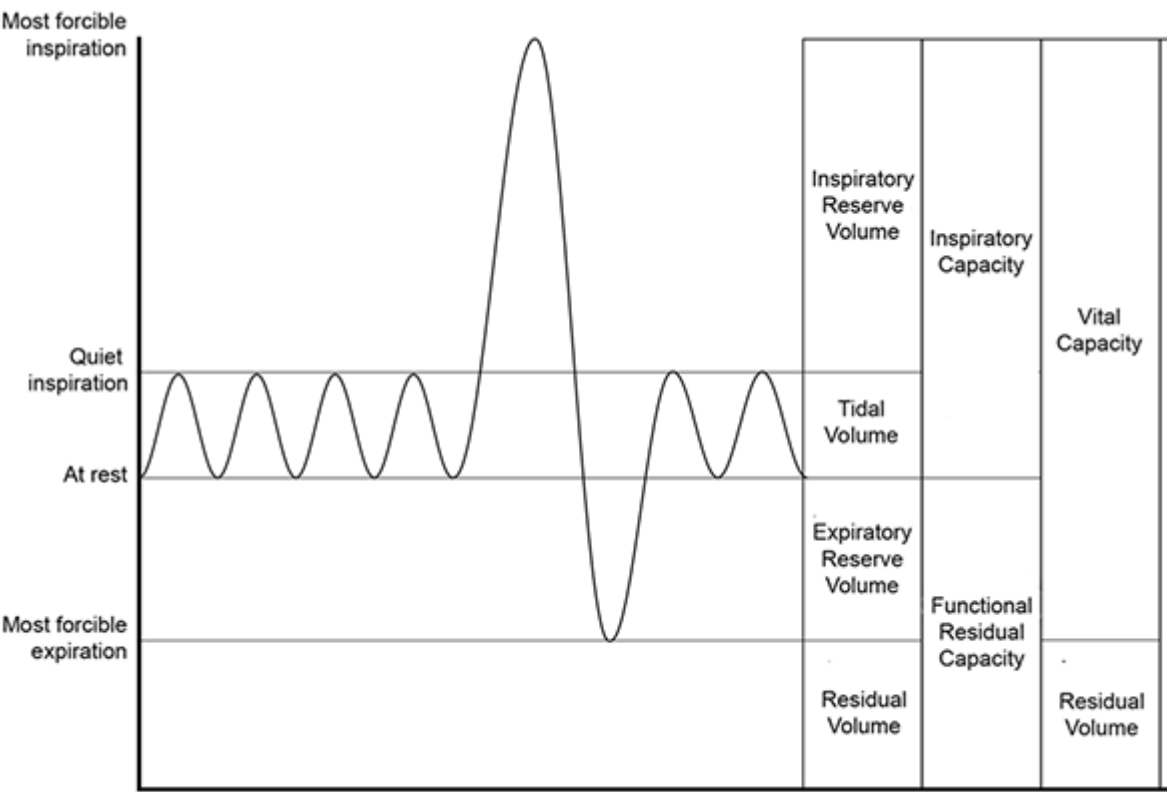
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235. A 65-year-old woman remains intubated in the intensive care unit after undergoing a prolonged operation. Arterial blood gas analysis shows respiratory acidosis. An increase in respiratory minute ventilation is planned. Minute ventilation is calculated by multiplying the respiratory rate and which of the following parameters?

- A) Inspiratory capacity
- B) Residual volume
- C) Tidal volume
- D) Total lung capacity
- E) Vital capacity

The correct response is Option C.



Minute ventilation is calculated by multiplying respiratory rate and tidal volume. Tidal volume is the amount of air/gas displaced during each quiet breath, using no extra inspiratory (“deep breath”) or expiratory effort.

Minute ventilation is an important concept in mechanical ventilation because of its inverse relationship with blood carbon dioxide levels. The caveat of this relationship is that not all inhaled air/gas takes part in gas exchange, whether because it remains in the conductive airways (ventilator tubing, endotracheal tube, trachea, etc) or it reaches alveoli that are not adequately perfused. The volume of air/gas that does not take part in gas exchange is called dead space.

Residual volume is the volume of air still remaining in the lungs after the most forcible expiration possible.

Inspiratory capacity is the volume of air that enters the lungs during the most forcible inspiration possible, starting at rest. Inspiratory reserve volume equals inspiratory capacity minus tidal volume, or the difference between the deepest breath and a quiet breath.

