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- Select the “Start Exam” link and read and acknowledge the honor code statement.
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American Society of Plastic Surgeons In-Service Examination



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for the

In-Service Examination



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Section 1: Comprehensive

1. Epithelial cell migration across an acute skin laceration is initiated by which of the following mechanisms?
 - A) Contraction of myofibroblasts
 - B) Deposition of collagen into the wound
 - C) Formation of a fibrin-fibronectin plug
 - D) Loss of contact inhibition
 - E) Secretion of anti-inflammatory products

The correct response is Option D.

Epithelial cell migration is initiated by loss of contact inhibition and occurs from the periphery of the wound and adnexal structures. Cell division occurs in 48 to 72 hours, resulting in a thin epithelial cell bridge across the wound. A key role is played by epidermal growth factors.

Myofibroblasts are involved in wound contraction and play no role in epithelialization. Collagen deposition is seen in the remodeling phase of wound healing. Fibronectin produced by fibroblasts serves as an adhesion molecule anchoring cells to collagen or proteoglycan substrates. Release of cytokines from platelets plays an important role in the initiation of the hemostatic initial phase.

References

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2. A 64-year-old woman is evaluated because of pulmonary distress that begins in the postanesthesia care unit after undergoing a 3-hour elective abdominoplasty and progressively worsens during the next 6 hours. History includes long-standing hypertension that is well controlled with metoprolol. She smokes one pack of cigarettes per week, but she discontinued smoking 2 weeks before the surgery. Preoperative vital signs were within normal limits. Intraoperative studies show:

Crystalloid administration	4000 mL
Blood loss	250 mL
Urine output	125 mL

Postoperative studies show:

Nonrebreather face mask flow rate	10 L/min to maintain oxygen saturation > 90%
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Heart rate is 80 bpm, respirations are 24/min, and blood pressure is 162/95 mmHg. Evaluation shows no abdominal discomfort, chest pain, or changes in mental status. A portable chest x-ray study shows pulmonary venous congestion. ECG shows sinus rhythm, signs of left ventricular hypertrophy, and normal S-T segments. Which of the following is the most likely cause of the pulmonary failure?

- A) Acute coronary syndrome
- B) Congestive heart failure
- C) Exacerbation of chronic obstructive pulmonary disease
- D) Pneumonia
- E) Pulmonary embolism

The correct response is Option B.

The patient described has developed early postoperative pulmonary failure most likely caused by congestive heart failure. Perioperative fluids were administered with the assumption that the patient had normal cardiac function. Her history of long-standing hypertension, combined with postoperative studies that included the ECG showing left ventricular hypertrophy and chest x-ray study consistent with pulmonary edema, support diastolic dysfunction.

Congestive heart failure is currently the leading admission diagnosis for medicine and cardiology hospital services. The main reason is the overlooked high prevalence of diastolic dysfunction secondary to long-standing systemic hypertension. Patients with hypertension and cardiac diastolic dysfunction have preserved left ventricular contractile function, but they also have hypertrophied ventricular muscle that is unable to maintain normal diastolic compliance. This can lead to higher left ventricular filling pressures, elevated atrial pressures, atrial distension, atrial arrhythmias, elevated postcapillary pulmonary pressures, ventilation/perfusion mismatches, and pulmonary and peripheral edema. Treatment involves afterload and preload reduction.

Acute coronary syndrome is caused by an atherosclerotic plaque rupture blocking a coronary artery. The acute event is usually associated with chest pain and elevation of S-T segments on ECG. Pulmonary embolism is always a concern, but that usually occurs later in the postoperative period. Onset of symptoms is sudden and characterized by chest pain, respiratory distress, and anxiety. Pneumonia and chronic obstructive pulmonary disease exacerbation are not supported by the clinical history.

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3. A 55-year-old man is brought to the emergency department after sustaining electrical burns. He has numbness of the left hand; pulse in the hand and sensation to touch are diminished. Which of the following is the most effective management to restore perfusion to the left hand?

- A) Anticoagulation
- B) Embolectomy
- C) Burn excision
- D) Escharotomy
- E) Fasciotomy

The correct response is Option E.

The patient described has a circumferential electrical injury to the forearm consistent with compartment syndrome. Fasciotomy is indicated.

Acute burn injury exceeding 20% can lead to a significant systemic response, with release of vasoactive mediators, third spacing, increased metabolic requirement, and immune suppression. Surgical debridement and closure of the wound can limit the inflammatory process.

Anticoagulation and embolectomy do not address the underlying problem, which is increased compartment pressure in a confined space. Burn excision is a method of removing devitalized burned tissue, usually in a tangential fashion down to the fascia, followed by split-thickness skin grafting. This is not a treatment for compartment syndrome.

When there is circumferential injury of an extremity or in deep burns to the chest wall, escharotomy, or creating incisions through the burn eschar, is important in releasing constriction and allowing circulation to the extremity or airflow to the chest. Incisions must extend beyond the zone of the burn injury to assure complete release of the constriction to restore circulation. Escharotomy is performed within the first 24 hours of admission.

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(Please note that this pictorial appears in color in the online examination)

4. A 46-year-old man comes to the office because of a 10-year history of a painless mass in the mons (shown). He reports that it has enlarged gradually and prevents him from conducting daily activities. He has had episodes of cellulitis in the skin overlying the mass several times a year for the past 5 years. BMI is 51 kg/m^2 . Which of the following is the most appropriate management?
- A) Elevation and compression
 - B) Incision and drainage
 - C) Resection and negative pressure wound therapy
 - D) Suction lipectomy and Charles procedure
 - E) Weight reduction and physical therapy

The correct response is Option C.

Massive localized lymphedema (MLL) is an emerging complication of morbid obesity. Also known as lymphedema of obesity, MLL is usually a benign overgrowth of soft tissue.

MLL is a form of secondary lymphedema; it represents an acquired dysfunction of otherwise normal lymphatics. Secondary lymphedema has an identifiable cause—in this case, obesity—that destroys or renders inadequate the otherwise normal lymphatics. Worldwide, the most common cause is filariasis, the direct infestation of lymph nodes by the parasite *Wuchereria bancrofti*. Other causes include vein stripping, peripheral vascular surgery, oncologic surgery, radiation, infection, and tumor invasion or compression.

As shown in the photograph, the overlying skin is thickened and displays the typical peau d'orange (orange skin) appearance of congested dermal lymphatics. The epidermis forms thick, scaly deposits of keratinized debris and may display a warty verrucosis. Cracks, pits, fissures, and open wounds may develop and accommodate debris and bacteria, which lead to lymphorrhea, the leakage of lymph onto the surface of the skin.

Surgical treatment is palliative, not curative, and it does not obviate the need for continued conservative therapy. Resection is indicated for restoration of mobility, prevention of recurrent infections, or if there is a question of malignancy. Rarely, chronic lymphedema may predispose to cutaneous angiosarcoma.

Incision and drainage is performed for wound infection. Weight reduction, physical therapy, elevation, and compression are all conservative management options in lymphedema and would not be appropriate in a patient who is bed-bound as a result of MLL and has recurrent cellulitic episodes. Suction lipectomy would not be effective for the patient described and does not address skin excess. The Charles procedure is a radical surgery performed for lower extremity lymphedema, where fascial excision of skin and soft tissue is performed and then skin from the resected specimen is used for immediate autografting.

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2. Garfein ES, Borud LJ, Warren AG, et al. Learning from a lymphedema clinic: an algorithm for the management of localized swelling. *Plast Reconstr Surg*. 2008 Feb;121(2):521-528.
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5. A 24-year-old man who sustained burns over 60% of the total body surface area in a chemical fire requires skin grafting for release of ectropion after 8 weeks in the intensive care unit. When administering anesthesia, which of the following drugs is most likely to have adverse effects in this patient?

- A) Atropine
- B) Diazepam
- C) Enflurane
- D) Pentobarbital
- E) Succinylcholine

The correct response is Option E.

Succinylcholine-induced hyperkalemia is most frequently observed in patients with large burns who have also had long hospitalizations. Without treatment, potentially fatal cardiac arrhythmias can occur. This condition is also observed in patients who have endured long hospitalizations for neurologic disorders, limiting mobility. Upregulation of acetylcholine receptors is thought to be responsible for the increased efflux of potassium from muscle cells when depolarizing neuromuscular blocking drugs such as succinylcholine are administered to such patients. Treatment includes supportive measures and administration of calcium, glucose, insulin, albuterol, furosemide, and/or sodium polystyrene sulfonate (Kayexalate), depending on the patient's symptoms.

Benzodiazepines are widely used and well tolerated as anxiolytic agents in all types of patients. Burn patients are not at increased risk for side effects, and use of these agents preoperatively for the patient described would be appropriate. Although halothane can induce malignant hyperthermia, especially in combination with succinylcholine, this complication is caused by a genetic predisposition. Although intravenous barbiturates cause severe respiratory depression and drowsiness, prolonging the postoperative recovery, they are nevertheless safe in young patients, including a burn patient. Belladonna alkaloids are used to chemically lower the heart rate (atropine) and prevent nausea (scopolamine), and they are not contraindicated in a young, otherwise healthy burn patient.

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6. A 55-year-old man comes to the office because of the ventral hernia shown. History includes a sigmoid colectomy for diverticular disease using a midline incision 7 years ago. Postoperatively, an incisional hernia developed. He underwent mesh repair, which was unsuccessful. Physical examination shows a 28 (horizontal at the level of the umbilicus) × 25-cm (vertical) palpable fascial defect. Which of the following is the most appropriate method of reconstruction of the abdominal wall?

- A) Component separation technique only
- B) Component separation technique with mesh repair
- C) Mesh repair only
- D) Tissue expansion and component separation technique with mesh repair
- E) Use of a pedicled tensor fascia lata flap



(Please note that this pictorial appears in color in the online examination)

The correct response is Option B.

Component separation is a well-described technique for repairing midline abdominal wall hernias. Originally described by Ramirez et al. in 1990, the technique involves incising the external oblique fascia lateral to the rectus muscle. The external oblique is elevated off of the internal oblique muscle in a loose areolar plane that is largely avascular, except for the intercostal branches to the external oblique muscles that are located far posteriorly. The posterior rectus sheath can be incised longitudinally to provide an additional 1 to 2-cm mobilization if needed. The attachments of the internal oblique to the rectus muscle are preserved, as are the intercostal neurovascular bundles that supply the rectus muscle. Hence, the rectus muscle is kept innervated and functional. Under ideal conditions, mobilization of the rectus-internal oblique muscle flap on both sides allows for closure of defects at the epigastrium, mid abdomen, and low abdomen of 10, 20, and 6 cm, respectively.

A component separation repair alone would be insufficient because the defect described is 28 cm wide. There would still be a persistent defect in the fascia. Therefore, component separation with supplemental mesh would be required to adequately close this defect. Component separation mobilizes functional muscle medially to help restore abdominal wall integrity and minimizes the amount of bridging that would be repaired with mesh.

A mesh repair alone would close the fascial defect but would do nothing to restore the functionality of the abdominal wall. Large defects repaired with mesh can be associated with hernia recurrence and long-term bulging.

Tissue expansion can be useful in situations where skin coverage may be lacking. Tissue expansion is unnecessary in the patient described because skin coverage is not an issue.

Free flap reconstruction, such as with a tensor fascia lata flap, has been described for abdominal wall defects and can provide vascularized fascia. There are even case reports of innervated free flap reconstructions. However, failure to maintain sufficient muscular tone in the long term leads to eventual attenuation of the fascia and abdominal wall bulging.

References

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7. An 83-year-old man undergoes radiation therapy and surgical resection and coverage with a cranial bone graft to treat meningioma. The graft becomes infected and is removed 6 weeks after the procedure. One year later, the patient is scheduled to undergo reconstruction of the resulting 23-cm² defect in the skull. Which of the following is a relative contraindication for the subsequent use of hydroxyapatite in this patient?

- A) Age of patient
- B) History of infection
- C) History of radiation
- D) Location of defect
- E) Size of defect

The correct response is Option C.

Hydroxyapatite cement is widely used in cranioplasty. In one study, the complication rate of the use of hydroxyapatite in patients who have received irradiation to the scalp was 100%. Therefore, its use is not recommended in this population.

Use of hydroxyapatite is not recommended in large, full-thickness defects in the pediatric population because it is largely nonresorbable and may be deleterious to the rapidly growing skull.

Reduction in the incidence of infection has been shown when a period of 1 year has elapsed between the initial injury or infection and the reconstruction with hydroxyapatite.

Use of hydroxyapatite in frontal areas causes twice the incidence of infection than in its use in all other areas.

Hydroxyapatite is approved by the FDA for reconstruction of bony defects up to 25 cm² in size.

References

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(Please note that this pictorial appears in color in the online examination)

8. A 64-year-old Hispanic woman comes for evaluation of a biopsy-proven basal cell carcinoma on her right cheek. She says that the lesion has been present for 8 months and has grown rapidly during the past 3 months. A photograph is shown. Which of the following is the most appropriate treatment?
- A) Cryotherapy
 - B) Electrodesiccation and curettage
 - C) Mohs micrographic surgery
 - D) Radiation therapy
 - E) Wide local excision

The correct response is Option C.

The patient described has a basal cell carcinoma (BCC), which is the most common type of cancer worldwide affecting approximately 1 million people per year. These types of cancers were once more common in people over 40 years of age, but they now are often diagnosed in younger people (85% of lifetime sun exposure occurs before age 18).

BCC starts in the epidermis and grows slowly and painlessly. It most often appears on areas of skin that are regularly exposed to sunlight or other ultraviolet radiation, such as the face, scalp, ears, chest, back, and legs.

These tumors can have several different forms. The most common appearance of BCC is that of a small dome-shaped bump that has a pearly white color. Telangiectasias may be seen on the surface. BCC can also appear as a pimple-like growth that heals, only to come back again and again. A common sign of BCC is a sore that bleeds and heals up, only to recur again; oozing or crusting spots within the sore are also common.

While there are many ways to treat BCC, Mohs micrographic surgery is the most appropriate option in the scenario described, as the lesion demonstrated has indistinct borders, is located in both a high-risk and cosmetically sensitive area, and is growing rapidly. Wide local excision would be indicated for BCC with discrete, distinct borders. Radiation therapy is not a primary option for BCC. Cryotherapy and electrodesiccation and curettage have lower cure rates and higher recurrence rates compared with Mohs micrographic surgery.

Generally accepted indications for Mohs micrographic surgery include the following:

1. Recurrent or incompletely excised BCC or squamous cell carcinoma (SCC)
2. Primary BCC or SCC with indistinct borders
3. Lesions located in high-risk areas (ie, eyelids, nose, ear, nasolabial folds, upper lip, vermillion border, columella, periorbital, temples, preauricular and postauricular areas, scalp)
4. Cosmetically and functionally important areas, including genital, anal, perianal, hand, foot, and nail units
5. Tumors with aggressive clinical behavior (ie, rapidly growing, greater than 2 cm in diameter)
6. Tumors with an aggressive histologic subtype (ie, morpheaform BCC) and/or those with perivascular invasion
7. SCCs ranging from undifferentiated to poorly differentiated, and SCCs that are adenosquamous, desmoplastic, infiltrative, perineural, periadnexal, or perivascular
8. Tumors arising in sites of previous radiation therapy
9. Tumors arising in immunosuppressed patients

10. Basal cell nevus syndrome patients

Mohs micrographic surgery has the highest 5-year cure rates for primary and recurrent BCC.

Five-year recurrence rates for primary BCC:

1. Mohs micrographic surgery—1%
2. Surgical excision—10.1%
3. Curettage and desiccation—7.7%
4. Radiation therapy—8.7%
5. Cryotherapy—7.5%

Five-year recurrence rates for recurrent BCC:

1. Mohs micrographic surgery—5.6%
2. Surgical excision—17.4%
3. Curettage and desiccation—40%
4. Radiation therapy—9.8%
5. Cryotherapy—13% (< a 5-year period)

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9. Which of the following is the most appropriate Mathes and Nahai classification of the rectus abdominis muscle?

- A) Type I
- B) Type II
- C) Type III
- D) Type IV
- E) Type V

The correct response is Option C.

The rectus abdominis muscle is a Mathes and Nahai classification Type III muscle.

The Mathes and Nahai classification of the vascular anatomy of muscles represents an important description in reconstructive surgery. Type I muscles have one vascular pedicle and include the gastrocnemius, rectus femoris, and tensor fascia lata. Type II muscles have a dominant and minor pedicle and include the abductor digiti minimi, abductor hallucis, biceps femoris, flexor digitorum brevis, gracilis, peroneus longus, peroneus brevis, platysma, semitendinosus, soleus, sternocleidomastoid, temporalis, trapezius, and vastus lateralis. Type III muscles have two dominant pedicles and include the gluteus maximus, rectus abdominis, serratus anterior, and semimembranosus. Type IV muscles have multiple segmental pedicles and include the extensor digitorum longus, extensor hallucis longus, flexor digitorum longus, flexor hallucis longus, sartorius, and tibialis anterior. Type V muscles have one dominant and secondary segmental pedicles and include the pectoralis major and latissimus dorsi.

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10. A 36-year-old woman comes to the office for consultation regarding augmentation mammoplasty. She wears a size 34B brassiere and wants the size increased to a full C cup. Height is 5 ft 6 in (168 cm) and weight is 126 lb (57 kg). She feels her breasts are reasonable in appearance but has been encouraged by her husband, from whom she is separated, to seek enhancement. The risks of the surgery, including loss of nipple-areola sensation and the need for prosthesis maintenance over time, are discussed. She opts to proceed with surgery, and 375-mL saline breast prostheses are placed subpectorally through inframammary fold incisions. Which of the following is most likely to cause patient dissatisfaction after the procedure?

- A) Continued separation from her husband
- B) Deflation of the breast prostheses
- C) Hypertrophy of the breast scars
- D) Inability to breast-feed
- E) Inadequate breast size

The correct response is Option A.

Thorough patient evaluation before surgery, including screening, discussion of risks and complications, and the need for realistic expectations, is necessary to optimize patient satisfaction after surgery. This is especially true of aesthetic surgery.

Despite these efforts, patient dissatisfaction occurs and can be extremely difficult to manage. Patient dissatisfaction is usually associated with failures in communication and patient selection criteria. Determining which patients are unsuitable for operation is a skill acquired with experience. General guidelines include patients who (1) have unrealistic expectations, (2) are excessively demanding, (3) have dissatisfaction with a previous surgical procedure, (4) are psychologically unstable, and (5) have a minimal deformity.

In the scenario described, the patient has an unrealistic expectation that the surgery might save her marriage. Because of her motivation for surgery, she is unlikely to be happy, despite a very good result, unless the expectation of reconciliation has been fulfilled.

The other options are possible causes of postoperative dissatisfaction; however, preoperative counseling and education of the potential complications allow for enhanced acceptance if they do occur.

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11. A 44-year-old woman has a biopsy-proven basal cell carcinoma of the cheek. An indication for resection using conventional excision, over Mohs micrographic surgery, includes which of the following?
- A) Diameter of 1.2 cm
 - B) Location next to the alar rim
 - C) Morpheaform subtype
 - D) Preexisting burn scar surrounding the lesion
 - E) Recurrent tumor

The correct response is Option A.

Indications for Mohs micrographic resection of a basal cell carcinoma include morpheaform or other aggressive subtypes, recurrence of a tumor, a previous scar, or locations where the preservation of tissue is critical for final reconstruction.

A basal cell carcinoma of the cheek, measuring 1.2 cm in diameter, would require a several millimeter margin circumferentially. It could be resected and closed without difficulty using a variety of tissue rearrangements, such as a rhomboid flap or a slide-swing flap.

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12. A 54-year-old man is scheduled for correction of a defect on the back 1 week after undergoing resection of a 3×3 -cm recurrent sarcoma. The skin was closed primarily during the procedure, but skin necrosis and wound breakdown occurred. History includes radiation therapy to the spine for soft-tissue sarcoma 2 years ago. Physical examination shows a 5×5 -cm defect in the mid back at the level of T10 with exposed spinous processes. Which of the following is most appropriate to achieve complete wound closure?

- A) Latissimus dorsi flap
- B) Rectus abdominis free tissue transfer
- C) Split-thickness skin graft
- D) Trapezius muscle flap
- E) Wide undermining with primary reclosure

The correct response is Option A.

The latissimus dorsi flap would allow for the mobilization of sufficient skin and muscle to close the defect in the patient described. The latissimus dorsi muscle is a Mathes-Nahai Type V flap, with the main blood supply from the thoracodorsal artery and vein, and secondary segmental pedicles from the posterior intercostal and lumbar perforators. The latissimus dorsi insertion onto the humerus can be divided to provide further mobilization of the flap. To close the defect, the flap can be used as a “turnover flap,” with its blood supply based medially on the secondary pedicles. It can also be transposed and advanced on its main blood supply. If needed, interposition vein grafts can be used to extend the vascular pedicle. The flap has a very well-defined anatomy with few anatomical variations, and its harvest is fairly straightforward. It has found tremendous use in reconstructing defects of the scalp, lower extremity, breast, and chest wall.

A free rectus abdominis muscle flap could be performed, but recipient vessels in this area are not readily available. There have been reports of utilizing posterior intercostal perforators as recipient vessels for microvascular anastomosis, but this is an option best reserved as a last resort. Split-thickness skin grafting over a previously irradiated wound bed with exposed bone is not likely to heal. A trapezius muscle flap will not reach the level of T10. Wide undermining is a poor choice because this would lead to further devascularization of previously irradiated skin. Reclosure of the skin primarily is likely to occur under significant tension and would be prone to further necrosis and wound breakdown.

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13. Which of the following skin substitutes contains foreskin-derived neonatal human fibroblasts and keratinocytes?

- A) AlloDerm
- B) Apligraf
- C) Biobrane
- D) Integra
- E) Surgisis

The correct response is Option B.

Apligraf is a permanent, biosynthetic, bilayered living construct of cultured foreskin-derived neonatal human keratinocytes and fibroblasts. They are cultured on a matrix consisting of bovine-type collagen.

AlloDerm is a human cryopreserved, acellular, cadaveric, de-epidermalized dermis. The complex is immunologically inert and becomes repopulated with host fibroblasts and endothelial cells.

Biobrane contains Type I porcine collagen peptides in a bilaminate of silicone film and nylon fabric.

Integra is a temporary bilaminate composed of silicone and a matrix of cross-linked bovine tendon collagen and shark-derived glycosaminoglycans.

Surgisis is derived from porcine small intestine and is processed into a biocompatible three-dimensional, extracellular matrix composed of collagen, noncollagenous proteins, and other biomolecules.

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14. A 45-year-old woman comes to the emergency department because of redness at the site of injury 24 hours after being bitten by a cat. Temperature is 98.6°F (37.0°C), heart rate is 77 bpm, respirations are 16/min, and blood pressure is 125/82 mmHg. Physical examination shows mild erythema and edema around the puncture marks over the volar second phalanx of the long finger of the left hand. No purulent material is expressed. Resting position of the digit is normal, and there is no pain with passive extension. Assuming that the patient has no allergies to medications, which of the following is the most appropriate antimicrobial therapy?

- A) Amoxicillin-clavulanate
- B) Cefazolin
- C) Cephalexin
- D) Erythromycin
- E) Vancomycin and gentamicin

The correct response is Option A.

Cat bites usually result in puncture wounds because of their long, slender, sharp teeth. It has been reported that as many as 80% of cat bites become infected. *Pasteurella* species are the most common, occurring in as many as 75% of cat bite infections. Other types of bacteria can also be involved as well, including Streptococci, Staphylococci, and anaerobes.

Appropriate antimicrobial treatment for bite wounds must take into account the usual bacteriology of these infections. *Pasteurella* species are susceptible to penicillin, ampicillin, second- and third-generation cephalosporins, doxycycline, trimethoprim-sulfamethoxazole, fluoroquinolones, clarithromycin, and azithromycin, but are resistant to cephalexin, dicloxacillin, erythromycin, and clindamycin. Appropriate choices for prophylaxis and treatment of cat bite wounds would include amoxicillin and clavulanate or a combination of penicillin plus cephalexin. For those patients who have an allergy to penicillin, moxifloxacin or combination therapy with ciprofloxacin and clindamycin are appropriate choices. Azithromycin may also be effective for the penicillin-allergic patient, but it has less activity against anaerobes. Coverage for community-acquired MRSA (CA-MRSA) infection is not recommended because oral colonization of the human and animal mouth with CA-MRSA is unlikely.

Cefazolin, an intravenous form of a first-generation cephalosporin, is not an appropriate treatment for this wound as *Pasteurella* species are resistant, just as they are to cephalexin, the oral form.

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15. A 40-year-old woman is undergoing chemotherapy for metastatic lung cancer. During administration of her first dose of doxorubicin, she reports pain at the site of injection. The following day, physical examination shows the hand to be swollen and an ulcer measuring 2 × 3 cm is seen over the dorsum surrounded by an area of ischemia. Which of the following is the most appropriate immediate treatment?

- A) Administration of hyperbaric oxygen
- B) Application of cold packs
- C) Application of hot packs
- D) Application of topical dimethyl sulfoxide
- E) Immediate surgical excision and autografting

The correct response is Option D.

The specific treatment of an extravasation injury is dependent on the drug infused. Application of topical dimethyl sulfoxide has been advocated for the treatment of extravasation of anthracyclines and is supported by several studies.

The value of hyperbaric oxygen therapy has not been proven. In the case of doxorubicin extravasation injury, cold compresses may exacerbate the complication by venous constriction, which localizes the drug, whereas hot packs may cause vasodilatation with further extravasation. Inflammation and pain can be managed with anti-inflammatory analgesics.

Early excision is rarely performed without evidence of at least ulceration, and the main indication would then be for pain control. In the scenario described, an option would be early surgical debridement and delayed closure of the wound; however, some of the surrounding skin may heal. Thus, a conservative initial approach with later excision after 2 to 3 weeks is recommended since this will give a better cosmetic result.

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16. A 65-year-old woman is evaluated because of nonhealing sores on her lower extremities. She has a history of alcoholism and is homeless. She appears cachectic, pale, and severely malnourished. She has lost most of her teeth; the gums are purplish and spongy in appearance. Skin examination shows numerous petechiae. Large, superficial, nongranular sores are noted on the legs. Scurvy is suspected. Which of the following processes is most likely to be adversely affected by this patient's nutritional deficiency?

- A) Collagen cross-linking
- B) DNA synthesis
- C) Epithelialization
- D) Fibroblast proliferation
- E) Immune modulation

The correct response is Option A.

The patient described most likely has a vitamin C deficiency. Vitamin C is an essential nutrient for collagen cross-linking via the hydroxylation of proline and lysine to hydroxyproline and hydroxylysine, respectively. The lack of cross-linking results in impaired collagen synthesis and a decrease in collagen tensile strength. Collagen-containing tissues, such as skin, dentition, bone, and blood vessels, are therefore affected, leading to the development of scurvy. The hallmark signs of scurvy are hemorrhaging in any organ (ie, petechiae, swollen gums), loss of dentition, and a lack of osteoid formation. Deficiency of vitamin C is rare in the United States; however, it can be seen in patients who are severely malnourished; have a history of alcoholism; or have restrictive diets for medical, social, or economic reasons.

Other nutrients also play a major role in healing. Folate and vitamin B₆ (pyridoxine) are integral in DNA synthesis and cellular proliferation. Vitamin A is an essential factor in epithelialization and fibroblast proliferation. Vitamin E is a strong antioxidant and immune modulator. Zinc is one of the most important micronutrients, as it acts as a cofactor for numerous metalloenzymes and proteins. It is essential for proper protein (like collagen) and nucleic acid synthesis.

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17. A 60-year-old woman receives low-molecular-weight heparin (LMWH) 40 U subcutaneously 1 hour before undergoing breast reconstruction using a unilateral transverse rectus abdominis musculocutaneous (TRAM) flap. Weight is 185 lb (84 kg); BMI is 32 kg/m². Which of the following is the most likely effect of the LMWH on perioperative risks in this patient?

- A) Decreased risk of flap failure
- B) Decreased risk of postoperative hematoma
- C) Decreased risk of pulmonary thromboembolism
- D) Increased risk of blood transfusion
- E) Increased risk of infection

The correct response is Option C.

There are no uniform standards or guidelines for the routine use of chemoprophylaxis of venous thromboembolism in plastic surgery. At a minimum, lower extremity mechanical compression devices should be used on all patients undergoing general anesthesia. The patient described has multiple risk factors for developing deep venous thrombosis (DVT) and pulmonary embolism, such as an age over 50, prolonged surgery time, malignancy, and being overweight.

In such high-risk patients, data support the use of chemoprophylaxis with either standard heparin or low-molecular-weight heparin given subcutaneously. As the risk of developing DVT begins with anesthesia induction, it is generally recommended that heparin therapy be started before surgery. Out of concern for bleeding, some surgeons start heparin therapy in the early postoperative period. While more data are needed to clarify the optimal start time of therapy, it is clear that starting therapy before surgical incision is generally safe when dosed appropriately.

In large retrospective studies, chemoprophylaxis patients were not more likely to require blood transfusion, though they do demonstrate a slightly greater decrease in postoperative hemoglobin as compared with control patients. There is clearly a decreased risk of postoperative DVT and pulmonary embolism, both clinically apparent and asymptomatic. The data regarding postoperative hematoma are less clear, with some studies showing no increase in “take-backs” to the operating room for hematoma with chemoprophylaxis. One study did show an increase in hematomas in oncologic breast surgery with LMWH versus standard, unfractionated heparin. There is no association between flap survival or infection and subcutaneous heparin use.

Until reliable prospective, randomized data of sufficient study size are available to demonstrate optimal treatment, the studies seem to support the routine use of mechanical and perioperative subcutaneous heparin prophylaxis in high-risk patients.

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18. A 53-year-old woman comes to the office because of ulcerated tissue 6 weeks after undergoing radiation therapy for breast cancer. She underwent mastectomy 1 year ago. Analysis of the radiated tissue is most likely to show an increase in which of the following?

- A) Acute inflammatory response
- B) Cytokines and growth factors
- C) Neutrophil function
- D) Tissue oxygenation
- E) Vessel thrombosis

The correct response is Option E.

Analysis of radiated tissue will show increased vessel thrombosis. Ionizing radiation directly damages the genome or injures the DNA through free radical production. In acute radiation injury, the skin becomes erythematous and edematous with the dilation of fine blood vessels, endothelial edema, and lymphatic obliteration. Although perfusion of the skin assessed with fluorescein injection appears normal, tissue oxygenation is inadequate. Healing is impaired with slowed fibroblast proliferation and impairment of the acute inflammatory response. Fibroblast defects are the main problem in the inhibited healing of chronic radiation injury. Phagocytosis and bacteriocidal metabolic functions in neutrophils are also impaired. This effect increases after therapy, which cannot be a direct effect of radiation on the neutrophils because their lifespan is too short. The local wound environment and irradiated tissue do not prime the neutrophils with the appropriate cytokines and growth factors needed for activation. This may lead to an increased incidence of postoperative infections in patients with previous radiation.

Recent studies have shown promise in the treatment of radiation tissue damage with lipoaspirate transplantation. Adipose-derived stem cells have been hypothesized to target damaged areas, release angiogenic factors, form new vessels, and increase tissue oxygenation.

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19. A 35-year-old man undergoes coverage of a soft-tissue defect on the posterior right elbow with a reverse lateral arm flap. He does not have a history of serious illness and has never smoked cigarettes. Vascular examination shows no abnormalities. Arterial blood to the flap is provided primarily by which of the following arteries?

- A) Artery to the biceps muscle
- B) Inferior cubital
- C) Musculocutaneous perforating branches from the brachioradialis muscle
- D) Posterior radial collateral
- E) Radial recurrent

The correct response is Option E.

The most likely dominant arterial supply to the reverse lateral arm flap is the radial recurrent artery. It is a branch of the radial artery and arises in the cubital fossa. It anastomoses with the posterior radial collateral artery just above the lateral epicondyle and medial to the brachioradialis within the lateral intermuscular septum. This pedicled flap can be used to cover defects of the elbow and requires retrograde flow through the posterior radial collateral artery via the radial recurrent artery. Prior trauma or radical surgery around the elbow and severe peripheral vascular disease warrant confirmation of presence or patency of the pedicle via Doppler ultrasonography or angiography. After rotating this flap more than 180 degrees, venous insufficiency may result and require microanastomosis of a superficial vein in the flap to a receptor vein in the defect to augment outflow.

The posterior radial collateral artery is the dominant inflow for the standard lateral arm flap. The inferior cubital artery is the dominant inflow and the musculocutaneous perforating branches from the brachioradialis muscle are the minor pedicles for the antecubital flap. The artery to the biceps muscle supplies the medial arm flap.

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20. An otherwise healthy 38-year-old man comes to the emergency department after inadvertently hitting the tip of the index finger of the nondominant left hand with a hammer. He has smoked one pack of cigarettes daily for 20 years. Physical examination shows a subungual hematoma from a nail bed laceration, as well as edema and ecchymosis of the finger tip. There are no exposed vital structures. To repair the injury, a digital block is performed with 1% lidocaine in 1:200,000 epinephrine. Two hours after administration of the local anaesthetic, the finger remains pale and cool. Which of the following is the most appropriate next step in management?

- A) Administration of low-dose aspirin
- B) Application of a warm compress to the affected digit
- C) Elevation of the hand
- D) Injection of phentolamine
- E) Topical application of papaverine to the digit

The correct response is Option D.

While it has been traditionally taught that the use of epinephrine-containing local anesthesia in performing digital blocks is to be shunned, recent peer-reviewed literature suggests that this is a potentially safe practice. There have been no reported cases of digital gangrene after commercially available lidocaine with epinephrine was introduced in 1948, except for reports of inadvertent iatrogenic injection with 1:1000 epinephrine. The previous reports of digital ischemic necrosis were all associated with older anesthetics, such as cocaine, eucaine, and procaine, which were mixed with epinephrine by hand. Furthermore, those older reports relate excessive volumes of injection, prolonged use of the tourniquet, use of hot soaks, and concomitant infection.

Regardless of current practice or teaching, however, if an epinephrine-containing compound is to be administered to the digit, the surgeon must be familiar with how to reverse the pharmacologically induced vasoconstriction. In these situations, local infiltration of phentolamine, an alpha-receptor blocker, is able to reverse the effects of epinephrine and salvage the digits.

Ingestion of low-dose aspirin will not counter vasoconstriction. It is an option for use in the replanted digit to help promote vascular patency, although this has not been definitely proven.

Although application of warm compresses is a potential treatment for hypothermia-induced vascular embarrassment, it would not reverse the pharmacologically induced effects of the epinephrine, and therefore is not the most appropriate choice for the patient described.

Elevation of the hand will not reverse the epinephrine-induced vasospasm.

Topical administration of a calcium channel blocker, such as papaverine, would also not have the desired effect of reversing epinephrine-induced vasospasm when applied as described. Topical administration has been used in digital replantation to help reverse vasospasm. However, in the scenario described, the digital vessels are not exposed, and direct injection of a reversal agent is the most appropriate, direct method of addressing this situation.

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21. A 30-year-old woman who is morbidly obese is admitted to the burn unit with partial-thickness burns on 40% of the total body surface area involving the trunk and lower extremity. Maintenance of which of the following is the most appropriate measure to guide proper fluid management of the patient?
- A) Arterial systolic pressure greater than 90 mmHg
 - B) Cardiac output greater than 5 L/min
 - C) Mean arterial pressure greater than 55 mmHg
 - D) Pulse rate less than 120 bpm
 - E) Urinary output of 0.5 mL/kg/h

The correct response is Option E.

Routine vital signs, such as blood pressure and heart rate, can be very difficult to interpret in patients with large burns. Catecholamine release during the hours after the burn can support cardiac output despite the extensive intravascular depletion that exists. The formation of edema in the extremities can limit the usefulness of noninvasive blood pressure measurements. Evaluation of arterial line pressures is subject to error from peripheral vasospasm from the high-catecholamine state. Tachycardia, normally a clue to hypovolemia, can be secondary to pain and is also almost universally present from the adrenergic state. Moreover, placement of a central line to measure the cardiac output in a morbidly obese patient may pose risks and should be avoided unless the burns involve the upper part of the body, which will lead to edema in the later stages of resuscitation. Blood pressure is not an accurate measure of tissue perfusion.

Hourly urine output is a well-established parameter for guiding fluid management. The rate of fluid administration should be titrated to a urine output of 0.5 mL/kg/h or approximately 30 to 50 mL/h in most adults and older children (> 50 kg [110 lb]). The urge to maintain urine output at rates greater than 30 to 50 mL/h should be avoided. Fluid overload in the critical hours of early burn management leads to unnecessary edema and pulmonary dysfunction. It can necessitate morbid escharotomies and extend the time required for ventilator support. Several complicating factors exist with monitoring urine output as a guide for volume status and end-organ perfusion. The presence of glycosuria can result in an osmotic diuresis and lead to artificially elevated urine output values. Performing a urinalysis at some point during the first 8 hours is prudent, especially for patients with larger burns, to screen for this potentially serious overestimation of the intravascular volume.

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22. A frail 89-year-old man is brought to the office because he has had a large pressure sore on the sacrum for the past 2 months. Medical history includes type 2 diabetes mellitus and multi-infarct dementia. He is incontinent of stool and urine. Which of the following factors is the most important contributor to the development of the pressure ulcer in this patient?

- A) Fecal and urinary incontinence
- B) Inadequate cushioning on the wheelchair
- C) Malnutrition
- D) Poorly controlled diabetes mellitus
- E) Prolonged bed rest

The correct response is Option E.

The most important factor in the development of pressure sores is excessive and prolonged pressure above end capillary pressure (32 mmHg). Pressure greater than 70 mmHg for 2 hours has been shown to cause irreversible tissue ischemia. Pressure sores in the sacrum, heel, and occiput occur from lying in the prone position because pressures range from 40 to 60 mmHg. For patients with altered levels of awareness, position changes at least every 2 hours and a pressure-relieving mattress are essential for prevention of ulcers.

Ulcers in the ischium occur from prolonged pressure in the sitting position. Proper wheelchair cushioning is a hallmark of prevention.

Diabetes, incontinence, and malnutrition are common exacerbating factors in pressure sores, although they are secondary to pressure as the most important factor in ulcer development. The patient described is likely to have decreased serum protein levels, which will result in inhibited wound healing. Incontinence can result in skin maceration, contamination of open sores, and delayed healing. Without strict glucose control, chronic wounds are unlikely to heal normally.

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23. Which of the following anesthesia techniques is contraindicated in a 44-year-old man scheduled to undergo open carpal tunnel release?

- A) General anesthesia
- B) Local anesthesia with lidocaine and epinephrine
- C) Local anesthesia with lidocaine only
- D) Regional anesthesia with a Bier block
- E) Regional anesthesia with a nerve block at the cubital tunnel

The correct response is Option E.

A nerve block at the cubital tunnel, through which the ulnar nerve passes, will provide appropriate anesthesia for the ulnar nerve, but not for the median nerve, which passes anterior to the cubital tunnel at the elbow and through the carpal tunnel at the wrist. This would not provide sufficient anesthesia to perform carpal tunnel release.

Both general anesthesia and regional anesthesia with a Bier block are acceptable choices for use in hand surgery.

When used in hand surgery, local anesthesia with epinephrine has been documented to be safe, despite incorrect dogma that epinephrine is dangerous in this anatomical region. Several recent critical analyses demonstrate that epinephrine neither causes significant ischemia in the hand nor risks digital infarction.