Expiratory reserve volume is the amount of air that can still be expired after a quiet expiration ends. It requires contraction of expiratory chest wall muscles, as opposed to quiet expiration, which is passive.

Vital capacity is the total amount of air that can be forcefully expired from the lungs after the most forcible inspiration possible. It represents the addition of inspiratory reserve, tidal, and expiratory reserve volumes.

Total lung capacity is the combination of vital capacity and residual volume.

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236. A 54-year-old woman with a history of left mastectomy for breast cancer presents for right reduction mammoplasty for symmetry. In this patient, the incidence of occult breast cancer discovered incidentally in tissue specimens at the time of reduction mammoplasty is approximately which of the following?
- A) 0.4 %
 - B) 1 %
 - C) 5 %
 - D) 15 %
 - E) 23 %

The correct response is Option C.

There have been multiple studies on the incidence of breast cancer discovered in reduction mammoplasty specimens. The incidence of occult cancer detected in reduction mammoplasty specimens is typically very low (0.06 to 5.45%) but varies depending on the patient's age and history of breast cancer. One specific study compared women undergoing reduction mammoplasty for symptomatic macromastia with women undergoing reduction mammoplasty for symmetry after mastectomy with or without reconstruction. Incidentally discovering occult breast cancer was much higher in women undergoing symmetry procedures (5.5 vs. 0.4%) versus those undergoing reduction mammoplasty for symptomatic macromastia. The important distinction in this clinical vignette is that the woman has had a mastectomy for breast cancer, and highlights several important points including:

- 1) The importance of a thorough history before reduction mammoplasty
- 2) Preoperative clinical examination
- 3) Screening mammography prior to the reduction mammoplasty
- 4) Pathologic examination of reduction mammoplasty specimens

Based on multiple studies, the other percentages listed are either too high or too low.

The treatment of occult cancers discovered during reduction mammoplasty depends on several factors including family history and evaluation of surgical margins.

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237. A 30-year-old woman undergoes augmentation mammoplasty in an office-based operating room. Intravenous midazolam and fentanyl are used, and a lidocaine field block is administered. An hour later, while in the recovery room, the patient experiences disorientation, muscle twitching, and light-headedness. Administration of which of the following drugs is the most appropriate next step in management?
- A) Dantrolene
 - B) Fat emulsion
 - C) Flumazenil
 - D) Naloxone
 - E) Propofol

The correct response is Option B.

This patient is experiencing symptoms of lidocaine toxicity. Lidocaine toxicity occurs within a few minutes after injection but can occur up to 60 minutes after injection. The maximum dose of lidocaine without epinephrine is 4.5 mg/kg and with epinephrine is 7 mg/kg. Symptoms of lidocaine toxicity can range from central nervous system (CNS) excitement (circumoral/tongue numbness, metallic taste, light-headedness, dizziness, visual and auditory disturbances, disorientation, drowsiness), and at higher doses CNS depression (muscle twitching, convulsions, unconsciousness, coma, respiratory depression and arrest, cardiovascular depression and collapse). Cardiovascular manifestations include chest pain, shortness of breath, palpitations, hypotension, and syncope. Of the options presented, fat emulsion (Intralipid) is the treatment of choice. Flumazenil is the treatment for benzodiazepine overdose, naloxone is for opioid overdose, dantrolene is for malignant hyperthermia, and propofol is used for induction and maintenance of general anesthesia.

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238. A 25-year-old right-hand–dominant woman sustains a full-thickness circumferential burn to the right upper extremity from the shoulder to the wrist. She undergoes early excision and grafting. Six months after treatment, she undergoes operative release of a severe flexion contracture of the elbow (greater than 50% loss of joint motion), resulting in a large defect. Which of the following is the most appropriate option for reconstruction of the defect?
- A) Free fasciocutaneous flap
 - B) Full-thickness skin grafting
 - C) Local perforator flap
 - D) Split-thickness skin grafting
 - E) Z-plasty

The correct response is Option A.

In severe burn scar contractures, adjacent tissue transfer (Z-plasty, VY-plasty) and skin grafts are not indicated. Perforator-based local flaps have low recurrence rates but one limitation of this technique is the availability of local normal skin. In this specific case, no normal skin is available. Free tissue transfer is the best option. Perforator vessels are normally protected and can serve as recipient vessels for the free flap transfer.

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1. Hayashida K, Akita S. Surgical treatment algorithms for post-burn contractures. *Burns Trauma*. 2017; 5:9.
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239. An otherwise healthy 62-year-old woman presents with mild edema, some hemosiderin deposition, and a clean, shallow, painful ulcer about 2 cm in size above the left medial malleolus. Medical history includes a left ankle fracture 15 years ago. She does not smoke cigarettes. She has a job which requires that she stand for 8-hour shifts. Distal pulses are present and ankle brachial index is .94. Which of the following is the most appropriate initial management?
- A) Debride the wound and apply a split-thickness skin graft
 - B) Elevate and apply serial compression dressings (Unna boot)
 - C) Hyperbaric oxygen therapy (HBOT)
 - D) Optimize the wound bed with bilaminate neodermis (Integra)
 - E) Strip the greater saphenous vein and ligate the perforators

The correct response is Option B.

Venous insufficiency is staged using the CEAP (clinical, etiologic, anatomical, and pathophysiologic) classification. The patient presented in this scenario meets the criteria for C6 (Clinical 6) criteria with the presence of an active ulcer. Compression and keeping the wound clean are the initial, primary, and mainstay therapies for healing venous ulcers. The only option listed that provides compression and wound care is to clean the wound, elevate, and apply serial compression dressings (Unna boot). After a trial of compression and wound bed optimization, closure can be considered. The literature does not provide conclusive evidence that skin grafting is a superior or desired closure. There are studies that demonstrate the superiority of Apligraf in achieving wound closure. If the perforators are found to be the source of the issue, ligation may reduce the recurrence of ulcers in the area but studies comparing ligation and wound care do not show earlier closure of ulcers present. Hyperbaric oxygen therapy (HBOT) is not indicated in this situation.

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2. Game FL, Jeffcoate WJ. Dressing and Diabetic Foot Ulcers: A Current Review of the Evidence. *Plast Reconstr Surg.* 2016 Sep;138(3 Suppl):158S-64S.

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240. A 63-year-old woman has a superficial surgical site infection at her abdominal incision two weeks following deep inferior epigastric perforator (DIEP) breast reconstruction. The CDC categorizes a "superficial incisional surgical-site infection" as occurring within how many days of the procedure?
- A) No more than 7 days
 - B) No more than 14 days
 - C) No more than 30 days
 - D) No more than 60 days
 - E) No more than 90 days

The correct response is Option C.

Superficial incisional surgical-site infection is defined by the following criteria:

Date of event for infection occurs within 30 days of a procedure
AND
involves only skin and subcutaneous tissue of the incision
AND
the patient has at least one of the following:

- A. purulent drainage at incision site
- B. positive cultures from the incisions or underlying tissue
- C. superficial incision that is deliberately opened by a surgeon or other designee with the following signs or symptoms: pain or tenderness; localized swelling; erythema; or heat
- D. diagnosis by the surgeon or attending physician designee

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241. An 8-year-old boy presents with a pectus excavatum deformity and social isolation due to concern about his appearance. Cardiopulmonary function testing is normal. Which of the following is most closely associated with deformity relapse following surgical correction?
- A) Anterior sternal protrusion greater than 20 cm
 - B) Failure to respond to a trial of external bracing
 - C) Isolated deformity in absence of other affected family members
 - D) Postponing surgical intervention until after skeletal maturity
 - E) Progressive deformity in early childhood

The correct response is Option E.

Pectus excavatum (PE) is a deformity of the chest wall characterized by a sternal depression beginning over the mid manubrium and progressing centrally down to the xiphoid process in a “funnel chest” fashion. It accounts for 90% of anterior chest wall deformities, occurring with an incidence of 1 in every 400 to 1000 live births. In contrast to PE, pectus carinatum (PC) is a deformity characterized by a protrusion of sternum. PC is the second most common anterior chest wall deformity, although much less common, occurring with an incidence of approximately 1 in 1500 live births.

External bracing can be effective in reducing PC deformities when instituted prior to skeletal maturity. External bracing is not effective for correcting PE deformities and can worsen subjective respiratory symptoms and objective measures of cardiopulmonary compression.