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(Please note that this pictorial appears in color in the online examination)

24. A 57-year-old man develops exposure keratitis, corneal ulceration, and bilateral upper and lower eyelid ectropions 2 months after sustaining burns to the head and neck during a gas grill explosion. A photograph is shown. A tracheostomy was performed at the time of the accident for inhalation injury. Which of the following is the most definitive treatment modality for this patient's condition?

- A) Adhesion tarsorrhaphy
- B) Bilateral tarsoconjunctival flaps
- C) Frost sutures
- D) Lateral tarsal strip canthoplasty
- E) Staged upper and lower ectropion releases with skin grafts

The correct response is Option E.

The patient described requires definitive treatment of the burn ectropions, which involves release of the ectropion and resurfacing of the orbicularis muscle with high-quality skin that will resist contraction. Although full-thickness skin grafts will have less of a tendency to contract than

split-thickness skin grafts, the shoulder and supraclavicular fossa are superior to the groin as donor sites in terms of texture and color match. Photographs are shown.



Tarsorrhaphy alone will provide temporary coverage of the cornea but neither addresses the underlying pathophysiology nor provides definitive correction of the ectropion. Simultaneous correction of all four eyelids does not permit adequate release of the ectropions, which must be overcorrected before grafting.

Although Frost sutures, tarsoconjunctival flaps, and lateral tarsal strip canthoplasties will provide temporary corneal protection, these procedures do not address the underlying problem, which is contracture of eyelid, forehead, and cheek skin, secondary to burn injury.

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25. A 30-year-old woman is referred for consultation because of a 3-year history of pain and irritation of the labia minora when she exercises. She now has enlarged, protuberant labia. Labioplasty is planned. Which of the following postoperative adverse outcomes is most likely in this patient?

- A) Group B streptococcal infection
- B) Incomplete correction
- C) Keloid formation
- D) Painful intercourse

The correct response is Option B.

Labioplasty is a common surgical procedure used to reduce the size of excessively protruding or enlarged labia. The condition can result in discomfort or irritation with exercise or intercourse. Frequently, surgery is sought for cosmetic reasons alone. The goal of surgery is to reduce the size of the labia so that they become closer to the level of, or posterior to, the labia majora. Direct amputation-excision should be avoided, as an anterior scar line can cause postoperative discomfort in clothing or with sexual activity. Effective surgical methods use incisions that place the scars inferior, interior, or transverse, such as the inferior wedge resection with superior flap technique. When the surgery is performed properly, long-term sexual complaints are rare.

The condition is sporadic in nature and does not seem to be associated with endocrinopathy. The most frequent postoperative complaint is incomplete correction, wherein the patients are not completely satisfied with the aesthetic result (about 15% of cases). Group B streptococcal infection is associated with postpartum infections, not routine genital surgery. Scars typically heal very well, and keloid formation is not a common concern.

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26. A 60-year-old man undergoes debridement and coverage with a gracilis muscle free flap to correct exposed hardware 6 weeks after undergoing fracture fixation of the right ankle. During the hospital stay after the fracture fixation procedure, heparin was administered subcutaneously for deep venous thrombosis prophylaxis. The flap coverage procedure is complicated by thrombosis of the arterial anastomosis that requires thrombectomy and reanastomosis. Systemic heparin is administered because of the complication and continued postoperatively. Three days after this surgery, his right lower extremity, including the flap, is swollen and congested. Pulses in the leg are weak. Which of the following is the most appropriate test for this patient?

- A) Activated partial thromboplastin time (aPTT)
- B) D-dimer
- C) Factor V Leiden
- D) Platelet count
- E) Prothrombin time (PT)

The correct response is Option D.

The most appropriate test is a platelet count to determine the possibility of heparin-induced thrombocytopenia (HIT) with thrombosis. This immune-mediated complication can occur in up to 3 to 5% of patients on heparin therapy, especially those previously exposed to heparin within the last 3 months of the second exposure. Approximately 20% of patients with HIT will have thrombotic events with potentially devastating consequences: 30% mortality and 30% limb loss. The pathogenesis of HIT involves the formation of multimolecular complexes between heparin and platelet factor 4. In some patients, immunoglobulin G-class antibodies are generated against the heparin: platelet factor 4 complexes. This results in potent platelet activation, platelet aggregation, and a marked increase in thrombin generation. The key to successful treatment is early recognition, and clinical diagnosis remains the “gold standard.” A 30% decrease in baseline platelet count combined with any form of thrombosis in a patient receiving heparin should be considered heparin-induced thrombocytopenia and thrombosis until proven otherwise. The most essential element in the treatment of heparin-induced thrombocytopenia and heparin-induced thrombocytopenia and thrombosis remains discontinuation of all heparin, including heparin line flushes, subcutaneous heparin, and heparin-coated indwelling catheters. Starting alternative anticoagulant therapy (eg, danaparoid sodium, lepirudin, or argatroban) as soon as there is a strong clinical suspicion of HIT is advocated. This should be continued until platelet levels have returned to baseline. Although HIT is typically diagnosed on the basis of clinical signs, the diagnosis should be confirmed by laboratory testing whenever possible (platelet aggregation test

and/or specific heparin-platelet factor 4 enzyme-linked immunosorbent assay [ELISA] assay). In this patient, knowing if he may have HIT with thrombosis is essential because stopping the heparin drip becomes paramount.

D-dimer is a fibrin degradation product that is elevated in the presence of thrombosis. Factor V Leiden is the name given to a variant of factor V that causes hypercoagulability. Genetic tests are done to confirm this. PT is a measure of the extrinsic pathway of coagulation, and aPTT is a measure of both the intrinsic and common pathways of coagulation.

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27. A 22-year-old woman comes for evaluation of a lesion on her right anterior thigh (shown). She says that the lesion has been present for a number of years and that she frequently nicks it when shaving. She has no other similar lesions, and no family history of similar lesions. Physical examination shows a single, firm lesion. The nodule contracts with lateral compression. No other abnormalities are noted. Which of the following is the most appropriate next step in management?



(Please note that this pictorial appears in color in the online examination)

- A) Cryotherapy
- B) Excisional biopsy
- C) Mohs micrographic surgery
- D) Shave biopsy
- E) Observation

The correct response is Option B.

The lesion is a dermatofibroma, which is a benign nodule derived from mesodermal and dermal cells. They can be found anywhere on the body but most commonly appear on the anterior surface of the lower legs. Studies have not definitely determined whether these are true neoplasms or whether they are fibrous reactions to minor trauma, insect bites, viral infections, ruptured cysts, or folliculitis. Dermatofibromas are asymptomatic, firm, raised papules, plaques, or nodules that can vary in size from 3 to 10 mm in diameter. Coloration ranges from brown to purple, red, yellow, and pink. They are diagnosed based on physical examination and commonly display a Fitzpatrick sign, which is the dimpling or retraction of the lesion beneath the skin with lateral compression.

Underlying autoimmune disorders, such as systemic lupus erythematosus, may be suspected if multiple dermatofibromas (ie, > 15) are found on a patient.

Treatment is generally performed for cosmetic reasons or histologic diagnosis in case there is any question about the clinical diagnosis. Excisional biopsy is the procedure of choice to ensure clear histology, as well as complete removal of the lesion, as it exists in the dermal plane; however, the drawback to this technique is scar formation. Cryosurgery is an option for a less invasive treatment, but it will not completely destroy the lesion. Mohs micrographic surgery is not indicated for this benign lesion. Observation is not advised in this particular case, as the patient described notes a “significant nuisance” that motivated her to seek treatment. Shave biopsy would not completely eliminate the lesion, as it frequently does not penetrate deep enough into the dermis to clear the pathology.

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28. A 72-year-old man who is a farmer comes to the office because of a 15-year history of scaly patches of skin. Physical examination shows multiple actinic keratoses on the face, neck, and arms and a 1-cm squamous cell carcinoma on the tip of the nose. Which of the following components of sunlight is the most likely primary cause of these findings?

- A) Gamma (10 pm wavelength)
- B) Infrared (10 nm wavelength)
- C) Microwave (1 mm wavelength)
- D) Ultraviolet A (320–400 nm wavelength)
- E) Ultraviolet B (290–320 nm wavelength)

The correct response is Option E.

Ultraviolet B has been shown to be the most carcinogenic component of sunlight. Ultraviolet A is also carcinogenic but to a lesser degree. Gamma radiation is the most dangerous form of ionizing radiation because it can damage DNA and be fatal at extremely high doses. Although there is natural outdoor exposure to gamma radiation, it occurs at a very low dose. Infrared radiation is not known to cause squamous cell carcinoma. Microwave radiation does not have a sufficient amount of energy to directly and chemically change substances through ionization. Microwaves can affect the body by producing dielectric heat and denaturing proteins, which can cause cataracts and burns. Infrared radiation in high heat settings, which are used in industry, can cause damage to the eyes, and, therefore, protective glasses should be worn.

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29. A 56-year-old woman who has type 2 diabetes mellitus is scheduled to undergo removal of prosthetic mesh that became infected after ventral hernia repair. Weight is 311 lb (141 kg); BMI is 53 kg/m². Reconstruction with component separation technique and onlay grafting of reinforcing mesh is planned. Compared with polytetrafluoroethylene, acellular dermal matrix is preferable for this patient because of its ability to undergo which of the following processes?

- A) Contraction
- B) Encapsulation
- C) Imbibition
- D) Inosculation
- E) Revascularization

The correct response is Option E.

Implant infection is a common clinical complication of abdominal hernia repair. Use of biologic mesh in contaminated cases has gained widespread acceptance. The ability of acellular dermal matrix (ADM) to revascularize is most likely the key to its successful application in contaminated scenarios. Revascularization subsequently helps clear bacteria.

Contraction is a normal part of wound healing mediated by myofibroblasts, which are not present in polytetrafluoroethylene (PTFE) or ADM. Encapsulation is a foreign body reaction, whereby the organism forms a sterile scar around an alloplastic material. Imbibition is the process by which autogenous grafts perform initial metabolic exchange through diffusion. Inosculation is the first stage of neoangiogenesis, whereby immature vasculature between graft and recipient bed begin to organize in preparation for ingrowth. Neither process occurs in PTFE or ADM, as there is no existing vasculature in either product.

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30. A 38-year-old woman has severe hidradenitis suppurativa of the groin and axillae. Which of the following dermal appendages are located in these areas and implicated in the disease process?

- A) Apocrine glands
- B) Eccrine glands
- C) Glomus bodies
- D) Hair follicles
- E) Sebaceous glands

The correct response is Option A.

Apocrine glands are uniquely located in the axillae, groin, and perineum, and they secrete a viscid, milky fluid that becomes malodorous with bacterial colonization. Occlusion of the glands causes inflammation and subcutaneous abscess formation with pain, drainage, and foul odor. This crippling disease can be medically managed with chronic suppressive topical and systemic antibiotics but often requires intermittent incision and drainage, or even surgical resection.

Eccrine glands are found throughout the skin, secreting a thin, clear, hypotonic fluid (“sweat”). Glomus bodies are located in tissues exposed to the cold, such as the fingertips and ears. They form a thickening in the arterial wall before naturally occurring thermoregulatory arteriovenous shunts, and they are thought to control the flow through these shunts. Although some recent data suggest that hair follicle occlusion and folliculitis lead to apocrine gland occlusion and subsequent hidradenitis suppurativa, hair follicles are located all over the body and do not form the abscesses responsible for the clinical disease. Sebaceous glands secrete sebum, an oily substance that lubricates hair follicles and surrounding skin. They are found throughout the skin, except for the palms and soles. They are found in abundance in the face and scalp.

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31. A 43-year-old man who is HIV positive comes to the emergency department because of a 1-month history of gradually progressive swelling and pain in the tip of the right index finger. Examination shows significant swelling, erythema, and small vesicles on the fingertip and perionychium. A few nodular, reddish brown lesions are noted on the chest and forearms. Which of the following is the most appropriate management?

- A) Administration of acyclovir
- B) Administration of cefuroxime
- C) Administration of ketoconazole cream
- D) Excision of proximal nail plate
- E) Incision and drainage

The correct response is Option A.

Herpes simplex virus (HSV) infection of the hand is clinically diagnosed when characteristic multiple vesicular lesions on an erythematous base are present. The infection generally resolves within 3 weeks. If symptoms last longer than 3 weeks, suggestion of immunosuppression or AIDS should be raised. This is particularly true for the patient described, given his sickly appearance and lesions that are suggestive of Kaposi sarcoma. The staining of scrapings from the base of the lesions with a Tzanck preparation for a Papanicolaou stain demonstrates giant cells or intranuclear inclusions of HSV infection. Treatment with an antiviral such as acyclovir is recommended.

The scenario described does not primarily involve a fungal or bacterial infection. Oral/topical bacterial or antifungal treatments by themselves will not be effective. However, acute paronychia is most commonly caused by bacterial inoculation, and the most common agent is *Staphylococcus aureus*. Chronic bacterial infections of the subungual space are usually secondary infections of a preexisting fungal infection. Treatment consists of nail removal and application of appropriate topical antibiotics until the nail regrows.

The fungal organisms are the primary cause of chronic paronychia. *Candida* is the most common infecting organism. Most often affecting women, this low-grade smoldering infection causes thickening and fibrosis. Topical and systemic antifungal agents have been used for treatment of minimal-to-moderate fungal infections. For extensive infection, the nail plate is removed and topical antifungals are used. Recurrence is common.

Herpetic infections of the pulp should not be mistaken for felons or paronychia, and they should not be violated with incision and drainage. Inappropriately treated with surgery, patients may develop a local secondary bacterial bone lysis or metastatic viral encephalitis.

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32. A 60-year-old woman with type 1 diabetes mellitus has a 1-cm puncture wound to the lower leg sustained 2 days ago. Physical examination shows erythema of the surrounding tissue, tenderness of the entire calf, and crepitus. Which of the following is the most appropriate initial management of the wound?

- A) Hyperbaric oxygen therapy
- B) Silver sulfadiazine dressing
- C) Surgical debridement
- D) Unna boot compression dressing
- E) Vacuum-assisted closure therapy

The correct response is Option C.

The patient described has a severe, necrotizing soft-tissue infection, as suggested by tenderness and swelling of the entire limb compartment. Urgent debridement is required. Necrotizing fasciitis must be suspected in any patient with a compromised immune system, even when he or she has a relatively small surface wound. The infection spreads along deep tissue planes—in this scenario, the muscle fascia. Severe inflammation may result in elevated compartment pressures, requiring fasciotomy. Intraoperative bacterial cultures should guide specific antibiotic therapy. Patients with severe continued or extensive necrosis may benefit from hyperbaric oxygen (HBO) therapy. After all of the necrotic tissue is removed, vacuum-assisted compression (VAC) dressings may be applied to expedite granulation. Definitive closure may involve healing by second intention, skin grafts, or flaps as clinically indicated.

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33. A 35-year-old man who is HIV positive undergoes liposuction for lipodystrophy of the neck. During closure of the incisions, the surgeon sustains a needlestick injury to the left index finger. Zidovudine (AZT) therapy is initiated within 2 hours. If the surgeon is compliant with this therapy, the risk for seroconversion will be decreased by which of the following percentages?

- A) 20%
- B) 40%
- C) 60%
- D) 80%
- E) 95%

The correct response is Option D.

A case-controlled study among health care workers showed that treatment with AZT for 4 weeks after needlestick exposure to HIV-infected blood reduces the risk of HIV seroconversion by 80%.

HIV-associated lipodystrophy is becoming more prevalent as larger numbers of patients are surviving with the disease. The range of lipodystrophy syndromes includes malar wasting, hypertrophy of the cervicodorsal fat pad, adiposity in the submental and mandibular regions of the face, and central adiposity. Patients afflicted with these stigmata of HIV often seek a plastic surgeon for correction of these deformities.

As more patients with HIV are treated, it is important to understand the risks involved with this elective surgery. Percutaneous exposure to HIV-infected blood carries a 0.3% risk of transmission. Exposure from contact of mucous membrane or nonintact skin with blood, tissue, or other body fluids can carry risk. Universal precautions developed over the past 20 years have led to an increasing awareness of this risk. Although this is well understood from a hospital and institutional perspective, the trend toward office-based surgery emphasizes the need for public education.

If exposed to a percutaneous needlestick, postexposure prophylaxis is recommended within 24 hours, but preferably within 2 hours. The drug regimen chosen must balance against the potential drug toxicity. The use of AZT dates back to 1989. It is well tolerated, but side effects include nausea, malaise, and fatigue. Health care workers show a substantial noncompliance rate (17 to 47%) with a 4-week therapy for prophylaxis, despite the fact that there is an 80% reduction of

risk. Current recommendations from the Centers for Disease Control and Prevention have further expanded to two to three drug regimens for prophylaxis based on the level of risk and exposure.

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34. A 42-year-old man is brought to the emergency department after being rescued from an avalanche. History includes type 2 diabetes mellitus that is well controlled by diet. He has smoked one pack of cigarettes daily for the past 10 years. Physical examination shows erythema, edema, and blistering of the right lower extremity extending from the distal tibia to the tips of the toes. Which of the following is the most appropriate first step in management?

- A) Debridement and negative pressure wound therapy
- B) Hyperbaric oxygen therapy
- C) Intravenous administration of heparin
- D) Primary amputation
- E) Rewarming in a water bath 104°F (40°C)

The correct response is Option E.

The mainstay of treatment for frostbite injuries is rapid rewarming by submersion of the affected body part in a water bath maintained at a constant temperature of 104 to 108°F (40 to 42°C). Frostbite involves the formation of extracellular ice crystals that produce cellular damage. Rapid rewarming is the primary treatment for frostbite and has not changed in nearly three decades. The optimal temperature was demonstrated in controlled experiments by Entin and Baxter in 1952. Rewarming may take 20 to 40 minutes and is deemed adequate when there is evidence of distal perfusion, such as a blush. Addition of an antibacterial soap solution to the water bath is often recommended. The affected body part should then be splinted and elevated. It may take weeks or months for tissues to fully declare themselves. Delayed amputation is often required in severe frostbite injuries.

Debridement and negative pressure wound therapy have not been shown to be an effective initial step in management compared with rapid rewarming, but they may have a role in secondary wound management.

Hyperbaric oxygen (HBO) therapy has been reported as an adjunctive treatment to frostbite, but mostly as case reports. HBO may have a role in limiting the progressive tissue necrosis that follows the acute injury, but the lack of a prospective randomized controlled study has prevented it from achieving wide acceptance.

Heparin and other anticoagulants and thrombolytics have been tried with some variable success, but they should be instituted only after rapid rewarming measures have been applied. There is experimental and clinical evidence to suggest that one of the mechanisms of tissue injury is

thrombosis of the microvasculature that occurs from direct tissue injury and is mediated through free radicals.

Primary amputation would not be appropriate as an initial step in management, as this would commit the patient to a morbid operation with significant disability.

Gradual rewarming should not be used, as this has been associated with greater tissue injury.

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35. A 7-year-old boy with sickle cell disease is brought to the emergency department after sustaining a Gustilo Type IIIB fracture of the lower extremity during an all-terrain vehicle collision. Soft-tissue coverage of exposed hardware and bone is planned. Which of the following factors is most likely to adversely affect perfusion to microsurgical reconstruction in this patient?

- A) High sympathetic tone
- B) Prostacyclines
- C) Sludging
- D) Young age of patient

The correct response is Option C.

Abnormally elevated rheologic factors associated with hematologic disorders such as sickle cell disease can seriously compromise perfusion. This usually happens in the form of sludging within the vessel lumen, causing flap compromise.

Microvascular surgery in young patients was once considered high risk because of misconceptions of higher sympathetic tone and higher propensity for spasm. This has been proven false. Many studies have proven microvascular surgery to be safe for children.

Humoral factors such as prostaglandin I₂ (prostacyclin) and E₁, as well as histamine and bradykinin, cause vasodilation.

Local factors such as acidosis, hyperthermia, and hypercapnia cause vasodilation.

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36. A 72-year-old man is being evaluated because of a 3-month history of lesions on the nasal dorsum and cheek (shown). He is a poor surgical candidate and is treated with imiquimod (Aldara). Which of the following is the most likely mechanism of action of this treatment?

- A) Inhibition of the cyclooxygenase pathway
- B) Inhibition of DNA synthesis
- C) Modification of gene transcription
- D) Modulation of cell differentiation
- E) Stimulation of proinflammatory cytokine production



(Please note that this pictorial appears in color in the online examination)

The correct response is Option E.

Imiquimod (Aldara) is a new immune response enhancer that stimulates host cytokine production and induces apoptosis of tumor cells. It has been used to treat actinic keratoses, viral warts, and nonmelanoma skin malignancy. Topical 5-fluorouracil is a topical chemotherapeutic agent that directly inhibits DNA synthesis. Retinoids prevent new skin cancer development by regulating cell differentiation. Topical diclofenac is an anti-inflammatory drug that inhibits the cyclooxygenase pathway and has been found useful in the treatment of actinic keratoses. Interferons control cell differentiation by modification of gene transcription and have been used in combination with retinoids for advanced squamous cell cancers.

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37. A 32-year-old man is brought to the emergency department after being lost during a snowstorm in the mountains for 24 hours. Physical examination shows significant edema, loss of sensation, grayish blue discoloration, and hemorrhagic blisters on both hands and feet. Which of the following is the most appropriate initial management?

- A) Debridement of the hemorrhagic blisters
- B) Oral administration of ibuprofen
- C) Rapid cycles of freezing and thawing
- D) Rapid rewarming using a radiant heat source

The correct response is Option B.

Ibuprofen provides antiprostaglandin activity to limit the potential for secondary mediator damage.

Debridement of hemorrhagic blisters may cause exposure of the deeper structures and run the risk of desiccation and subsequent necrosis. Traditionally, early and aggressive debridement and amputation are avoided. The development of deep, dry gangrene can be allowed to declare the specific regions that must undergo amputation. On the other hand, triple-phase scanning can be used to delineate viable tissue early on and obviate prolonged demarcation.

Cycles of freezing and thawing lead to greater inflammatory mediator release and, in the long run, greater tissue injury.

Rapid warming decreases further tissue damage by halting both direct injury and continued release of secondary mediators. This occurs by submersion of the injured part in 104°F (40°C) water for 15 to 30 minutes. Use of radiant heat sources in frostbite can lead to iatrogenic injury because of uneven thawing and secondary thermal burn to insensate tissue.

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38. A 21-year-old man comes to the office for consultation because he thinks his ears protrude. He appears self-conscious about his ears and wears his hair long to hide them. He repeatedly looks in the mirror during his evaluation. On examination, postauricular measurement shows a helical rim-to-head distance of 12 mm at the superior pole, 17 mm at the midpoint, and 23 mm at the lobule bilaterally. Which of the following is the most appropriate next step in management?

- A) Referral for psychological evaluation
- B) Re-evaluation in 1 year
- C) Resection of the conchal bowl
- D) Scoring of the anterior cartilage
- E) Conchal-mastoid suturing

The correct response is Option A.

The patient described exhibits traits consistent with body dysmorphic disorder (BDD). DSM-IV describes BDD as a preoccupation with an appearance that is either imagined or is a slight physical anomaly. The preoccupation must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. The degrees of emotional distress and behavioral impairment, rather than the size or nature of the physical defect, may be more accurate indicators. Although possibly more difficult to diagnose in the cosmetic surgery patient population, plastic surgeons should evaluate for possible underlying psychiatric disorders. Psychiatric illnesses are not absolute contraindications for surgery; however, cosmetic surgery is unlikely to benefit those with BDD, psychoses, or eating disorders.

Normal helical rim-to-head measurements for each third of the ear are 10 to 12 mm at the helical apex, 16 to 18 mm at the midpoint, and 20 to 22 mm at the lobule.

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39. A 4-year-old boy has wound cellulitis, pneumonia, and bacteremia one week after sustaining burns on 38% of the total body surface area in a house fire. He undergoes debridement of the wounds. Grafting is performed to reconstruct the resulting defects. Debrided tissue is sent for culture. While awaiting the results of culture, which of the following is the appropriate empiric antibiotic therapy?

- A) Ampicillin-sulbactam, ciprofloxacin, and tobramycin
- B) Penicillin G, clindamycin, and gentamicin
- C) Vancomycin and piperacillin-tazobactam
- D) Vancomycin, piperacillin-tazobactam, and amphotericin
- E) Vancomycin, piperacillin-tazobactam, and fluconazole

The correct response is Option C.

The most common bacteria causing burn wound infections include methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas*, and *Klebsiella*. Empiric antibiotic therapy for the patient described would need to cover these gram-positive cocci and gram-negative rods.

Of the antibiotics listed, only vancomycin covers MRSA. Piperacillin-tazobactam is the most appropriate choice for pseudomonal coverage. Antifungal coverage with fluconazole or amphotericin is not necessary and is not supported by the literature. Antifungal prophylaxis remains controversial.

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40. A 41-year-old man is being evaluated prior to ventral hernia repair. History includes a traumatic abdominal injury with exposed bowel 4 years ago treated with negative pressure dressings and skin grafting. A separation of components technique will be used. The connection between which of the following layers will most likely remain intact during this procedure?

- A) Bowel and fascial edge
- B) External oblique and internal oblique
- C) External oblique and subcutaneous layer
- D) Internal oblique and transversus abdominis
- E) Rectus muscle and posterior rectus sheath

The correct response is Option D.

The principle of component separation is that the layers of the abdominal wall are able to be mobilized to a greater degree when they are separated from one another. In a ventral hernia repair, the bowel is freed from the fascial edges. Large skin flaps are developed that expose the abdominal fascia. The external oblique layer is separated from the internal oblique layer just lateral to the rectus sheath. Incising the posterior rectus sheath can add 1 to 2 cm of additional mobilization if necessary. The internal oblique muscle is usually not separated from the transversus abdominis muscle because it contains the intercostal nerves and blood vessels. This makes dissection difficult, bloody, and heightens the risk of denervating the rectus abdominis muscle.

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41. A 34-year-old man is scheduled to undergo soft-tissue coverage with an anterolateral thigh free flap to treat a nonhealing, complex, traumatic wound involving the distal third of the left lower extremity. Which of the following is most likely to have the greatest effect on anastomotic patency?

- A) Anastomotic type
- B) Anticoagulation
- C) Magnification equipment
- D) Surgical skill
- E) Suture technique

The correct response is Option D.

Acland outlined five basic factors that influence anastomotic patency: (1) surgical precision, (2) size of the vessel, (3) blood flow, (4) tension, and (5) use of anticoagulation and antithrombotic medication.

Studies have not demonstrated the efficacy of anticoagulation in improving microvascular patency rates and free flap survival. Studies evaluating types of anastomosis, including end-to-end and end-to-side, and those comparing suture techniques, including interrupted or running sutures, have also not demonstrated significant differences in patency rate. Both loupe magnification and an operating microscope can be successfully utilized in microsurgery.

The skill and experience of the surgeon in using an atraumatic technique for the dissection and anastomosis of the vessels, assuring good vessel apposition, and avoiding tension, compression, or kinks in the vascular pedicle, remain the most critical factors in microsurgery.

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42. An 86-year-old woman comes to the office because of an 18-month history of the isolated, painful lesion shown. History includes CREST (calcinosis cutis, Raynaud phenomenon, esophageal dysfunction, sclerodactyly, and telangiectasia) syndrome. Which of the following is the most appropriate initial management?

- A) Debridement
- B) Hyperbaric oxygen therapy
- C) Injection of corticosteroids
- D) Measurement of serum calcium level
- E) Measurement of serum uric acid level



(Please note that this pictorial appears in color in the online examination)

The correct response is Option A.

CREST syndrome is a member of the heterogeneous sclerodermas. Calcinosis cutis is the pathologic calcification of soft tissues and skin.

The calcific deposits, when symptomatic, can be tender and painful. They can ulcerate, drain a white chalky substance, and become secondarily infected. In scleroderma, calcific deposits are found predominantly in the extremities and around joints and bony prominences. Deposits are typically found in the flexor surfaces of the hands and the extensor surfaces of the forearms and knees. The deposits rest in the dermis but can also be found in deeper periarticular tissues.

Serum calcium, phosphorus, and alkaline phosphatase levels typically are normal; serum measurement does not contribute to management.

CREST is not associated with gout, so measurement of serum uric acid is noncontributory. Autografting prior to wound debridement and removal of calcific deposits is not recommended. Hyperbaric oxygen therapy may follow debridement.

No consistently reliable pharmacologic treatment, including injection of corticosteroids, has been shown to prevent or eliminate calcinosis. However, surgical excision of localized, painful large deposits can relieve symptoms; recurrence is rare. If calcinosis is diffuse, recurrence is more common. Successful palliation and significant remission of calcinosis using a carbon dioxide laser for debridement was shown in two case reports with a total of seven patients.

Calcinosis cutis is distinct from calciphylaxis, which is a poorly understood and highly morbid syndrome of vascular calcification and skin necrosis typically seen in 1 to 4% of patients with end-stage renal disease. Wound debridement in this setting is controversial and may cause exacerbation of skin necrosis.

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43. A 45-year-old woman who has breast cancer comes to the office for consultation regarding bilateral breast reconstruction. Reconstruction using autologous abdominal tissue is considered. The risk of abdominal morbidity is discussed. Which of the following flap techniques is most likely to result in the lowest level of overall abdominal morbidity?

- A) Deep inferior epigastric artery perforator
- B) Free muscle-sparing transverse rectus abdominis musculocutaneous (TRAM)
- C) Free TRAM
- D) Pedicled TRAM
- E) Superficial inferior epigastric artery flap

The correct response is Option E.

The superficial inferior epigastric artery (SIEA) flap results in the lowest level of overall abdominal morbidity, as the technique used in harvesting this flap leaves the abdominal fascia intact. These vessels are only present in less than one third of patients, and only one half of those patients will have vessels of sufficient diameter to support a free tissue transfer. The SIEA flap is also associated with a higher frequency of total flap loss, in addition to a higher incidence of fatty necrosis.

The deep inferior epigastric artery perforator (DIEAP or DIEP) flap involves dissection of one or two (occasionally more) perforators through the rectus muscle to the inferior epigastric vessels. Although this technique does not include any rectus muscle or sheet/fascia within the flap itself, it does involve moderate-level trauma to those organs and can cause abdominal wall morbidity.

The free TRAM or free muscle-sparing TRAM techniques are free tissue transfer variants of the TRAM, whereby a small amount of the rectus is taken with the flap. In the more advanced MS free TRAM technique, the amount of muscle taken is only enough to allow safe transfer of the perforators. Although this technique is less invasive than the pedicled TRAM, it does still involve removal of a variable portion of the rectus muscle and fascia.

A pedicled TRAM flap technique involves transferring of the flap based on the superficial epigastric vessel that runs within the rectus muscle. Therefore, the entirety of the rectus (unilateral or bilateral) is elevated out of its native abdominal wall location.

Many publications have compared the other modes of breast reconstruction with reference to abdominal wall morbidity. This area remains controversial. The general consensus remains that

in a bilateral reconstruction, pedicled TRAM flaps are associated with higher levels of overall abdominal morbidity (hernias, bulges, weakness, intolerance to exercise, etc) when compared with the use of MS free TRAM, DIEP, or SIEA flaps. The use of SIEA flaps results in minimal to no abdominal wall morbidity.

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44. A 55-year-old man is referred for evaluation after undergoing Mohs micrographic surgery for excision of the nasal lesion shown. The defect measures 1.2×1.4 cm and extends to, but does not involve, the underlying cartilage. The patient is very concerned about the cosmetic outcome. Which of the following is the most appropriate treatment?

- A) Bilobed flap from the nose
- B) Full-thickness skin graft
- C) Paramedian forehead flap
- D) Purse-string closure
- E) Split-thickness skin graft



(Please note that this pictorial appears in color in the online examination)

The correct response is Option A.

The technique chosen for skin replacement for the nasal side wall subunit is dictated by the size of the defect. Defects measuring less than 10 mm in greatest diameter can be managed either by primary closure or by second intention. For defects from 10 to 15 mm, the modified bilobed flap is a versatile, single-stage technique that can yield outstanding results. Bilobed flaps provide an appropriate color and texture match. Although not all of the scars can be hidden at the margins of aesthetic subunits, the superior scar formation on the nose minimizes this disadvantage. A postoperative photograph is shown.



For defects greater than 15 mm, the flap of choice is the paramedian forehead flap. It can be used to reconstruct either the entire nasal dorsum or lateral wall of the nose. When managing defects of this size, it is preferable to enlarge the defect when necessary to comprise the entire aesthetic subunit. If the wound involves both the dorsum and lateral wall of the nose, a cheek advancement flap should be used to replace the lateral nasal skin up to its junction with the dorsum. The forehead flap should then be used to resurface the nasal dorsum.

The advantages of skin grafts are that they are fast, simple, and have low donor site morbidity. The best results appear to be for shallow wounds with enough soft-tissue support to prevent a conspicuous depression. One disadvantage is a color and texture mismatch, which may result in a patch-like appearance; this effect often is not very noticeable in fair-skinned individuals. A second disadvantage is the natural tendency for grafts to contract, which may distort the shape of the nose.

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45. A 25-year-old man who is a soldier from Afghanistan is evaluated because of deep frostbite of the right hand after being in the field for 36 hours. Rewarming is performed in the field. He is transferred to a hospital for further evaluation. Physical examination shows hemorrhagic blisters and eschar formation on the hand, erythema of the surrounding area, and streaking up the forearm. Which of the following is the most appropriate next step in management?

- A) Administration of dextran
- B) Administration of penicillin
- C) Hyperbaric oxygen therapy
- D) Intra-arterial injection of reserpine
- E) Observation

The correct response is Option B.

Field management for frostbite includes rapid rewarming of the affected area with circulating water at 104 to 107.6°F (40 to 42°C) for a period of 15 to 30 minutes, protection from mechanical trauma, and appropriate analgesia.

Next steps in management include elevation, antitetanus prophylaxis, debridement of clear blisters, leaving hemorrhagic blisters intact, and application of aloe vera. Penicillin should be administered for cellulitis.

Adjuvant therapies can include anticoagulation, thrombolytics, hyperbaric oxygen, and sympathetic blockade; however, data to support these therapies are scant and equivocal at best. Definitive surgical amputation should be delayed for at least 3 weeks to allow for tissues to demarcate, in terms of viability.

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46. Which of the following is the most important management for patients with xeroderma pigmentosum?

- A) Cryotherapy
- B) Fluorouracil
- C) Isotretinoin
- D) Minimization of sun exposure
- E) Skin grafting

The correct response is Option D.

Xeroderma pigmentosum (XP) is an autosomal recessive disorder demonstrating defective DNA repair. The ability to repair damage caused by ultraviolet (UV) light is deficient. In severe cases, it is necessary to avoid sunlight completely. The most common defect in XP is a genetic defect whereby nucleotide excision repair (NER) enzymes are mutated, leading to a reduction in or elimination of NER. Unrepaired damage can lead to mutations, altering the information of the DNA in individual cells. If mutations affect important genes, like tumor suppressor genes or proto-oncogenes, then this disorder may lead to cancer. Patients with XP exhibit elevated risk of developing cancer. Multiple basalomas and other skin malignancies, such as squamous cell carcinoma, occur as early as 8 years of age.

Patients with XP are usually diagnosed at 1 to 2 years of age. The sunburn usually occurs during a child's first sun exposure. An unusually severe sunburn that may last for several weeks even after a short sun exposure course is common. Other symptoms include development of many freckles at an early age, irregular dark spots on the skin, thin skin, excessive dryness of skin, rough-surfaced growths (solar keratoses), and skin cancers; eyes that are painfully sensitive to the sun and may easily become irritated, bloodshot, and clouded; blistering or freckling on minimum sun exposure; premature aging of skin, lips, eyes, mouth, and tongue; skin crusting; spidery blood vessels; scaly skin; and oozing raw skin surface.

The most important management is minimizing sun exposure. The number of keratoses can be reduced with isotretinoin (though there are significant side effects). Existing keratoses can be treated using cryotherapy or fluorouracil. Skin cancers are detected at approximately 8 years of age. Frequent skin cancer surgical excisions may be necessary for local control.

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47. A 54-year-old man is scheduled for soft-tissue reconstruction of an esophageal defect caused by cancer. A free anterolateral thigh flap will be used. Harvest of the flap will most likely involve taking a cuff of which of the following muscles?

- A) Gracilis
- B) Rectus femoris
- C) Sartorius
- D) Tensor fascia lata
- E) Vastus lateralis

The correct response is Option E.

The anterolateral thigh flap is based on the descending branch of the lateral femoral circumflex vessels. Although classically thought of as providing septocutaneous perforators between the rectus femoris and the vastus lateralis muscle, increased familiarity with this flap and critical anatomical evaluation have shown that its perforators are primarily musculocutaneous through the vastus lateralis in the majority of cases. This anatomy is important to understand during flap elevation and harvest. Surgeons unfamiliar with these anatomical variations may find it confusing if no septocutaneous perforators are identified. They may unnecessarily abandon the anterolateral thigh flap because of this. However, once musculocutaneous perforators are found, it may be safer to harvest a cuff of vastus lateralis muscle with the perforators to maximize perfusion, as an intramuscular dissection can be tedious and risks damage to the perforators.

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48. A 48-year-old woman is scheduled to undergo abdominoplasty. She has smoked one pack of cigarettes daily for the past 10 years. During the preoperative visit, she informs the plastic surgeon that she has been on a nicotine patch and has not been smoking for 3 weeks. Which of the following mechanisms is most likely to cause wound healing complications in this patient?

- A) Decreased availability of hemoglobin
- B) Decreased red blood cell deformability
- C) Impairment of leukocyte function
- D) Increased fibrinogen production
- E) Increased microvascular vasoconstriction

The correct response is Option E.

The nicotine in cigarettes causes vasoconstriction of cutaneous blood vessels with resultant decreased tissue oxygenation. Smoking also increases carboxyhemoglobin, increases platelet aggregation, increases blood viscosity, decreases collagen deposition, and decreases prostacyclin formation, which all negatively affect wound healing. In addition, vasoconstriction associated with smoking is not a transient phenomenon. Smoking a single cigarette may cause cutaneous vasoconstriction for up to 90 minutes; hence, a patient who smokes one pack of cigarettes daily remains tissue hypoxic for most of each day. Vasoconstriction is mediated directly and indirectly by nicotine, a colorless, odorless, and poisonous alkaloid. A reduction in tissue perfusion results from elevated cellular levels of nicotine. The indirect pathways of vasoconstriction include the enhancement of thromboxane A_2 and the stimulation of catecholamine release from the adrenal medulla, sympathetic ganglia and nerve endings, and cardiac chromaffin tissue. Other by-products, such as hydrogen cyanide, inhibit the enzymatic pathways vital for cellular oxidative metabolism and oxygen transport, effectively diminishing the ability for cellular repair and wound healing. Combined with acrolein, another toxic gaseous component, hydrogen cyanide inhibits leukocyte function, further impairing the inflammatory phase of healing. The proliferation of macrophages and fibroblasts, which are integral to the phases of wound healing, is also diminished by the presence of nicotine. Additionally, the presence of nicotine and catecholamines stimulates the production of chalcones, which are hormones that retard and decrease the rate of wound epithelialization. Collagen deposition is also decreased in smokers. Nicotine is also associated with thrombogenesis by interfering with prostaglandin I_2 (prostacyclin) activity. Prostaglandin I_2 is a potent vasodilator and inhibitor of platelet aggregation. Platelet adhesiveness is augmented, raising the potential for thrombotic microvascular occlusion and subsequent tissue ischemia.