Spontaneous regression of PE has been reported in infancy but is rare, and no spontaneous improvement can be expected after 6 years of age. On the other hand, PE deformity worsens in one third of patients during the adolescent growth spurt up to the time of skeletal maturity, with no reliable markers to predict progression. During adolescence, simple symmetrical lesions can progress to more complex asymmetric deformities, and symptoms may increase significantly. Optimal timing of intervention is the period from late childhood to mid-adolescence, because these patients are young enough to retain compliant costal cartilage amenable to remodeling, but old enough to reduce the potential for recurrence that can accompany progressive deformity that can accompany the pubertal growth spurt.

Accepted indications for treatment include cardiopulmonary morbidity and psychosocial impact of the deformity. Two surgical procedures in active use today for PE include open repair with remodeling (Ravitch procedure) and closed minimally invasive reduction with internal contoured bar (Nuss procedure). Outcomes for the procedures have not been directly compared in organized trials, but overall success in terms of appearance, self-reported exercise capacity, and objective measures of cardiopulmonary function have been reported with each. Other approaches for management include external traction (e.g., vacuum bell, sternal magnet) devices, and subcutaneous prostheses.

PE is usually sporadic, and reports of familial patterns of inheritance are rare. Reported genetic associations include connective tissue disorders such as Marfan syndrome, Ehlers Danlos syndrome, and osteogenesis imperfecta, as well as neuromuscular disease such as spinal muscular atrophy. By contrast, PC demonstrates a strong familial incidence, with up to 25% of affected patients reporting abnormality in other family members.

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242. A 52-year-old man presents with a chronic ulcer of the lower extremity. Current medications include prednisone for management of rheumatoid arthritis. In addition to standard local wound care, which of the following treatments is most appropriate?
- A) Folate
 - B) Hyperbaric oxygen therapy (HBOT)
 - C) Long-acting insulin
 - D) Vitamin A
 - E) Vitamin C

The correct response is Option D.

Malnutrition is a well-established risk factor for the development of chronic wounds. Vitamin A has been shown in multiple studies to offset the detrimental effects of corticosteroids on wound healing.

Appropriate glucose management is critical to the treatment of diabetic ulcers, but insulin would not be indicated in the absence of uncontrolled diabetes mellitus.

Vitamin C is required as a cosubstrate for enzymes involved in collagen production, and its supplementation is recommended for the nutritionally deficient. However, vitamin C has not been shown to be of any benefit to wound healing in the setting of chronic corticosteroid therapy per se.

Hyperbaric oxygen therapy delivers oxygen to tissues by both hemoglobin-dependent transport and vastly increased dissolved oxygen content in blood when a patient breathes 100% oxygen at pressures well above atmospheric level. This improves wound healing by multiple cellular mechanisms in select wounds. However, benefits in treatment of chronic corticosteroid use have not been demonstrated.

Elevated serum homocysteine has been associated in multiple studies with impaired wound healing and increased risk of coronary and cerebrovascular disease due to its enhancement of clotting pathways. Folate supplementation is often used to treat hyperhomocysteinemia, but conclusive benefit in chronic wounds is not as well-established.

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2. Wang AS, Armstrong EJ, Armstrong AW. Corticosteroids and wound healing: clinical considerations in the perioperative period. *Am J Surg*. 2013;206:410-7.

243. A 45-year-old woman comes to the office for consultation about immediate bilateral breast reconstruction of a right-sided tumor measuring 2.5 cm. Biopsy reveals a HER-2/neu negative invasive ductal carcinoma without lymphovascular invasion. The patient requests nipple-sparing mastectomy. Physical examination shows a palpable mass is located in the right upper outer quadrant approximately 1.5 cm from the nipple-areola complex and is freely mobile. There is no lymphadenopathy on exam. Based on current literature, which of the following best describes this patient's candidacy for the requested procedure?
- A) Good candidate based on current presentation
 - B) Not a candidate because of lymph node status
 - C) Not a candidate because of tumor location
 - D) Not a candidate because of tumor pathology
 - E) Not a candidate because of tumor size

The correct response is Option C.

Nipple-sparing mastectomy or total skin-sparing mastectomy is becoming an increasingly popular choice for women because of the excellent cosmetic outcomes and the ability to save the nipple-areola complex that may provide psychological benefits with increased patient satisfaction as well. Nipple-sparing mastectomy appears to be oncologically safe with low risks of cancer recurrence in the literature thus far. However, there has been little long-term follow-up, so this approach is still somewhat controversial because the oncologic safety and locoregional recurrence have not been examined definitively. Although certain centers are pushing the envelope regarding the use of this technique in a wide range of patients, the current literature supports the following exclusion criteria:

- A. Tumor size greater than 5 cm
- B. Tumor location less than 2 cm from the nipple
- C. Evidence of axillary disease
- D. Tumor involvement on retroareolar biopsy
- E. Lymphovascular invasion, human epidermal growth factor receptor-2 positivity, and/or HER-2/neu positivity on biopsy

The current patient's tumor was found to have a tumor-to-nipple distance of 1.5 cm which is a relative contraindication to nipple-sparing mastectomy in this case.

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1. Headon HL, Kasem A, Mokbel K. The Oncological Safety of Nipple-Sparing Mastectomy: A Systematic Review of the Literature with a Pooled Analysis of 12,358 Procedures. *Arch Plast Surg*. 2016 Jul; 43(4): 328–338.
2. Mallon P, Feron JG, Couturaud B, et al. The Role of Nipple-sparing Mastectomy in Breast Cancer: A Comprehensive Review of the Literature. *Plast Reconstr Surg*. 2013 May;131(5):969-84.

244. Which of the following factors has been shown to have the greatest impact on infection reduction in trauma patients with a lower-extremity open fracture?
- A) Definitive irrigation and debridement, and initiation of negative pressure wound therapy within 12 hours of injury
 - B) Early intramedullary reaming and nail fixation
 - C) Evaluation of the patient at a level I trauma center
 - D) Initial debridement of the wound by a senior surgeon
 - E) Intravenous administration of an antibiotic within 3 hours of injury

The correct response is Option E.

Early administration of antibiotics (less than 3 hours after injury) has been shown to be the most important determinant of infection prevention after traumatic open fractures of the lower extremity; this is more influential than other factors including time to initial washout, seniority of surgeon involved, as well as severity of the extremity trauma. Guidelines differ by institution but at least a cephalosporin is advocated with consideration given to additional gram-negative plus or minus anaerobic coverage in grossly contaminated wounds.

In a large multi-institutional study of open fractures, Pollak et al, showed a significant decrease in infection rate with either early direct admission (<2 hours) or transfer (<11 hours) to a level I trauma center, though this was only true for the Gustilo Type III open tibial fracture subgroup and not all open fractures. The authors hypothesized that early transfer resulted in earlier administration of antibiotics, though this was not directly compared.

While prompt debridement is important in obtaining wound control in traumatic lower-extremity open fractures, no clear advantage has been shown to debridement within 6 hours versus 24 hours, with the accepted standard that this can typically wait until daylight hours in the setting of timely prophylactic antibiotic administration.

Intramedullary reaming has not been shown to decrease infection risk in open tibial fractures, although early skeletal reduction and stability will minimize ongoing soft tissue damage.

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2. Gosselin RA, Roberts I, Gillespie WJ. Antibiotics for preventing infection in open limb fractures. *Cochrane Database Syst Rev.* 2004(1):CD003764.
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245. A 16-year-old transmasculine (female-to-male) patient is evaluated for bilateral mastectomy for gender confirmation. According to the World Professional Association for Transgender Health (WPATH) Standard of Care Guidelines, this procedure is considered to be medically necessary, appropriate, and indicated when which of the following conditions is met?

- A) The patient has the capacity to make a fully informed decision
- B) The patient has had 6 months of continuous hormone therapy
- C) The patient has one physician who can document gender dysphoria
- D) The patient has recently started pharmacologic therapy for depression
- E) The patient must be at least 21 years of age

The correct response is Option A.

The criteria among most insurance plans for coverage of procedures for treatment of gender dysphoria are quite stringent and rely on the concept of medical necessity for the patient. According to the World Professional Association for Transgender Health (WPATH), which is considered the authority on transgender health, standard-of-care guidelines to verify medically necessary procedures include:

- the capacity of the patient to make a fully informed decision and provide consent (patients who are younger than 18 may provide assent, along with parental consent, for mastectomy)
- at least 12 months of hormone therapy, consistent with the individual's gender goals
- living life fully in the role of the desired sex for at least 12 months
- psychiatric illnesses must be stable and well-controlled
- documentation of gender dysphoria and the potential benefit from surgery by at least two health-care providers

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3. *Standards of Care for the Health of Transsexual, Transgender, and Gender Nonconforming People*. 7th ed. The World Professional Association for Transgender Health, 2011.