Carbon monoxide is another toxic by-product common in tobacco smoke. The oxygen-carrying capacity of blood is reduced by the competitive, inhibitory binding of carbon monoxide to hemoglobin. Carboxyhemoglobin levels rise, and tissue delivery of oxygen is reduced as the oxygen-hemoglobin saturation curve is shifted to the left. The decrease in oxygen available for tissue consumption leads to diminished wound healing. The resulting hypoxic state stimulates erythropoiesis, red blood cell aggregation, and fibrinogen production, leading to increased blood viscosity, which potentiates an environment already ripe for thrombogenesis. Decreased red blood cell deformability is also noted in smokers but through an unknown mechanism.

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49. A 52-year-old man is scheduled to undergo a midline laparotomy for colon cancer. History includes cutis laxa. Examination shows hypoelastic skin that does not spring back when stretched. This patient is at increased risk for which of the following complications?

- A) Anastomotic dehiscence
- B) Hypertrophic scarring
- C) Thrombosis
- D) Ventral hernia
- E) Wound dehiscence

The correct response is Option D.

Cutis laxa patients are at a higher risk for ventral hernia formation.

Cutis laxa is a rare condition with hypoelasticity of the skin from a defect in elastin fibers. The skin does not spring back in place immediately upon being stretched, as compared to Ehlers-Danlos syndrome, where the skin springs back without wrinkling. These conditions can be congenital (autosomal dominant, recessive, X-linked recessive) and acquired (drug ingestion, paraneoplastic, postinflammatory). There is an increased risk of hernia formation. Scar formation and healing appear normal; however, procedures to reduce skin redundancy, such as rhytidectomy and blepharoplasty, may require serial procedures as progression of skin laxity continues.

Ehlers-Danlos syndrome (cutis hyperelastica) is characterized by skin hyperextensibility, joint laxity, and tissue friability. It is one of the most frequently inherited collagen disorders and is frequently underdiagnosed. Patients can dehisce their wounds or anastomoses at 1 to 2 weeks. Wound failure is common. Ventral hernias are common and may require closure techniques, such as components separation. Scar formation is wide and extremely thin, and it has been described as papyraceous and cigarette-paper.

Homocystinuria is associated with an increased risk of thrombosis.

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50. An unconscious 25-year-old man is brought to the emergency department after being electrocuted while working near high-voltage power lines. The patient is resuscitated. Examination shows a 4×3 -cm burn on the skin over the left antecubital fossa and significant swelling of the forearm. Which of the following is the most appropriate next step in management?
- A) Dressing of the affected area and observation in the burn unit
 - B) Excision and coverage with a local flap
 - C) Excision and coverage with a split-thickness skin graft
 - D) Fasciotomy of the forearm
 - E) Splinting of the hand in the intrinsic plus position

The correct response is Option D.

In high-voltage injuries, the electrical current often travels deep into the skin, causing internal damage that may not be readily visible. The current causes tissue damage at the entry point in the skin and along its path through the muscle, nerves, and bone. As electrical current is conducted through the body, heat is generated in direct proportion to the tissue resistance. Because bone has a high resistance, heat is generated rapidly in this area, resulting in deep tissue injury. Compartment syndrome can develop in a patient with an electrical injury because of the deep tissue injury and subsequent subfascial edema. Immediate treatment is aimed at resuscitation of the patient, followed by salvage of the affected limb. The key to the acute management of electrical injuries to the upper extremity is to have a high index of suspicion for potential damage to deeper tissues, even at a distance from the point of contact. The optimal management of electrical injuries to the upper extremity includes initial exploration, decompression (fasciotomy), and aggressive repeated debridement, followed by reconstruction. Fasciotomy serves a dual role as both a therapeutic and diagnostic tool in the treatment of electrical injuries.

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Section 2: Breast and Cosmetic

51. A 4-year-old boy is referred for evaluation because of a 6-month history of bilateral epiphora. Examination shows that the eyelashes are rubbing against the inferior corneas bilaterally. Which of the following is the most likely cause of this patient's condition?

- A) Abnormal attachment of the orbital septum
- B) High-riding tarsal plane
- C) Laxity of the lateral canthal tendons
- D) Laxity of the tarsal plate
- E) Redundancy of skin and orbicular muscle of the eye

The correct response is Option E.

The most common cause of epiblepharon is excess pretarsal skin and orbicular muscle at the lower eyelid margin. In this congenital anomaly, a fold of skin and underlying orbicular muscle of the eye override the eyelid margin, often pushing the cilia against the globe. The eyelid margin and tarsus are stable and maintain the proper orientation. Epiblepharon usually affects the lower eyelids, is more common in people of Asian descent, and is accentuated on downward gaze.

Laxity of the tarsal plate and the lateral canthal tendons are seen in the aging lower eyelid. Abnormal attachment of the orbital septum can be seen after trauma.

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52. A 23-year-old woman comes to the office for consultation regarding significant skin laxity and volume loss in the face, torso, and upper and lower extremities following gastric bypass surgery 22 months ago. She has lost 120 lb (54 kg) since the procedure was performed. Rhytidectomy, abdominoplasty, brachioplasty, back lift, and thigh lift will be performed in three stages. Which of the following procedures will most likely result in hypertrophic scarring?

- A) Abdominoplasty
- B) Back lift
- C) Brachioplasty
- D) Mastopexy
- E) Rhytidectomy

The correct response is Option C.

Hypertrophic scarring is reported to occur in up to 40% of brachioplasty cases. These scars require compression therapy, silicone sheeting, or mild corticosteroid injections. The other body regions are less likely to scar in a hypertrophic fashion.

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53. A 47-year-old woman is referred by her primary care physician to evaluate a suspected intracapsular rupture of her prosthesis on the left identified during routine mammography. She underwent primary augmentation mammoplasty with subglandular placement of single-lumen silicone breast prostheses in 1990. Physical examination shows a smaller breast on the left. An MRI is requested. Which of the following findings on MRI is most likely to confirm the diagnosis?

- A) Double wall sign
- B) Linguine sign
- C) Multiple echogenic lines
- D) Reverse double-lumen sign
- E) Snowstorm sign

The correct response is Option B.

MRI, mammography, ultrasonography, and CT scanning have all been used to diagnose silicone breast prosthesis rupture.

Although each modality has specific strengths and weaknesses that may make a particular modality the study of choice for an individual patient, MRI of silicone breast prostheses reports the highest sensitivity and specificity for detection of silicone prosthesis rupture.

Of the options listed, only the linguine sign is consistent with intracapsular silicone prosthesis rupture and represents the prosthesis shell floating in free silicone gel.

The double wall sign, also known as Rigler sign, is a radiographic sign of pneumoperitoneum.

Snowstorm sign and echogenic lines may be seen on ultrasound examination.

Water suppression or a reverse double-lumen sign would not be expected findings in a single-lumen device but may have a role in double-lumen devices.

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54. Which of the following is the ideal amount of tooth show with the lips in repose?
- A) 2 mm of lower incisor show
 - B) 4 mm of lower incisor show
 - C) 2 mm of upper incisor show
 - D) 4 mm of upper incisor show
 - E) No tooth show

The correct response is Option C.

The ideal amount of tooth show with the lips in repose is 2 mm of the maxillary incisors. In women, up to 4 mm may be acceptable. However, more show of the upper dentition results in a gummy appearance. One possible etiology for a gummy appearance is vertical excess of the maxilla. Orthognathic surgery with maxillary impaction is the typical treatment for this deformity.

Over time, elongation of the upper lip decreases the amount of show of the upper dentition. Gravitational pull on the lower lip may result in the increased display of the mandibular dentition with advancing age. Techniques such as lip augmentation and lip lift are designed to correct these changes of aging.

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55. A 38-year-old woman comes to the office desiring abdominoplasty. History includes easy bruising and four spontaneous abortions in the first trimester and one live birth. Her infant weighed 10 lb 8 oz (4.5 kg) at birth. The patient's BMI is 28 kg/m². Examination shows a 6-cm diastasis recti, an abdominal pannus, and a well-healed Pfannenstiel incision. Which of the following consultations is most appropriate for this patient before proceeding with surgery?

- A) Cardiologist
- B) Endocrinologist
- C) General surgeon
- D) Hematologist
- E) Nutritionist

The correct response is Option D.

Venous thromboembolic events (VTEs), which include both deep venous thrombosis and pulmonary emboli, remain a significant cause of morbidity and mortality in surgical patients. The most commonly associated aesthetic procedure is abdominoplasty. For this reason, protocols should be in place to identify patients who are at higher risk. Multiple spontaneous abortions are highly suggestive of a hypercoagulation diathesis and should be further evaluated. The most common genetic abnormality is Factor V Leiden, which is a mutated factor V resistant to inactivation by activated protein C. This abnormality is present in 3 to 7% of the Caucasian population.

Other genetic thrombophilic conditions include prothrombin variant 20210A, antiphospholipid antibodies, protein C or S deficiency, antithrombin deficiency, and hyperhomocysteinemia. The risk of VTE increases greatly when more than one of these abnormalities is present. Hematologic evaluation through blood testing can identify these high-risk patients. Following this evaluation, the hematologist can provide insight regarding the risk of VTE. The decision is then made to use VTE prophylaxis or not to perform the operation at all. The most common protocol is subcutaneous administration of enoxaparin (Lovenox) 40 mg once daily begun 12 hours postoperatively and continued until full ambulation. Protocols vary in both time of initiation of low-molecular-weight heparin and length of treatment.

The patient delivered an infant weighing 10 lb 8 oz (4.5 kg). This occurrence may represent gestational diabetes; however, a more thorough history can identify this possibility.

A trained plastic surgeon should be able to identify the difference between a diastasis recti and a true hernia. Only in extraordinary cases should a general surgeon be required, for example, if the patient has a history of multiple recurrent hernias or a very thin abdominal wall.

Studies have shown that complication rates in abdominoplasty increase in patients with a BMI greater than or equal to 30 kg/m^2 .

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56. A 33-year-old woman comes to the office because of a new lump in her right breast 6 weeks after undergoing bilateral reduction mammoplasty using the inferior pedicle technique. Preoperative examination of the breasts showed no abnormalities. Current examination shows a hard, nontender mass in the lateral aspect of the upper right breast. Which of the following is the most likely diagnosis?

- A) Abscess
- B) Fat necrosis
- C) Fibroadenoma
- D) Hematoma
- E) Seroma

The correct response is Option B.

A patient presenting with a hard, nontender lump 6 weeks after reduction mammoplasty is most likely to have fat necrosis. This is usually the result of vascular compromise to areas of the parenchyma associated with hemorrhagic necrosis. Drainage from fat liquefaction is often the first sign of infection. Cellulitis and fever may then result. Small areas of fat necrosis can be managed conservatively, and secondary revision can be performed after a period of 6 months to 1 year. If skin and fat necrosis is extensive and associated with an infection, surgical debridement and antibiotics are required. Secondary closure and grafting are required after the infection has resolved.

An abscess or hematoma would be firm but likely tender. Fibroadenoma would not likely be palpable so early postoperatively. However, if the lump does not resolve within a few weeks, CT scan or ultrasonography should be considered to rule out malignancy. Seroma would most likely have a softer consistency.

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57. A 52-year-old woman has numbness of the left earlobe 2 weeks after undergoing rhytidectomy. Which of the following nerves was most likely injured during the procedure?

- A) Auriculotemporal
- B) Great auricular
- C) Greater occipital
- D) Lesser occipital
- E) Vagus

The correct response is Option B.

The ear is innervated by multiple nerves. The great auricular nerve is a branch of C2 and C3. It travels on the superficial surface of the sternocleidomastoid muscle and enters the lower, posterior surface of the ear. Its branches supply the lobule as well as the helix, antihelix, and most of the cranial surface of the ear.

The auriculotemporal nerve is a branch of the third division of the trigeminal nerve and enters the ear near the tragus. It supplies the tragus and the root of the helix. The greater occipital nerve, which is a branch of C2 and C3, supplies the posterior scalp. The lesser occipital nerve is also a branch of C2. It sends off an auricular branch that supplies the upper third of the cranial surface of the ear. The vagus (X) nerve supplies the concha via its branch called the Arnold nerve.

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58. A 66-year-old man is referred for evaluation of left eyelid ptosis. He reports decreased vision in the left eye only, which bothers him throughout the day. Physical examination shows mild-to-moderate left eyelid ptosis and elevation of the left supratarsal crease. Brow position and function and pupillary size are normal bilaterally. Which of the following is the most likely diagnosis?

- A) Congenital ptosis
- B) Facial nerve injury
- C) Horner syndrome
- D) Myasthenia gravis
- E) Senile ptosis

The correct response is Option E.

Senile ptosis is characterized by dehiscence of the levator aponeurosis, the most common cause of ptosis in the elderly. Elevation of the supratarsal crease is seen. Levator plication or advancement is required for correction.

Congenital ptosis is seen in young patients who have moderate-to-severe ptosis with absence of the eyelid crease and poor levator function. Upper eyelid frontalis sling is sometimes required for correction.

Facial nerve injury results in brow ptosis but not blepharoptosis.

Horner syndrome is marked by ptosis, miosis, and anhidrosis. It occurs after loss of sympathetic innervations of the superior cervical ganglion. The eyelid crease is usually not affected.

Myasthenia gravis may cause unilateral or bilateral ptosis that is exaggerated with fatigue. The condition typically affects young women or elderly men. Pharmacologic testing establishes the diagnosis.

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59. A 26-year-old woman comes to the office for consultation regarding right mammary hypoplasia and a superiorly displaced nipple-areola complex. Examination shows a depressed right chest wall. The pectoralis major muscle is anatomically normal. Which of the following is the most likely diagnosis?

- A) Anterior thoracic hypoplasia
- B) Pectus carinatum
- C) Pectus excavatum
- D) Poland syndrome
- E) Sternal cleft

The correct response is Option A.

The most likely diagnosis in this patient is anterior thoracic hypoplasia. Anterior thoracic hypoplasia is a syndrome composed of an anterior chest wall depression resulting from posteriorly displaced ribs, hypoplasia of the ipsilateral breast, and a superiorly displaced nipple-areola complex. The sternum is in normal position, and the pectoralis major muscle is normal.

Pectus excavatum is the most common congenital chest wall abnormality in which the ribs and sternum form abnormally, resulting in a concave anterior chest wall. Typically, the lower third of the sternum is involved. In the most severe form, pectus excavatum can present with the sternum adjacent to the vertebral bodies associated with cardiopulmonary abnormalities. In contrast, pectus carinatum is a chest wall deformity in which the sternum and ribs are forced anteriorly, creating the appearance of a “pigeon’s chest.” Pectus excavatum and carinatum have sternal involvement, but they do not involve changes in the development of the breast.

Poland syndrome is a congenital anomaly characterized by a number of unilateral findings. The classic features of Poland syndrome include absence of the sternal head of the pectoralis major, hypoplasia and/or aplasia of the breast or nipple, deficiency of subcutaneous fat and axillary hair, abnormalities of the rib cage, and upper extremity anomalies. In its simplest form, Poland syndrome may present with only mild hypoplasia of the breast and lateral displacement of the nipple. Complex presentations of Poland syndrome include hypoplasia or aplasia of the chest wall musculature (serratus, external oblique, pectoralis minor, and latissimus dorsi muscles) or total absence of the anterolateral ribs with herniation of the lung.

Sternal cleft is a rare congenital defect of the anterior chest wall resulting from a failure of midline fusion of the sternum. Depending on the degree of clefting, there are complete and incomplete forms. The sternal cleft is clinically significant because of the potential for the lack of

protection to the heart and great vessels. Sternal clefts are not associated with aplasia or hypoplasia of the breast.

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60. A 45-year-old woman comes to the office because of a rash and a burning sensation on her face 1 week after undergoing carbon dioxide cutaneous laser resurfacing. Physical examination shows erythematous pustules on the right side of the face in the V3 distribution. Which of the following agents is the most appropriate treatment?

- A) Oral acyclovir
- B) Oral cephalixin
- C) Oral prednisone
- D) Topical bacitracin
- E) Topical petrolatum

The correct response is Option A.

The patient's symptoms are consistent with a viral infection. Viral, bacterial, and fungal infections can develop after cutaneous laser resurfacing, usually at the time of the first postoperative week during the reepithelialization process. The most frequent infectious complication associated with resurfacing is a reactivation of the herpes simplex virus (HSV). It is suspected that direct laser trauma to the skin leads to latent viral activation and shedding. Herpetic outbreaks are experienced by roughly 2 to 7% of all laser-treated patients despite antiviral prophylaxis. In addition, due to the high incidence of latent HSV infection, any patient (regardless of prior HSV history) planning to undergo full-face or perioral resurfacing should be given oral antiviral prophylaxis in an effort to reduce viral reactivation, which could subsequently lead to scarring. Early postlaser detection of HSV is often difficult because there is no intact epithelium, and, rather than the characteristic grouped vesicles or pustules, infection is manifested by small, superficial erosions. Symptoms of HSV reactivation include tingling, burning, or discharge from isolated foci within the treated areas. Extensive eruptions can result in disseminated infection and atrophic scarring, and therefore, must be recognized early and treated aggressively. Oral antiviral agents, such as acyclovir, famciclovir, or valacyclovir, are routinely administered 1 to 2 days before the laser resurfacing procedure and are continued for another 7 to 10 days until reepithelialization is complete. If a herpetic outbreak occurs despite prophylaxis, patients should either be switched to a different antiviral agent or have their dosage increased to maximal herpes zoster doses (acyclovir 800 mg 5 times daily or famciclovir or valacyclovir 500 mg 3 times daily).

Cephalexin would be more appropriate for bacterial skin infections. Bacitracin does not have antiviral coverage. Topical petrolatum is a bland emollient and would not treat the HSV outbreak. Oral corticosteroids do not have any role in the treatment of viral infections.

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61. A 56-year-old woman who has undergone injections of botulinum toxin type A (BOTOX Cosmetic) for orbital spasms for the past 16 years has developed resistance to the treatment. Botulinum toxin type B (Myobloc) is considered as an alternative. Compared with BOTOX Cosmetic, which of the following is most likely to result from treatment with Myobloc?

- A) Greater pain with injection
- B) Less effacement of the rhytides
- C) Longer duration of action
- D) Longer onset of action
- E) Lower radius of diffusion

The correct response is Option A.

Injection of botulinum toxin to improve rhytides is currently the most common cosmetic procedure performed in the United States. Although only BOTOX Cosmetic is currently approved by the FDA for cosmetic use in the United States, other toxins have been used abroad and will likely be available to practitioners in the United States in the near future. Myobloc has not yet received cosmetic approval but is approved by the FDA for treatment of cervical dystonia and hemifacial spasm. Given the concerns surrounding the potential for antibody development after chronic and repeated injection of BOTOX Cosmetic, in addition to the fact that serotypes do not cross-neutralize, there has been heightened interest in developing a neuroblocker that is effective for patients who may become resistant to BOTOX Cosmetic.

Myobloc has been studied for treatment of various muscle disorders, including cervical dystonia. Its effectiveness in the treatment of canthal rhytides has also been evaluated and compared to BOTOX Cosmetic in a double-blind randomized study. All major studies have shown that Myobloc safely and effectively produces a neuromuscular blockade and reduction in rhytides similar to BOTOX Cosmetic. There are, however, key differences between the two. Myobloc has an acidic pH of 5.6. Its low pH is the reason that it is stable in solution; for this reason, it is preconstituted in liquid, as opposed to BOTOX Cosmetic, which is packaged as a powder. Myobloc remains stable in liquid, providing a prolonged shelf life without diminished potency. It is also the acidic pH that accounts for a higher degree of pain on injection, which is noticed by most patients. Other differences that have been noted for Myobloc as compared to BOTOX Cosmetic are a shorter duration of action, quicker onset of action, and greater radius of diffusion. The duration effect may be secondary to inadequate dosing in the studies that have been performed to date. Optimal dosing for Myobloc for cosmetic applications has yet to be established.

The increased potential for diffusion with Myobloc may be seen as an advantage in certain circumstances and a disadvantage in others. While diffusion after injection into small muscle groups such as the glabellar region may lead to undesirable side effects (eg, ptosis), diffusion after injection of the platysma, for example, may lead to a more uniform and complete blockade. This characteristic may also be advantageous when injecting the axilla for the treatment of hyperhidrosis.

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3. Matarasso SL. Comparison of botulinum toxin types A and B: a bilateral and double-blind randomized evaluation in the treatment of canthal rhytides. *Dermatol Surg*. 2003 Jan;29(1):7-13.

62. A 13-year-old boy is brought for evaluation by his mother because of development of his breasts during the past 3 months. The patient is at the 50th percentile for height and weight; BMI is 22 kg/m². Physical examination shows no abnormalities except for moderately severe bilateral symmetric gynecomastia. Which of the following is the most appropriate next step in management?

- A) Liposuction
- B) Liver function studies
- C) Observation and follow-up in 12 months
- D) Surgical excision
- E) Testicular ultrasonography

The correct response is Option C.

Three months is considered a relatively short duration for gynecomastia. Rohrich advocates waiting 12 months prior to considering surgery in the absence of other findings. Gynecomastia during puberty is common, and arbitrary use of laboratory tests in the absence of any clinical history or physical findings is not recommended. Careful history and physical examination are all that is required to identify pubertal gynecomastia. Reassurance and reassessment at 12 months are the most reasonable alternatives. If the patient still had gynecomastia that is not receding at 12 months, then surgery or liposuction would be a reasonable option. The use of other tests or biopsy is unnecessary and possibly dangerous.

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63. A 34-year-old man comes to the office because he is dissatisfied with the appearance of his nose 1 month after undergoing rhinoplasty. Examination shows a depressed bridge consistent with a saddle-nose deformity. Which of the following is the most likely cause?

- A) Collapse of the upper lateral cartilage
- B) Depression of the nasal bones after lateral osteotomy
- C) Inadequate infracture of the nasal bones
- D) Misalignment of the maxilla during lateral osteotomy
- E) Overresection of the septum

The correct response is Option E.

The most likely cause of the saddle-nose deformity is overresection of the septum. The deformity can also occur without significant septal resection if the cartilaginous septum is separated from the vomer. Another explanation may be if the septum was shaped as an L-strut and the vertical component of this L-strut collapses.

Collapse of the upper lateral cartilage creates an inverted V deformity. This is likely to occur in patients after a hump reduction. Prevention involves placement of spreader grafts of cartilage between the upper lateral cartilage and the dorsal septum.

Nasal bone collapse after a lateral osteotomy can occur with disruption of the periosteal attachments of the deep side of the nasal bones. Nasal bones fall medially during an osteotomy and may collapse with multiple attempts.

Open-roof deformity is the failure of the nasal bone sidewalls to come together during infracture. Small open roofs may fill with scar tissue, but larger ones may not. Closure usually involves a lateral osteotomy or a dorsal graft to cover the roof.

A stair-step deformity develops when a lateral osteotomy is not flush with the maxilla. This problem can be avoided if the osteotome is directed flush with the maxilla at the level of the pyriform fossa.

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64. A 40-year-old man becomes increasingly disoriented and obtunded 1 day after belt lipectomy. He has had a 200-lb (91-kg) weight loss since undergoing gastric bypass surgery 22 months ago. Which of the following is the most appropriate initial step in management?

- A) Anesthesia consultation
- B) Duplex ultrasonography of the legs
- C) Heparin therapy
- D) Psychiatric evaluation
- E) Thiamine therapy

The correct response is Option E.

Many massive weight-loss patients suffer from malnutrition, including thiamine deficiency, which can lead to Wernicke-Korsakoff encephalopathy. Treatment is intravenous administration of 100 mg/d of thiamine, continuing with 100 mg every 8 hours until resolution of symptoms. Administration of thiamine is low risk and may reverse symptoms. CT scan of the head is worthwhile but can wait until after thiamine is administered. It is possible the patient could have suffered a “kink” in his carotid or vertebrobasilar system with prone positioning, particularly if the head was positioned to the side and the neck was not in neutral position. Duplex ultrasonography of the legs, which can rule out deep venous thrombosis and possible pulmonary embolism, is recommended if there is a high-risk background, but it is unlikely 1 day after surgery. Therapeutic heparin administration would present a danger for postoperative bleeding only 1 day after belt lipectomy. Metabolic or surgical issues should be addressed before a psychiatrist is involved.

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65. A 20-year-old woman comes to the office for consultation regarding augmentation mammoplasty. Height is 5 ft 4 in (163 cm) and weight is 120 lb (54 kg). Physical examination shows mammary hypoplasia. She currently wears a size 34B brassiere and would like to wear a size C brassiere. Which of the following is the most appropriate option for breast enhancement?
- A) Autologous fat transfer
 - B) Breast Enhancement and Shaping System (BRAVA)
 - C) Saline prostheses
 - D) Smooth gel prostheses
 - E) Textured gel prostheses

The correct response is Option C.

Augmentation mammoplasty is one of the most common plastic surgery operations. During the moratorium on silicone gel prostheses between 1992 and 2006, the saline breast prosthesis became the prosthesis of choice. When a saline prosthesis ruptures, it decreases in size as the saline leaks out and is absorbed by the body. The deflated side is usually noticeable to the patient and can be compared to the nondeflated side for further distinction. The saline may leak out slowly, taking a week or longer to be noticeable.

When the Food and Drug Administration lifted the moratorium on silicone gel prostheses, it stipulated that women must be 22 years of age to use the gel prosthesis. Therefore, for the patient described, the only option is saline.

Saline prostheses are firm to the touch, and on very thin patients the normal rippling can be palpated through the skin, especially noticeable along the lower, outer pole where there is no pectoral muscle coverage.

Autologous fat transfer is reported in the literature but would be difficult to do on this very thin patient. Harvesting enough fat to achieve the goal of a size C brassiere would be difficult.

The BRAVA system can increase breast size but only minimally, so it is unlikely that this would give the patient enough volume for her goal of a size C brassiere.

The deflation rate of saline prostheses is debated in the literature, related to prosthesis type (textured versus smooth), fill volumes, and physician technique. It is agreed that the expected lifespan of the saline prosthesis is 10 years.

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66. A 37-year-old man comes to the office because of a 2-year history of difficulty breathing through his nose after undergoing two rhinoplasty procedures. An inverted V deformity is noted on physical examination. Placement of which of the following types of graft is most likely to correct his functional and aesthetic deformities?

- A) Alar base
- B) Alar rim
- C) Dorsal onlay
- D) Nasal sidewall onlay
- E) Spreader

The correct response is Option E.

Placement of a spreader graft can correct the inverted V deformity by correcting the collapse of the internal nasal valve, which will improve breathing. Spreader grafts also increase the width at the middle nasal vault and reestablish dorsal nasal aesthetic lines.

Placement of alar base, alar rim, dorsal onlay, or nasal sidewall onlay grafts will not improve the inverted V deformity or breathing.

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67. A 60-year-old man undergoes excision of a nodular basal cell carcinoma of the nasal tip, followed by immediate reconstruction with a bilobed flap. The procedures are performed in the office by the same plastic surgeon. Which of the following is the most appropriate Current Procedural Terminology (CPT) coding?

- A) Coding for the excision only
- B) Coding for the flap closure only
- C) Coding for both the excision and closure
- D) Coding for the excision with the -22 modifier (complex or unusual)
- E) Coding for the flap closure with the -22 modifier (complex or unusual)

The correct response is Option B.

If a lesion is excised and an adjacent tissue transfer or arrangement (14XXX codes) is performed at the same site, excision of the lesion is not reported separately. The specific code used is determined by the size of the defect plus the size of the flap donor site (primary plus secondary defects). This is different from any other type of closure coded in current CPT coding, as excisions and closures are otherwise reported separately. If two lesions are removed from the same anatomical area and two flaps are rotated, the adjacent tissue transfer code can be used twice, provided that the lesions have distinct margins and are not contiguous.

The -22 modifier is used for more complex and lengthy procedures and is not appropriate for the scenario described.

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68. A 42-year-old woman with Grade 3 ptosis of the breasts is scheduled to undergo augmentation mammoplasty and mastopexy. Which of the following operative decisions is most likely to have an adverse effect on the outcome of the procedure?

- A) Augmentation mammoplasty and use of vertical mastopexy technique
- B) Augmentation mammoplasty and use of a Wise-pattern mastopexy technique
- C) Mastopexy and placement of 450-mL saline prostheses in a dual-plane pocket
- D) Mastopexy and placement of 200-mL silicone prostheses in a subpectoral pocket
- E) Performance of the operation in two stages

The correct response is Option C.

Augmentation mammoplasty and mastopexy is a complex procedure that can increase the risks and difficulties beyond those of each one performed independently. A mastopexy is designed to raise the nipple-areola complex and reshape the breast by resecting skin and tightening the parenchyma. In direct opposition to this shaping, an augmentation enlarges the volume of the breast and expands the skin envelope. Further, mastopexy techniques involve elevation of flaps that require adequate vascularity, while prosthesis placement devascularizes the breast and puts direct pressure on the remaining circulation.

The larger the prosthesis, the greater the adverse effect on vascularity. This can lead to early problems with nipple-areola complex loss, skin flap loss, prosthesis infection and exposure, and resultant deformities.

Larger prostheses are also associated with long-term complications of soft-tissue attenuation. This results in tissue thinning, stretching, atrophy, rippling, and recurrent ptosis. Despite conflicting studies, prosthesis size of 350 mL is considered the crossover to large prostheses.

Despite these risks, most patients want to have both operations performed simultaneously. If these patients are accepted, it is the surgeon's responsibility to minimize complications.

Some surgeons prefer to perform augmentation and mastopexy in two separate operations to control the result and reduce the complication rate.

Placement of 200-mL silicone prostheses in a subpectoral pocket is less likely to cause problems because of their modest size.

Vertical mastopexy and Wise-pattern techniques are both acceptable procedures that can be applied to patients with Grade 3 ptosis.

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69. A 45-year-old woman comes to the office for consultation regarding lower eyelid blepharoplasty. Physical examination shows prominent eyes; exophthalmos is suspected. Measurement of the distance between the anterior border of the globe and the most anterior point of which of the following aspects of the orbital rim is most appropriate to confirm this diagnosis?

- A) Inferior
- B) Lateral
- C) Medial
- D) Radix
- E) Superior

The correct response is Option B.

Orbital morphology is increasingly recognized as an important predictor of postoperative complications in eyelid surgery. Several studies have shown increased lower eyelid morbidity in patients with exophthalmos. A recent study of 269 consecutive patients suggests that patients with enophthalmic orbits, combined with horizontal lower eyelid laxity, are also at increased risk. The Hertel exophthalmometer measures the distance between the anterior border of the globe and the most anterior point of the lateral aspect of the orbital rim. Enophthalmos is defined as less than 14 mm; midrange 15 to 18 mm, and exophthalmos greater than 18 mm.

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70. A 36-year-old man is scheduled to undergo correction of grade IV gynecomastia. On physical examination, the distance from the nipple to the sternal notch is 25 cm and the inframammary crease is 4 cm inferior to the lower pectoral border. A mastectomy and free nipple grafting are planned. Which of the following is the most appropriate configuration and position of the new nipple-areola complex?

- A) Oval; placement at the fourth-to-fifth intercostal space
- B) Oval; placement 20 cm from the midclavicle
- C) Oval; placement 25 cm from the sternal notch
- D) Round; placement 25 cm from the sternal notch
- E) Round; placement at the fourth-to-fifth intercostal space

The correct response is Option A.

The number of male body contouring procedures performed in the United States has been steadily increasing over recent years, and correction of high-grade gynecomastia remains one of the most challenging procedures performed by plastic surgeons today. A grading system for gynecomastia was originally described in 1973 and later modified in 2003. Pseudogynecomastia after massive weight loss, in which the redundant breast tissue consists primarily of fat and skin, has been separately classified, and a grading system was published in 2008. Although there are minor differences between the varying classification schemas, it is generally agreed that high-grade gynecomastia, with severe ptosis and a large amount of redundant skin, may require skin resection and movement of the nipple-areola complex using either a pedicled or free nipple grafting technique.

The proper position, shape, and viability of the nipple-areola complex remain the major factors in successful outcome after mastectomy and free nipple grafting in the correction of gynecomastia. Many studies have evaluated these parameters with results that are fairly consistent, although recommendations can be somewhat formulaic and cumbersome.

In the simplest of schema, 100 normal male volunteers were measured to determine the appropriate anatomical parameters for nipple position and areolar diameter. It was found that patient height was the most important fixed parameter from which nipple position should be calculated. The average diameter of the nipple-areola complex in men was found to be 28 mm, and the sternal notch-to-nipple distance was found to be 20 cm. These numbers may, however, apply less in the setting of obesity or severe weight loss.

One consistent finding with respect to nipple-areola configuration in men is the shape. In one study of 100 healthy male subjects performed in 2001, it was found that 91% had an oval-shaped complex with a mean ratio of horizontal-to-vertical diameter of 27:20 mm. The mean nipple-areola diameter of the 9% of patients who had a round complex was 2.3 cm. It was also found that the center of the nipple-areola complex was in the fourth intercostal space in 75% of patients and in the fifth intercostal space in 23% of patients.

Unsatisfactory results after surgical correction of gynecomastia are largely secondary to improper nipple placement, with the nipple-areola complex being placed too low and close to the sternum. Moreover, to avoid a “stuck-on” appearance, use of a small oval, rather than a perfectly round shape, will result in a more natural appearance.

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71. An otherwise healthy 33-year-old woman comes to the office because of back pain, brassiere grooving, and an inframammary rash. She wears a size 42 L brassiere. She has one child and says she would like to have more children. BMI is 33 kg/m^2 . The distance from nipple to sternal notch is 37 cm bilaterally, and the distance from nipple to inframammary fold is 16 cm bilaterally. A photograph is shown. Which of the following is the most appropriate reduction mammoplasty technique for this patient?



(Please note that this pictorial appears in color in the online examination)

- A) Inferior pedicle with Wise skin pattern
- B) Lower pole amputation with nipple grafting
- C) Medial pedicle with vertical skin pattern
- D) Superior pedicle with vertical skin pattern
- E) Superior pedicle with Wise skin pattern and nipple grafting

The correct response is Option A.

The patient described is a young, healthy woman, who may desire to have more children later in life, making nipple preservation an optimal choice. She is large in size and has ptosis, making an inferior pedicle with Wise pattern the best technique to ensure adequate tissue removal. This technique is also able to reduce the vertical dimension of the breast, which is more challenging with vertical skin pattern reduction mammoplasty. Inferior pedicle reduction mammoplasty can achieve significant reduction in breast volume and alleviate preoperative symptoms with a low risk of complications.

Nipple grafting techniques are unnecessary in this woman, whose nipple needs to be elevated only 13 to 16 cm, and who may desire to have another child in the future. Medial pedicle technique is not widely used. It has been described with limited incision techniques and in combination with Wise pattern for severe macromastia. Limited incision techniques might fail to achieve reliable reduction in breast volume and result in aesthetic dimensions as well. These vertical scar techniques are best reserved for smaller volume reductions.

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72. Which of the following anatomical events occurs during eyelid closure?

- A) The lacrimal canaliculi occlude
- B) The lacrimal diaphragm returns to a relaxed position
- C) The lacrimal puncta close
- D) The lacrimal sac collapses
- E) The nasolacrimal duct shortens

The correct response is Option C.

During eyelid closure, the lacrimal puncta close because of simple forced position. In contrast, during eyelid opening, the lacrimal puncta are open and in contact with the lacrimal lake at the medial aspect of the lower eyelid. The lacrimal sac is collapsed and empty at this stage, and the canaliculi are patent. Reopening the eyelid allows the lacrimal diaphragm to return to its resting position through cessation of the sphincter action of the orbicular muscle of the eye.

Upon eyelid closure, tears are milked lateral to medial. The deep heads of the preseptal muscles contract, shortening the canaliculi and closing their ampullae. Simultaneously, the deep heads of the preseptal muscles that are attached to the fascia of the sac (lacrimal diaphragm) pull the sac laterally. This creates negative pressure and results in the opening of the sac.

As the eyelids reopen, the lacrimal diaphragm returns to its relaxed position, creating sufficient pressure to propel the tears into the nasolacrimal duct. The canaliculi reopen at this phase to allow collection of more tears.

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73. A 65-year-old man has involutional ptosis of the left upper eyelid. Which of the following is the most important factor to consider when determining the appropriate management?

- A) Amount of brow ptosis
- B) Amount of excess eyelid skin
- C) Degree of levator function
- D) Distance between the tarsal edge and the brow
- E) Position of the supratarsal fold

The correct response is Option C.

Involutional ptosis, the most common type of acquired eyelid ptosis, is caused by a defect in the levator aponeurosis that occurs with stretching and allows downward positioning of the tarsal plate. Involutional ptosis is associated with good-to-excellent levator function, a high supratarsal crease, and thinning of the eyelid tissues above the tarsal plate.

The degree of levator function determines the required degree of correction. With a poor levator function (0–6 mm of excursion), frontalis suspension is required. With a moderate function (6–10 mm), levator resection (shortening) is required. For patients with excellent levator function (>10 mm), aponeurotic surgery is appropriate.

The amount of brow ptosis will help determine whether additional corrective procedures are necessary. The amount of excess skin and the distance between the tarsal edge and the brow indicate the amount of excess skin to be excised in a blepharoplasty.

The position of the supratarsal fold indicates the cause of ptosis and is useful in determining placement of corrective incision.

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74. A 45-year-old woman is scheduled to undergo delayed breast reconstruction using a transverse gracilis myocutaneous flap. Which of the following arteries provides the dominant blood supply of this flap?

- A) Deep femoral circumflex
- B) Lateral femoral circumflex
- C) Medial femoral circumflex
- D) Superficial femoral circumflex

The correct response is Option C.

The gracilis muscle arises from the anterior body and the inferior ramus of the pubis and the ischium. It passes distally in the medial thigh posterior to the long adductor and sartorius muscles and inserts on the medial aspect of the proximal tibia posterior, deep to the sartorius tendon and anterior to the semitendinous muscle insertion. Its innervation comes from a branch of the anterior division of the obturator nerve, which has 2 to 4 fascicles entering the muscle 6 to 10 cm from the origin.

The obturator nerve accompanies the dominant vascular pedicle, the medial femoral circumflex artery, and its venae comitantes arising from the profunda femoris artery and vein 8 to 12 cm from the muscle origin. A vascular pedicle can be obtained that is 4 to 6 cm long with a vessel diameter of 1 to 2 mm. Two minor vascular pedicles, which are branches of the superficial femoral artery, are located distally and may be sacrificed. No significant functional loss can be seen after removal of the gracilis muscle.

The transverse myocutaneous gracilis free flap with a transverse orientation of the skin paddle in the proximal third of the medial thigh region allows taking a moderate amount of tissue for autologous breast reconstruction in selected patients. The donor-site morbidity is similar to that of a classic medial thigh lift. The proximal pedicle enters the gracilis muscle 8 to 12 cm below the pubic tubercle and sends both septocutaneous and musculocutaneous perforators. These branches have a pronounced tendency to travel in a transverse direction, supplying the cutaneous territory over the long adductor and sartorius anteriorly and extending for greater than 5 cm beyond the posterior margin of the gracilis muscle. This flap is reliable and consistent.

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75. A 35-year-old woman comes to the office for consultation regarding correction of her pronounced nasolabial folds. Soft-tissue fillers are considered. Which of the following injectables is most likely to result in a hypersensitivity reaction?

- A) Bovine collagen (Zyplast)
- B) Calcium hydroxylapatite (Radiesse)
- C) Human collagen (CosmoPlast)
- D) Hyaluronic acid (Juvéderm)
- E) Porcine collagen (Evolve)

The correct response is Option A.