246. A 25-year-old woman comes to the office for excision of a skin lesion with local anesthesia. Medical history includes multiple food and drug allergies. Shortly after the procedure is initiated, the patient reports itchy eyes and runny nose and becomes very anxious. Within the next 5 minutes, the patient develops diffuse skin erythema and shortness of breath, which progresses to respiratory stridor. Intravenous access has not been established. Intramuscular administration of which of the following drugs is the most appropriate next step in management?
- A) Diphenhydramine
 - B) Epinephrine
 - C) Ketamine
 - D) Midazolam
 - E) Triamcinolone

The correct response is Option B.

Epinephrine is the first line of treatment for patients with anaphylaxis and should be administered intramuscularly (anterolateral thigh) as soon as the diagnosis is made. In a setting where an exact dose can be drawn up, the recommended dosage is 0.01 mg/kg (maximum dose of 0.5 mg), administered intramuscularly every 5 to 15 minutes as necessary to control symptoms. It can also be administered more frequently than every 5 minutes if needed.

Greater emphasis has been placed on early administration of epinephrine in the management of anaphylaxis. The mean time to cardiac or respiratory arrest from medication-induced anaphylaxis in a hospital setting has been shown in one study to be only 5 minutes, with only 14% of patients receiving epinephrine prior to arrest.

Besides intramuscular epinephrine, recommended immediate interventions for anaphylaxis include an assessment of airway, breathing, and circulation; intravenous access; supplemental oxygen; monitoring; and placing the patient in supine position. Depending on the initial response, other interventions include establishing an airway, rapid intravenous fluid infusion, intravenous epinephrine infusion, bronchodilators, steroids, H1/H2 antihistamines, and glucagon.

Ketamine and midazolam (versed) are not indicated for the treatment of anaphylaxis. Diphenhydramine (Benadryl) and other antihistamine drugs are recommended as a second line of therapy for anaphylaxis. The same applies to systemic corticosteroids.

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2. Campbell RL, Li JT, Nicklas RA, et al. Emergency department diagnosis and treatment of anaphylaxis: a practice parameter. *Ann Allergy Asthma Immunol*. 2014 Dec;113(6):599-608.

247. A 2-year-old boy is brought to the office for evaluation of unilateral blepharoptosis. Examination shows a 2-mm eyelid ptosis of the right eye with 7-mm of upper eyelid excursion without visual obstruction. The left side shows no abnormalities. Which of the following is the most appropriate treatment in this patient?

- A) Frontalis suspension
- B) Lenticular skin excision
- C) Levator palpebrae advancement
- D) Tarsconjunctival Müllerectomy (Fasanella-Servat procedure)
- E) Observation and re-evaluation at age 3

The correct response is Option E.

Correction of mild to moderate eyelid ptosis in children should be delayed until the child can cooperate with the preoperative assessment and post operative care. This would not be reliably possible for a 2-year-old patient. Intervention before age 3 should be considered if there is significant obstruction of the visual axis. Levator advancement provides appropriate correction in pediatric patients with fair to good levator function. Frontalis suspension is generally reserved for instances when levator function is poor (less than 4 mm). Lenticular skin excision will have no reliable effect on lid position.

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248. A 37-year-old woman is brought to the operating room after sustaining a crush injury to the left upper arm during a rollover motor vehicle collision that included prolonged extraction from the vehicle. In the operating room, the patient underwent bypass grafting to reconstruct the brachial artery after fixation of the humerus. Postoperatively, the patient reports increasing pain of the left forearm with increasing pain control requirement. Doppler shows intact radial and ulnar pulses. Which of the following clinical studies is most likely to help determine the treatment plan at this time?
- A) Assessment of capillary refill of the finger tips
 - B) Doppler examination of the digital arteries
 - C) Duplex scan to check patency of graft
 - D) Measurement of the compartment pressures of the forearm
 - E) Pulse oximetry of the digits

The correct response is Option D.