Hypersensitivity reactions with soft-tissue fillers are relatively uncommon. Local reactions can occur with any of the fillers, but most reactions likely stem from local irritation associated with the technique of injection or quantity injected versus a true allergic reaction. In the case of Zyplast, approximately 3% of patients will exhibit a hypersensitivity reaction caused by a preexisting allergy to bovine collagen. Thus, for the bovine collagen products (Zyderm I and II; Zyplast), a skin test should be performed prior to use.

The other fillers listed have much lower incidences of reactions. Thus, they do not require skin tests prior to injection. CosmoPlast is derived from a single human fibroblast cell culture and is treated with glutaraldehyde to decrease its immunogenicity. Evolve is a porcine-derived collagen. It is much less immunogenic than bovine collagen. During its preparation, it is treated to remove allergenic telopeptides. Juvéderm is a hyaluronic acid-based product. Because it is not derived from animals, it is also associated with a lower risk of allergic reactions than the bovine product.

Juvéderm (a hyaluronic acid-based product) and Radiesse (calcium hydroxylapatite) are not derived from animals and are thus associated with a lower risk of allergic reactions than the bovine product.

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76. A 57-year-old woman comes for evaluation for body contouring. She takes no medications except garlic herbal tablets daily. Use of the herbal medication increases her risk for which of the following postoperative events?

- A) Bleeding
- B) Hypertension
- C) Nausea and vomiting
- D) Prolonged anesthesia effects
- E) Tachycardia

The correct response is Option A.

Among the general population, garlic is used as a common herbal supplement and, as such, is taken by a significant percentage of surgical patients. Proposed benefits of this supplement include its activity as a potential antibiotic, diuretic, antihypertensive, lipid-lowering agent, and antitussive.

However, garlic ingestion may also increase the risk of intraoperative or postsurgical bleeding secondary to its platelet inhibitor activity or its role as a stimulator of fibrinolytic activity.

Common medication classes that may interact with garlic include anticoagulants, hypoglycemics, cardiovascular medications, and monoamine oxidase inhibitors. Because a number of prescription medications may interact with garlic, and because most patients do not consider herbal substances “medications,” it is important to make the appropriate inquiries during the evaluation of the surgical patient.

It is generally recommended that patients discontinue garlic use 7 days prior to surgery to reduce the risk of possible bleeding complications.

Hypertension, nausea and vomiting, prolonged anesthesia effects, and tachycardia are not well-documented sequelae of garlic supplementation.

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77. Which of the following innervates the nipple-areola complex?

- A) Intercostal
- B) Lateral pectoral
- C) Long thoracic
- D) Supraclavicular
- E) Thoracodorsal

The correct response is Option A.

The classic teaching ascribes nipple innervation to the fourth intercostal nerve. More recent anatomical studies have confirmed that the nipple is innervated by a rich subdermal plexus of nerves that provide both tactile and pressure sensation. This plexus receives innervation from the lateral and anterior cutaneous branches of the second to fifth intercostal nerves. This plexus explains why the nipple can retain sensation despite extensive surgical procedures.

The lateral pectoral innervates the pectoralis major muscle. The long thoracic innervates the serratus anterior muscle. The supraclavicular innervates the skin of the upper breast. The thoracodorsal innervates the latissimus dorsi muscle.

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78. A 32-year-old woman is scheduled to undergo suction lipectomy of the outer thighs and flank areas. One liter of solution composed of Ringer's lactate solution mixed with 20 mL of 2% lidocaine and one ampule of epinephrine with a concentration of 1:1000 will be used. Which of the following is the amount of lidocaine in the mixture described?

- A) 100 mg
- B) 200 mg
- C) 300 mg
- D) 400 mg
- E) 500 mg

The correct response is Option D.

Each liter of solution contains 400 mg of lidocaine with a concentration of 0.04% and 1:1,000,000 epinephrine.

Lidocaine is used more often as the anesthetic agent in the wetting solution. It has a wider range of safety than bupivacaine (Marcaine) and is more easily reversed. Historically, the recommended dose of lidocaine is less than 7 mg/kg. However, this dose does not take into consideration the slow absorption from fat, the persistent vasoconstriction from epinephrine, and the lidocaine removed in the suction lipectomy aspirate, all of which contribute to a reduced risk of systemic toxicity. It is generally accepted that a dose of lidocaine up to 35 mg/kg is safe when injected into the subcutaneous fat with solutions containing epinephrine, although doses up to 50 mg/kg have been utilized.

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79. Which of the following acids is a component of Jessner solution?

- A) Ascorbic acid
- B) Glycolic acid
- C) Kojic acid
- D) Malic acid
- E) Salicylic acid

The correct response is Option E.

Jessner solution is a preparation used for light peels alone or in preparation for a trichloroacetic acid (TCA) peel. It contains resorcinol USP, salicylic acid USP, and lactic acid USP, 14% each in ethanol USP. It is a clear, pale-to-medium, yellow-pink solution with an odor of alcohol. Fresh resorcinol should be used because it turns dark with exposure to light and air. Salicylic acid is light sensitive. Trace amounts of ferric iron cause salicylic acid to turn red. Jessner peel solution should be kept in an air-tight amber bottle. Lactic acid absorbs water in moist air, and the use of old lactic acid can result in a subpotent preparation.

Kojic acid, which is not part of Jessner solution, is used as a skin lightener that works by inhibiting tyrosinase. Kojic acid is used in the treatment of melasma; side effects include slight skin irritation and possible development of sun sensitivity. Ascorbic acid, glycolic acid, and malic acid are not components of Jessner solution.

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80. A 36-year-old woman comes to the office for consultation regarding augmentation mammoplasty. She is concerned about the effect of the procedure on nipple sensitivity. Which of the following factors is most likely to result in diminished nipple sensation postoperatively?

- A) Incision location
- B) Pocket placement
- C) Prosthesis volume
- D) Use of a saline prosthesis
- E) Use of a silicone prosthesis

The correct response is Option C.

Two different studies show that prosthesis volume relative to the skin envelope has a potential adverse effect on the sensation of the nipple-areola complex. The type of prosthesis and the pocket placement have no influence on sensitivity. No difference was found between the periareolar and inframammary incision approaches. Other factors, such as a previous history of breast-feeding or minor complications, were not associated with sensory alterations.

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81. Which of the following sequelae is more likely to result from the use of textured silicone gel prostheses rather than smooth silicone gel prostheses?

- A) Capsular contracture
- B) Hematoma
- C) Malposition
- D) Rippling
- E) Rupture

The correct response is Option D.

The use of textured prostheses is associated with a significant rate of rippling when compared with smooth prostheses. One study reported over a two-fold increase. Visible rippling can be minimized with subpectoral implantation as well as by limiting the use of these prostheses to patients with more native breast tissue. Rippling is more pronounced with saline-filled prostheses.

Rippling occurs when the breast skin and soft tissue are thin. This rippling will worsen with time because of the skin stretching and thinning. The key to treatment is to thicken the breast skin or change the prosthesis characteristics. Overinflation of saline prostheses is thought to minimize rippling; however, one recent study did not show any difference in the incidence of rippling in underfilled saline prostheses. Surgical treatment for rippling is usually incomplete. Dermal grafts have been used with some success to thicken the rippled breast skin. Changing a saline prosthesis to a cohesive silicone gel prosthesis will also improve rippling. Various flaps can also be used to reinforce the thinned breast skin.

Textured surface prostheses are superior to smooth prostheses in decreasing capsular contracture. However, this advantage is minimal when using saline prostheses in a subpectoral pocket.

The incidence of hematoma formation is similar for both types of prostheses.

Rupture rates for textured gel and saline gel are similar; however, textured saline prostheses have a higher rate of deflation than smooth saline prostheses.

Malposition rates are not higher with the use of textured prostheses.

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82. A 36-year-old woman is referred for evaluation because of a 1-year history of nasal airway obstruction. Physical examination shows hypertrophy of the inferior turbinates. The primary advantage of submucous resection of the inferior nasal turbinate over turbinate ablation is a decrease in the risk for which of the following complications?

- A) Atrophic rhinitis
- B) Chronic infection
- C) Ciliary dysfunction
- D) Malodorous secretions
- E) Mucosal desiccation and crusting

The correct response is Option A.

The management of nasal airway obstruction secondary to inferior turbinate hypertrophy has been actively debated for more than a century. The threat of undesirable postoperative sequelae has dissuaded many surgeons from surgically manipulating the inferior turbinates. When a partial submucous resection technique is used, atrophic rhinitis almost never occurs. The complications of chronic infection, ciliary dysfunction, malodorous secretions, mucosal desiccation and crusting, and irreversible fibrous atrophy of the mucosa are concerning for both patient and surgeon, although the actual incidence may be lower than previously thought.

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83. A 45-year-old man comes to the office for consultation regarding deep nasolabial folds. He is interested in a product approved for use by the FDA, but it is difficult to obtain in the United States because the manufacturing company went out of business. The patient is able to obtain the product from Canada and brings a 1.4-mL syringe of the product to the office, requesting injection. Which of the following is the most appropriate action by the plastic surgeon?
- A) Do not inject the product because the company went out of business, revoking the product's FDA-approved status
 - B) Do not inject the product because it would be a violation of the Federal Food, Drug, and Cosmetic Act
 - C) Do not inject the product because the patient obtained it from outside the United States
 - D) Inject the product because it is approved by the FDA
 - E) Inject the product because it was legally obtained

The correct response is Option C.

The act of importing drugs already manufactured or approved in the United States from another country is called reimportation. Currently, only manufacturers are permitted to reimport their own product. It would not be a violation of the Federal Food, Drug, and Cosmetic Act because the physician's conduct did not relate to the interstate delivery of a non-approved drug or device in the practice of medicine. Although the product is FDA-approved, it is illegal to inject it because of the way it was obtained.

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84. A 40-year-old nulliparous woman comes to the office because she is dissatisfied with the "saggy" appearance of her breasts following a 120-lb (54-kg) weight loss. Physical examination shows bilateral Grade 3 ptosis. Which of the following additional findings on examination of the breasts is most likely in this patient?

- A) Flatness of the upper pole
- B) High inframammary fold
- C) Lack of axillary fat roll
- D) Lack of excess skin
- E) Laterally displaced areolas

The correct response is Option A.

The types of breast deformities seen following massive weight loss are relatively new. To adequately manage these patients and assess outcomes, it is important to understand the defect. Classification systems exist for breast ptosis for other causes; however, these are based mainly on nipple position. Breast deformities after massive weight loss vary significantly. Patients typically present with severe breast ptosis (Grade III), medialization of the nipple-areola complex, lateralization of the breast mound, and extension to a lateral axillary fat roll, which often extends well into the back. The inframammary fold is often in a lower position because of deflation of the entire skin and connective tissue envelope. Beyond the typical breast changes of glandular tissue loss and ptosis, there tends to be more asymmetrical volume loss in the massive weight loss breast, and there is more of a deflated and flat appearance of the breast (particularly a flat upper pole). Skin laxity is very apparent, and the degree of excess skin can be significant.

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85. A 42-year-old woman comes to the office because of a 20-year history of difficulty taking a deep breath through her nose. She says the tip of her nose has looked "pinched" since she underwent rhinoplasty 25 years ago. Examination shows a narrow nasal tip and collapse of the external nasal valve on deep inspiration. Which of the following grafts is the most appropriate management of this patient's condition?

- A) Alar batten
- B) Columellar strut
- C) Radix onlay
- D) Septal extension
- E) Upper lateral spreader

The correct response is Option A.

External nasal valve collapse is caused by weakened lower lateral cartilages. In an attempt to narrow the nasal tip, the surgeon may overresect or transect the lower lateral cartilage, leaving an inadequate alar rim support. Further, if transdomal sutures are tightened excessively, the lateral cartilages can curl inward and obstruct the external nasal opening. The key to treatment is to provide adequate support to the ala. A lateral crural strut graft (alar batten) is a strip of cartilage 3 to 4 mm in width sutured to the deep surface of the lateral crura and then buried laterally in the soft tissue of the pyriform aperture. The length and exact placement can be varied depending upon the exact anatomic requirements. Variations of this technique include an alar sliding graft, which is different from the batten graft in that one strip spans both lower lateral cartilages. Rhinomanometric studies have shown two-fold and greater improvement of airflow following correction of external nasal incompetence.

Columellar strut grafts are placed for tip support and control.

Radix onlay grafts are needed when there is a contour deficiency in the upper third of the nasal dorsum. Care must be taken when placing these grafts because the dorsal skin of the upper third of the nose is thin; therefore, thick or sharp angled visible grafts can result.

Septal extension grafts are used to control nasal tip projection as well as lengthen an overly shortened nose.

Upper lateral spreader grafts are performed to correct collapse of the internal nasal valve, not the external nasal valve.

References

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86. An otherwise healthy 38-year-old woman reports feeling faint when she stands up 1 day after undergoing contouring of the abdomen, back, and thighs. Prior to the contouring procedure, she underwent a Roux-en-Y procedure 2 years ago and lost 183 lb (83 kg). BMI is now 23 kg/m². Pulse is 120/min, and blood pressure is 90/60 mmHg. Which of the following is the most likely underlying cause of this patient's condition?

- A) Anemia
- B) Hypothermia
- C) Pain
- D) Skin necrosis
- E) Vitamin deficiency

The correct response is Option A.

Many patients who have undergone Roux-en-Y gastric bypass surgery have underlying iron deficiency anemia, vitamin B₁₂ (cobalamin) deficiency, and fat soluble vitamin deficiency. These deficiencies may lead to blood clotting disorder. Significant blood loss may occur during body contouring procedures, which is underestimated, and there is little reserve and potential difficulty with blood clotting from malnutrition. It is important to examine the patient carefully for any signs of hematoma. High output of bloody drainage, possibly followed by no drainage at all from clogging of the drain by blood, should be checked. Vital signs and urine output must also be checked. If there is uncertainty and the patient is stable, a complete blood count and CT scan may be checked. Early significant blood loss mandates a return to the operating room to look for a treatable source of bleeding and blood transfusion.

Prolonged hypothermia may increase risk of infection or wound healing problems. Pain is more likely to cause hypertension and tachycardia. Skin necrosis is a complication of lower body lift, particularly in patients who smoke or wear tight garments. This complication would not lead to the systemic issues described. Skin necrosis risk can be minimized by limiting undermining.

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87. A 24-year-old woman is undergoing endoscopic transaxillary augmentation mammoplasty. Which of the following is most appropriate to preserve sensation in the medial aspect of the upper extremity?

- A) Avoiding dissection into the axillary fat
- B) Blunt dissection near the clavicle
- C) Identification of the sensory nerves within the axilla
- D) Positioning of the prosthesis subpectorally
- E) Preservation of the lateral pectoral nerve

The correct response is Option A.

During transaxillary augmentation mammoplasty, prevention of sensory changes to the medial aspect of the upper extremity requires a subdermal dissection and avoids dissection into the axillary fat. Branches of the intercostobrachial and medial brachial cutaneous nerves provide sensory innervation to the medial upper extremity. Both nerves course superficially through the axillary fat posterior to the lateral border of the pectoralis major muscle. Dissection within the axillary fat risks injury to these nerves with subsequent anesthesia or paresthesia of the inner arm.

Identification of the nerves within the axilla requires dissection into axillary fat and risks injury to the sensory nerves. Sensory innervation to the medial aspect of the upper extremity is not affected by the positioning of the prosthesis (subpectoral versus subglandular) or dissection near the clavicle. The lateral pectoral nerve provides motor innervation to the lower third of the pectoralis major muscle.

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88. A 47-year-old woman comes to the office for consultation regarding rejuvenation of the upper periorbital area. Physical examination shows excess skin on the upper eyelids with no fat herniation. Brow contour is normal. Upper blepharoplasty is planned. Which of the following best represents the postoperative pretarsal eyelid show in primary gaze to achieve the ideal cosmetic result?

- A) 0 to 1 mm
- B) 2 to 5 mm
- C) 6 to 10 mm
- D) 11 to 15 mm

The correct response is Option B.

The ideal youthful eyelid appearance can be seen in models and movie stars by studying their periorbital. Ideal eyelids are full, not hollow, with a crisp tarsal upper eyelid crease and elastic support of the upper eyelid tissue. This creates smooth and taut pretarsal and preseptal upper eyelid skin. The pretarsal eyelid show is often only 2 to 3 mm in the aesthetically attractive eye. Current methods of periorbital rejuvenation are more conservative in the resection of soft tissue from the eyelids, as they avoid the harsh overresected look that greater pretarsal eyelid show causes, which accelerates the apparent aging process.

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89. A 41-year-old Asian woman comes to the office because of a persistent red eye 8 weeks after undergoing transconjunctival lower eyelid blepharoplasty. The procedure was performed using a guarded needle tip cautery and corneal shield eye protection. Examination shows an adhesion of the palpebral conjunctiva to the bulbar conjunctiva. Which of the following is the most likely diagnosis?

- A) Chalazion
- B) Chemosis
- C) Entropion
- D) Hordeolum
- E) Symblepharon

The correct response is Option E.

The pathologic adhesion of palpebral conjunctiva to the bulbar conjunctiva or cornea is called symblepharon. Symblepharon is generally related to thermal injury. Entropion is the inversion or infolding of the eyelid margin. This is usually secondary to scar tissue formation involving the capsulopalpebral fascia. Chemosis is edema of the bulbar conjunctiva that forms swelling around the cornea. Chalazion is a small, nonmalignant, localized swelling of the eyelid, usually found on the inside of the eyelid or eyelash line, secondary to obstruction that involves retained secretions of the meibomian glands. Hordeolum, or sty, is an inflammation of one or more sebaceous glands of the eyelash. The disorder is usually found on the external surface of the eyelid or eyelash line.

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90. A 35-year-old woman comes to the office for consultation regarding augmentation mammoplasty. A preoperative mammogram is most indicated if the patient's history includes which of the following?
- A) A grandmother diagnosed with breast cancer at age 73 years
 - B) A mother diagnosed with breast cancer at age 45 years
 - C) Personal history of breast cysts
 - D) Personal history of fibroadenoma
 - E) A sister diagnosed with ovarian cancer

The correct response is Option B.

Among the risk factors for breast cancer, family history is the most significant. It can be divided into two broad categories: familial breast cancer, which most likely results from changes in multiple low penetrance genes coupled with environmental influences, and hereditary breast cancer, which results in high penetrance mutation in a single gene.

Familial breast cancer is relatively common and conveys a modest elevation in risk compared with genetic breast cancer, which is rare but associated with high risk.

A family history of breast cancer has been demonstrated to increase the risk of breast cancer in multiple studies. Breast cancer in a first-degree relative increases the risk of breast cancer, and that risk decreases as the age of the affected relative increases (ie, it is a 2.3 relative risk factor if the affected relative is under 50 years of age; it is 1.8 if she is over 50). Individuals whose first-degree relatives have bilateral breast cancer have an increased risk of 5.5 times the normal population.

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91. A 41-year-old woman comes to the office for a routine follow-up appointment 1 month after undergoing upper and lower blepharoplasty. She reports that since the procedure she has had double vision when she looks up. Which of the following structures was most likely injured during the procedure?

- A) Inferior oblique muscle
- B) Inferior rectus muscle
- C) Levator aponeurosis tendon
- D) Müller muscle
- E) Superior oblique tendon

The correct response is Option A.

The inferior oblique muscle abducts, elevates, and laterally rotates the eye. The superior oblique tendon abducts, depresses, and medially rotates the eye. Injury to these muscles, while infrequent, can be debilitating.

The inferior oblique muscle is more commonly injured, and it is the cause of the diplopia with distorted images on upward lateral gaze. Patients may exhibit a head tilt position to compensate for their symptoms. The muscle can be injured during dissection and management of the medial and central compartment fat pads.

The levator aponeurosis tendon and Müller muscle are also at risk for injury during blepharoplasty. However, these muscles are upper eyelid retractors and would not result in the symptoms seen in the patient described. Injury to the inferior rectus muscle is not common during blepharoplasty.

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92. A 45-year-old woman with brow ptosis and periocular rhytides undergoes treatment with botulinum toxin type A (BOTOX Cosmetic). Injection of BOTOX Cosmetic into which of the following muscles is most likely to result in lateral brow elevation?

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

The correct response is Option D.

Injection of BOTOX Cosmetic into the orbicularis oculi is most likely to result in lateral brow elevation. Facial rhytides of the periocular region are common aesthetic concerns resulting from hyperactivity of the facial musculature. Clinical studies have demonstrated the effectiveness of botulinum toxin in the treatment of periocular rhytides resulting from activity of the orbicularis oculi. Botulinum injections within the periorbital region can produce elevation of the brow.

The frontalis muscle is the primary elevator of the eyebrow. Muscles that antagonize elevation of the brow and therefore produce depression of the brow include the orbicularis oculi, corrugator supercilii, depressor supercilii and procerus. Laterally, the orbicularis oculi muscle acts a lateral eyebrow depressor. Botulinum toxin injections in the orbicularis oculi weaken the muscle and result in unopposed frontalis elevation of the lateral brow. Depression of the medial brow is produced by action of the corrugator supercilii, depressor supercilii, and the procerus. Weakening the action of these muscles will augment the primary function of the frontalis muscle and produce elevation of the medial brow.

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93. A 45-year-old man comes to the office for consultation regarding breast cancer after undergoing gene testing and learning that he is a carrier of the *BRCA2* gene mutation. He has a strong family history of breast, prostate, and ovarian cancers. Which of the following best represents his lifetime risk for developing breast cancer?

- A) 6%
- B) 15%
- C) 30%
- D) 60%
- E) 85%

The correct response is Option A.

Since the identification of the first breast cancer gene in 1990, the field of molecular breast cancer testing has grown enormously. It is estimated that approximately 5% to 10% of patients diagnosed with breast cancer last year carry highly penetrant cancer susceptibility genes. It is important to identify these patients early, as the presence of genetic mutations or other high-risk factors may alter management strategies for patients, both prior and subsequent to the diagnosis of breast cancer.

Male breast cancer accounts for less than 1% of all breast cancer cases in the United States and is more common in men with a family history of breast cancer. The relationship between male breast cancer and a deleterious *BRCA2* mutation has been well established. In the largest study to date, the lifetime risk of developing breast cancer in a *BRCA2* male carrier is approximately 7%. The correlation with *BRCA1* and male breast cancer is less clear, but it seems that the presence of *BRCA1* mutation confers a lower lifetime risk of developing breast cancer than a *BRCA2* mutation. The relative risk of developing breast cancer is highest for men in their 30s and 40s, and it decreases with increasing age.

The lifetime risk for the development of breast cancer in female carriers of *BRCA1* and *BRCA2* mutations is significantly higher than for males. Female *BRCA1* carriers have an 85% risk of developing breast cancer and a 62% risk of developing ovarian cancer. Female *BRCA2* carriers have an 85% risk of developing breast cancer and a 25% risk of developing ovarian cancer.

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94. A 44-year-old woman is brought to the emergency department because of the sudden onset of heart palpitations and anxiety 12 hours after undergoing abdominoplasty and liposuction. History includes breast cancer. She uses a transdermal patch for contraception. Height is 5 ft 5 in (165 cm) and weight is 152 lb (69 kg). During the abdominoplasty procedure, 4 L of Ringer's lactate containing lidocaine 25 mg/L and epinephrine 1 mg/L were infused prior to the first incision, and 4.1 L of aspirate were obtained. Recovery had been uneventful until the current episode. Which of the following is the most appropriate management?
- A) Administration of 0.5 mg alprazolam (Xanax)
 - B) CT scan of the chest
 - C) Determination of serum lidocaine concentration in the blood
 - D) Doppler ultrasonography of the lower extremities
 - E) Reassurance and observation

The correct response is Option B.

The patient described most likely has an acute pulmonary embolism (PE) and should receive urgent medical attention at the nearest emergency department. Her age, recent diagnosis of breast cancer, and estrogen-based contraceptive use places her at moderate-to-high risk for deep venous thrombosis (DVT) and/or PE following surgery. In addition, the combination of large-volume liposuction and full abdominoplasty as a single procedure further increases her risk for these complications. Heart palpitations and anxiety are common complaints in patients experiencing a PE, as are shortness of breath and hyperventilation, but the diagnosis should not be overlooked in a situation like this, even if it is not a presenting symptom. A CT scan of her chest as dictated in a PE protocol is the appropriate diagnostic study to evaluate for PE and will provide the necessary justification to initiate anticoagulation therapy.

Advising her to go to the nearest emergency department to be monitored for lidocaine toxicity is not appropriate because lidocaine toxicity is not likely to be the correct diagnosis. Although serum lidocaine concentrations peak approximately 12 hours postoperatively, the lidocaine dose that she received was well within the established limits of safe lidocaine administration based on her body weight (7 mg/kg with the use of epinephrine).

Attributing her complaints to a preexisting anxiety disorder could have disastrous consequences in the scenario described. The patient is at a significant risk for a PE based on her medical history and her procedure; therefore, she should receive urgent medical care. Alprazolam (Xanax) is a respiratory depressant that could exacerbate her apparent hypoxia.

Doppler ultrasonography would be useful to evaluate for a lower extremity DVT, but it is not the most appropriate study to diagnose a PE.

Reassurance over the phone and arranging to see the patient in your office early the next morning is inappropriate, as any delay in diagnosis of such a serious complication could be potentially lethal.

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95. A 65-year-old woman comes to the office because she is dissatisfied with the aging appearance of her face. Physical examination shows a loss of facial volume and a moderate amount of skin laxity. Autologous fat grafting is planned. Which of the following techniques is most appropriate to maximize the "take" of the fat graft?

A) Ensuring contact with other grafted fat with each successive pass

B) Injecting a small amount of fat per pass

C) Optimizing placement along the cortical facial bone

D) Rinsing the graft with Ringer's lactate

E) Using standard suction lipectomy to harvest the graft

The correct response is Option B.

One of the main concerns after fat grafting is the potentially high rate of absorption in the grafted site over time, which may reach up to 70% of the filled volume. To maximize surface area contact between graft and vascularized bed tissues, the placement of extremely small amounts of fat with each pass is considered to be one of the keys to a successful fat graft "take." Diffuse infiltration with multiple passes and attempts to separate the newly grafted fat parcels from each other are also considered important. Avoiding contact with other grafted fat with each pass means that more of the fat will be in contact with the vascularized bed tissue; this result stabilizes placed fat to deter migration and enhance integration. Placing fat directly on cortical bone may not enhance graft "take" because of the relatively poorer vascularity of the recipient bed. One animal study of the use of hyperbaric oxygen therapy following fat grafting failed to show any associated increased graft "take"; this technique has not been studied adequately in humans. Rinsing the graft with Ringer's lactate will have no effect on the graft "take." The use of standard suction lipectomy harvest techniques has been shown to reduce viability of adipocytes within harvested fat grafts, compared with syringe or direct excision harvest.

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96. A 21-year-old woman comes to the office for consultation regarding a palpable lump in the left breast that she first noticed 4 months ago. Phyllodes tumor of the breast is diagnosed. Which of the following is the most appropriate management at this time?

- A) Observation and incisional biopsy
- B) Neoadjuvant chemotherapy
- C) Local excision and annual surveillance
- D) Wide local excision and radiation therapy
- E) Mastectomy with immediate reconstruction

The correct response is Option C.

Phyllodes tumors of the breast were once called cystosarcoma phyllodes because of the fleshy nature of the tumor. Because most tumors are benign, the name may be misleading. Thus, the favored terminology is now phyllodes tumor.

Phyllodes tumor is the most commonly occurring nonepithelial neoplasm of the breast but represents only about 1% of tumors in the breast. It has a sharply demarcated, smooth texture and is typically freely movable. It is a relatively large tumor; the average size is 5 cm. However, lesions greater than 30 cm have been reported. Approximately 90% of phyllodes tumors are benign and approximately 10% are malignant.

In considering excision, the tumor-to-breast ratio should be small enough to allow for segmental excision of the tumor and possible reduction mammoplasty technique (eg, inferior pedicle for a superior tumor or a superior pedicle for an inferior lesion). Annual surveillance and follow-up is recommended because the pathologic appearance does not always predict the clinical behavior.

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97. A 48-year-old man comes to the office for consultation regarding correction of deepened nasolabial folds. He is interested in long-lasting results but is able to miss only a few days of work. Treatment with which of the following is most likely to result in the longest recovery time?

- A) Calcium hydroxylapatite (Radiesse)
- B) Collagen (Zyderm)
- C) Fat graft
- D) Hyaluronic acid (Restylane or Juvéderm)
- E) Poly-L-lactic acid (Sculptra)

The correct response is Option C.

Patients who cannot tolerate excess post-treatment downtime are not ideal candidates for fat transfer procedures. These treatments are placed deeper in the dermis with large-gauge needles and can result in more significant bruising and swelling. For patients who require rapid recovery, the thinner hyaluronic acid products or even collagen-based products may be better choices. Radiesse is a long-lasting filler and has a rapid recovery time as well. Poly-L-lactic acid (Sculptra) is FDA-approved for the management of HIV facial lipoatrophy. It serves as a volume enhancer and is used for indications similar to those for autologous fat transfer.

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98. A 47-year-old woman with moderate jowling and minimal cervical skin redundancy undergoes a minimal access cranial suspension (MACS) lift. Which of the following is the most appropriate description of the management of this patient's superficial musculoaponeurotic system (SMAS)?

- A) Anchoring to the zygomatic arch
- B) Division and excision
- C) Elevation and rotation to the mastoid
- D) Purse-string suturing to the deep temporal fascia
- E) Suspension to the orbital rim

The correct response is Option D.

In a MACS lift, the SMAS is purse-string sutured to the deep temporal fascia. The MACS lift is a short scar rhytidectomy technique that elevates the deep tissues and skin using a vertical vector only. The skin flap is elevated through a preauricular and pretemporal hairline incision only. Following elevation of the skin, the deep facial tissues are suspended using purse-string sutures into the SMAS tissue. They are then anchored to the deep temporal fascia above the zygomatic arch, avoiding the facial nerve. In the simple MACS lift, two purse-string sutures are placed in the SMAS to correct the neck and lower third of the face. In the extended MACS lift, an additional third purse-string suture is placed in the SMAS to suspend the malar fat pad. As with the SMAS, a vertical vector is utilized to redrape and inset the skin.

Although there are many techniques for modification of the SMAS, the MACS lift does not involve SMAS plication, excision, elevation, or SMAS suspension to the zygomatic arch.

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99. A plastic surgeon is approached by a guest while attending a fund-raising event. The woman asks whether she should have an abdominoplasty procedure, and they discuss specific details regarding it. The woman subsequently calls the office and makes an appointment. On arrival, she gives a detailed history to the office nurse and is examined by the plastic surgeon. The procedure is scheduled and performed 3 weeks later. At which of the following stages of this scenario was a doctor-patient relationship established?

- A) When the discussion at the fundraiser took place
- B) When the patient made an appointment
- C) When the nurse took a detailed history
- D) When the physician examined the patient
- E) When the procedure was performed

The correct response is Option A.

Malpractice is negligence that occurs in the performance of a profession. The four elements of negligence are

- 1. Duty owed—the existence of an obligation
- 2. Duty breached—failure to deliver the obligation
- 3. Causation—the link between breach and harm
- 4. Damages—patient injury

Duty is created when the doctor-patient relationship is established. Simply being a physician does not obligate one to establish that relationship. The doctor-patient relationship is formed when a doctor has professional contact with a patient, but it is not necessary to see the patient physically to form this relationship. Anyone the physician supervises and has authority over, even an office clerk, can form the doctor-patient relationship with the physician. If the plastic surgeon gives specific advice, it establishes a doctor-patient relationship. A physician should never enter into a doctor-patient relationship by accident.

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100. A 48-year-old woman comes to the office because she is dissatisfied with the "sagging" appearance of her breasts. Physical examination shows the location of the nipples 1 cm above the inframammary fold bilaterally. The majority of breast tissue is below the fold. Which of the following is the most likely diagnosis?

- A) Grade 1 ptosis
- B) Grade 2 ptosis
- C) Grade 3 ptosis
- D) Pseudoptosis

The correct response is Option D.

Regnault defined the degree of ptosis by evaluating the relationship of the nipple to the inframammary fold.

In pseudoptosis, the nipple is above or at the level of the inframammary fold, with the majority of the breast tissue below. This gives the impression of ptosis.

In Grade 1, or mild ptosis, the nipple is within 1 cm of the level of the inframammary fold and above the lower contour of the breast and skin envelopes. In Grade 2, or moderate ptosis, the nipple is 1 to 3 cm below the inframammary fold but above the lower contour of the breast and skin envelopes. In Grade 3, or severe ptosis, the nipple is more than 3 cm below the inframammary fold and below the lower contour of the breast and skin envelopes.

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Section 3: Craniomaxillofacial

101. A 45-year-old man comes to the office for follow-up examination 3 months after undergoing surgical repair of a through-and-through laceration of the left cheek. During the procedure, an injury to the parotid duct was noted and repaired. He says he feels fine, but he now has difficulty playing the trumpet because he is unable to create sufficient air pressure in his mouth. Which of the following muscles was most likely also severed?

- A) Buccinator
- B) Levator labii superioris
- C) Masseter
- D) Risorius
- E) Zygomaticus major

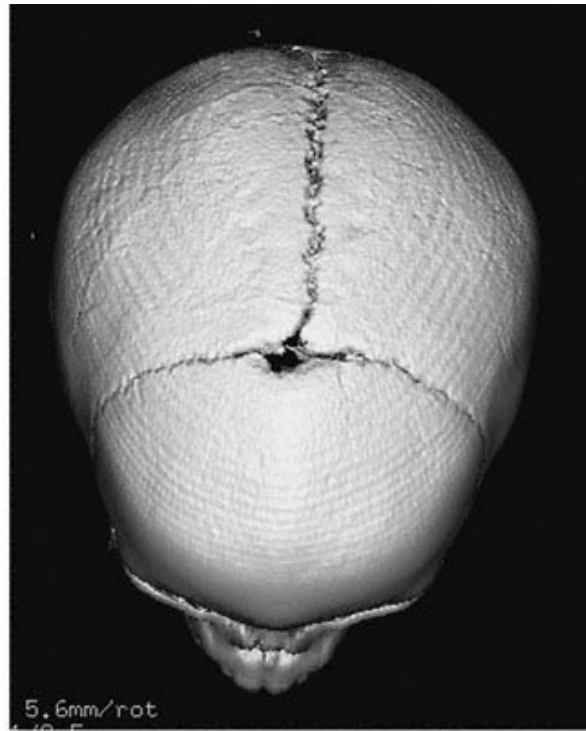
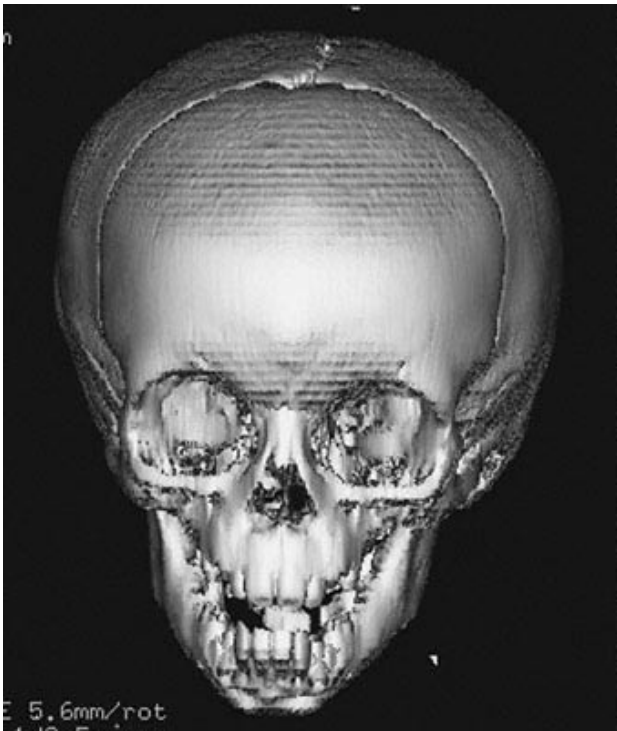
The correct response is Option A.

The buccinator muscle is the only muscle of facial expression that compresses the cheeks, which is an essential function for playing air-based instruments such as the trumpet. Both the buccinator and the orbicularis oris compress the lips, also necessary for playing trumpets. The buccinator muscle ordinarily contributes to the function of forming a food bolus during mastication. The path of the parotid duct typically leaves the parotid gland from its anterior border and courses superficially to the masseter muscle toward the mid cheek and then pierces the substance of the buccinator muscle, reaching the mucosa of the oral cavity opposite the maxillary second molar.

The levator labii superioris, the risorius, and the zygomaticus major muscles all have a function that contributes to separating the lips, which releases the pressure from inside the mouth. These muscles arise from bone and fascia and attach to the lips. The masseter, which originates in the zygomatic arch and inserts on the lateral surface of the ramus, elevates the mandible. The masseter has no role in holding intrabuccal or lip pressure.

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102. A 12-month-old boy is referred by his pediatrician for possible craniosynostosis. He is healthy and has achieved developmental milestones appropriately. His parents report that he has a ridge on his forehead that they first noticed when he was 3 months of age. Physical examination shows a palpable midline ridge with normal facial contour. CT scans obtained by his pediatrician are shown. Which of the following is the most appropriate management?

- A) Diagnostic plain x-ray studies
- B) Endoscopic strip craniectomy and postoperative helmet therapy
- C) Fronto-orbital advancement
- D) Serologic testing for mutations of fibroblast growth factor receptors 1, 2, and 3
- E) Observation

The correct response is Option E.

Craniosynostosis results in characteristic changes to the cranium. The metopic suture is different because unlike other calvarial sutures that ultimately fuse in the third decade of life, it normally

closes before 12 months of age. Accordingly, the finding of a closed suture at this age is not abnormal. The phenotype associated with premature (or pathological) metopic fusion is trigonocephaly (“triangle head”). Patients present with a midline forehead prominence, a variable degree of frontal and lateral orbital narrowing, bilateral parietal widening, and hypotelorism. In contrast, the presence of an isolated metopic ridge is a normal variant. It is the shape of the fronto-orbital region that determines the need for operative intervention.

The CT scans clearly demonstrate metopic fusion; plain x-ray studies are not necessary to confirm the diagnosis. Because the patient described has only an isolated metopic ridge (not trigonocephaly), operative treatment is not warranted. Additionally, endoscopic strip craniectomy is generally not effective after 3 months of age. Mutations in fibroblast growth factor receptors 1, 2, and 3 have been identified in unilateral and bilateral coronal synostosis but not in isolated metopic synostosis.

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(Please note that this pictorial appears in color in the online examination)

103. A 67-year-old woman comes to the office because of a 2-month history of halitosis and pain and swelling in the jaw. History includes placement of dental implants 20 years ago. The patient is currently undergoing chemotherapy for Stage IV lung cancer with metastases to the spine. Physical examination shows exposure of the mandible and dental implant posts. A photograph is shown. Examination of a specimen obtained on biopsy is consistent with osteonecrosis and is negative for malignancy. Administration of which of the following is the most likely cause of this patient's condition?

- A) Bevacizumab
- B) Bisphosphonate
- C) Cetuximab
- D) Dexamethasone
- E) Doxorubicin

The correct response is Option B.

The patient described has osteonecrosis of the mandible and an orocutaneous fistula caused by bisphosphonate (Zometa) therapy. Bisphosphonates bind to calcium crystals in the bone and are resistant to degradation by alkaline phosphatase. As such, they inhibit osteoclast-mediated bone resorption. They are used in the treatment of osteoporosis and, in higher doses, for treatment of bone metastases. Although they are an important tool in cancer therapy, bisphosphonates can initiate osteonecrosis of the jaw, particularly in the presence of trauma, infection, foreign body, and radiation injury. Prevention with oral hygiene and avoidance of invasive dental procedures is important. However, once osteonecrosis occurs, it must be treated. Treatment often consists of stopping bisphosphonate therapy and thorough debridement of bone with removal of hardware. More extensive surgical intervention is determined on a case-by-case basis. In the scenario described, the patient was treated with a marginal mandibulectomy, removal of involved dental implant posts, and a submental artery flap to cover the floor-of-mouth defect and seal the orocutaneous fistula.

Although bevacizumab (Avastin) and dexamethasone (Hexadrol) have been associated with poor wound healing, and doxorubicin (Adriamycin) and cetuximab (Erbix) have been associated with mouth sores, none has been associated with osteonecrosis.

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104. A 16-month-old boy who underwent correction of a complete unilateral cleft lip 2 months ago is brought to the office because his mother is concerned about the appearance of the scar on his lip. Physical examination shows a corrected upper lip with a good pout and contour. The scar is flat, slightly widened, and moderately erythematous. Which of the following is the most appropriate management at this time?

- A) Continued optimal scar management
- B) Immediate revision of the scar
- C) Laser resurfacing of the scar
- D) Revision of the scar in 4 months

The correct response is Option A.

The patient described displays a good result after unilateral cleft lip repair. However, the mother is overly concerned about the appearance of the scar, and she needs to be reassured about the result. She should be reeducated concerning good scar care, which includes use of a strong sunblock, and massage of the scar. Even if the scar were a bad one, the best option at this early stage would be optimal scar care. Revision of scars in children earlier than 12 months is generally not advisable, as they typically continue to improve during this time. Laser resurfacing has not been shown to be an effective early modifier of scar outcomes.

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105. An 18-year-old man undergoes Le Fort I advancement for correction of a 10-mm maxillomandibular discrepancy as a result of maxillary hypoplasia. Which of the following diagnoses places this patient at greatest risk for postoperative development of velopharyngeal incompetence?

- A) Apert syndrome
- B) Clefting of the lip and palate
- C) Craniofacial microsomia
- D) Mandibular prognathism

The correct response is Option B.

Substantial advancement of the maxilla in patients with mid face hypoplasia secondary to a repaired cleft of the lip and palate is a risk factor for the development of velopharyngeal incompetence. Key preoperative findings to evaluate the risk include nasal air emission, nasal resonance, borderline velopharyngeal incompetence, or a combination of findings. In patients with an Angle class III malocclusion due to mandibular prognathism, mandibular setback, rather than maxillary advancement, is the procedure of choice. This should not increase a patient's risk for development of velopharyngeal incompetence. Patients undergoing maxillary advancement for other craniofacial anomalies, such as craniofacial microsomia or Apert syndrome, are at lower risk for development of velopharyngeal incompetence.

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106. A 1-year-old girl is brought to the office because of a 1-cm hemangioma over the right brow and upper eyelid. The parents report that they first noticed the lesion shortly after birth and that it has enlarged since then. Results of ophthalmologic examination are normal bilaterally. Which of the following is the most appropriate management at this time?

- A) Patching of the contralateral eye
- B) Pulsed-dye laser therapy of the lesion
- C) Surgical resection
- D) Systemic and intralesional injection of a corticosteroid
- E) Observation

The correct response is Option E.

The most appropriate action at this time is close observation with frequent vision and refractive examination by an ophthalmologist. Hemangiomas are the most common tumor of infancy, with a predilection for the head and neck and the upper eyelid. They are more common in females, usually noted in the weeks following birth, and are characterized by a rapid proliferative phase of 6 to 12 months. This phase is followed by a period of quiescence, then slow involution beginning the second year of life. Most hemangiomas are initially managed by observation. When a hemangioma interferes with the visual axis or airway, medical or surgical intervention may be indicated.

Periocular hemangiomas may permanently affect vision by causing ptosis of the eyelids, resulting in visual field obstruction, strabismus, or anisometropia (a condition in which the two eyes have unequal refractive power). Each of these may, in turn, result in astigmatism, amblyopia (impairment of vision without an organic cause within the eye, in this case, caused by deprivation of visual stimuli centrally), or blindness. As this particular lesion is not interfering with the child's vision and, based on her age, is likely to enter a quiescent phase, observation is the most reasonable course of action. Cosmetic and functional results of spontaneous involution, particularly for smaller lesions, are often superior to those obtained by invasive treatment. Systemic corticosteroids can have multiple side effects, and intralesional corticosteroids carry the risk of blindness secondary to central retinal artery occlusion. Patching of the contralateral eye is usually performed after debulking of a hemangioma to treat amblyopia.

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(Please note that this pictorial appears in color in the online examination)

A 70-year-old man comes to the office because of a 6-month history of a wound in the right supraorbital region that is draining fluid. Photographs are shown. History includes type 1 diabetes mellitus, chronic obstructive pulmonary disease, and basal and squamous cell carcinoma in the supraorbital area, which was treated with Mohs micrographic surgery, cranial burring, split-thickness skin grafting, and radiation. He has smoked one pack of cigarettes daily for 60 years. Physical examination shows a 4 × 2-cm area of exposed bone with no mobility in the immediately adjacent skin. Echocardiography shows an ejection fraction of 25%. Examination of a specimen obtained on biopsy shows recurrence of squamous cell carcinoma. After excising the tumor, a bony deformity of the supraorbital rim and exposed dura are present. Which of the following is most appropriate to correct this patient's defect?

- A) Alloplastic reconstruction and a local flap
- B) Rib graft with local soft-tissue coverage
- C) Scalp flap
- D) Skin graft

The correct response is Option C.

In the scenario described, bony reconstruction will not impact function, and therefore soft-tissue coverage is adequate. A scalp flap is the most appropriate option because it will bring in blood supply and soft-tissue coverage without the risks associated with extended general anesthesia.

Skin grafting would likely not heal in a radiated bed. The long history of a draining wound is a contraindication to the use of alloplastic material. Although a rib graft would provide bony support, it would also increase risk because of the donor site morbidity in the patient described, who has chronic obstructive pulmonary disease and is at high risk for postoperative pneumonia.

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108. A 20-year-old man comes to the office because he has had paraesthesia of the anterior lateral aspect of the tongue since undergoing removal of the mandibular third molars 3 weeks ago. The most likely cause is injury to which of the following nervous structures?

- A) Chorda tympani
- B) Facial
- C) Glossopharyngeal
- D) Hypoglossal
- E) Lingual

The correct response is Option E.

General sensation of the anterior two thirds of the tongue is supplied by the lingual nerve, which is a branch of the mandibular division of the trigeminal. Taste in the anterior two thirds of the tongue is supplied by the chorda tympani from the facial nerve. The chorda tympani joins the lingual nerve and runs anteriorly in its sheath. The glossopharyngeal nerve supplies the mucosa of the posterior one third of the tongue. The hypoglossal nerve is the motor nerve to the tongue, and the facial nerve is the motor nerve to the face.

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109. A 59-year-old man comes to the emergency department because of erythema of a neck incision and salivary drainage from the wound 10 days after undergoing pharyngolaryngectomy with immediate hypopharyngeal reconstruction with a jejunal free flap to treat recurrent carcinoma of the larynx. He underwent radiation therapy for laryngeal cancer 3 years ago. Endoscopic evaluation shows a viable jejunal free flap. Which of the following is the most appropriate initial management?

- A) Debridement and anterolateral thigh free flap
- B) Debridement and ipsilateral pectoralis major myocutaneous flap
- C) Debridement of the wound edges and local flap advancement closure
- D) Local wound care
- E) T-tube decompression of the jejunal segment

The correct response is Option D.

Complications of free jejunal transfer include thrombosis and flap loss, salivary fistula, and stricture. Thrombosis and flap loss typically occur in the first few days after surgery. Because of the poor ischemic tolerance of the jejunum flap, thrombosed flaps are rarely salvageable. In these instances, early debridement and repeat free flap reconstruction is the best approach. The instance of salivary fistula is approximately 10%, with the majority of patients having received prior radiation therapy. Postoperative salivary fistula after free jejunal transfer can usually be treated conservatively with maintenance of nothing by mouth (NPO) status, dressing changes, and wound care. Larger and more persistent leaks may respond to advancement of wound edges and local flap closure with T-tube decompression of the bowel segments, or pectoralis myocutaneous flap reinforcement of the wound closure. In the setting of a viable free tissue transfer, conservative measures are the most appropriate initial management of this complication.

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110. An 11-year-old boy is brought to the office because of a 1-year history of progressive left-sided hemifacial atrophy. He has the classic coup de sabre appearance. Examination shows facial bony structures that are intact. Which of the following imaging studies is most appropriate to include in a diagnostic workup of this patient?

- A) MRI of the abdomen
- B) MRI of the brain
- C) Plain x-ray study of the chest
- D) Plain x-ray studies of the hands

The correct response is Option B.

The patient described has progressive hemifacial atrophy, or Parry-Romberg syndrome (PRS). This rare disorder is characterized by progressive wasting of the skin and subcutaneous tissues, and, in some cases, the muscle and bone of the face. It is typically unilateral. Age of onset is the first or second decade of life in most cases. Progression of the wasting may continue for several years. The etiology is unknown, but autoimmune, infectious, neurologic, and traumatic causes have all been implicated in various cases and investigations, and it is considered by many to be part of the spectrum of linear scleroderma. Lacking any adequate medical treatment, PRS is typically allowed to run its course, with reconstruction of the resulting defects with fat injection, soft-tissue augmentation with free tissue transfer, bone grafting, and orthognathic surgery as indicated.

Neurologic symptoms are commonly associated with PRS, including seizures, migraine, Horner syndrome, and hemiplegia. Various ophthalmologic conditions are also common. Abnormalities are frequently seen on MRI of the brain, even in the absence of neurologic symptoms, and therefore MRI of the brain is indicated such that these abnormalities might be investigated further as needed. Defects in the skin may also occur elsewhere in the body, but bony abnormalities of the extremities or abnormalities of the chest, abdomen, or neck are not typically found. Therefore, the other imaging studies listed would not be expected to yield useful information in most cases of PRS. Other appropriate tests might include serology for viral or autoimmune etiologies of PRS.

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111. A 25-year-old woman who is pregnant with her second child comes to the office for consultation regarding the risk that the child will have a cleft lip and palate. She has a history of a cleft lip and palate, and her first child also has a cleft lip and palate. The father has no history of cleft lip or palate. Which of the following best represents the likelihood that the patient's second child will be born with a cleft lip and palate?

- A) 2%
- B) 4%
- C) 5%
- D) 10%
- E) 14%

The correct response is Option E.

An affected parent with one affected child has a 14% risk for future offspring to have a cleft lip and palate. If both parents are not affected, and their first child has a unilateral defect, the risk would be 2.7% for the next child and 5.4% if the first child had a bilateral defect. If both parents were unaffected and had two affected children, then the risk for the subsequent pregnancy to result in a cleft lip and palate would be 10%.

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112. A 65-year-old man undergoes hemiglossectomy and modified radical neck dissection for tongue cancer. Which of the following flaps is most appropriate for reconstruction?

- A) Jejunum
- B) Latissimus
- C) Radial forearm
- D) Scapula
- E) Vertical rectus abdominus myocutaneous

The correct response is Option C.

The radial forearm flap is based on the radial artery and its vena comitans. In addition, the cephalic vein can usually be harvested together with the flap to provide venous outflow. In the patient described, the radial forearm flap is the best choice because it provides a thin, pliable skin paddle suitable for repair of a hemiglossectomy defect. In addition, the long pedicle vessels enable anastomosis to the contralateral neck. The scapula flap can be used in this defect; however, the flap is more bulky. The latissimus flap and the rectus flap are similarly too bulky for a hemiglossectomy and are better choices for a total glossectomy. Finally, the jejunum flap is not useful for a hemiglossectomy defect and is used most commonly for circumferential pharyngeal defects.

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113. A 48-year-old woman is evaluated because of a 2.5-cm defect on the dorsum of the nose after undergoing Mohs micrographic surgery for morphea-type basal cell carcinoma. Examination shows a defect extending from the dorsum of the nose to the nasal sidewall on the right and to the upper borders of the nasal ala. The defect includes the full thickness of skin, subcutaneous tissue, and nasal muscle. The perichondrium of the lower lateral and upper lateral cartilages is missing. Which of the following is the most appropriate reconstructive technique?

- A) Acellular dermis covered by a thin split-thickness skin graft
- B) Bilobed flap
- C) Full-thickness skin graft
- D) Paramedian forehead flap
- E) Superiorly based nasolabial flap

The correct response is Option D.

There are a multitude of techniques for reconstructing nasal defects. The defect in the scenario described is 2.5 cm and full thickness in nature. A paramedian forehead flap would be the most appropriate means of reconstruction for this defect. Superiorly and inferiorly based nasal labial flaps are a favorite technique for repair of alar defects up to 2 cm in diameter. They can also be used for reconstruction of the columella and nasal lining. In general, small defects that are less than 5 mm in diameter can be closed primarily. Defects ranging from 5 to 10 mm, particularly on the concave portions of the nose and upper lateral sidewall, can be treated with skin grafts or left to heal by secondary intention. The larger the defect, the less aesthetic the skin graft will appear. Lesions ranging from 1 to 1.5 cm and confined to the nose are best treated by local flaps, such as bilobed flaps, dorsal nasal flaps, or banner flaps. Defects larger than 1.5 cm are often too large for reconstruction with a local flap and are best reconstructed with a paramedian forehead flap. The skin color match of the forehead flap is excellent. Although this is a staged reconstruction requiring division of the flap pedicle as well as potential step for thinning of the flap, the forehead flap provides an excellent option for aesthetic reconstruction of the nose for larger defects.

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114. When reattaching the medial canthal ligaments during a transnasal canthal wiring procedure, which of the following is the most appropriate placement of the drill holes with respect to the lacrimal fossa?

- A) Anterior and inferior
- B) Anterior and posterior
- C) Posterior and inferior
- D) Posterior and superior

The correct response is Option D.

When treating congenital and traumatic deformities of the naso-orbital-ethmoid region, reconstruction and reattachment of the medial canthal tendons are often necessary. Overcorrection with this procedure is essentially impossible, and every effort should be made to prevent relapse and recurrent telecanthus. To this end, the transnasal wires containing the medial canthus should be placed through drill holes positioned posterior and superior to the posterior crest of the bony lacrimal fossa.

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(Please note that this pictorial appears in color in the online examination)

115. A 17-year-old girl is brought to the emergency department after she was hit in the left eye with a batted softball. A photograph is shown. Physical examination shows increased intraorbital pressure and decreasing visual acuity. Review of the CT scan confirms fracture of the orbital floor. Which of the following is the most appropriate immediate management?
- A) Administration of mannitol followed by exploration of the orbital floor
 - B) Anticoagulation
 - C) Exploration of the orbital floor and repair with a bone graft
 - D) Exploration of the orbital floor and repair with synthetic material
 - E) Lateral canthotomy and cantholysis

The correct response is Option E.

Immediate lateral canthotomy and cantholysis are the most appropriate management of the condition described. Retrobulbar hematoma or orbital hemorrhage can follow either a direct injury to the orbital contents or a fracture that involves surrounding bones. Symptoms and signs include pain, reducing visual acuity, history of trauma, periorbital/lid hematoma, chemosis, proptosis, raised intraocular pressure, and ophthalmoplegia. There is a narrow therapeutic interval of 90 minutes before permanent damage to vision may occur. Immediate exploration of the orbital floor is contraindicated when a significant retrobulbar hematoma resulting in increased intraorbital pressure is present. A delayed repair of the orbital fracture, generally within one week of the trauma, is performed if necessary.

Medical treatment of raised intraorbital pressure with mannitol or dexamethasone should be regarded as an adjunct to surgery. The first line of treatment is surgical, and lateral canthotomy at the bedside is the most effective immediate treatment for increased intraorbital pressure.

Anticoagulation is contraindicated because of suspected bleeding.

References

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2. Jones N. Orbit and eye injuries. In: Jones N, ed. *Craniofacial Trauma.* New York: Oxford University Press; 1997:119-161.

116. A 26-year-old woman is being evaluated because she has had complete left-sided, flaccid facial paralysis since she awoke 3 hours ago. She also has a metallic taste in her mouth and hypersensitivity to sound. Denervation of which of the following muscles is the most likely cause of the hypersensitivity to sound?

- A) Levator palatini
- B) Stapedius
- C) Tensor tympani
- D) Tensor veli palatini
- E) Zygomaticus major

The correct response is Option B.

The 26-year-old woman described has the typical history of Bell palsy. In patients with Bell palsy, the entire nerve is inflamed, but the maximum conduction block is either in the meatal or labyrinthine segments. Because the conduction block is proximal to the chorda tympani and stapedial nerve, patients also experience a change in taste and a decreased ability to accommodate (ie, dampen) loud noises.

When an acoustic tumor causes facial paralysis, the paralysis is usually slowly progressive. Patients generally present with a hearing loss, not a hypersensitivity to noise.

The tensor tympani muscle attaches to the malleus and is innervated by the trigeminal nerve, not the facial nerve. The tensor veli palatini muscle is also innervated by the trigeminal nerve and is responsible for active dilatation of the eustachian tube. Blockage of the eustachian tube would cause a hearing loss.

The zygomaticus major muscle is innervated by the facial nerve. Denervation causes a decreased ability to smile, not hearing loss. The levator palatini muscle is innervated by the vagus nerve.

References

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2. Adour KK, Hilsinger RL, Callan EJ. Facial paralysis and Bell’s palsy: a protocol for differential diagnosis. *Am J Otol*. 1985;(Suppl):68-73.

117. A 30-year-old man comes to the office for consultation regarding the facial abnormality shown. He reports that he first noticed a change 15 years ago and that the deformity has worsened since then. Medical history includes atrophy of the soft tissue and bone of the face. The facial atrophy in this syndrome progresses according to the specific distribution of which of the following nerves?

- A) Facial (VII)
- B) Glossopharyngeal (IX)
- C) Hypoglossal (XII)
- D) Trigeminal (V)
- E) Vagus (X)



(Please note that this pictorial appears in color in the online examination)

The correct response is Option D.

Parry-Romberg syndrome is a progressive hemifacial atrophy that follows a specific distribution of one or more branches of the trigeminal nerve (cranial nerve V). It involves the skin, soft tissue, cartilage, and bone and was first described in 1825 by Parry and then in 1846 by Romberg. The epidemiology shows a female-to-male ratio of 1.5:1. It can appear in early infancy or adolescence. The etiology is unclear, and theories include a genetic alteration in the embryogenesis of the central nervous system, loss of the cervical sympathetic nerve after neuritis, and viral or bacterial infection.

References

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2. Dawczynski J, Thorwarth M, Koenigsdoerffer E, et al. Interdisciplinary treatment and ophthalmological findings in Parry Romberg syndrome. *J Craniofac Surg.* 2006;17:1175-1176.

118. A 28-year-old man comes to the office because of fever and increasing pain 1 week after partial amputation of the right ear when he was bitten during a fight. The wound was irrigated and repaired in the emergency department. Temperature is 100.4°F (38.0°C). Examination shows erythema and swelling of the entire ear and a small area of dehiscence containing pus along the posterior suture line. Which of the following is the most important step in management?

- A) Application of wet-to-dry dressings
- B) Completion of the amputation with sparing of cartilage in a remote subdermal pocket
- C) Intravenous antibiotic therapy
- D) Irrigation, debridement, and packing the wound open
- E) Oral antibiotic therapy

The correct response is Option D.

Auricular chondritis and perichondritis is a serious surgical infection requiring immediate surgical intervention as the primary course of treatment in traumatic cases. Culture swabs should also be obtained and will guide antibiotic therapy for associated cellulitis; however, broad spectrum coverage initially is appropriate. Chondritis complicating elective otoplasty is sometimes handled in a more stepwise approach, sometimes initiating intravenous antibiotics while removing a few sutures to allow drainage and/or insertion of a small irrigating catheter. Without a reasonable response in these cases, then standard open irrigation and debridement are done with removal of all sutures, and repeat otoplasty correction is deferred until several months after resolution of the infection.

Antibiotics alone, orally or intravenously, for localized suppurative chondritis are likely to be ineffective without surgical treatment. Likewise, topical dressings without formal opening of the suture line for wide exposure and drainage of the infected cartilage would also be ineffective.

Completing the amputation when the tissues still appear viable is overaggressive at this stage. If and when the majority of the tissue appears unable to sustain sufficient circulation to support its viability, then discarding precious tissue is justified. Salvaging the cartilage framework component in a remote subdermal pocket may be useful; however, the cartilage is infected in this scenario and would require caution, including thorough debridement and lavage with antibiotic solution and close monitoring of the bank.

References

1. Stelnicki EJ. Infections of the face. In: Greer SE, Benhaim P, Lorenz HP, et al, eds. *Handbook of Plastic Surgery*. New York: Marcel Dekker; 2004:141-143.
2. Stal S, Klebuc M, Spira M. Otoplasty. In: Goldwyn RM, Cohen MN, eds. *The Unfavorable Result in Plastic Surgery, Avoidance and Treatment*. Philadelphia: Lippincott Williams & Wilkins; 2001:437-450.

119. A 68-year-old woman undergoes partial glossectomy, resection of the anterior floor of the mouth, and bilateral modified radical neck dissection to treat squamous cell carcinoma in the ventral tongue and anterior floor of the mouth. The resulting defect is reconstructed with a 5 × 6-cm radial forearm free flap. The free flap is anastomosed to the left facial artery and left internal jugular vein. The forearm donor site is reconstructed with a split-thickness skin graft from the thigh. In addition to Current Procedural Terminology (CPT) code 15758 (free fascial flap with microvascular anastomosis), which of the following is most appropriate?

- A) 13152: Complex repair mouth 2.6–7.5 cm
- B) 15100: Split thickness skin graft, arm; less than 100 cm²
- C) 35761: Exploration of vessels without repair
- D) 40840: Anterior vestibuloplasty
- E) 69990: Use of operating microscope

The correct response is Option B.

Free flap procedure codes are global and include:

1. Elevation of the flap
2. Isolation of donor flap vessels used for microvascular anastomosis
3. Transfer of the flap to the recipient site
4. Isolation of the recipient vessels used for microvascular anastomosis
5. Microvascular anastomosis of one artery
6. Microvascular anastomosis of one or two veins
7. Inset of the flap in the recipient site
8. Primary closure of the donor site

If a free flap procedure involves more than one of the above global components, it is appropriate to report these as added elements, as they are considered over and above the usual free flap procedure. These can include:

1. Vein grafts
2. Neurorrhaphy
3. Nerve grafts
4. Skin grafts – donor site or recipient site
5. Closure of the donor site that is more extensive than primary closure

6. Wound preparation of the recipient site

Additionally, CPT 69990, use of the operating microscope, is also included with the free flap codes. It should not be coded separately.

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120. A 4-year-old girl is brought to the office for evaluation of hemifacial microsomia. Physical examination shows maxillary hypoplasia, orbital dystopia, and complete absence of the mandibular condyle. The presence of which of the following additional findings is most suggestive of Goldenhar syndrome?

- A) Epibulbar dermoids
- B) Facial nerve VII impairment
- C) Midfacial port-wine stain
- D) Multiple pits of the lower lip
- E) Upper eyelid colobomas

The correct response is Option A.

The presence of epibulbar dermoids is a key clinical finding that distinguishes Goldenhar syndrome from hemifacial microsomia. Although Goldenhar syndrome is also frequently associated with defects of cranial nerve VII, this finding is also commonly described in other craniofacial anomalies, including hemifacial microsomia.

A port-wine stain present within the V1 or V2 distribution is suggestive of potential Sturge-Weber syndrome.

Van der Woude syndrome is commonly associated with lower lip pits as well as cleft lip/palate.

Upper lid colobomas are often described in relation to hemifacial microsomia, of which Goldenhar syndrome is a variant.

References

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121. A 77-year-old man comes to the office because of a 5-month history of a bruise-like patch of skin on the forehead that has enlarged gradually in a centrifugal pattern. Examination shows a 3 × 4-cm irregular ovoid lesion confined to the superior forehead and anterior scalp with small nodular areas of ulceration. A specimen obtained on biopsy shows angiosarcoma. Which of the following is the most appropriate initial management?

- A) Chemotherapy
- B) Cryotherapy
- C) External beam radiation therapy
- D) Intralesional injection of interferon-alfa
- E) Wide excision

The correct response is Option E.

The lesion described is a classic angiosarcoma. The most common form of this disease is cutaneous angiosarcoma without lymphedema in elderly patients. The highest incidence occurs in patients over 70 years of age, with a 2:1 male-to-female predilection. At least half of these tumors involve the head and neck. Lesions typically present as deceptively benign-appearing bruise-like patches on the central face, forehead, or scalp. Facial swelling and edema may be present. More advanced lesions are violaceous and contain elevated nodules that bleed easily. Ulceration may be present. The lesion gradually spreads and eventually covers large portions of the head and neck. Prognosis is invariably poor with a less-than-15% survival rate over a 5-year period.

Surgical excision with wide margins and immediate reconstruction is the most appropriate initial management. In spite of aggressive initial surgical management, the goal of histologically negative margins is extremely difficult to achieve in this disease process. Given the poor results obtained with surgery alone, radiation therapy has been offered as the best possible adjuvant therapy. However, there is no proof that radiation therapy provides benefit. Adjuvant chemotherapy offers no statistically significant benefit for survival, although one agent that appears to have some activity against this disease is paclitaxel. Immunomodulators, such as interferon or interleukin, may be successful alternatives to chemotherapy, but data are lacking. There is no role for cryotherapy in the management of angiosarcoma.

References

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2. Ward JR, Feigenberg SJ, Mendenhall NP, et al. Radiation therapy for angiosarcoma. *Head Neck*. 2003 Oct;25(10):873-878.

122. A 4-year-old girl is undergoing mandibular reconstruction involving the temporomandibular joint. Use of which of the following types of bone graft is most likely to result in overgrowth on the reconstructed side?

- A) Calvaria
- B) Fibula
- C) Iliac crest
- D) Radius
- E) Rib

The correct response is Option E.

A variety of bone sources may be used in reconstructing the deficient mandible in pediatric patients. The majority of reconstructions are done for congenital anomalies involving the mandible, such as hemifacial microsomia and Treacher Collins syndrome. However, bone grafting may also be needed following tumor resection and traumatic loss.

Cortical bone may be harvested from the iliac crest, calvaria, rib, radius, and fibula. Typically, when rib bone is used to reconstruct the mandible, including the temporomandibular joint, a cartilaginous cap is left on the end of the rib when it is harvested. This allows for growth of the rib as the child grows, but it can also result in overgrowth. This overgrowth can result in further asymmetry and malocclusions.

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123. A 14-year-old boy is referred by his pediatrician for evaluation because of a 2-year progressive enlargement of the right side of the face. History includes capillary malformation since birth and seizures. Physical examination shows enlargement of the soft tissues and the maxilla on the right and macular capillary staining of the forehead, eyelid, and cheek. Which of the following syndromes is the most likely diagnosis?

- A) Cobb
- B) Fibrous dysplasia
- C) Klippel-Trénaunay
- D) Nevus flammeus neonatorum
- E) Sturge-Weber

The correct response is Option E.

Sturge-Weber syndrome is characterized by capillary malformations in the distribution of the ophthalmic or the maxillary division of the trigeminal nerve. It may be unilateral or bilateral. Often there is also gradual enlargement and hypertrophy of the cheek, lip, and maxilla, and occasionally there is gradual enlargement and hypertrophy of the mandible. MRI may show additional vascular anomalies of the leptomeninges and choroid plexus.

Cobb syndrome consists of a capillary malformation in the midline scalp region overlying an encephalocele or in the skin posterior to an area of dysraphism in the cervical or lumbosacral spine.

Fibrous dysplasia is an overgrowth syndrome of bones that is caused by abnormal proliferation of bone-forming mesenchyme. It does not involve soft-tissue hypertrophy nor is it associated with vascular malformations. Albright syndrome is a specific variety of polyostotic fibrous dysplasia and includes endocrine abnormalities and café-au-lait spots.

Klippel-Trénaunay syndrome is a capillary-lymphatic-venous malformation typically involving hypertrophy of the extremities and sometimes the thorax of one side of the body. It does not involve the head and neck. The skin surface shows deep red staining with hemolymphatic vesicles. A pathognomonic feature of this condition is the presence of the embryonal lateral vein of Servelle in the lower extremity.

Parkes-Weber syndrome is similar to Klippel-Trénaunay but is confined to an upper or lower extremity. Overgrowth of the extremity is characteristic along with microscopic arteriovenous

fistulas, and unlike Klippel-Trénaunay, lymphatic anomalies are rare. It does not involve the head or neck.

Nevus flammeus neonatorum is an entity that behaves more like a hemangioma and not a vascular malformation in that it is usually gone or faded by 1 year of age. It is typically located on the upper face and posterior neck but is not associated with soft-tissue or bony hypertrophy.

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124. A 52-year-old man is evaluated for reconstruction of a nasal defect resulting from right nasal resection for a neglected squamous cell cancer. Physical examination shows a full-thickness defect involving the right lateral nasal wall. The nasal ala and tip subunits are intact. What is the blood supply of the most appropriate lining flap?

- A) Anterior ethmoid artery
- B) Facial artery
- C) Inferior labial artery
- D) Radial artery
- E) Supratrochlear artery

The correct response is Option A.

Successful reconstruction of full-thickness defects of the nose requires reconstruction of the skin, lining, and support system of the nose. A number of options are available for the lining of nasal defects. Intranasal lining flaps are commonly used because they allow simultaneous placement of cartilage grafts. In addition, cartilage grafts may be harvested from the nasal septum. In the scenario described, the entire lateral nasal wall has been resected, leaving the nasal ala and tip subunits intact. A contralateral mucoperichondrial flap can be harvested based on the anterior ethmoid artery and used for lining of the nasal reconstruction. The septal cartilage is also harvested and removed to provide support. Therefore, the most appropriate answer is the anterior ethmoid artery. The supratrochlear artery together with branches from the supraorbital vessels is the blood supply of the forehead flap and would be used in this case for external skin coverage. The facial artery is the blood supply to the medial cheek and the nasolabial flap. Although the nasolabial flap can be used for lining, it is usually reserved for smaller defects, particularly those involving the nasal ala. The radial artery is the blood supply for the radial forearm flap. Although this flap is occasionally used to provide intranasal lining, it is usually reserved for total or subtotal nasal reconstruction. The inferior labial artery is the blood supply of the lips and is not useful for nasal reconstruction. The septum composite flap can be used for subtotal nasal reconstruction and transfers the residual septum based on the superior labial artery.

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125. Which of the following tooth root apexes is at greatest risk for damage during a Le Fort I osteotomy for maxillary advancement?

- A) Bicuspid
- B) Canine
- C) Central incisor
- D) First molar
- E) Lateral incisor

The correct response is Option B.

The canine tooth root is the longest root extending onto the maxillary wall near the piriform rim. The length of the canine tooth from the incisal edge to the root apex is approximately 30 mm. The root is at risk during both osteotomy and plating and serves as an important landmark in operative planning. The roots of central and lateral incisors and bicuspid and molars are at less risk because they have shorter roots. Crowns of the central and lateral incisors are at greater risk during disimpaction of the Le Fort I segment if the maxillary disimpaction forceps are not placed properly. With careful osteotomy planning, disimpaction and plating dental injury are infrequent occurrences.

References

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126. An otherwise healthy 50-year-old man is evaluated prior to excision of squamous cell carcinoma of the anterior aspect of the floor of the mouth. CT scan shows invasion into the lingual mandibular cortex. Lymph nodes are suspicious for metastases bilaterally. No distant metastases are noted. In addition to bilateral neck dissection, which of the following is the most appropriate treatment?

- A) Marginal mandibulectomy, reconstruction with radial forearm fasciocutaneous free flap, and postoperative radiation therapy
- B) Marginal mandibulectomy, reconstruction with split-thickness skin graft, and postoperative radiation therapy
- C) Segmental mandibulectomy, reconstruction with fibula osteocutaneous free flap, and postoperative radiation therapy
- D) Segmental mandibulectomy, reconstruction with radial forearm fasciocutaneous free flap and titanium plate, and postoperative radiation therapy

The correct response is Option C.

The patient described has an advanced (stage IV) cancer of the floor of the mouth. The most appropriate treatment for the primary cancer is segmental mandibulectomy, reconstruction with a fibula osteocutaneous free flap, and postoperative radiation therapy. A marginal mandibulectomy is defined as excision of the alveolar process, sparing a portion of the mandible. It is performed when the cancer abuts or is adherent to the mandibular periosteum but does not invade the bone. Reconstruction after marginal mandibulectomy is performed by primary closure, secondary intention, skin grafting, or free flap, depending on the size and nature of the defect. For segmental mandibular defects of the anterior mandible, reconstruction with vascularized osseous or osteocutaneous flaps, such as the fibula osteocutaneous free flap, is preferred, particularly when postoperative radiation therapy is planned. Reconstruction of the anterior mandible using a titanium reconstruction plate and soft-tissue free flap or pedicled flap is associated with a high rate of complications. Postoperative radiation therapy results in good local control in patients with floor-of-mouth cancers, but it is associated with poor survival rates in advanced-stage cancers when used as a single treatment modality.

References

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127. An 8-year-old girl (shown) is brought to the office because of bilateral microtia. She has severe conductive hearing loss bilaterally. Her middle ear ossicles are fused, and she is not a good candidate for middle ear reconstruction.

Reconstruction of the ears using autologous rib cartilage and placement of bone-anchored hearing aids (BAHAs) are planned. Which of the following is the most appropriate time for placement of the BAHAs?

- A) During elevation of the carved-rib framework
- B) During placement of the carved-rib framework
- C) During rotation of the earlobe
- D) Following completion of the ear reconstruction
- E) Prior to the ear reconstruction



(Please note that this pictorial appears in color in the online examination)

The correct response is Option D.

Patients with severe microtia almost invariably have conductive hearing loss resulting from abnormalities of the middle ear. In some patients, the auditory ossicles are sufficiently formed to allow attempted reconstruction of the auditory canal and the middle ear ossicles. Eligibility for this procedure depends upon the development and shape of the auditory ossicles (Jahrsdoerfer grade), as determined by a specialized CT scan of the temporal region. In patients with unilateral microtia and normal contralateral hearing, assistive devices or middle ear reconstruction are

rarely indicated and would serve only to improve sound localization. In these patients, protection of hearing in the normal ear is paramount. When bilateral conductive hearing loss is present, methods to improve hearing competence include external hearing aids, bone-anchored hearing aids (BAHAs), and middle ear reconstruction in selected patients. The BAHA is affixed in the mastoid region using an osseointegrated implant. Since this can compromise the integrity and mobility of the skin envelope that will cover the autologous rib cartilage framework, it is often recommended that placement of the BAHA device be deferred until after the ear construction is complete.

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128. An 8-year-old boy is brought to the office because he has been unable to smile, close his mouth, or completely close his eyes since birth. Physical examination shows facial immobility, strabismus, and syndactyly of the ring and little fingers. Which of the following is the most likely diagnosis?

- A) Klippel-Trénaunay syndrome
- B) Möbius syndrome
- C) Pierre Robin sequence
- D) Poland syndrome
- E) Treacher Collins syndrome

The correct response is Option B.

Although von Graefe described a case of congenital facial diplegia in 1880, the syndrome was reviewed and defined further by Paul Julius Möbius, a German neurologist, in 1888 and 1892. Because of these contributions, Möbius is now the eponym used to describe the syndrome. In most studies, Möbius syndrome is defined as congenital facial weakness combined with abnormal ocular abduction – weakness of cranial nerves VII and VI. The typical phenotypic appearance of an affected individual includes an immobile facial appearance and ocular palsy. A mask-like facial appearance is pathoneumonic. Additional musculoskeletal abnormalities occur in one third of patients with Möbius syndrome.

The typical physical features of Treacher Collins syndrome include downward slanting eyes, lower eyelid colobomas, micrognathia, conductive hearing loss, underdeveloped zygoma, and malformed or absent ears. This is also considered the combination of Tessier No. 6, 7, and 8 clefts.

Poland syndrome is characterized by underdevelopment or absence of the pectoralis muscle on one side. Syndactyly often occurs on the ipsilateral hand. There are no associated facial anomalies.

Pierre Robin is not a syndrome but rather a sequence or a collection of physical findings that appear together. Phenotype includes micrognathia, glossoptosis, and cleft palate. Breathing and eating difficulty often results.

Klippel-Trénaunay syndrome is characterized by a triad of port-wine stain, varicose veins, and bony and soft-tissue hypertrophy involving an extremity.

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129. A 58-year-old man comes to the office for consultation regarding treatment 3 weeks after receiving a diagnosis of squamous cell cancer of the soft palate. He says he has had pain in the left ear for the past 2 months. Examination of the ear shows no abnormalities. The most likely cause of the pain is involvement of which of the following nerves?

- A) Auricular branch of the vagus (X)
- B) Auriculotemporal
- C) Great auricular
- D) Superficial temporal
- E) Vestibulocochlear (VIII)

The correct response is Option A.

The auricular branch of the vagus nerve (Arnold nerve) carries sensory input from the ipsilateral concha and oropharynx. Chronic external ear pain may alert the astute physician of more serious intraoral pathology. The auriculotemporal nerve carries sensory information from the anterior and superior external auditory canal, and the great auricular nerve relays sensation from the lower half of the ear. The lesser occipital nerve provides sensory input from the superior cranial surface of the ear. Although the superficial temporal nerve is not an anatomically recognized structure, the superficial temporal artery supplies vascular inflow to the anterior external ear.

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130. An 18-year-old man is evaluated because of the facial mass shown. The mass was present at birth as a faint red patch of skin. Throughout his life, the mass has continued to enlarge, change color, and has become increasingly painful. Examination of a specimen obtained on biopsy 2 years ago ruled out malignancy. Gadolinium-enhanced MRI shows high vascular flow in and around the lesion. Which of the following is the most likely diagnosis?

- A) Arteriovenous malformation
- B) Infantile hemangioma
- C) Lymphatic malformation
- D) Sturge-Weber syndrome
- E) Venous malformation



(Please note that this pictorial appears in color in the online examination)

The correct response is Option A.

The clinical history and MRI findings strongly suggest that the condition described is an arteriovenous malformation. When there is cutaneous involvement, these anomalies can be observed at birth as a faint area of pink discoloration. Over time, there is a tendency for gradual expansion of the malformation to involve adjacent tissues and to become warm and painful. They are considered “high flow” lesions, implying a significant arterial component to the mass.

Most vascular anomalies can be diagnosed clinically. Gadolinium-enhanced MRI can be useful to determine the extent and nature of the vascular components in the lesion. In spite of significant advances in the understanding and classification of vascular anomalies, many malformations are still mislabeled as hemangioma. This type of malapropism is not

inconsequential, as the natural history and recommended interventions for these distinct lesions are very different. Infantile hemangioma is a vascular tumor that typically appears shortly after birth, grows aggressively over the first year of life (proliferation), and subsequently regresses (involution). Intervention is rarely indicated, except when there is functional impairment or to facilitate aesthetic improvement after involution. In contrast, vascular malformations are present at birth, tend to enlarge gradually over time, and do not regress. Treatment of these lesions depends on the type of malformation and includes sclerotherapy with or without resection for lymphatic and venous malformations, as well as selective embolization with or without resection in arteriovenous malformation.