In this scenario, the physician should rule out compartment syndrome for several reasons: the crush injury, the reperfusion state, and pain unrelieved by pain medications prior to providing more pain relief. Pain that is out of proportion to the expected level or out of proportion to examination findings should alert the clinician to the possibility of compartment syndrome.

The only study option provided that would give the clinician the ability to rule out compartment syndrome is the direct measurement of compartment pressures, which is recommended by several authors. Loss of peripheral artery pulses or perfusion to the distal skin would be very late presentations of the ischemic process, at a point where intervention, such as fasciotomy may not be effective. Missing this diagnosis in a patient such as this one, may lead to loss of muscular function (ischemic muscle contracture) even if the limb as a whole is salvaged.

The presence of palpable pulses is reassuring evidence for the patency of the bypass graft but does not tell the clinician about the perfusion in the capillary beds of the muscle. Similarly, perfusion of the skin and the digits does not guarantee flow in the muscle that was reperfused.

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2. Prasarn ML, Ouellette EA. Acute compartment syndrome of the upper extremity. *J Am Acad Orthop Surg.* 2011 Jan;19(1):49-58.

249. Which of the following must be present in order to initiate a brain death examination?

- A) Absence of deep tendon reflexes
- B) Anoxia
- C) Cause of brain death
- D) Hypothermia
- E) Ventilatory dependence with muscle relaxation (neuromuscular blockade)

The correct response is Option C.

Brain death is a permanent and irreversible state. There will be no return of cerebral or cortical function.

Hypothermia is not required for brain death examination; it needs to be reversed for at least 4 hours (up to 24 hours) to establish brain death.

Neuromuscular blockade must be reversed and patient must have normal peripheral muscle response to peripheral nerve stimulus in order to undergo brain death examination. Brain death examination includes elicitation of brain reflexes, which can be muted by neuromuscular blockade.

Anoxic brain injury must be observed for at least 24 hours prior to beginning brain death examination.

Cause or reason for brain death must be established prior to beginning brain death examination.

Absence of deep tendon reflexes is not required to initiate the examination.

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250. A 56-year-old man is scheduled to undergo excision of a lower extremity melanoma during regional anesthesia. Current medications include lisinopril and occasional motrin. He does not smoke cigarettes. Which of the following factors increases the risk of postoperative nausea and vomiting in this patient?
- A) Age over 50 years
 - B) Male gender
 - C) Nonsmoking status
 - D) Use of anti-inflammatory medications
 - E) Use of local anesthetic

The correct response is Option C.

Risk factors for postoperative nausea and vomiting fall into four categories: patient-related, anesthesia-related, surgery-related, and other factors.

Patient-related predictors are: female sex, non-smoking status, history of postoperative nausea and vomiting/motion sickness, genetics, age of 50 years or younger, and obesity (BMI greater than 30 kg/m²).

Anesthesia-related predictors are: postoperative opioids, inhalational anesthetics, and nitrous oxide.

Surgery-related predictors are: surgery duration and surgery type.

Other factors including high patient anxiety and postoperative pain.

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2. Horn CC, Wallisch WJ, Homanics GE, et al. Pathophysiological and neurochemical mechanisms of postoperative nausea and vomiting. *Pharmacol*. 2014;722:55-66.
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Thank you for your participation.