Infantile hemangioma is incorrect for the reasons described above. Lymphatic and venous malformations are present at birth and enlarge with growth, but they do not have significant arterial components, and they appear as “low flow” lesions on gadolinium-enhanced MRI. Sturge-Weber syndrome is the associated findings of capillary malformation in the V₁ distribution of the trigeminal nerve, leptomeningeal vascular malformations, glaucoma, and seizure disorder.

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131. A 45-year-old woman comes to the office because she has had a 4-week history of a rapidly enlarging left parotid mass. On physical examination, the patient has ptosis of the left eyebrow and is unable to fully close the left eye or depress the left lower lip. The most likely cause of these findings is tumor involvement at which of the following foramina at the base of the skull?

- A) Jugular
- B) Lacerum
- C) Ovale
- D) Rotundum
- E) Stylomastoid

The correct response is Option E.

A history of a progressive facial paralysis associated with a parotid mass suggests the diagnosis of a malignant parotid tumor. The temporal, zygomatic/buccal, and ramus mandibularis branches are affected, indicating that the main trunk of the facial nerve is invaded by tumor. The facial nerve exits the skull base from the stylomastoid foramen. The foramen lacerum, foramen ovale, and the foramen rotundum contain the internal carotid artery, mandibular (V_3) nerve, and maxillary (V_2) nerve, respectively. The glossopharyngeal (IX), vagus (X), and spinal accessory (XI) nerves emerge from the jugular foramen.

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132. A 2-day-old male newborn is evaluated in the neonatal intensive care unit because of a "jaw deformity" and difficulty breathing. The patient was born at term following an uncomplicated pregnancy and delivery. He responds appropriately to stimulation. Examination shows micrognathia, glossoptosis, and a cleft palate. The infant demonstrates retractions while breathing. Pulse oximetry shows an oxygen saturation of 92%. Which of the following is the most appropriate initial management?

- A) CT scan of the head with three-dimensional reconstruction
- B) Endoscopic evaluation of the airway
- C) Prone positioning of the newborn
- D) Tongue-lip adhesion
- E) Tracheostomy

The correct response is Option C.

The patient described has Pierre Robin sequence. These patients have micrognathia and glossoptosis; sometimes they will have a cleft palate in addition to the other findings. Most patients do not require operative intervention to correct their mandibular hypoplasia. The most important first step is airway control. These patients have airway obstruction secondary to the large size of their tongue relative to their diminutive mandible. Placing them in prone position allows for the tongue and jaw to fall forward, frequently alleviating their airway problems. Should this be insufficient, tongue-lip adhesion is a possibility. Many surgeons would consider a more thorough evaluation of the airway endoscopically and by CT scan to decide on subsequent management. Should the airway obstruction be tongue-based as expected, bilateral mandibular distraction could be considered. If lower airway anomalies are also present, then tracheostomy is more appropriate.

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133. A 30-year-old woman comes to the office because of a 1-year history of a clicking sensation when she opens her mouth. She was involved in a motor vehicle collision in which her face struck the steering wheel 1 year ago. Physical examination shows midline dental structures without deviation. Which of the following is the most likely cause of this patient's condition?

- A) Disruption of the lateral pterygoid muscle
- B) Foreign body within the joint space
- C) Malunion of a coronoid fracture
- D) Nonunion of a condylar fracture
- E) Subluxation of the articular disk

The correct response is Option E.

Motion at the temporomandibular joint (TMJ) is best appreciated by placing one's fingers either inside the external auditory canal or just anterior to it. The sensation of clicking when the jaw is repeatedly opened and closed is usually caused by subluxation of the articular disk. The disk normally lies centrally between the two joint spaces. Conservative treatment involves adjustment of the patient's bite with a splint, anti-inflammatory drugs, and physical therapy. Surgical treatment is reserved for patients who fail conservative therapy. Air within the joint space may occur following open fractures of the mandibular condyle. The presence of a foreign body within the joint space produces pain and decreased range of motion rather than clicking. Similar symptoms are also noted in patients with degenerative disease affecting the TMJ.

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134. A 5-year-old boy is brought to the office because of a 10-day history of inflammation of a midline neck mass that his parents first noticed 1 year ago. Physical examination shows a 35-mm mass just inferior to the hyoid bone. Which of the following is the most likely diagnosis?

- A) Branchial cleft remnant
- B) Lingual thyroid gland
- C) Mucoepidermoid carcinoma
- D) Reactive lymph node
- E) Thyroglossal duct cyst

The correct response is Option E.

The patient described has a thyroglossal duct cyst. Thyroglossal duct cysts can form anywhere along the thyroglossal duct, which extends from the foramen cecum of the tongue to the final position of the thyroid gland in the neck, below the laryngeal cartilage. Normally, the thyroglossal duct atrophies and disappears. However, a remnant of it may persist and form a cyst in the tongue or anterior midline of the neck, most commonly inferior to the hyoid bone. Thyroglossal duct cysts are often asymptomatic unless they become infected, as this one has.

Reactive lymph nodes are the most common neck mass in children. They are usually found laterally in the submandibular and jugulodigastric areas. Branchial cleft remnants (sinuses and cysts) arise from the branchial apparatus. They are also located laterally, along the anterior border of the sternocleidomastoid muscle, usually just inferior to the angle of the mandible. Lingual thyroid glands are a type of ectopic thyroid located within the tongue. Ectopic thyroid glands can be located along the course of the thyroglossal duct and are a result of failure of the thyroid to descend. Unlike thyroglossal duct cysts, they represent the only thyroid tissue present in the patient. Mucoepidermoid carcinomas are salivary gland malignancies found in children, and they most commonly appear within the parotid gland.

References

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135. A 2-month-old female infant is brought to the office because her parents are concerned about the flat appearance of her forehead that they first noticed 2 weeks ago. Physical examination shows flattening of the right side of the forehead and left side of the occiput, and the left ear is positioned farther forward than the right. A photograph is shown. Which of the following is the most appropriate initial management?



(Please note that this pictorial appears in color in the online examination)

- A) Calvarial vault remodeling
- B) CT scan
- C) MRI
- D) Placement of a molding helmet
- E) Repositioning exercises

The correct response is Option E.

The physical findings described are consistent with deformational (positional) plagiocephaly. In contradistinction to craniosynostosis, deformational plagiocephaly will demonstrate deviation of the nasal root away from the side of the forehead with flattening, and the supraorbital rim will be depressed or lowered. Physical findings are sufficient in the scenario described to diagnose the child without CT scan. Occupational and physical therapy should be instituted to encourage behaviors such as head-turning to the right and tipping the top of the head to the left shoulder. In cases that are either severe or are diagnosed late, molding helmets may be advisable.

References

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136. A 19-year-old man comes to the office because he has a deformity of the bridge of the nose and numbness of the nasal tip 2 weeks after being struck in the nose with a baseball. X-ray studies show a fracture of the nasal bones. The most likely cause of the loss of sensation is injury to which of the following nerves?

- A) Anterior ethmoidal
- B) Infraorbital
- C) Infratrochlear
- D) Nasopalatine
- E) Superior alveolar

The correct response is Option A.

The external branch of the anterior ethmoidal nerve emerges between the nasal bone and the upper lateral nasal cartilage to supply sensation to the skin, the dorsum of the lower nose, and tip. The innervation of the nose is supplied by the trigeminal nerve. Cranial nerve V₁ (ophthalmic division) supplies the infratrochlear nerve, which provides sensation to the skin of the bridge, the upper lateral nasal area, and the anterior ethmoidal nerve. Cranial nerve V₂ (maxillary nerve) distributes the infraorbital nerve, which supplies sensation to the skin on the lower lateral half of the nose, and the nasopalatine nerve, which innervates the nasal septum and anterior hard palate. The superior alveolar nerve is also a branch of V₂ but does not provide sensation to the nose.

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137. Which of the following muscles is used to construct the sphincter during a sphincter pharyngoplasty for the treatment of velopharyngeal insufficiency?

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

The correct response is Option C.

Routinely, postoperative velopharyngeal insufficiency is treated with either a posterior pharyngeal flap or a sphincter pharyngoplasty. A sphincter pharyngoplasty is performed by taking the posterior tonsillar pillar, containing the palatopharyngeus muscle, and elevating it inferiorly to superiorly. The elevated posterior tonsillar pillar, pedicled superiorly, is rotated 90 degrees medially, positioned side by side, and sewn into an incision made horizontally on the posterior pharyngeal wall at the level of the adenoid pad.

The levator veli palatini muscle, in the normal palate, rests horizontally (coronally) within the middle third of the velum (soft palate) and functions as the motor of the velum. This muscle pulls the soft palate posteriorly and superiorly, allowing for apposition of the free edge of the velum against the posterior pharyngeal wall (velopharyngeal competence).

The muscoli uvulae arise as paired slips from the palatine aponeurosis and course sagittally in the velar midline, ending in the uvula. The muscoli uvulae act as a flexible beam, providing a stiffness-modifying mechanism for the velum.

The superior pharyngeal constrictor arises from the hamulus and course sagittally along the lateral pharyngeal walls to decussate in the midline of the posterior pharyngeal wall. The superior pharyngeal constrictor is the muscle from the posterior pharyngeal wall that is utilized in the posterior pharyngeal flap.

The tensor veli palatini muscle arises from the skull base and courses inferiorly and medially around the hook of the hamulus and into the palate as the tensor aponeurosis. It joins the velum (soft palate) to the hard palate.

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138. A 9-month-old boy is brought to the office because of a midline glabellar mass. The parents report that it has enlarged gradually since they first noticed it 6 months ago; it does not change in size when the patient cries. Physical examination shows a nonmobile, firm, and nontender mass. The nasal root is not broadened, and intercanthal distance is within normal limits. Which of the following is the most likely diagnosis?

- A) Dermoid cyst
- B) Encephalocele
- C) Glioma
- D) Hemangioma
- E) Pilomatricoma

The correct response is Option A.

The most likely diagnosis in the scenario described is a dermoid cyst. Nasal dermoids are the most common congenital nasal mass. Dermoid cysts most often occur in children in the lateral brow or midline glabellar region. They generally grow slowly, and intracranial communication should be ruled out with either a CT scan or MRI. Intracranial communication is less likely in this scenario because there is no broadening of the nasal root or increased intercanthal distance.

An encephalocele is a midline malformation that is present at birth and addressed shortly thereafter. On physical examination, it would be soft and mobile. CT scan or MRI would confirm this diagnosis. A hemangioma or encephalocele may change size with crying.

A glioma is heterotopic neural tissue left during the regression of neurologic tissue during embryonic development. Like an encephalocele, broadening of the nasal root and widened intercanthal distance are common.

A hemangioma typically presents with sporadic growth during the first 12 months of life, then it reaches a plateau and eventually regresses in most cases. On physical examination, this would be neither fixed nor firm and is typically discolored.

A pilomatricoma is a rare, benign, circumscribed epithelial neoplasm that is derived from hair matrix cells. It is classically not fixed and very superficial.

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139. A 73-year-old man undergoes mandible reconstruction for squamous cell cancer. A microvascular thrombosis is most likely to occur within what period of time after the completion of the microvascular anastomosis?

- A) 0 to 24 Hours
- B) 25 to 36 Hours
- C) 37 to 48 Hours
- D) 49 to 72 Hours
- E) 73 to 96 Hours

The correct response is Option A.

During head and neck reconstruction, a microvascular thrombosis is most likely to occur within 12 hours of completion of the anastomosis. The thrombosis often occurs intraoperatively or upon arrival in the postanesthesia care unit. Nearly 90% of all thromboses occur within 24 hours. Most commonly, thromboses occur as a result of technical issues. Microvascular thrombosis can occur in a delayed manner, even 7 to 14 days postoperatively; however, the rate of these events is much lower than during the initial 24 hours.

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140. An 18-year-old man is evaluated because of an overbite. Cephalometric analysis shows an SNA angle of 83 degrees ($N 82 \pm 3$) and an SNB angle of 74 degrees ($N 80 \pm 3$). Which of the following is the most likely underlying cause of this condition?

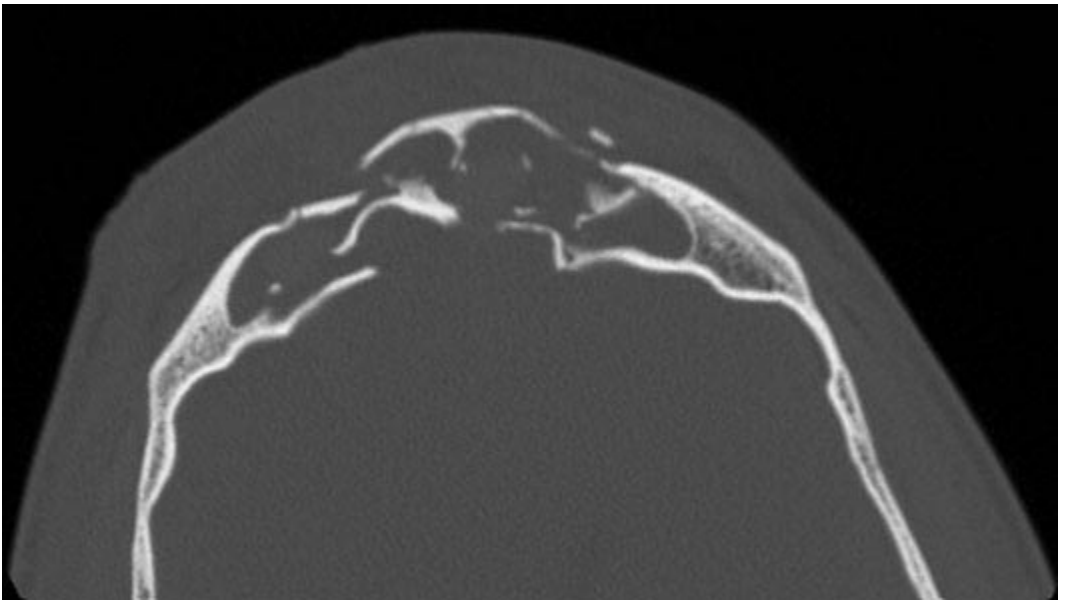
- A) Prognathic maxilla
- B) Retrognathic maxilla
- C) Prognathic mandible
- D) Retrognathic mandible

The correct response is Option D.

An “overbite” (Angle class II malocclusion) may be caused by several different etiologies: a prognathic maxilla, a retrognathic mandible, or both; even a prognathic mandible with a more severely prognathic maxilla, or a retrognathic maxilla with a more severely retrognathic mandible, is possible. The patient described is exhibiting isolated mandibular deficiency, or retrognathia, which is characterized by a decreased sella-nasion-point B (SNB) angle combined with a normal sella-nasion-point A (SNA) angle. The SNA and SNB angles determine the position of the maxilla and mandible relative to the cranial base. The SNA angle measures the position of point A (subspinale) relative to the anterior cranial base with the normal value being 82 degrees plus or minus 3 degrees. The SNA angle is increased in maxillary prognathism and decreased in maxillary retrognathism. The SNB angle measures the position of point B (supramentale) relative to the anterior cranial base with the normal value being 80 degrees plus or minus 3 degrees. The SNB angle is increased in mandibular prognathism and decreased in maxillary retrognathism.

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141. A 33-year-old man is brought to the emergency department after sustaining injuries to the face during a snowmobile collision. Axial CT scan is shown. Which of the following is the most appropriate management?
- A) Ablation of the frontal sinus
 - B) Cranialization and reconstruction of the anterior frontal sinus wall
 - C) Obliteration of the frontal sinus
 - D) Observation with x-ray studies monthly
 - E) Reconstruction of the nasofrontal duct and anterior and posterior frontal sinus walls

The correct response is Option B.

A comminuted fracture of the frontal sinus is shown in the CT scan, with significant displacement of fragments involving both the anterior and posterior frontal sinus walls and the region of the nasofrontal duct. The most appropriate treatment is cranialization and reconstruction of the anterior wall to restore normal forehead contour and protect the brain. Cranialization involves removing the posterior frontal sinus wall to make the sinus part of the intracranial space and blocking the nasofrontal duct, typically with bone or a pericranial flap so that sinus mucosa is excluded from the intracranial space. The anterior frontal sinus wall is also reconstructed as part of this procedure to restore normal forehead contour and to protect the brain.

Ablation (or exenteration) involves removing the anterior frontal sinus wall and allowing the skin to collapse in on the posterior wall, if it is intact, or on the dura if the posterior wall requires removal as well (as it would in this scenario). While this may lead to a stable, healed wound in the patient described, it is not the most appropriate management as it would leave the patient with a significant deformity that would be difficult to reconstruct. It would also leave the underlying brain unprotected by bone. Ablation is appropriate only in extreme cases of acute infection that require open drainage and removal of infected bone.

Obliteration of the frontal sinus involves removing the sinus mucosa and burring the bony walls to remove mucosal invaginations, plugging the nasofrontal duct, and filling the sinus cavity with fat, muscle, bone, or alloplasts. A variation of this is osteoneogenesis, where the cavity is not filled but allowed to fill spontaneously with bone or scar over time. This would not be feasible in the patient described because of the extreme comminution and displacement of the posterior wall fracture fragments.

Observation is appropriate for minimally or nondisplaced fractures of the frontal sinus that do not involve the nasofrontal duct or do not acutely obstruct the nasofrontal duct. Regular plain x-ray studies should be obtained for several months afterward to monitor for development of a frontal sinus mucocele, which requires surgical treatment.

Reconstruction involves preserving sinus mucosa and reducing fractures of the nasofrontal duct and sinus walls. There are currently no data to support this technique, and in the patient described it could lead to mucocele development as the nasofrontal duct became scarred and obstructed postoperatively.

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142. A 53-year-old woman comes to the office for consultation about lip reconstruction 1 week after resection of an upper lip adnexal tumor with negative margins. Examination shows a central full-thickness defect of 75% of the upper lip. Which of the following is the most appropriate method of functional reconstruction?

- A) Abbe flap only
- B) Bilateral Estlander flaps with an Abbe flap
- C) Bilateral Karapandzic flaps with an Abbe flap
- D) Radial forearm flap only
- E) Radial forearm flap with a palmaris longus sling

The correct response is Option C.

Lip defects are commonly encountered as a result of skin cancers, such as squamous cell cancer and basal cell cancers; however, tumors of the minor salivary glands are also seen. In the relatively young patient described, who has a large resection of the central upper lip, the most appropriate choice for reconstruction is bilateral Karapandzic flaps with a central Abbe flap for philtral reconstruction. Karapandzic flaps enable transfer of the remaining upper lip while maintaining the innervations of the musculature (unlike the Gilles flap). Although bilateral Karapandzic flaps may be useful for defects up to 80% of the width of the upper lip, in the patient described, this is not an ideal choice because the philtrum would be lost, thereby resulting in a significant cosmetic deformity. The Estlander flap is useful for reconstruction of commissure defects and not central defects. The Abbe flap alone would be insufficient to close a 75% defect. The radial forearm flap, either with or without a palmaris sling, would be suboptimal because of differences in color match, innervation, and lack of vermillion reconstruction.

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143. The vector of commissure movement in a free gracilis muscle flap for facial reanimation should simulate the pull of which of the following facial muscles?

- A) Buccinator
- B) Levator labii superioris
- C) Risorius
- D) Temporalis
- E) Zygomaticus major

The correct response is Option E.

Free gracilis muscle transfer is a common method to produce a smile in patients who have complete facial nerve paralysis. It has several properties that make it ideal for this purpose: it is thin, has good contractility, leaves no functional deficit after muscle harvest, and has a relatively long motor nerve. The inset of the muscle, including appropriate tensioning and orientation, are critical for success. The muscle is attached proximally to the body of the zygoma or the temporalis fascia and distally to the orbicularis oris muscle near the modiolus just lateral to the oral commissure. Although there can be some variation in flap positioning, the desired vector of pull most closely simulates the normal pull of the zygomaticus major muscle.

The temporalis and buccinator muscles are not involved in smiling. The levator labii superioris originates from the anterior zygoma and inserts near the orbicularis oris muscle in the upper lip. The vertical direction of this makes it a powerful vertical elevator of the upper lip. The risorius does not elevate the oral commissure but instead pulls the corner of the mouth in a nearly horizontal direction.

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144. A 15-year-old girl with a history of an optic glioma, multiple café-au-lait spots, and a large plexiform neurofibroma of the cheek comes to the office for evaluation. Which of the following best represents her lifetime risk of developing a malignant peripheral nerve sheath tumor?

- A) Less than 15%
- B) 20% to 35%
- C) 40% to 60%
- D) 65% to 80%
- E) Greater than 85%

The correct response is Option A.

The patient described has neurofibromatosis 1 (NF1), an autosomal genetic disorder that leaves affected individuals at risk for developing a variety of benign and malignant tumors. The most common tumors are neurofibromas and optic gliomas. Plexiform neurofibromas are clinically present in approximately 25% of patients. This type of neurofibroma consists of a network of neurofibroma tissue and grows along the length of nerves, often involving multiple nerve fascicles, branches, and plexi. Individuals with NF1 have a 7 to 13% lifetime risk of developing a malignant peripheral nerve sheath tumor (MPNST), which usually arises in a pre-existing plexiform neurofibroma. Diagnosis of a MPNST is problematic within the context of NF1 because the emergence of a lump is not unusual. The clinical symptoms of malignancy are intertwined with the symptoms of benign tumors. Rapid growth and other symptoms, such as pain, are indications for the need for a biopsy.

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145. A 45-year-old man is brought to the emergency department 2 hours after sustaining a laceration to the face from a circular saw. Physical examination shows a deep, vertically oriented wound that extends from the lateral aspect of the right lower eyelid to the neck. The patient is unable to elevate the right upper lip. Which of the following is the longest interval after the injury during which the distal nerve can be successfully stimulated?

- A) 3 Hours
- B) 3 Days
- C) 3 Weeks
- D) 3 Months

The correct response is Option B.

Injury to the facial nerve should be suspected in any deep laceration in the vicinity of the parotid gland and posterior cheek. Clinical confirmation can be readily observed by signs of complete or partial paralysis of facial musculature. Primary end-to-end repair yields the best results, but interposition nerve grafting may be necessary if there is a segmental defect. The distal end of the transected facial nerve may be stimulated for approximately 72 hours after nerve injury. Beyond this period, the neurotransmitter stores become depleted, and depolarization at the motor end plates of the facial musculature does not occur.

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146. A 4-year-old child has a congenital sinus tract opening at the anterior border of the lower third of the sternocleidomastoid muscle. Which of the following nerves is most likely to be injured during surgical excision of the fistulous tract?

- A) Accessory (XI)
- B) Facial (VII)
- C) Hypoglossal (XII)
- D) Lingual
- E) Vagus (X)

The correct response is Option C.

The child described has a branchial cleft sinus or fistula, which is an embryologic remnant of the cleft between the second and third branchial arches. The fistulas can be bilateral in up to 30% of cases. Histologically, they are lined with stratified squamous epithelium but may also have some pseudostratified columnar ciliated epithelium in their walls. They also contain keratin, hair follicles, sweat glands, and sebaceous glands. They must be completely excised to prevent recurrence.

The second branchial arch descends over the third, resulting in an external opening in the lower neck. The internal opening lies at the anterior aspect of the posterior pillar of the fauces, just behind the tonsil (which is the junction between the second and third branchial arches). Usually, the fistula will follow the carotid sheath upwards before crossing the hypoglossal (XII) nerve and passing between the internal and external carotid arteries to reach the tonsillar fossa. As a result, the hypoglossal nerve is at risk during surgery. The facial (VII) nerve is not in the vicinity of the fistula. The facial nerve is intimately related to first branchial arch sinuses and cysts. The spinal accessory (XI) nerve is in the posterior triangle of the neck and is not in the vicinity of the surgical field to remove this type of fistula. The lingual nerve lies at a higher level and is safe. The left recurrent laryngeal nerve arises from the vagus (X) nerve low in the neck before hooking around the subclavian artery and passing medially behind the common carotid artery to reach the groove between the trachea and the esophagus. As a result of this anatomy, it too is out of harm's way. The vagus (X) nerve lies in the carotid sheath behind, and somewhat between, the internal jugular vein and the common carotid artery. The fistula lies on the other side of the great vessels. At the carotid bifurcation, the vagus nerve is lateral to the fistulous tract and stands less chance of injury than does the hypoglossal nerve.

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147. A 66-year-old man comes for a follow-up examination 7 months after resection of a T4 N1 M0 squamous cell carcinoma in the region of the retromolar trigone, including alveolectomy, followed by soft-tissue reconstruction with a platysma flap. Postoperatively, he received radiation therapy to the primary tumor site (6 Gy) and to the neck bilaterally (64 Gy). He completed radiation therapy 5 months ago. Examination today shows a malodorous, tender area of exposed, soft bone at the operative site. A panoramic x-ray study (Panorex) is shown. Multiple biopsies are negative for recurrent carcinoma. Which of the following is the most appropriate management?

- A) Long-term intravenous antibiotic therapy
- B) Open reduction and internal fixation
- C) Segmental resection and vascularized tissue transfer
- D) Sequestrectomy

The correct response is Option C.

The patient described has osteoradionecrosis of the mandible, a complication that occurs in up to 40% of patients receiving adjuvant radiation therapy for head and neck malignancies caused by hypoxia, hypovascularity, hypocellularity, and impaired collagen synthesis. The traditional definition is an area of exposed, irradiated bone that is nonhealing over 3 months. Treatment depends on the severity of the disease. Debridement and antibiotic therapy, plus or minus

hyperbaric oxygen therapy, with soft-tissue reconstruction as needed, may be curative in up to 90% of cases of osteoradionecrosis limited to the alveolar ridge or mandible superior to the alveolar canal. When more extensive destruction of the mandible is present, or when there is a pathologic fracture, as seen in the scenario described, resection of all the necrotic bone and soft tissue is indicated, followed by reconstruction with vascularized bone and soft tissue. Successful healing occurs in up to 80 to 90% of patients with more extensive disease when treated in this way. Local flaps are of limited use for soft-tissue coverage because of the radiation.

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148. A 20-year-old man comes to the emergency department because of a deep laceration of the lower lip. Bilateral mental nerve blocks will be used to anesthetize the lip properly prior to repair. Which of the following is the most appropriate landmark for needle placement for the blocks?

- A) Mandibular second premolar
- B) Maxillary canine
- C) Oral commissure
- D) Retromolar fossa
- E) Sigmoid notch

The correct response is Option A.

The inferior alveolar nerve enters the mandible on the medial side of the ramus about 10 mm below the sigmoid notch. It then courses through the canal closest to the buccal cortical plate in the region of the ramus, angle, and down to the third molar with an average distance of $1.8 \text{ mm} \pm 1 \text{ mm}$. The nerve then swerves away at a position of $4.1 \text{ mm} \pm 1 \text{ mm}$ from the buccal cortex as it passes the region of the first and second molars. As it traverses the mandibular body, it is lowest and closest to the inferior cortex ($7.5 \pm 1.5 \text{ mm}$) near its exit site at the level of the first molar and second premolar via the mental foramen on the anterior surface of the mandible. The mental nerve supplies the skin of the lower lip and chin right up to the midline.

The maxillary canine may be used as a landmark for needle insertion toward the infraorbital foramen during infiltration of the infraorbital nerve. The maxillary second molar is a landmark typically used to locate the opening of the Stensen duct.

The oral commissure is used for facial aesthetic measurements and not for nerve blocks.

The retromolar fossa, posterior to the mandibular third molar, is the preferred location for needle insertion to anesthetize the buccal nerve, which normally supplies sensibility to the central cheek.

The sigmoid notch is used as a landmark to reference the location of the inferior alveolar nerve.

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(Please note that this pictorial appears in color in the online examination)

149. A 1-year-old boy has had the anomaly shown since birth. Which of the following syndromes is the most likely diagnosis?

- A) Apert
- B) Crouzon
- C) Goldenhar
- D) Saethre-Chotzen
- E) Treacher Collins

The correct response is Option E.

Bilateral lower eyelid colobomas are commonly found in patients with Treacher Collins syndrome (TCS). TCS is also known as mandibulofacial dysostosis, first and second branchial arch syndrome, and Franceschetti-Zwahlen-Klein syndrome. Edward Treacher Collins described the syndrome in 1900. It is autosomal dominant with variable penetrance and has an incidence of 1 in 7000 live births. TCS has significant dysmorphology, which includes lower eyelid colobomas, cleft and hypoplastic zygomas, cleft lateral orbit, hypoplastic mandible, lateral canthal vertical dystopia, antimongolian palpebral fissure, ear deformities, long anterior sideburns, anterior open bite, cleft palate, and macrostomia.

Crouzon, Apert, and Saethre-Chotzen syndromes involve craniosynostosis, typically bicoronal. Patients with these syndromes also have underdevelopment of the mid face. They do not have eyelid abnormalities. Patients with Apert syndrome also may have a cleft palate and syndactyly of the hands and feet.

Goldenhar syndrome involves epibulbar dermoids of one or both eyes and underdevelopment of one or both sides of the face. It is also known as hemifacial and bifacial microsomia. The soft tissue and the bone are hypoplastic.

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150. A 2-year-old boy with a cleft palate and recurrent episodes of serous otitis media caused by impaired eustachian tube function is scheduled to undergo cleft repair. In reconstructing the palate, repair of which of the following muscles is most likely to improve eustachian tube function?

- A) Levator veli palatini
- B) Palatopharyngeus
- C) Salpingopharyngeus
- D) Superior constrictor
- E) Tensor veli palatini

The correct response is Option A.

In cleft palate reconstruction, repair of the levator veli palatini can improve eustachian tube function.

Individuals with unrepaired cleft palate suffer chronic otitis media, which can lead to permanent hearing loss. This is thought to be caused by the dysfunction of the eustachian tube. There are several paratubal muscles that are responsible for the opening and closing of the eustachian tube: the tensor veli palatini, the levator veli palatini, and the salpingopharyngeus.

Contraction of the levator veli palatini with superior and posterior displacement of the levator sling opens the eustachian tube. In an unrepaired cleft palate, the ability of the levator veli palatini to open the tube is lost because of its abnormal insertion on the posterior hard palate. Repositioning of this muscle during cleft palate repair restores the levator sling, allowing dilation of the eustachian tube.

The tensor veli palatini opens the eustachian tube and may have “pumping action” that milks the contents of the tube. This muscle’s function is likely unaffected by clefting. However, its ability to open the eustachian tube may be iatrogenically reduced by complete hamular fracture or division of its tendon during cleft palate repair.

The salpingopharyngeus also opens and closes the eustachian tube. However, because of its small size, it is the least important of the paratubal muscles and has minimal functional significance.

The palatopharyngeus muscle optimizes velopharyngeal closure. Along with the superior constrictor, it causes medial displacement of the lateral pharyngeal wall.

The superior constrictor is the main component of the Passavant ridge and functions to bring about medial displacement of the lateral pharyngeal wall through a sphincteric mechanism.

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Section 4: Hand and Lower Extremity

151. A 24-year-old woman comes to the emergency department after jamming her left thumb while playing basketball. An incidental finding on x-ray study of the hand is shown. Which of the following is the most likely diagnosis?

- A) Enchondromatosis
- B) Metachondromatosis
- C) Osteochondroma
- D) Solitary enchondroma
- E) Synovial chondromatosis



The correct response is Option D.

The lesion shown in the x-ray study is consistent with an enchondroma based on its classic pattern of calcifications with rings and arcs, intramedullary position, and proximal phalanx location. They may expand enough to cause endosteal scalloping of the cortex. Solitary enchondromas are the most common benign bony tumors. They have a predilection for the small bones of the hands and feet. Of these, approximately 50% are in the proximal phalanx, followed

in frequency by the metacarpal and middle phalanx. Enchondromas account for 12 to 14% of benign bone neoplasms and 3 to 10% of osseous neoplasms in general. They occur equally in men and women.

Solitary enchondromas are most frequently discovered in patients aged 20 to 40 years and often as incidental findings on x-ray studies, while enchondromatosis (Ollier disease) is more commonly discovered from birth to age 10 years. Metachondromatosis is a rare inherited disease associated with multiple enchondromas and osteochondromas. Osteochondroma is a cartilage-capped bony exostosis adjacent to the external surface of the bone and therefore not consistent with the x-ray study shown. Synovial chondromatosis is a rare condition where the synovial lining of a joint develops cartilage loose bodies. This does not occur within the bone.

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152. A 36-year-old executive comes to the office because of an 8-year history of cold intolerance and ulcers on the tips of the index and long fingers bilaterally. The patient is a nonsmoker. Physical examination shows thin fingers with shiny skin. Which of the following is the most likely diagnosis?

- A) Buerger disease
- B) CREST syndrome
- C) Hyperthyroidism
- D) Hypothenar hammer syndrome
- E) Sickle cell anemia

The correct response is Option B.

The set of symptoms in the patient described are consistent with scleroderma or systemic sclerosis. Findings in these patients include calcinosis, Raynaud phenomenon, esophageal dysphasia, sclerodactyly, and telangiectasia, or CREST syndrome. Those with overlap syndrome have associated findings characteristic of lupus, dermatomyositis, or rheumatoid arthritis. Therefore, CREST syndrome is the most likely diagnosis. A history of heavy smoking is more consistent with finger ulcers associated with thromboangiitis obliterans (Buerger disease); however, these patients do not have shiny skin, and their symptoms are generally limited to the hands and feet. A blow or repetitive vibration to the hand might suggest ulnar artery thrombosis and hypothenar hammer syndrome, which can also lead to fingertip ulceration, but these conditions are often limited to one hand and in most cases involve only the ring and little fingers. This syndrome is often seen in patients employed as manual laborers. Hyperthyroidism has nothing in common with the symptoms of the patient described. Finally, sickle cell anemia is characterized by severe pain in the long bones, abdomen, and face. Although hand pain with dactylitis and leg ulcers can be present, ulceration of the fingertips is not common.

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153. A 17-year-old boy is brought to the emergency department after sustaining a traumatic injury to the left lower extremity in a motor vehicle collision. Physical examination shows a large area of crush injury, loss of soft tissue, and open fracture of the tibia with exposed bone. The lower leg is cool to touch and pale. No distal pulses are palpable. Angiography shows transection of the popliteal artery. Which of the following is the most appropriate Gustilo classification of this patient's fracture?

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

The correct response is Option E.

The most appropriate classification for this injury is Gustilo Type IIIC.

The Gustilo classification is the most widely accepted method for characterizing open fractures of the lower extremity. Injuries are divided into three grades. Type I open fractures involve soft-tissue lacerations smaller than 1 cm. Type II fractures include lacerations of 1 to 10 cm, with moderate soft-tissue damage. Type III fractures are greater than 10 cm and involve extensive soft-tissue damage. These injuries create difficulties in coverage of bone or fixation hardware. Gustilo Type III fractures are further subdivided into A, B, and C subtypes. Type IIIA fractures have sufficient soft tissue to provide for bony coverage. Type IIIB fractures involve periosteal stripping and extensive tissue damage, and local soft-tissue coverage is not possible. These typically result from high-energy mechanisms, such as high-velocity gunshot wounds or significant crush injuries. Gustilo Type IIIB fractures are the most common injuries for which plastic surgeons are consulted. Gustilo Type IIIC fractures include vascular injuries that require repair. The presence of a vascular injury significantly increases the probability of amputation.

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(Please note that this pictorial appears in color in the online examination)

154. An 18-month-old boy is brought to the office because of a 3-month history of rapidly enlarging lesions on the long and ring fingers (shown). Examination of a specimen obtained on incisional biopsy of the lesion on the ring finger shows histology with interlacing fibroblasts and characteristic intracytoplasmic eosinophilic inclusion bodies. Which of the following is the most appropriate next step?
- A) Administration of acyclovir
 - B) Distal finger amputations
 - C) MRI
 - D) Observation for spontaneous involution
 - E) Wide excision of both lesions with full-thickness skin grafting

The correct response is Option E.

This is the classic appearance of infantile digital fibromatosis. Age at presentation can range from 5 months to 6 years. Lesions are rapidly growing, broad-based masses on the dorsal or lateral aspects of fingers. They have classic intracytoplasmic inclusion bodies in cellular tumors. They may be multiple with characteristic “kissing” lesions.

Recommended treatment is complete wide excision and reconstruction, often with full-thickness skin grafting or coverage with a local flap. Inadequate resection leads to recurrence.

Acyclovir would be appropriate for herpetic whitlow, but not for this condition. It is inappropriate for children younger than 2 years. Safety and efficacy in children younger than 2 years have not been established.

Distal finger amputation is overly aggressive and unnecessary for this condition.

Despite the possibility of spontaneous regression in some cases, these tumors may cause finger deformities if observed and must be distinguished from fibrosarcoma. MRI is not helpful in distinguishing any better the extent of the tumor.

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155. A 28-year-old woman is evaluated because of a 2-month history of progressive swelling in the left upper extremity. Physical examination shows edema extending from the hand to the arm. Diameter of the left upper limb is larger than that of the right upper limb. Ultrasonography shows no venous obstruction, and CT scan is negative for a tumor or mass. Which of the following is the most appropriate next step in management?

- A) Administration of a diuretic
- B) Elevation and compression
- C) Liposuction
- D) Microlymphatic anastomosis
- E) Placement of buried dermal flap

The correct response is Option B.

The most appropriate next step in management is elevation and compression.

Lymphedema is caused by inadequate clearance of fluid from the interstitial space, resulting in buildup of fluid and protein. The classic finding involves edema, beginning in the distal extremity. Measurements of limb circumference at multiple levels may show enlargement compared with the contralateral side. Other conditions may cause peripheral edema, but in general bilateral lower extremity edema is caused by systemic disease. Unilateral edema is more likely a result of venous insufficiency or lymphedema. Worldwide prevalence of lymphedema is estimated at 90 million cases, with approximately 90% of these attributed to filariasis. This is relatively rare in the United States, however, and breast cancer therapy is a much more likely etiology for secondary lymphedema in this country.

Lymphedema is a chronic disease that is difficult to manage and treat, and there is no medical or surgical cure. In general, simpler methods are recommended for patients with newly diagnosed lymphedema, such as elevation and a compression garment, with or without manual lymphatic drainage or massage therapy. Pneumatic compression pumps have also been used as an adjunct to compression and elevation. Surgery is generally recommended for patients who have failed conservative therapy.

Diuretics are ineffective in treating lymphedema.

A variety of surgical options have been attempted for management of lymphedema. Liposuction has been used for milder cases, but there is a high rate of edema recurrence. Combination with lymphatic drainage and compression helps to improve outcomes.

Microlymphatic procedures have been proposed to restore lymphatic drainage channels. However, long-term patency of these channels is uncertain.

The placement of a buried dermal flap has been performed in an attempt to reestablish lymphatic communications. It is generally believed that the primary benefit is excision of the tissue, rather than the flap component.

Excision of subcutaneous tissue and skin grafting has been described, with the goal of removing lymphedematous tissues. However, skin graft problems and poor cosmetic outcomes may result, as well as edema that occur distal to the area of excision (ie, hand).

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(Please note that this pictorial appears in color in the online examination)

156. A 15-year-old boy is brought to the emergency department 1 hour after his left foot was severed when his leg was run over by a train. Photographs are shown. Which of the following is the most appropriate management?

- A) Construction of a foot filet free flap
- B) Replantation and ankle fusion
- C) Revision amputation to the level of the skin edge and primary closure
- D) Split-thickness skin grafting
- E) Temporary revascularization with shunts and delayed replantation

The correct response is Option C.

The patient described has a limb amputation that includes a significant avulsion component, exemplified in the long tendon stumps that appear ripped off from their muscle bellies, and ankle disarticulation. Avulsion amputations of the lower extremity are not suitable for replantation because of the extended neurovascular damage that is present on both ends well beyond the level of the injury. The incidence of thrombosis at the anastomosis is high. Use of vein grafts on a free flap could be considered, but, in this case, they may have to be connected as high as knee level to ensure patency. The amputated part likely has massive microscopic endothelial damage extending to terminal vessels and could only be used as a donor site for skin grafts. Therefore, there is no role for immediate or delayed replantation.

While preservation of maximum tibial length is desirable in preparing the amputation stump, prosthetic fitting for ankle disarticulations is fraught with trouble. Some tibial shortening is required to have a comfortable, reliable prosthesis. In the scenario described, tibial shortening of 2 and 4 in would have equivalent results because there is still ample length of proximal tibia

available to provide the same functionality and equivalent energy expenditure. Therefore, use of a free flap to protect an additional 2 in of tibia adds no advantage for this patient. When the level of amputation is through the proximal tibia, some benefit could be found in that a minimum of 6 in of proximal tibia is available for prosthetic fitting. Split-skin grafts are generally unstable in weight-bearing surfaces and take longer to heal and mature, which causes delay in rehabilitation. Skin grafts will not take or perform well when applied over an articular surface.

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157. A 5-day-old male newborn is evaluated in the neonatal intensive care unit because of hypoplasia of the thumb. His parents are distressed and would like him treated immediately. Physical examination shows Buck-Gramcko Grade V thumb hypoplasia. At which of the following ages is it most appropriate to perform reconstruction?

- A) 1 Month
- B) 1 Year
- C) 4 Years
- D) 10 Years
- E) 14 Years

The correct response is Option B.

A Buck-Gramcko Grade V or Type V thumb is the most severe form of thumb hypoplasia, as it constitutes an absence of the thumb. Therefore, the patient described will need a pollicization procedure. Though the literature is unclear as to the exact timing of such a procedure, it is recommended by Kozin that it be performed prior to the patient developing an undesired side-to-side pinch pattern between fingers, which is a compensatory mechanism that will develop after the first year. Furthermore, arguments have been made by Kleinman and Strickland to await the proper development of a newborn patient's cardiopulmonary system, development of bimanual grasp, involution of embryonic endosteal circulation, and development of the digital vessels to a more substantial thickness. Each of these considerations will help to decrease complications in carrying out such a difficult procedure in a small hand. Therefore, the most appropriate timing would be at 1 year of age.

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158. A 40-year-old man who is an avid cyclist comes for evaluation of a 5-week history of numbness and tingling of the ring and little fingers of the left hand. Conservative management has failed. Physical examination shows weakness of grip strength. Sensation over the dorsal ulnar aspect of the hand is intact, and results of elbow flexion testing are negative. Which of the following structures are most appropriate for surgical release?

- A) Osborne ligament and arcade of Struthers
- B) Osborne ligament and volar carpal ligament
- C) Pisohamate ligament and volar carpal ligament
- D) Transverse carpal ligament and arcade of Struthers
- E) Transverse carpal ligament and pisohamate ligament

The correct response is Option C.

The patient described has ulnar tunnel syndrome or compression of the ulnar nerve in the Guyon canal. Sensory sparing on the dorsal ulnar aspect of the hand suggests a lesion distal to the origin of the dorsal cutaneous branch of the ulnar nerve. Nerve conduction studies and electromyography can be used to confirm the diagnosis. Conservative treatment includes activity modification, splinting, and administration of a nonsteroidal anti-inflammatory drug.

The most appropriate management of this condition is exploration of the entire ulnar tunnel and release of the pisohamate and volar carpal ligaments. The ulnar tunnel, which is 4 to 4.5 cm in length, begins at the proximal volar carpal ligament and ends at the fibrous edge of the hypothenar muscles. Zone I is the region of the tunnel proximal to the bifurcation of the nerve. Zone II is the area around the deep motor branch, which ends at the pisohamate ligament, and Zone III is the area surrounding the superficial branch. The ulnar nerve courses between the volar carpal ligament and the transverse carpal ligament.

The Osborne ligament and the arcade of Struthers are potential sites of compression of the ulnar nerve at the elbow, or cubital tunnel syndrome. The fascia of Osborne, or the cubital tunnel retinaculum, is a band bridging the two origins of the flexor carpi ulnaris muscle and the medial epicondyle. The arcade of Struthers is 8 to 10 cm proximal to the medial epicondyle and extends from the medial intermuscular septum to the medial head of the triceps.

Release of the transverse carpal ligament is appropriate for management of compression of the median nerve at the wrist, or carpal tunnel syndrome.

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159. A 43-year-old man has footdrop and numbness of the left foot following reconstruction of a soft-tissue defect resulting from a Gustilo Type IIIB fracture of the proximal tibia. Which of the following pedicled flaps was most likely used for reconstruction?

- A) Gracilis
- B) Lateral gastrocnemius
- C) Reversed sural artery
- D) Sartorius
- E) Soleus

The correct response is Option B.

The pedicled gastrocnemius flap has been shown to be a reliable source of vascularized soft tissue for injuries of the distal thigh, knee, and proximal leg. The lateral or medial head may be harvested. Lateral gastrocnemius harvest risks damaging the common peroneal nerve, with an incidence of 7.7%. Medial gastrocnemius harvest, for obvious anatomical reasons, does not carry this risk.

There are few data on the morbidity of donor sites, but those studies that have been done demonstrate no functional debility at a walking gait for less than 200 m. Patients do notice difficulty standing on their toes and have slowing with variable calcaneal gait when walking fast. Forty-two percent of patients could run, 22% had pain in the donor site at rest, and 20% had pain when walking more than 200 m. Seventy percent had pain and weakness in the operated leg when attempting to run. Range-of-motion deficit existed in the operated limb, with average loss of 27% flexion and 14% extension.

The gracilis and sartorius muscles are not routinely used for pedicled reconstruction of the proximal tibia, nor would their harvest cause the symptoms of the patient described.

The reversed sural artery flap is an adipofascial flap that could be used for this described defect; however, its dissection does not jeopardize the common peroneal nerve.

The soleus muscle has better venous muscle pump function than the gastrocnemius, and edema, not nerve damage, is more common after use of the gastrocnemius. The limited data available suggest that the functional deficit with resulting limitation to ankle flexion is also more severe with soleus harvest.

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160. A 45-year-old man is brought to the emergency department immediately after sustaining injuries to the right upper extremity during a motorcycle collision. On admission, physical examination shows a flaccid and insensate right upper extremity, and x-ray studies show no abnormalities. Follow-up nerve conduction studies 4 weeks later show preservation of sensory nerve action potentials and evidence of fibrillations and denervation in the motor action potentials from the paravertebral muscles, biceps, triceps, and deltoid. The nerve injury is most likely located at which of the following levels of the nerve?

- A) Anterior division
- B) C5 and C6 trunk
- C) Lateral cord
- D) Preganglionic root
- E) Subscapular nerve

The correct response is Option D.

Following a traction injury to the brachial plexus, the nerves may rupture, be avulsed at the level of the spinal cord, or significantly stretch but remain intact. There are five possible levels where the nerve can be injured: (1) root, (2) anterior branches of the spinal nerves, (3) trunk, (4) cord, and (5) peripheral nerve. Root injuries may be further localized with respect to the dorsal root ganglion. Infraganglionic (postganglionic) injuries are located distal to the dorsal root ganglion, and supraganglionic (preganglionic) lesions are located proximal to the ganglion. With both types of lesions, patients will have the symptom of loss of muscle function. In supraganglionic injuries, the nerve has been avulsed from the spinal cord, separating the motor nerve fibers from the motor cell bodies in the anterior horn cells. The sensory fibers and cell bodies are still connected at the dorsal root ganglion; however, the efferent fibers entering the dorsal spinal column have been disrupted. Thus, sensory nerve action potentials will be preserved in patients with supraganglionic injuries, while motor nerve action potentials will be absent. In infraganglionic injuries, both the motor and sensory nerve cells have been disrupted, so there will be abnormalities in both motor and sensory action potentials. An injury to the C5 and C6 roots would show preservation of triceps function, as would an injury to the medial or lateral cord.

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161. A 42-year-old man sustains an avulsion injury to the index finger of the left hand after it is caught in a piece of machinery. He says he needs to return to his job as a manual laborer as soon as possible. The bone of the proximal phalanx is exposed. The avulsed segment of the finger includes the distal and middle phalanges and soft tissue to the level of the mid-proximal phalanx, along with segments of tendons, nerves, and vessels. Which of the following is the most appropriate management?

- A) Coverage with a groin flap
- B) Coverage with a reverse radial forearm flap
- C) Microvascular replantation
- D) Revision amputation
- E) Skin grafting

The correct response is Option D.

The most appropriate management is revision amputation.

For the patient described, the tendons, nerves, and vessels have been stretched and avulsed, which results in an extensive zone of injury.

A well-planned amputation should be considered a reconstructive procedure and can return functional use of the hand to the patient. Goals include preservation of functional length, provision of durable coverage, preservation of sensibility, prevention of neuromas, prevention of joint contractures, minimal morbidity, early prosthetic fitting, and early return to activities of daily living. The surgeon should take into account the patient's occupation, functional status, and attitude toward the proposed amputation. In the scenario described involving a proximal phalanx amputation of the index finger in a manual laborer, the shortened finger will likely be bypassed in favor of the long finger for use in pinch. Amputation can result in a reliable and functional outcome and allow the patient to return to work quickly. Completion of the amputation can be performed, or ray amputation can be undertaken, to eliminate the intervening index finger segment and improve thumb pinch function.

A groin flap can be used for soft-tissue coverage but requires the hand to be attached to the groin for a period of time. This can result in stiffness of the other digits and requires a staged procedure.

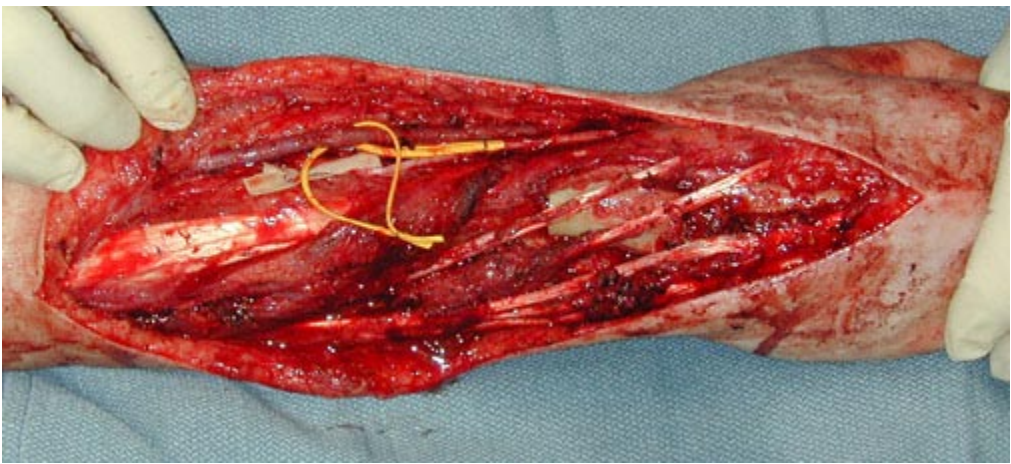
A reverse radial forearm flap can be used for coverage of soft-tissue defects in the hand. This requires sacrifice of a major vessel to the hand and, in this case, would only preserve a section of bone that will serve little function.

Microvascular replantation is a challenging prospect in the setting of a ring avulsion injury. Relative contraindications in the patient described would include the avulsion nature of the injury and presence of single-digit amputation within Zone 2. These factors lead to less successful outcome, and replantation would delay the return to work.

Skin grafting is not likely to be successful in this patient, who has exposed bone. The lack of tendons would result in absence of movement, and the lack of nerves would lead to loss of sensibility.

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(Please note that this pictorial appears in color in the online examination)

162. A 62-year-old man is scheduled to undergo reconstruction of a 7-cm bone defect (shown) resulting from excision of a tumor of the distal radius. He has hypertension and has smoked one pack of cigarettes daily for 30 years. Which of the following is the most appropriate technique for reconstruction of the defect?

- A) Allograft bone graft
- B) Fibula free flap
- C) Locking fixation plate
- D) Pedicled ulna bone flap

The correct response is Option B.

Composite tissue reconstruction after tumor ablation is a significant challenge to the plastic surgeon. Generally, bony defects greater than 6 cm require vascularized bone for reconstruction. For large defects, the optimum choice of bone is the vascularized fibula. The fibula also has a reliable blood supply from the peroneal artery and can be harvested with a cutaneous skin paddle. The fibula free flap is the most appropriate technique. Reconstruction with free flaps can be successfully performed in a patient with a smoking history and, in fact, is often the optimal method of reconstruction in smokers. The use of allograft cadaver bone is not indicated, especially in a patient with a history of smoking. For defects of the size shown in the photograph, the locking fixation plate would not give adequate long-term support. A local bone flap is also not a viable option.

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163. A 45-year-old man comes to the office because of a 6-month history of a painless mass on the right distal forearm. Physical examination shows a well-circumscribed 6-cm mass. MRI of the chest, axilla, and forearm shows no other lesions. Examination of a specimen obtained on incisional biopsy shows epithelioid sarcoma. Which of the following is the most appropriate initial management?

- A) Chemotherapy
- B) Excisional biopsy
- C) Forearm amputation
- D) Radiation therapy
- E) Wide local excision

The correct response is Option D.

Preoperative radiation should be administered for epithelioid sarcomas, as it will help decrease tumor size and local recurrence rates. Chemotherapy is appropriate for tumors that are high grade, greater than 10 cm in diameter, involve the lymph node, or are metastatic. As chemotherapy plays an important role in epithelioid sarcomas, it is usually given postoperatively. Excisional biopsy is reserved for low-grade tumors. Epithelioid sarcomas are usually high grade, so excisional biopsy would not be appropriate. Forearm amputation should be considered if negative margins cannot be achieved. Wide excision with negative margins is a mainstay of surgical treatment.

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164. A 30-year-old electrician comes for follow-up evaluation for inability to move his right index finger 6 months after undergoing repair of the flexor digitorum profundus tendon of that finger at the mid middle phalanx. Physical examination shows a well-healed surgical scar. Passive range of motion is full and pain free, but there is no active range of motion. Sensation over the finger is intact. During surgery for tenolysis, it is apparent that a rupture of tendon repairs and scarring of the flexor sheath occurred. A 5-cm gap is visible. Which of the following is the most appropriate next step?
- A) Fusion of the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints
 - B) Implantation of a Hunter rod in preparation for staged tendon grafting
 - C) Ray amputation
 - D) Tendon grafting with a palmaris longus tendon graft
 - E) Tendon transfer of the fourth flexor digitorum superficialis tendon to the index finger

The correct response is Option B.

The patient described has no injury other than the laceration of the flexor digitorum profundus (and possibly flexor digitorum superficialis) tendon of his index finger. He has excellent passive range of motion, is healthy, and would benefit from reconstruction of his injured tendons. In addition, as an electrician, he needs each of his fingers for function.

In the scenario described, a Hunter rod would provide a smooth, well-organized “pseudosheath” through which a subsequent tendon transfer or graft could be placed and allow a gliding surface. Though certain patients would benefit from arthrodesis or amputation, a young and motivated patient with an otherwise normal finger would benefit from two-stage flexor tendon reconstruction. Immediate tendon transfer or tendon grafting would not be ideal because of the scarred flexor sheath. Extensive scarring and the loss of the retinacular pulley system would not provide the ideal bed for immediate transfer or grafting.

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165. A 40-year-old woman comes to the office because of a 2-year history of lymphedema of the lower extremity. She has been unsuccessful in her attempts to lose weight through diet. BMI is 32 kg/m². Physical examination shows asymmetry of the left lower extremity with enlarged circumference of the thigh and calf. Which of the following is the most appropriate treatment of this patient's lymphedema?

- A) Administration of a benzopyrene
- B) Administration of a diuretic
- C) Application of Unna boots
- D) Caloric restriction
- E) Intermittent pneumatic pump compression therapy

The correct response is Option E.

Intermittent pneumatic pump compression therapy should be instituted on an outpatient basis and/or in the home. The mainstay of treatment is medical; this includes meticulous hygiene and regular inspection, as well as encouraging patients to lose weight, avoid even minor trauma, and avoid constrictive clothing and elevation of the affected extremity.

Benzopyrenes, including flavonoids and coumarin, have become a useful adjuvant in other countries but are currently not available for clinical use in the United States. These drugs bind to accumulated interstitial proteins, inducing macrophage phagocytosis and proteolysis. Diuretics play no role in the treatment of lymphedema. All patients should also use compression garments continuously during the day; Unna boots are used for venous stasis ulcers of the lower extremity. The patient described has failed weight loss attempts, so caloric restriction may also have little effect.

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166. A 48-year-old woman has numbness and paresthesia of the right hand 2 years after mastectomy and radiation therapy. She reports no pain or night waking. Symptoms have not improved with cock-up wrist splints or injection of a corticosteroid into the carpal tunnel. Physical examination shows swelling and weakness of the right arm, most prominently in the C5-C6 distribution; no varicosities, stasis ulcers, dermatitis, or symptoms of Horner syndrome are noted. Allen test is normal. Electromyography shows myokymia. CT scan shows diffuse swelling but no mass. Which of the following is the most likely diagnosis?

- A) Acute ischemic injury
- B) Carpal tunnel syndrome
- C) Chronic venous insufficiency
- D) Radiation-induced brachial plexopathy
- E) Tumor recurrence

The correct response is Option D.

The most likely diagnosis is radiation-induced brachial plexopathy, which can occur when radiation therapy is directed at the chest, axillary region, thoracic outlet, or neck. The incidence is 1.8 to 4.9% of those patients receiving radiation therapy to the above areas and is most common in patients with underlying breast or lung carcinoma. Patients often have sensory symptoms, with swelling and a generalized weakness of the arm. Eighteen percent of patients have pain in the shoulder, wrist, or hand. The neurologic findings are most prominent in the C5-C6 distribution. The lymphatic-vascular system may show prominent lymphedema of the involved extremity without cyanotic or dusky features. There should be no disturbance of arterial or venous circulation in the involved extremity and no changes in the limb to suggest venous insufficiency (ie, varicosities, stasis ulcers, or dermatitis). The Allen test should be normal. Horner syndrome is not present in patients with radiation-induced brachial plexopathy.

Eighty percent of patients with tumor infiltration into the brachial plexus come to the office because of pain in the shoulder, upper arm, elbow, and ring and little fingers. Symptoms progress to atrophy and weakness of the C7-T1 distribution with persistent pain and occasional Horner syndrome. CT scan shows a discrete mass with circumscribed tissue infiltration. Electromyography shows segmental slowing.

Patients with acute ischemic injury have symptoms of paresthesia in the C5-C6 nerve distribution and acute, nonprogressive weakness and sensory loss. CT angiography would

demonstrate subclavian artery segmental obstruction. Electromyography shows segmental slowing.

Patients with carpal tunnel syndrome often have night waking and experience a period of symptomatic relief after injection of a corticosteroid into the carpal tunnel.

Chronic venous insufficiency does not typically have neurologic sequela.

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(Please note that this pictorial appears in color in the online examination)

167. A 23-year-old man has decreased grip strength in the right hand 4 years after sustaining a volar forearm laceration. A photograph of the hand posture is shown. No nerve repair was performed at the time of injury. During testing with the metacarpophalangeal (MCP) joints blocked, the patient attempts to extend the interphalangeal (IP) joints (Bouvier maneuver) but is unable to do so. Passively, the IP joints can be extended. Tendon transfer to improve grip strength is planned. During this procedure, the tendon is best inserted distally at which of the following locations?
- A) A2 pulley
 - B) Dorsal apparatus lateral band
 - C) MCP joint volar plate
 - D) Palmar fascia
 - E) Proximal phalanx

The correct response is Option B.

The patient described has a classic case of ulnar nerve palsy. If MCP hyperextension is passively prevented by dorsal pressure, the extensor digitorum communis may be able to extend the middle and distal phalanges (Bouvier maneuver). If this cannot be done, then the tendon transfer insertion is into the dorsal apparatus. Tendon transfer insertion into the A2 pulley and proximal phalanx will result in MCP joint flexion, but will have no effect on IP joint extension. Tendon transfer insertion into the MCP joint volar plate and palmar fascia are not appropriate locations.

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168. A 35-year-old man is scheduled to undergo a medial thigh lift. He underwent bariatric surgery 2 years ago and has lost 120 lb (54 kg). To decrease the risk of seroma formation, care must be taken to preserve the area defined by the inguinal ligament and which of the following additional structures?
- A) Adductor longus muscle and sartorius muscle
 - B) Gracilis muscle and adductor magnus muscle
 - C) Great saphenous vein and sartorius muscle
 - D) Iliopsoas muscle and adductor magnus muscle

The correct response is Option A.

The incidence of seroma following medial thigh lift ranges from 4 to 20%, making it one of the most common complications of body contouring. It is critical to have an appreciation of the anatomical borders of the femoral triangle for two reasons. First, the concentration of lymphatics draining the lower extremity is very high within the femoral triangle. Second, direct injury to the inguinal lymphatic system often occurs inconspicuously, and so a preemptive approach should be taken to protect these structures.

The femoral triangle is bordered by the inguinal ligament, adductor longus muscle, and sartorius muscle. The iliopsoas muscle, pectineus muscle, inguinal lymph nodes, and femoral nerve, artery, and vein reside within the femoral triangle, as does the proximal portion of the great saphenous vein.

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169. A 65-year-old Caucasian man comes to the office because of a dark, pigmented lesion on the thumb that he first noticed 3 months ago. There is no history of trauma to the digit. Physical examination shows a variegated lesion with asymmetrical borders in the germinal matrix of the nail bed of the right thumb. Which of the following is the most appropriate first step in management?

- A) Amputation to next joint
- B) Radiation therapy
- C) Shave biopsy
- D) Wide excision
- E) Observation

The correct response is Option C.

This pigmented lesion in the patient described could be a post-traumatic subungual hematoma, benign nevus, or subungual melanoma. Benign streaks in the nail plate (melanonychia striata longitudinalis) are extremely common in African American patients and often occur spontaneously with advancing age. Similar streaking of pigment in the nail plate may reflect the presence of a benign subungual nevus of the germinal matrix. Broader streaks of variegated color and streaks with cubical pigmentation should raise suspicion of a subungual melanoma. Evaluation of a suspiciously pigmented lesion in the nail bed should commence with a shave biopsy of the lesion. A core biopsy of the germinal matrix could produce a nail bed and plate abnormality. Furthermore, there is no need for a core biopsy to determine the depth of the lesion, as the histology and staging of the nail bed are different from the skin. Wide excision or amputation is not warranted until an attempt at diagnosis has been completed. The lesion has been present for 3 months and has not grown out to the sterile matrix; because the patient says there has been no previous trauma, further observation would be inappropriate. After an injury, the nail plate and corresponding matrix grow to tip by 3 to 4 months. Radiation therapy is not appropriate without a diagnosis.

Melanocytic hyperplasia without atypia is considered benign and can be observed. The presence of atypia or melanoma in situ requires complete excision with clear margins. The wound is closed with a full- or split-thickness nail bed graft. Acral-lentiginous melanoma is found beneath the nail, on the palm of the hand, or on the sole of the foot. These lesions represent approximately 3% of all cutaneous melanomas. The prognosis for subungual melanomas is worse than for other cutaneous melanomas, probably because of delay in diagnosis. When symptoms occur, 25 to 30% of patients have metastases. Treatment of subungual hand melanomas consists of amputation through the joint, just proximal to the lesion. Volar flaps are

used for the closure of the defect. For lesions of the thumb, deepening the first space with local z-plasty is recommended to improve function.

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170. A 36-year-old man comes for evaluation because he is dissatisfied with the appearance of his nail (shown) after burning his hand. After removal of the nail, it is clear that more than one third of the nail bed is involved. Which of the following procedures is most likely to improve the appearance of the nail?

- A) Debridement of the nail bed and full-thickness skin grafting
- B) Dermabrasion of the nail bed and placement of a silicone rubber stent
- C) Excision of the scar tissue, reconstruction with an eponychial flap, and nail bed graft from a toe
- D) Reconstruction with a cross-finger flap to the distal pad and bone graft to the distal phalanx
- E) Resection of the scar, elevation of the nail bed for advancement, and primary repair of the nail bed



(Please note that this pictorial appears in color in the online examination)

The correct response is Option C.

Nail bed deformities are common after injury to the fingertip. The photograph shows that the patient has a synechia of the nail bed at the lateral aspect of the eponychial fold. In the scenario described, the problem is twofold. First, the eponychial fold is contracted and adherent to the underlying nail bed. Second, the nail bed itself is likely scarred. Therefore, dermabrasion and

stent will not affect the status of the nail bed and will not improve the deformity. Reconstruction with a cross-finger flap and bone graft is good for a hook nail deformity but is not appropriate for scarred nail bed. Excision of the scar and attempt at advancement and primary closure is likely to fail in the scenario described as it is limited to defect of 1 mm or less. Given these constraints, resection of the scar and replacement with a graft from an adjacent finger or from one of the toes along with a flap procedure on the eponychial fold is most likely to correct the deformity. Full-thickness skin grafting will not affect this patient's goal of improved appearance.

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171. A 70-year-old man is brought to the emergency department after he was hit by a car while walking across the street. Numerous fractures of the ribs, a nonoperative laceration of the spleen, a fracture of the right humerus, and a Gustilo Type IIIC fracture of the middle third of the left lower leg are noted. Examination shows an 8 × 7-cm soft-tissue defect over the anterior aspect with exposed bone. The patient is unable to plantar flex his left foot, and sensation is absent over the plantar aspect. Surgical exploration shows transection of the posterior tibial artery and tibial nerve. Which of the following is the most appropriate management of the injured leg?

- A) Above-knee amputation
- B) Below-knee amputation
- C) Irrigation, debridement, external fixation, free tissue transfer, and delayed repair of the nerve
- D) Irrigation, debridement, external fixation, immediate repair of the artery and nerve, and free tissue transfer
- E) Irrigation, debridement, internal fixation, immediate repair of the artery and nerve, and skin grafting

The correct response is Option B.

The treatment goal in the management of open tibial fractures and lower extremity salvage is to preserve a limb that will be more functional than an amputation. If the extremity cannot be salvaged, the goal is to maintain the maximum functional length.

Given the advanced age of the patient described, his associated injuries, and an insensate injured lower extremity, the most appropriate management of the injured leg would be a below-knee amputation.

Below-knee amputations provide better prosthetic function and require less energy for ambulation than above-knee amputations.

Although improved microvascular techniques have allowed for nerve repair and nerve grafting, the results of nerve repair and grafting in the lower extremity have been poor. In addition, the repair of the posterior tibial artery would not be necessary if the anterior tibial and peroneal arteries were to remain patent.

Free tissue transfer might be indicated for the soft-tissue defect. However, any anticoagulation used would increase the chance of serious bleeding complications because the patient is being treated nonoperatively for a splenic laceration.

Skin grafting over exposed bone would not be a good option.

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172. A 1-year-old child is evaluated because of a radial polydactyly deformity with a duplicated distal phalanx of the thumb (Wassel Type II). Excision of the radial-sided thumb and reconstruction of the ulnar-sided thumb are planned. Which of the following is most likely to reestablish stability of the thumb?
- A) Early mobilization of the thumb 3 days after surgery
 - B) Excision of the central bone and soft tissue (Bilhaut-Cloquet procedure)
 - C) Pollicization of the index finger
 - D) Reinsertion of the flexor pollicis brevis and abductor pollicis brevis muscles
 - E) Use of a ligamentous and periosteal flap for radial collateral ligament reconstruction

The correct response is Option E.

Careful collateral ligament reconstruction in thumb duplication Types II and IV is critical in achieving stability during reconstruction. This is best done through the technique described by Manske, using a ligamentous and periosteal flap for reconstruction of the radial collateral ligament. In this technique, the radial thumb is excised, with care given to detaching the radial collateral ligament with a periosteal sleeve of tissue. The periosteal sleeve provides additional length to achieve a good repair of the radial collateral ligament.

Early mobilization of the thumb 3 days after surgery would likely be premature and may lead to destabilization of the reconstruction, rather than assisting with final stability. A thumb spica splint is typically used to immobilize such reconstructions for 4 to 6 weeks to aid healing.

Excision of central bone and soft tissue, commonly known as the Bilhaut-Cloquet procedure, can be used in Type II or Type IV duplications but would not be appropriate in the scenario described, in which the surgeon chooses to remove the radial-sided thumb and reconstruct the ulnar-sided thumb.

Pollicization of the index finger would not be appropriate at this level of duplication (Wassel Type II) because a very effective thumb can be made without resorting to the sacrifice of the index finger.

Reinsertion of the flexor pollicis brevis and abductor pollicis brevis muscles is not necessary in a Type II duplication, as the duplication is too distal (distal phalanx) to require any disinsertion or reinsertion of these muscles.

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173. A 30-year-old woman comes to the office because she is unable to flex the distal interphalangeal (DIP) joint of the right long finger. An x-ray study is shown. She reports that she injured the finger 2 days ago when attempting to restrain her dog. Physical examination shows no active flexion of the DIP joint; however, the DIP joint can be passively flexed from 0 to 80 degrees. During surgical exploration, the distal end of the flexor digitorum profundus tendon is most likely to be found at the level of which of the following structures?

- A) A4 pulley
- B) Camper chiasm
- C) Central slip
- D) Sagittal band
- E) Terminal tendon



The correct response is Option A.

The injury to the patient described is commonly referred to as a “jersey finger.” Patients have the sudden failure of fingertip-level grasp, like a football player attempting to tackle an opponent by the jersey. Injury may involve a pure soft-tissue rupture of the flexor digitorum profundus (FDP) tendon, or a portion of the volar proximal aspect of the distal phalanx may be avulsed along with the tendon. Injuries are classified based on the type of fracture and how proximally the FDP tendon has retracted. In the patient described, a large fragment of the distal phalanx base remained attached to the FDP tendon. The tendon and fragment are held in this position by the A4 pulley.

Camper chiasm is where the flexor digitorum superficialis (FDS) tendon splits to pass dorsal to the FDP tendon en route to its insertion at the base of the middle phalanx. Camper chiasm does not exist distal to the proximal interphalangeal (PIP) joint. The sagittal band is a stabilizer of the extrinsic extensor tendons over the dorsum of the metacarpophalangeal (MCP) joint. It also does not contact the FDP tendon. The terminal tendon and central slip are components of the finger extensor mechanism. They do not contact the FDP tendon.



The postoperative x-ray study shown demonstrates reduction of the bone fragments to the shaft of the distal phalanx. A Bunnell suture was used to capture the tendon and the multiple bone fragments. This suture was then passed through the distal phalanx and tied dorsally over a button.

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174. An 18-year-old man is brought to the trauma center after sustaining an injury to the right lower extremity. Examination shows an open fracture of the right tibia. Which of the following mechanisms of the injury is most likely to require the most extensive surgical debridement?

- A) A collision on the rink during which one skater runs over another
- B) A fall from a bicycle onto a curb after a collision with a pedestrian
- C) A fall from a 6-ft ladder onto a ceramic floor
- D) A fall from a shopping cart onto a parking lot
- E) A vehicle crash into a highway barrier while speeding

The correct response is Option E.

All of the mechanisms could have caused an open fracture requiring surgical intervention. Only the vehicle crash represents a high-energy injury. The approach to high-energy injuries must take into account a wider zone of injury beyond just the fracture site and skin laceration.

Open fractures in high-energy soft-tissue injuries have a high incidence of malunion and infection, especially with tibia fractures. These injuries require emergent debridement of both devitalized soft tissue and bone. Aggressive debridement will decrease the incidence of infection and increase the likelihood of successful reconstruction. Wounds frequently require multiple debridements followed by soft-tissue coverage including pedicled and free flaps. Vacuum-assisted closure applies negative pressure to an open wound causing increased granulation tissue, decreased edema, and decreased wound size. This technique has lowered the need for free flaps even in high-energy Gustilo Type III fractures.

The other options listed are not appropriate because the mechanisms of injury are low energy. Free-fall physics shows the housepainter hit the ceramic floor at a maximum of 13 mph. The patient's weight does not affect speed at impact. $\text{Distance} = 1/2 \times \text{Gravity} \times \text{Time}^2$, $\text{Velocity at impact} = \text{Gravity} \times \text{Time}$, $\text{Gravity} = 32 \text{ ft/s}^2$. The ice-skater sustained a sharp injury of low energy. The incident with the shopping cart is a low-energy injury, as is the bicyclist/pedestrian collision. The bicyclist hit a pedestrian and then fell. Average speed for a serious bicyclist is 13 to 18 mph. Colliding with a pedestrian would further decrease that speed.

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175. Which of the following congenital anomalies results from failure of differentiation?

- A) Complex syndactyly
- B) Congenital preaxial polydactyly
- C) Long finger macrodactyly
- D) Type 4 (pouce flottant variant) thumb hypoplasia
- E) Unilateral below-the-elbow congenital amputation

The correct response is Option A.

The embryologic classification of congenital anomalies consists of seven groups of anomalies based on mechanism.

The first group of anomalies is categorized by congenital amputations resulting from transverse or longitudinal failure of formation. The proximal third of the forearm is most commonly affected, and in utero vascular insult is thought to cause these anomalies.

All polydactylies are categorized in the third group of anomalies: duplications. These also include mirror hand, radial (preaxial) polydactyly, and ulnar (postaxial) polydactyly.

Both simple and complex syndactyly fall into the second group of anomalies: failure of differentiation. Additional anomalies within this group include radioulnar synostosis, symphalangia, clinodactyly, and camptodactyly. This group can be thought of as having all of the requisite parts present but with incomplete separation of those parts.

Pouce flottant represents a Type 4 thumb hypoplasia and, like all variants of thumb hypoplasia, falls into the fifth group: undergrowth. The currently accepted classification of thumb hypoplasia was modified by Buck-Gramcko.

Macrodactyly is an overgrowth classification and not a disorder of differentiation.

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(Please note that this pictorial appears in color in the online examination)

176. A 30-year-old man sustains a laceration to the radial nerve at the mid-humerus level. Physical examination shows wristdrop. A photograph is shown. Which of the following transfers is most appropriate to restore wrist extension in this patient?
- A) Axillary to radial nerve transfer
 - B) Biceps to triceps muscle transfer
 - C) Brachioradialis to extensor carpi ulnaris tendon transfer
 - D) Phrenic nerve to posterior cord transfer
 - E) Pronator teres to extensor carpi radialis tendon transfer

The correct response is Option E.

Pronator teres to extensor carpi radialis brevis (ECRB) transfer is well described for restoration of wrist extension in isolated radial nerve injury or palsy. The pronator teres is harvested from its insertion on the radius along with an extension of radius periosteum (necessary to have sufficient length for the transfer) and is woven either end-to-end into the ECRB or end-to-side into the ECRB if the surgeon feels the ECRB may recover some function. Some authors also advocate

weaving a portion of tendon graft harvested from the extensor carpi radialis longus (ECRL) to increase the strength of the repair. The image shown demonstrates the transfer. The pronator teres is raised with an extension of radius periosteum and woven into the ECRB tendon. Tendon grafting from ECRL reinforces the repair.



Axillary-radial nerve coaptation is performed in the proximal upper arm and uses the radial nerve as a donor to provide axons to the axillary nerve and deltoid muscle. Transfer of median nerve axons to the nerve to the ECRB may be used to provide wrist extension. Biceps to triceps transfer has been described to restore a component of radial nerve dysfunction in tetraplegia, but this transfer would provide elbow extension, not wrist extension. The brachioradialis muscle is innervated by the radial nerve. If the nerve were lacerated at the mid-humerus level, the brachioradialis would not be functional. The phrenic nerve could provide donor axons to the posterior cord, which would eventually become the radial nerve; however, axons transferred at this level would face the problem of interruption at the mid-humerus level within the radial nerve.

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177. A 43-year-old woman is brought to the emergency department after sustaining an injury to the right thumb and index finger from an ink press. Physical examination shows amputation of the right thumb at the carpometacarpal joint, and amputation of the index finger at the head of the middle phalanx. The amputated thumb was wrapped in a moist gauze towel immediately after the injury and appears to be severely mangled. Which of the following is the definitive management of the thumb?

- A) Debridement and closure of wounds
- B) Great toe-to-thumb transfer
- C) Osteoplastic thumb reconstruction
- D) Replantation of the thumb
- E) Residual index finger pollicization

The correct response is Option E.

The thumb contributes roughly 40% to hand function, and the fingers contribute 60% to hand function. Therefore, amputation of the thumb decreases hand function up to 40%, making reconstruction a high priority.

Pollicization refers to the neurovascular pedicle movement of a finger, often with its metacarpal, for thumb reconstruction. Pollicization can be used for amputations of the thumb between the middle of the first metacarpal and at the carpometacarpal joint, but it works best for amputation at the level of the carpometacarpal joint. If the index finger is injured and has little mobility, the injured index finger should be used for thumb reconstruction and serve as a stable post. If thenar muscles are intact, opposition can be expected. Benefits of index finger transfer include aesthetic results, potential motion of transferred and retained joints, and provision of reliable sensation.

Debridement and closure of wounds is not ideal, as this would impair function of the dominant hand.

Great toe-to-thumb microsurgical reconstruction is best for amputations between the metacarpophalangeal (MCP) joint and interphalangeal joints but can be used for amputations proximal to the MCP. In the patient described, the traumatized index finger serves as an excellent alternative for reconstruction of the amputated thumb with preservation of a normal foot.

Osteoplastic thumb reconstruction is rarely performed today, as it results in a stiff, broad, floppy thumb with limited sensation. It involves the combination of a bone graft and flap to lengthen the thumb. At least three stages are required: bone graft from iliac crest covered in a tubed distant flap; flap pedicle division; and transfer of the neurovascular sensory flap from the long finger to the thumb's pinch contact surface.

If the amputated part had been mangled, lost, or inappropriately preserved, then replantation would not have been an option.

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178. A 54-year-old woman comes to the office because of a 6-year history of weakness and numbness of the left hand. Physical examination shows decreased sensation in the thumb, index, long, and ring fingers. No other sensory abnormalities are noted. Examination of which of the following muscles is most likely to confirm a diagnosis?

- A) Abductor pollicis brevis
- B) Adductor pollicis
- C) First dorsal interosseous
- D) Flexor digiti minimi
- E) Flexor pollicis brevis

The correct response is Option A.

The examination of the patient described suggests an injury or compression neuropathy of the median nerve. The only intrinsic muscle innervated by the median nerve (recurrent branch) that can be reliably tested separately from the ulnar intrinsic muscles is the abductor pollicis brevis. The adductor pollicis, first dorsal interosseous, and flexor digiti minimi are all completely innervated by the ulnar nerve. The flexor pollicis brevis muscle has dual innervation from both the ulnar (deep head) and median (superficial head) nerves.

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179. A 36-year-old man comes to the office because of weakness in the right hand 4 months after sustaining a saw injury to the volar ulnar aspect of the proximal right forearm. At the time of injury, the wound was cleaned and sutured in the emergency department. Current physical examination shows finger clawing and ineffectual gripping of the right hand. An injury to the ulnar nerve is noted. Which of the following is the most effective transfer to restore function to the intrinsic hand muscles in this patient?