1	(A)	(B)	(C)	(D)	(E)
2	(A)	(B)	(C)	(D)	(E)
3	(A)	(B)	(C)	(D)	(E)
4	(A)	(B)	(C)	(D)	(E)
5	(A)	(B)	(C)	(D)	(E)
6	(A)	(B)	(C)	(D)	(E)
7	(A)	(B)	(C)	(D)	(E)
8	(A)	(B)	(C)	(D)	(E)
9	(A)	(B)	(C)	(D)	(E)
10	(A)	(B)	(C)	(D)	(E)
11	(A)	(B)	(C)	(D)	(E)
12	(A)	(B)	(C)	(D)	(E)
13	(A)	(B)	(C)	(D)	(E)
14	(A)	(B)	(C)	(D)	(E)
15	(A)	(B)	(C)	(D)	(E)
16	(A)	(B)	(C)	(D)	
17	(A)	(B)	(C)	(D)	(E)
18	(A)	(B)	(C)	(D)	(E)
19	(A)	(B)	(C)	(D)	(E)
20	(A)	(B)	(C)	(D)	(E)
21	(A)	(B)	(C)	(D)	(E)
22	(A)	(B)	(C)	(D)	(E)
23	(A)	(B)	(C)	(D)	
24	(A)	(B)	(C)	(D)	(E)
25	(A)	(B)	(C)	(D)	(E)
26	(A)	(B)	(C)	(D)	(E)
27	(A)	(B)	(C)	(D)	(E)
28	(A)	(B)	(C)	(D)	(E)
29	(A)	(B)	(C)	(D)	(E)
30	(A)	(B)	(C)	(D)	(E)
31	(A)	(B)	(C)	(D)	(E)
32	(A)	(B)	(C)	(D)	(E)
33	(A)	(B)	(C)	(D)	(E)
34	(A)	(B)	(C)	(D)	(E)
35	(A)	(B)	(C)	(D)	(E)
36	(A)	(B)	(C)	(D)	(E)
37	(A)	(B)	(C)	(D)	(E)
38	(A)	(B)	(C)	(D)	(E)
39	(A)	(B)	(C)	(D)	(E)
40	(A)	(B)	(C)	(D)	(E)
41	(A)	(B)	(C)	(D)	(E)
42	(A)	(B)	(C)	(D)	(E)
43	(A)	(B)	(C)	(D)	
44	(A)	(B)	(C)	(D)	(E)
45	(A)	(B)	(C)	(D)	(E)
46	(A)	(B)	(C)	(D)	(E)
47	(A)	(B)	(C)	(D)	(E)
48	(A)	(B)	(C)	(D)	(E)
49	(A)	(B)	(C)	(D)	(E)
50	(A)	(B)	(C)	(D)	(E)

51	(A)	(B)	(C)	(D)	(E)
52	(A)	(B)	(C)	(D)	(E)
53	(A)	(B)	(C)	(D)	(E)
54	(A)	(B)	(C)	(D)	(E)
55	(A)	(B)	(C)	(D)	(E)
56	(A)	(B)	(C)	(D)	(E)
57	(A)	(B)	(C)	(D)	(E)
58	(A)	(B)	(C)	(D)	(E)
59	(A)	(B)	(C)	(D)	(E)
60	(A)	(B)	(C)	(D)	(E)
61	(A)	(B)	(C)	(D)	(E)
62	(A)	(B)	(C)	(D)	(E)
63	(A)	(B)	(C)	(D)	(E)
64	(A)	(B)	(C)	(D)	(E)
65	(A)	(B)	(C)	(D)	
66	(A)	(B)	(C)	(D)	(E)
67	(A)	(B)	(C)	(D)	(E)
68	(A)	(B)	(C)	(D)	(E)
69	(A)	(B)	(C)	(D)	(E)
70	(A)	(B)	(C)	(D)	(E)
71	(A)	(B)	(C)	(D)	(E)
72	(A)	(B)	(C)	(D)	(E)
73	(A)	(B)	(C)	(D)	(E)
74	(A)	(B)	(C)	(D)	(E)
75	(A)	(B)	(C)	(D)	(E)
76	(A)	(B)	(C)	(D)	(E)
77	(A)	(B)	(C)	(D)	(E)
78	(A)	(B)	(C)	(D)	(E)
79	(A)	(B)	(C)	(D)	
80	(A)	(B)	(C)	(D)	
81	(A)	(B)	(C)	(D)	(E)
82	(A)	(B)	(C)	(D)	(E)
83	(A)	(B)	(C)	(D)	
84	(A)	(B)	(C)	(D)	(E)
85	(A)	(B)	(C)	(D)	(E)
86	(A)	(B)	(C)	(D)	(E)
87	(A)	(B)	(C)	(D)	(E)
88	(A)	(B)	(C)	(D)	(E)
89	(A)	(B)	(C)	(D)	(E)
90	(A)	(B)	(C)	(D)	(E)
91	(A)	(B)	(C)	(D)	(E)
92	(A)	(B)	(C)	(D)	(E)
93	(A)	(B)	(C)	(D)	(E)
94	(A)	(B)	(C)	(D)	
95	(A)	(B)	(C)	(D)	(E)
96	(A)	(B)	(C)	(D)	(E)
97	(A)	(B)	(C)	(D)	(E)
98	(A)	(B)	(C)	(D)	(E)
99	(A)	(B)	(C)	(D)	(E)
100	(A)	(B)	(C)	(D)	(E)

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