- A) Anterior interosseous nerve branch to the pronator
- B) Extensor carpi radialis longus tendon
- C) Flexor carpi ulnaris fascicle nerve
- D) Flexor digitorum superficialis tendon
- E) Medial antebrachial cutaneous nerve

The correct response is Option A.

A proximal ulnar nerve lesion with a segmental nerve loss in an adult is unlikely to have intrinsic muscle function restored by nerve grafting, especially after some delay before treatment. Each tendon transfer may restore one aspect of the ulnar motor deficit. Both extensor carpi radialis longus transfer and the Zancolli flexor digitorum superficialis lasso procedure have been described for the ulnar claw posture of the fingers, but the potential advantage of a nerve transfer over a tendon transfer under these circumstances is the capacity for restoration of function of multiple muscle groups with a single nerve transfer.

A nerve transfer is an alternative to nerve grafting when time from injury to reconstruction is prolonged and when a proximal nerve injury requires a long distance for regeneration. The Oberlin nerve transfer was described for restoration of elbow flexion in patients with brachial plexus injury. This utilizes the flexor carpi ulnaris fascicle transfer to the musculocutaneous nerve. The classically described nerve transfer for a high ulnar nerve palsy to restore hand intrinsic motor function is to use the anterior interosseous branch to the pronator quadratus as a transfer into the ulnar motor nerve branch.

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180. During coverage of a defect with a reverse cross-finger flap, which of the following is the most appropriate location for application of a full-thickness skin graft?

- A) Dorsal surface of the middle phalanx of the donor finger
- B) Dorsal surface of the middle phalanx of the recipient finger
- C) Volar surface of the distal phalanx of the donor finger
- D) Volar surface of the distal phalanx of the recipient finger
- E) Volar surface of the middle phalanx of the donor finger

The correct response is Option B.

Multiple local flaps are available for coverage of finger defects. A reverse cross-finger flap is used to cover soft-tissue defects on the dorsum of an adjacent digit. The skin on the donor finger is incised on the side closest to the recipient finger and elevated off of the underlying dorsal subcutaneous tissue. The dorsal subcutaneous tissue of the donor finger is raised as a flap based on the side closest to the recipient finger. The flap is sutured to the recipient finger and is used as a bed to receive a full-thickness skin graft. The native skin is then returned to the dorsum of the middle phalanx of the donor finger. If the volar surface of a finger requires coverage, a standard (not reverse) cross-finger flap is used.



The photograph shown on the left demonstrates the reverse cross-finger flap raised from the dorsum of the long finger and positioned over the index finger. After inset of the flap, the skin of

the donor finger is closed primarily. A skin graft is applied over the flap on the dorsum of the recipient finger as shown in the photograph on the right.

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181. A 52-year-old man is scheduled to undergo operative release of the A1 pulley for treatment of stenosing tenosynovitis of the index finger of the right hand after two injections of corticosteroids were unsuccessful. Which of the following is most likely to be useful in locating the proximal edge of the A1 pulley?

- A) Distal palmar crease
- B) Distance from the proximal digital crease to the proximal interphalangeal crease
- C) Distance from the proximal interphalangeal crease to the distal interphalangeal crease
- D) Proximal digital crease
- E) Thenar crease

The correct response is Option B.

The proximal edge of the A1 pulley can be found proximal to the proximal digital crease (PDC), a set distance that equals the distance from the PDC to the proximal interphalangeal (PIP) crease in a study of 256 cadaveric fingers. The distal palmar crease and thenar crease almost never continue into the area of the A1 pulley in the index finger. The palmar digital crease at the base of the digits is closer to the distal edge of the A1 pulley, which is just proximal to the palmar digital crease. Trigger finger syndrome and stenosing tenosynovitis result from a nonspecific process of proliferation of the flexor tenosynovium, which restricts entry to the fibro-osseous canal at the level of the A1 pulley. Patients with trigger finger syndrome complain of difficulty opening the finger, sometimes with popping on opening the finger. Patients can also have a palpable painful palmar nodule on examination. Several conditions have been associated with this condition, including rheumatoid arthritis, osteoarthritis, pregnancy, diabetes, hypothyroidism, and end-stage renal disease.

Initial treatment for stenosing tenosynovitis includes a corticosteroid injection if the patient has had symptoms for less than 4 months and the finger is not fixed in the flexed position. When patients fail or are not candidates for nonoperative treatment, they can be treated by A1 pulley release. Recently, percutaneous trigger finger release and A1 pulley release have gained popularity, but there is an increased risk of recurrence, persistence, tendon cuts, and neurovascular injury. Conventionally, the A1 pulley can be openly approached with either a small longitudinal, transverse, or oblique opening directly over the A1 pulley.

A1 pulley release should not be performed in patients with rheumatoid arthritis because of the risk of worsening the radial drift of the fingers toward the side of the lumbrical to each finger. In

these patients, trigger finger is managed by tenosynovectomy and partial debridement of the tendon.

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182. An otherwise healthy 46-year-old man comes to the emergency department because of pain in the right wrist 8 hours after falling onto his outstretched hand with the wrist extended. Plain anterior-posterior x-ray study shows widening of the joint between the scaphoid and lunate bones. Which of the following additional findings is most likely on lateral x-ray study?

- A) Dorsiflexion of the lunate bone
- B) Dorsiflexion of the lunate and scaphoid bones
- C) Dorsiflexion of the scaphoid bone
- D) Volar flexion of the lunate bone
- E) Volar flexion of the lunate and scaphoid bones

The correct response is Option A.

The mechanism of injury and the anterior-posterior x-ray study in the scenario described suggest dissociation between the scaphoid and lunate bones. This injury can result in a dorsal intercalated segmental instability (DISI), wherein the scaphoid bone loses the support of the scapholunate ligament and most commonly tips into volar or palmar flexion. In this scenario, the lunate then tips into dorsiflexion by the same mechanism; therefore, dorsiflexion of the lunate bone is correct. This also eliminates dorsiflexion of the scaphoid bone. A dissociation of the lunate and triquetral bones causes the opposite forces, and the lunate tips into volar flexion, eliminating volar flexion of the lunate bone. When the scaphoid and lunate bones dissociate, they can be expected to tip in opposite directions through the same forces, eliminating volar flexion of the lunate and scaphoid bones and dorsiflexion of the lunate and scaphoid bones. This would be a volar intercalated segmental instability (VISI).

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183. A 30-year-old man is referred for poor thumb opposition following an injury to the median nerve at the level of the wrist of the dominant right hand sustained 18 months ago. Physical examination shows strong function of the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) of the little, ring, long, and index fingers. Extension of the wrist, fingers, and thumb is also strong. Which of the following tendon transfers into the abductor pollicis brevis insertion is most appropriate for correction of the deficit in this patient?

- A) Transfer of the extensor carpi radialis brevis
- B) Transfer of the extensor indicis proprius
- C) Transfer of the FDP of the ring finger
- D) Transfer of the flexor carpi ulnaris
- E) Transfer of the flexor palmaris longus

The correct response is Option B.

The patient described most likely has a low median nerve palsy marked only by loss of opposition. The FDS of all the fingers and the FDP of the index and long fingers are functional. High median nerve palsy would result in loss of all FDS function, loss of FDP function of the index and long fingers, and loss of flexor palmaris longus function. Therefore, a tendon transfer that specifically addresses opposition is necessary.

Transfer of either the FDS of the ring finger or the extensor indicis proprius (EIP) is appropriate. FDS transfer requires formation of a pulley at approximately the level of the pisiform. This is most easily created using the ulnar half of the flexor carpi ulnaris tendon.

The EIP tendon is long and can be easily routed around the ulnar aspect of the forearm and still reach the thumb proximal phalanx, obviating the need for a pulley. This tendon transfer is considered by many authors to be superior to the FDS transfer because possible adhesion formation to a constructed pulley is avoided.

Transfer of the extensor carpi radialis brevis directly to the thumb proximal phalanx is not a described opponensplasty and would disrupt the most centralized wrist extender.

Transfer of the FDP of the ring finger is inappropriate because distal interphalangeal flexion of the ring finger would be lost.

Transfer of the palmaris longus is often performed during a carpal tunnel release following long-standing median nerve compression to augment weakened thenar muscles, but this tendon transfer does not provide as much opposition strength as the EIP and FDS transfers in lower median nerve palsy. This is especially true for reconstruction of the dominant hand.

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184. A 47-year-old woman comes to the office for elective thinning of a free flap to the forearm 6 months after undergoing an uncomplicated sarcoma reconstruction. During the procedure, a vascular clamp retained from the initial procedure is uncovered. The clamp did not adversely affect the patient's outcome or the need for the present operation. Which of the following is the most appropriate course of action?

- A) Inform the patient only, as risk management notification is not required because of lack of harm
- B) No action is required because there was no injury or deviation from standards
- C) Notify the risk management department and inform the patient
- D) Notify the risk management department only, as patient notification is not required because of lack of harm

The correct response is Option C.

The incidents of retained foreign bodies after surgery are estimated to be between 1/8000 to 1/18,000 operations for a mid- to large-sized hospital that performs 10,000 cases per year. This would amount to approximately one case per year.

The most commonly retained foreign body is a surgical sponge or laparotomy pad. The most common risk factors examined are emergency operation, unexpected change in the operation, more than one surgical team involved, change in nursing staff during the procedure, high BMI, volume of blood loss, female gender, and surgical counts. The most significant risk factors are emergency surgery, unplanned change in operation, and increased BMI.

Cases of retained foreign bodies after surgical procedures often enter into the legal realm. Proof of negligence is not required when a foreign body is erroneously left in a patient. The doctrine of *res ipsa loquitur*, or “the thing speaks for itself,” applies when a foreign body is encountered that is asymptomatic. The most important aspect is communication with the patient. Often, open lines of communication can prevent these incidents from becoming legal malpractice cases. It is important to have communication with the hospital risk management officials as well.

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185. A 5-year-old boy is brought to the office because of a 2-month history of pain and diffuse swelling in the left leg. His parents report that his left foot has always been larger than his right foot. Physical examination shows purple macular lesions over the majority of the lateral left leg. Circumference of the left leg is nearly twice that of the right leg. No other abnormalities are noted. MRI of the left leg shows numerous tortuous, low-flow vessels. There is no evidence of arteriovenous fistulas. The patient is at greatest risk for which of the following?

- A) Deep venous thrombosis
- B) Heart failure
- C) Pathologic fracture
- D) Seizure
- E) Thrombocytopenia

The correct response is Option A.

In the patient described with hallmark findings for Klippel-Trénaunay syndrome (KTS), the major risks relate to deep venous thrombosis and pulmonary embolism. Compression therapy may alleviate the pain and assist in venous return. Surgical interventions for the mixed vascular/lymphatic malformations have limited success and have been associated with increased incidence of deep venous thrombosis.

Heart failure can occur in high-flow vascular malformations, which often demonstrate significant arteriovenous fistulas. Patients with Parkes-Weber syndrome may have symptoms similar to KTS; however, KTS lacks the arteriovenous fistulas.

Patients with Maffucci syndrome manifest multiple cutaneous hemangiomas and extremity enchondromas. The risk of pathologic fracture is increased at sites of cortical thinning around the enchondromas.

Seizures are associated with Sturge-Weber syndrome; in the absence of a capillary malformation (port-wine stain) involving the V1 distribution of the face, Sturge-Weber syndrome would not be in the differential diagnosis.

Thrombocytopenia occurs either by sequestration, as in kaposiform hemangioendothelioma, or because of consumption in low-flow vascular malformations such as KTS. In the consumptive conditions, platelet counts are depressed (50,000-150,000 μ L) but not life-threatening. Profound

thrombocytopenia (<25,000 μ L), the Kasabach-Merritt phenomenon, is not associated with the clinical scenario of KTS.

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(Please note that this pictorial appears in color in the online examination)

186. A 62-year-old man is scheduled for release of Dupuytren contractures of the little finger of the left hand. A photograph of the finger is shown. The digital nerves have been pulled to a more central and superficial position at which of the following flexion creases?

- A) Distal interphalangeal
- B) Distal palmar
- C) Metacarpophalangeal
- D) Mid palmar
- E) Proximal interphalangeal

The correct response is Option C.

Dupuytren disease is characterized by changes in the palmar and digital fascias that create nodules and cords. These cords in turn progress at variable rates to cause contractures and limit hand function. The progression of disease adheres to well-defined anatomical pathways that follow the normally supple longitudinal bands of palmar fascia. Proximal interphalangeal (PIP) joint contractures are caused by shortening and thickening of the pretendinous band, spiral band, lateral digital sheet, and Grayson ligament, thus forming the spiral cord.

The spiral cord encircles the digital nerve and pulls it proximally, centrally, and superficially. In a contracture of 60 degrees, the digital nerve would be most vulnerable at the metacarpophalangeal (MCP) crease. This crease correlates to the mid-shaft level of the proximal phalanx. At the distal palmar and mid-palmar creases, the digital nerves are dorsal and lateral to the pretendinous cord. At the PIP and distal interphalangeal crease, the digital nerves are dorsal and lateral.

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187. A 30-year-old woman comes to the emergency department after cutting herself with a kitchen knife. Surgical exploration shows that the median nerve had been cut at the distal forearm. The distal nerve is relatively fixed, but the proximal nerve has been lifted and twisted. Immediate repair is planned. The motor fibers of the proximal nerve end are most likely in which of the following locations relative to the sensory fibers?

- A) Dorsal and radial
- B) Dorsal and ulnar
- C) Volar and radial
- D) Volar and ulnar

The correct response is Option C.

At the level of the distal forearm, the median nerve is a mixed nerve comprised of both motor (20%) and sensory (80%) fibers. The motor fibers become the thenar branch, which innervates the abductor pollicis brevis (AbPB), opponens pollicis (OP), and flexor pollicis brevis (FPB). The FPB is located distal to the AbPB and OP and also has innervation from the ulnar nerve, which is why patients with median nerve injuries can sometimes still bring the thumb to the little finger. The thenar nerve can be injured with a carpal tunnel release procedure. After coursing into the carpal tunnel, these median nerve motor fibers leave the median nerve volar and radial to the sensory fibers of the median nerve through a variety of branching patterns.

When patients have clean-cut injuries to nerves, the nerves can be repaired primarily. In a contaminated, dirty wound caused by a crush and mutilating injury, it can be difficult to determine the nonviable nerve required for debridement before repair. In the scenario described, the nerve ends are labeled with a permanent suture for later identification and repair at a second stage. In general, sensory-only nerves can be repaired by epineurial approximation, and group fascicular repair can be considered for mixed nerves.

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(Please note that this pictorial appears in color in the online examination)

188. A 2-year-old girl has an unstable carpometacarpal (CMC) joint at the base of the thumb of the left hand. A photograph and x-ray study of the hand are shown. According to Blauth and Manske, which of the following is the most appropriate classification of this hypoplastic thumb?

- A) II
- B) IIIA
- C) IIIB
- D) IV
- E) V

The correct response is Option C.

The Blauth classification of the hypoplastic thumb, as modified by Manske, is a true working classification that can be used for planning treatment (see table). Type IIIB has an unstable CMC joint and is the “cutoff point” for performing index finger pollicization and ablation of the hypoplastic thumb, versus attempting reconstruction of the original thumb.

Type of		
thumb hypoplasia	Findings	Treatment
I	Minor generalized hypoplasia	None
II	Absence of intrinsic thenar muscles	Opponensplasty
	First web space narrowing	Web space deepening
	Ulnar collateral ligament (UCL) insufficiency	UCL reconstruction
III	Similar findings as Type II, as well as:	
	- Extrinsic muscle and tendon abnormalities	
	- Skeletal deficiency	
	a) Stable CMC joint	Reconstruction with tendon transfers
	b) Unstable CMC Joint	Pollicization
IV	Pouce flottant of floating thumb	Pollicization
V	Absence	Pollicization

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189. A 25-year-old man is brought to the emergency department after falling down a staircase and landing on his outstretched hand. X-ray studies show a perilunate dislocation. The scapholunate and which of the following ligaments must be ruptured for this dislocation to occur?

- A) Dorsal intercarpal
- B) Dorsal radiotriquetral
- C) Lunotriquetral
- D) Radioscaphocapitate
- E) Ulnotriquetral

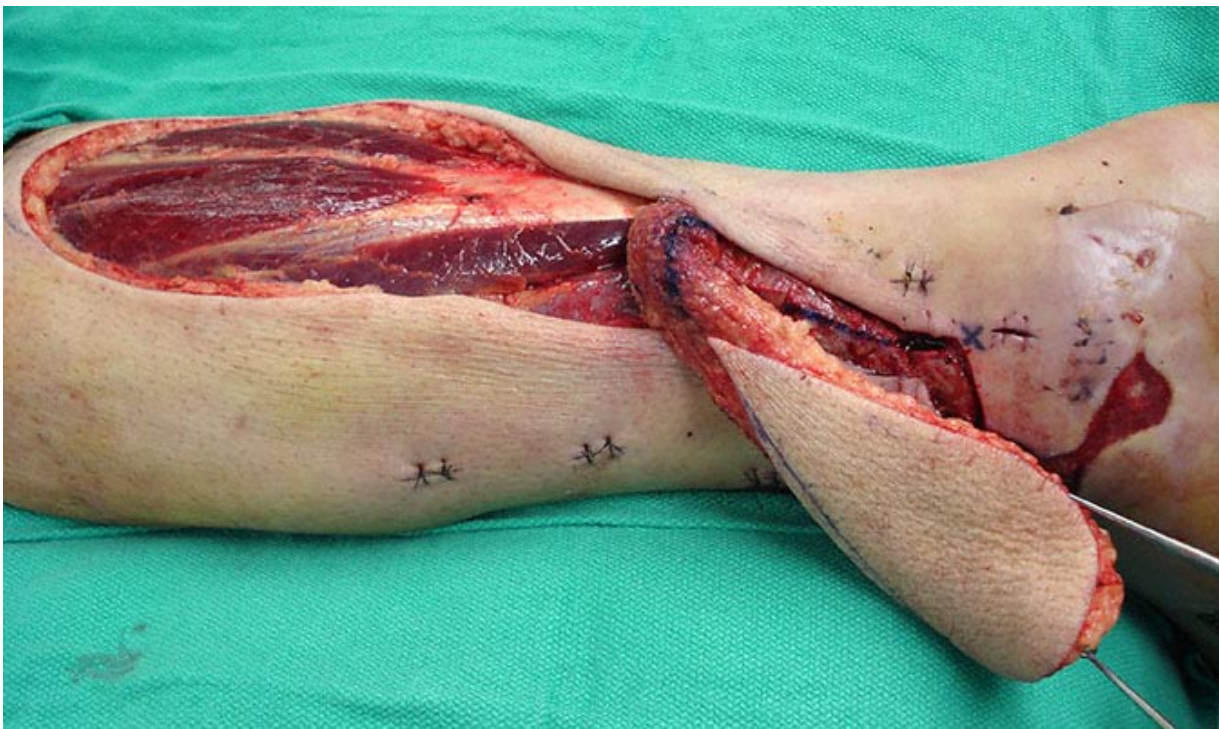
The correct response is Option C.

Perilunate dislocation is the most common form of carpal dislocation. There is disruption between the ligamentous connections of the lunate and other carpal bones and radius. In the scenario described, rupture of the scapholunate and lunotriquetral ligaments is the most likely cause of the dislocation. These ligaments are usually repaired, followed by open reduction and internal fixation.

The dorsal intercarpal, dorsal radiotriquetral, radioscaphocapitate, and ulnotriquetral ligaments are not appropriate choices because they do not connect to the lunate.

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(Please note that this pictorial appears in color in the online examination)

190. A 40-year-old man undergoes open reduction and internal fixation of an open fracture of the ankle. Debridement of nonviable tissue results in the exposure of the lateral joint and hardware. Coverage of the lateral malleolus with the flap shown is planned. Which of the following arteries must be intact for this flap to be viable?
- A) Anterior tibial
 - B) Dorsalis pedis
 - C) Lateral genicular
 - D) Lateral plantar
 - E) Peroneal

The correct response is Option E.

The reverse-flow sural flap has become one of the more dependable solutions in distal third leg wound and heel reconstruction. Survival of the flap depends on intact flow into the superficial

sural arterial network via perforators from the peroneal system. The largest perforator arises roughly 5 cm cephalad to the lateral malleolus and typically marks the lowest pivot point for the flap.

None of the remaining choices would provide adequate perfusion for this flap.

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191. A 9-month-old infant is evaluated because of syndactyly. For which of the following is surgical intervention most likely to be contraindicated?
- A) Complex syndactyly related to constriction band syndrome
 - B) Complex syndactyly related to Poland syndrome
 - C) First web syndactyly related to Apert syndrome
 - D) Simple syndactyly of the ring and little fingers
 - E) Web syndactyly related to Type I super digit

The correct response is Option E.

A contraindication for web correction is super digits. As these digits grow, common complications include enlargement and undergrowth; therefore, reconstruction into normally functioning digits is rare.

Other contraindications to surgery involve complex syndactyly with conjoined fingers functionally moving in unison; separating these jumbled masses may significantly jeopardize postoperative function. Surgery also is contraindicated in hands with no active muscular control.

In constriction band syndrome, syndactyly may be mild or severe. In Poland syndrome, syndactylies with hypoplasia are found in variations. In Apert syndrome, syndactyly patterns include complex syndactyly of the index, long, and ring fingers, and simple syndactyly of the web space between the ring and little fingers.

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192. A 23-year-old woman comes for evaluation of a laceration over the volar middle phalanx of the long finger of the right hand. Physical examination shows that flexion of the proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints is full. Exploration of the wound shows a complete laceration of the flexor digitorum profundus tendon. Which of the following structures is responsible for the continued ability to flex the DIP joint?

- A) Camper chiasm
- B) Oblique retinacular ligament
- C) Sagittal band
- D) Transverse retinacular ligament
- E) Vincula

The correct response is Option E.

The vincula are specialized vascular structures that provide nutrition to the flexor tendon and support tendon healing. They attach to the volar plate of the interphalangeal joints and can transfer the force of a divided tendon. Preservation of the vincula with a divided flexor tendon can result in preservation of motion of the tendon on clinical examination and missed diagnosis of a tendon injury.

Camper chiasm is the area in which the flexor digitorum profundus tendon enters between the two heads of the flexor digitorum superficialis. This is proximal to the laceration and would not allow for DIP flexion.

The oblique retinacular ligament, a structure between the middle phalanx and the distal phalanx, can provide extension of the distal phalanx when the extensor tendon is cut.

Sagittal bands are ligamentous structures over the metacarpophalangeal (MCP) joint that prevent tendon subluxation.

The transverse retinacular ligament is a ligament that originates at the flexor tendon sheath of the PIP joint inserting onto the conjoined lateral band. Its function is to prevent dorsal shift of the lateral band when the PIP extends.

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193. A 48-year-old woman undergoes coverage of a defect with an anterolateral thigh flap. Which of the following branches of the lateral femoral circumflex artery is the most likely dominant vascular supply for the flap perforator?

- A) Ascending
- B) Descending
- C) Oblique
- D) Transverse

The correct response is Option B.

In recent studies by Wong, et al, and Rozen, et al, attempts have been made to clarify the vascular perforator anatomy of the anterolateral thigh flap. It has been noted that sizeable vascular perforators may arise from the ascending, transverse, or descending branch of the lateral circumflex femoral artery. The most common supply, however, comes from the descending branch, followed by the transverse and ascending branches.

The descending branch is dominant in about 85% of cases.

A variable oblique branch, which can occasionally be the primary supply, has also been noted. This branch, when it exists, is usually the primary supply of the flap in 15% of cases. It typically is an offshoot of the descending or transverse branch.

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194. A 68-year-old woman comes to the office because of a 4-year history of numbness and tingling in the tips of the thumb, index, and long fingers. The symptoms have become progressively severe and now wake her at night. Physical examination shows decreased strength of thumb opposition and thenar atrophy. Sensation to pinprick is diminished over the median nerve distribution. Which of the following findings is most likely on electrodiagnostic testing?

	Median Sensory Latency	Median Motor Latency	Fibrillations
A)	Decreased	decreased	absent
B)	Decreased	decreased	present
C)	Unchanged	unchanged	absent
D)	Increased	increased	absent
E)	Increased	increased	present

The correct response is Option E.

The most likely finding on electrodiagnostic testing is increased median sensory latency, increased median motor latency, and presence of fibrillations.

For the patient described, compression of the median nerve results in numbness and paresthesias in the median nerve distribution. The disease has progressed to the point where physical findings include decreased strength and thenar atrophy, indicating the presence of denervation and median nerve damage.

On nerve conduction studies (NCS), the sensory and motor latency measurements detect the time necessary for a signal to travel across a segment of nerve from a stimulating electrode to a recording electrode. In the presence of nerve compression, demyelination results and conduction is slowed, resulting in a longer time and increased latency (measured in milliseconds).

On electromyography (EMG), the needle examination will assess the presence of denervation changes, manifested as fibrillations and positive sharp waves. These are signs of ongoing nerve injury and muscle denervation. Spontaneous muscle activity with fibrillation potentials is the earliest sign of denervation. In severe carpal tunnel syndrome, examination of the median-innervated abductor pollicis brevis muscle will reveal changes. There may also be alteration in the motor unit potentials caused by chronic episodes of denervation and reinnervation.

Carpal tunnel syndrome remains a clinical diagnosis based on history and physical examination. Clinical suggestion may be confirmed by electrophysiologic testing, but false-negative and false-positive results may occur.

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195. Volkmann ischemic contracture occurs when forearm compartment pressure is above 30 mmHg for a minimum of approximately how many hours?

- A) Less than 2
- B) 3-5
- C) 6-12
- D) 18-24
- E) Greater than 24

The correct response is Option C.

Permanent neuromuscular damage occurs at 12 hours, leading to subsequent Volkmann contracture. Timeline of ischemia, shown experimentally, is capillary endothelial damage at 3 hours; partially reversible muscle and nerve injury occurs at 6 hours.

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196. A 60-year-old woman comes to the office because of a 2-year history of disabling pain in the carpometacarpal joint of the thumb of the nondominant left hand. Physical examination shows swelling and tenderness. Grind test results are positive. X-ray study shows osteoarthritis with subluxation of the joint. Which of the following types of biomaterial is most appropriate for arthroplasty?

- A) Expanded polytetrafluoroethylene (GORE-TEX)
- B) Polypropylene (Marlex)
- C) Polyurethaneurea (Artelon)
- D) Porcine dermal collagen xenograft (Permacol)
- E) Silicone trapezial implant arthroplasty

The correct response is Option C.

Polyurethaneurea (Artelon) implants typically biodegrade by hydrolysis and are described as causing minimal giant cell and foreign body reaction. Although long-term studies are still pending, they currently appear to be the best biomaterial for this application.

The use of silicone trapezial implants was, at one time, a common procedure, but the long-term results of silicone arthroplasty wear and deformation led to multinucleated giant cell reactions with silicone granulomas and synovitis. This resulted in about a 25% failure rate with this modality.

Similarly, a study by Greenberg, et al, showed an incidence of 80% osteolysis and a high failure rate with GORE-TEX implants. A biopsy specimen of one retrieved implant showed giant cell reactions. Marlex implants also showed foreign body reactions and synovitis. A study by Belcher, et al, on Permacol implants was terminated prematurely because of adverse reactions to the implant in 6 of 13 patients, with significant pain and evidence of multinucleated giant cells.

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197. A 40-year-old man comes to the office with pain in the base of the left thumb after falling on his outstretched hand. X-ray study of the left thumb shows dislocation of the carpometacarpal (CMC) joint but no fracture. A tear of which of the following ligaments is most likely?

- A) Deep transverse metacarpal
- B) Dorsal ligament complex
- C) Ligament of Testut
- D) Oblique retinacular

The correct response is Option B.

Many ligaments provide support to the CMC joint of the thumb. The volar beak ligament passes between the trapezium and thumb metacarpal on the volar ulnar aspect of the joint and is an important stabilizer. The dorsal ligament complex (composed of the dorsal radial and posterior oblique ligaments) is the largest, thickest, strongest, and most important ligament. If this ligament complex is torn, such as in a dislocation of the CMC joint of the thumb or some Bennett fractures, the CMC joint is no longer stable.

The deep transverse metacarpal ligament connects the volar plates of the metacarpophalangeal joints of the fingers distally in the palm. The dorsal intercarpal ligament connects the triquetrum and the distal scaphoid bone. It does not cross the CMC joint of the thumb. The ligament of Testut resides in the volar carpus and connects the radius, scaphoid, and lunate bones. The oblique retinacular ligament is a supporting structure of the distal interphalangeal joint in the finger.

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198. A 37-year-old man who works as a carpenter is brought to the emergency department after falling 10 ft from a scaffold. He says he has pain in the left wrist and numbness of the thumb, index, and long fingers of the left hand. Trauma screening shows no other injury, and x-ray studies of the left wrist are obtained (shown). Which of the following is the most appropriate treatment?

- A) Application of finger traps and placement in traction
- B) Closed reduction and carpal tunnel release
- C) Open reduction and internal fixation
- D) Splinting of the wrist in 30 degrees of extension
- E) Total wrist fusion

The correct response is Option C.



Perilunate dislocations are relatively uncommon injuries that typically follow high-energy impact to the wrist. The pattern of injury traverses both the greater and lesser carpal arcs, disrupting the lunotriquetral ligament and either the scapholunate ligament or the body of the scaphoid (trans-scaphoid, perilunate dislocation). Although controversy surrounding the need for operative intervention existed in the past, poor long-term outcomes from closed reduction alone have showed the importance of early restoration of carpal alignment with repair of the injured ligaments. In the setting of trans-scaphoid, perilunate dislocation, this would include rigid internal fixation of the scaphoid.

Application of finger traps and placement in traction may assist in reduction of the dislocated lunate but will not, by itself, reduce the lunate and remove the need for internal fixation and repair of the injured ligaments.

Proximal row carpectomy and wrist function play a role in long-term salvage of the painful wrist following perilunate dislocations. Only in rare circumstances, such as nonreconstructible fractures of the proximal row bones, should acute proximal row carpectomy be considered.

Splinting of the wrist in extension often provides relief in the setting of idiopathic carpal tunnel syndrome; however, in the setting of lunate dislocation, the presence of the lunate in the carpal tunnel necessitates reduction of the lunate for relief of symptoms.

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199. A 34-year-old man who works as a pipe fitter sustains amputation of the radial three digits of the nondominant left hand. Replantation of the thumb and long finger is performed. Three weeks later, the replanted thumb becomes necrotic. Photographs are shown. Which of the following methods of reconstruction is most likely to provide the best functional outcome?

- A) Amputation and web space deepening
- B) Debridement and coverage with a radial forearm flap
- C) Distraction lengthening of the remaining thumb
- D) Pollicization of the long finger
- E) Toe-to-thumb transfer



(Please note that this pictorial appears in color in the online examination)

The correct response is Option E.

Toe-to-thumb transfer has become the standard of care for thumb reconstruction when the level of loss occurs at or around the metacarpophalangeal (MCP) joint. The functional outcomes from the transfer are excellent and the donor defect, while not completely free from morbidity, is acceptable. Wound and nerve complications, such as neuroma, can be successfully managed through traditional techniques.

Revision amputation of the thumb in the patient described would be at or proximal to the MCP joint level. Even with web space deepening, there would be insufficient length of the thumb against which the other fingers could oppose.

Distraction lengthening requires a higher-quality skin envelope than exists in the patient described to tolerate the increased space that would be occupied by the thumb metacarpal. In addition, the only remaining mobile joint in this patient would be the carpometacarpal (CMC) joint. Also, the distal end of a thumb created by this technique would have poor sensation and poor durability.

Debridement and coverage with a radial forearm flap would provide high-quality tissue that could even be made sensate with coaptation of the medial and lateral antebrachial cutaneous nerves to the digital nerve stumps. However, there would still be inadequate length of the thumb with this method.

Pollicization, while less commonly used in adult than in pediatric reconstruction, can still be useful when the level of amputation occurs at the CMC joint, or when the patient cannot tolerate or will not accept microsurgical transfer of a toe. Pollicization generally moves the index finger to the thumb position; pollicizing the long finger is technically very difficult to do because of the vascular pedicle. Given that the index finger is already lost in this patient, sacrifice of the long finger would leave only two mobile fingers on this hand.



Photographs of the patient several months after great toe-to-thumb transfer are shown. Although the great toe is slightly larger than a normal thumb, recovery of function is quite good.

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200. A 25-year-old man is brought to the emergency department after his right arm broke through a glass window. The right distal forearm is explored for injuries to multiple tendons and for the location of the proximal end of the flexor digitorum superficialis (FDS) tendon of the index finger. This tendon can be found in which of the following locations?

- A) Dorsal to the FDS tendon of the long finger
- B) Palmar to the FDS tendon of the little finger
- C) Palmar to the flexor pollicis longus tendon
- D) Radial to the flexor digitorum profundus (FDP) tendon of the index finger
- E) Ulnar to the FDP tendon of the ring finger

The correct response is Option A.

In the forearm, the FDS tendons of the long and ring fingers are located above or palmar to the FDS tendons of the index and little fingers, respectively. The FDS tendons sit in a stacked array; the FDS tendons of the long and ring fingers are located next to each other, volar to the FDS tendons of the index and little fingers. Therefore, the proximal end of the FDS tendon of the index finger can be found dorsal to the FDS tendon of the long finger. The FDP tendons rest dorsal to the FDS tendons, arranged along a transverse vector in an order corresponding to the finger in which it is inserting. The distal ends of the cut flexors can be identified by the finger and joint that they motor. The proximal ends can be identified by knowledge of this anatomy, which is useful when multiple flexor tendons have been severed at the level of the forearm (ie, a “spaghetti wrist” injury).

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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)	(E)
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)	(E)
24	(A)	(B)	(C)	(D)	(E)
25	(A)	(B)	(C)	(D)	
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)	
36	(A)	(B)	(C)	(D)	(E)
37	(A)	(B)	(C)	(D)	
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)	(E)
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)	(E)
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)	
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)	(E)
80	(A)	(B)	(C)	(D)	(E)
81	(A)	(B)	(C)	(D)	(E)
82	(A)	(B)	(C)	(D)	(E)
83	(A)	(B)	(C)	(D)	(E)
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)	
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)	(E)
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)	
101	(A)	(B)	(C)	(D)	(E)
102	(A)	(B)	(C)	(D)	(E)
103	(A)	(B)	(C)	(D)	(E)
104	(A)	(B)	(C)	(D)	
105	(A)	(B)	(C)	(D)	
106	(A)	(B)	(C)	(D)	(E)
107	(A)	(B)	(C)	(D)	
108	(A)	(B)	(C)	(D)	(E)
109	(A)	(B)	(C)	(D)	(E)
110	(A)	(B)	(C)	(D)	
111	(A)	(B)	(C)	(D)	(E)
112	(A)	(B)	(C)	(D)	(E)
113	(A)	(B)	(C)	(D)	(E)
114	(A)	(B)	(C)	(D)	
115	(A)	(B)	(C)	(D)	(E)
116	(A)	(B)	(C)	(D)	(E)
117	(A)	(B)	(C)	(D)	(E)
118	(A)	(B)	(C)	(D)	(E)
119	(A)	(B)	(C)	(D)	(E)
120	(A)	(B)	(C)	(D)	(E)
121	(A)	(B)	(C)	(D)	(E)
122	(A)	(B)	(C)	(D)	(E)
123	(A)	(B)	(C)	(D)	(E)
124	(A)	(B)	(C)	(D)	(E)
125	(A)	(B)	(C)	(D)	(E)
126	(A)	(B)	(C)	(D)	
127	(A)	(B)	(C)	(D)	(E)
128	(A)	(B)	(C)	(D)	(E)
129	(A)	(B)	(C)	(D)	(E)
130	(A)	(B)	(C)	(D)	(E)
131	(A)	(B)	(C)	(D)	(E)
132	(A)	(B)	(C)	(D)	(E)
133	(A)	(B)	(C)	(D)	(E)
134	(A)	(B)	(C)	(D)	(E)
135	(A)	(B)	(C)	(D)	(E)
136	(A)	(B)	(C)	(D)	(E)
137	(A)	(B)	(C)	(D)	(E)
138	(A)	(B)	(C)	(D)	(E)
139	(A)	(B)	(C)	(D)	(E)
140	(A)	(B)	(C)	(D)	
141	(A)	(B)	(C)	(D)	(E)
142	(A)	(B)	(C)	(D)	(E)
143	(A)	(B)	(C)	(D)	(E)
144	(A)	(B)	(C)	(D)	(E)
145	(A)	(B)	(C)	(D)	
146	(A)	(B)	(C)	(D)	(E)
147	(A)	(B)	(C)	(D)	
148	(A)	(B)	(C)	(D)	(E)
149	(A)	(B)	(C)	(D)	(E)
150	(A)	(B)	(C)	(D)	(E)

151	(A)	(B)	(C)	(D)	(E)
152	(A)	(B)	(C)	(D)	(E)
153	(A)	(B)	(C)	(D)	(E)
154	(A)	(B)	(C)	(D)	(E)
155	(A)	(B)	(C)	(D)	(E)
156	(A)	(B)	(C)	(D)	(E)
157	(A)	(B)	(C)	(D)	(E)
158	(A)	(B)	(C)	(D)	(E)
159	(A)	(B)	(C)	(D)	(E)
160	(A)	(B)	(C)	(D)	(E)
161	(A)	(B)	(C)	(D)	(E)
162	(A)	(B)	(C)	(D)	
163	(A)	(B)	(C)	(D)	(E)
164	(A)	(B)	(C)	(D)	(E)
165	(A)	(B)	(C)	(D)	(E)
166	(A)	(B)	(C)	(D)	(E)
167	(A)	(B)	(C)	(D)	(E)
168	(A)	(B)	(C)	(D)	
169	(A)	(B)	(C)	(D)	(E)
170	(A)	(B)	(C)	(D)	(E)
171	(A)	(B)	(C)	(D)	(E)
172	(A)	(B)	(C)	(D)	(E)
173	(A)	(B)	(C)	(D)	(E)
174	(A)	(B)	(C)	(D)	(E)
175	(A)	(B)	(C)	(D)	(E)
176	(A)	(B)	(C)	(D)	(E)
177	(A)	(B)	(C)	(D)	(E)
178	(A)	(B)	(C)	(D)	(E)
179	(A)	(B)	(C)	(D)	(E)
180	(A)	(B)	(C)	(D)	(E)
181	(A)	(B)	(C)	(D)	(E)
182	(A)	(B)	(C)	(D)	(E)
183	(A)	(B)	(C)	(D)	(E)
184	(A)	(B)	(C)	(D)	
185	(A)	(B)	(C)	(D)	(E)
186	(A)	(B)	(C)	(D)	(E)
187	(A)	(B)	(C)	(D)	
188	(A)	(B)	(C)	(D)	(E)
189	(A)	(B)	(C)	(D)	(E)
190	(A)	(B)	(C)	(D)	(E)
191	(A)	(B)	(C)	(D)	(E)
192	(A)	(B)	(C)	(D)	(E)
193	(A)	(B)	(C)	(D)	
194	(A)	(B)	(C)	(D)	(E)
195	(A)	(B)	(C)	(D)	(E)
196	(A)	(B)	(C)	(D)	(E)
197	(A)	(B)	(C)	(D)	
198	(A)	(B)	(C)	(D)	(E)
199	(A)	(B)	(C)	(D)	(E)
200	(A)	(B)	(C)	(D)	(E)