Taking Your Examination Offline

You may take the In-Service Examination offline, but you must submit your answers online. Select the "Download In-Service Exam (PDF)" link to open and print the pdf version of the exam. There will be notations next to the color pictorials if you do not have a color printer. When you are ready to enter your answers online, initiate your exam by selecting the "Start Exam" link and read and acknowledge the honor code statement. Pause the exam, and then select the "Enter answer sheet" link provided on the website; more specific details are provided below. You may save and print the answer sheet at any time, but do not select "Submit" until all responses have been entered.

Once you have completed your examination offline, follow these steps to enter and submit your answers for scoring.

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- Select the "Start Exam" link and read and acknowledge the honor code statement.
- Pause the exam.
- Select the "Enter answer sheet" link.
- Enter your answers in the provided form. If the form already contains answers, these are the answers you previously entered in your online examination or using the answer sheet.
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When your answers have been submitted successfully, you will be directed to an online survey about your examination experience. Your participation is critical to future planning so please answer all the questions.

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American Society of Plastic Surgeons
In-Service Examination



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

Material released March 2020.

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Section 1: Comprehensive

1. A 51-year-old woman is undergoing free flap breast reconstruction. Following anastomosis, the patient sustains a venous thrombotic event, and the decision is made to flush the flap with tissue plasminogen activator (tPA). Which of the following is the primary mechanism of action of tPA as used in this scenario?

A) Antithrombin III activation

B) Fibrinolysis

C) Inhibition of platelet aggregation

D) Protein C activation

E) Prothrombin cleavage

The correct response is Option B.

During microsurgical procedures, the normal clotting mechanism may disrupt flow at the anastomosis. Multiple medications are available to limit clotting following the failure of an anastomosis. However, only certain medications are fibrinolytic and actively break down clots, whereas others limit the formation of further clots. Tissue plasminogen activator (tPA) is one such fibrinolytic agent, which increases the cleavage of the zymogen, plasminogen, to its active form, plasmin. Plasmin is directly fibrinolytic.

Prothrombin cleavage, to form activated thrombin, is primarily facilitated by factor X and results in increased thrombogenesis. Aspirin is a common drug that inhibits platelet aggregation, but this does not have a fibrinolytic effect and is not the mechanism by which tPA functions. Antithrombin III activation is the main mechanism of action of heparin, which limits multiple points in the thrombosis pathway. This medication is not fibrinolytic. Activated protein C is a powerful anticoagulant that inhibits both factors V and VIII in the coagulation cascade. Use of a recombinant protein C has been used in septic shock, but its benefits remain controversial. tPA does not function by protein C activation.

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2. A 68-year-old woman presents with a 3-cm morpheaform basal cell carcinoma (BCCA) involving the left mid cheek. A photograph is shown. Which of the following is an indication for Mohs micrographic surgery over conventional excision?

A) Anatomic location of lesion

B) Diagnosis of BCCA

C) History of previous melanoma

D) Morpheaform subtype

E) Patient age

The correct response is Option D.

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Mohs micrographic surgical technique has demonstrated cure rates of 99% for primary basal cell carcinomas (BCCA) and up to 95% for recurrent BCCAs. In this particular patient, the strongest indication for utilization of the Mohs technique is the more aggressive morpheaform subtype of BCCA. This patient underwent Mohs excision with adjacent tissue transfer reconstruction. Patient age, history of previous melanoma, and the diagnosis of BCCA (without aggressive features) are not indications for Mohs excision.

Other indications for Mohs technique include the following:

1. Recurrent basal cell/squamous cell carcinomas;
2. Locations prone to recurrence—"H-zone" of the face: periorbital, periauricular, temple, upper lip, nose/nasolabial fold, and chin;
3. Tumors involving critical structures such as the eyelid or lip;
4. Functionally important areas such as the genitals, perianal location, hands, and feet;
5. Tumors arising in sites of previous irradiation therapy;
6. Large tumors (greater than 2 cm);
7. Lesions with ill-defined tumor margins;
8. Histologic aggressive subtype (morpheaform, basosquamous, perineural, and invasive/poorly-differentiated squamous cell carcinoma);
9. Tumors arising in immunosuppressed patients, such as transplant recipients or patients with genetic predisposition (e.g. basal cell nevus syndrome, xeroderma pigmentosum).

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3. A 55-year-old man presents for a large abdominal midline hernia repair. A component separation is planned with a posterior approach and a retrorectus mesh placement. Which of the following layers can be divided to provide further release and preserve the innervation to the rectus muscle?

A) Anterior rectus sheath

B) External oblique

C) Internal oblique

D) Transversalis fascia

E) Transversus abdominis

The correct response is Option E.

In the posterior component separation approach for ventral hernia repair, transversus abdominis release (TAR) can provide further mobility and preserve the innervation to the rectus muscle. The posterior approach reinforces hernia repair with a sublay mesh placed between the rectus muscle and posterior sheath. The Rives-Stoppa approach is associated with a 3 to 6% recurrence rate. To avoid disruption of the segmental nerves to the rectus, classical dissection was limited medial to the linea semilunaris. This, however, limited the space and reserved this technique for small- to medium-sized hernias. To extend this dissection laterally for use in larger defects, either the internal oblique or the transversus abdominis muscle can be divided. Division of the internal oblique divides the nerves to the rectus muscle. Division of the transversus abdominis can preserve these nerves. With this technique, the anterior rectus sheath is preserved as well as the external oblique and transversalis fascia.

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4. A 56-year-old man who works at a fertilizer production plant presents to the emergency department with 10% hydrofluoric acid burns to the palmar surface of both hands. He is in exquisite pain. Physical examination shows no other injuries. Which of the following is the most appropriate management of this burn injury?

A) Application of a dilute alkali to neutralize the acid

B) Copious surface irrigation and application of calcium gluconate gel

C) Frequent electrolyte and renal lab analyses due to systemic toxicity

D) Mafenide acetate (Sulfamylon) dressings

E) Pain control and maintenance intravenous fluids

The correct response is Option B.

The patient has sustained a hydrofluoric acid burn, an agent used in many industrial and domestic applications. Hydrofluoric acid is a unique acidic chemical agent because it can behave as a strong acid at higher concentrations and can also cause liquefactive necrosis, as alkalis do by the dissociation of fluoride ions into subcutaneous tissues. Fluoride ions combine with calcium resulting in local hyperkalemia, which is believed to be the cause for the “pain out of proportion" examination finding associated with hydrofluoric acid burns.

Application of a dilute alkali is not recommended for the treatment of acidic burns because the resulting reaction can be exothermic, resulting in additional injury as the acid is being neutralized.

For patients with greater than 5% total body surface area (TBSA) exposure to hydrofluoric acid or injury with less than 50% concentration of hydrofluoric acid, systemic toxicity can result, causing electrolyte disturbances and organ dysfunction. This patient’s injury resulted from a low-concentration hydrofluoric acid exposure to a small surface area, making serial laboratory assessment less of a priority during presentation.

Due to the intense pain that hydrofluoric acid burns can cause, pain control will be required for management, but maintenance fluid and pain control alone will not treat the burn injury.

The hallmark of hydrofluoric acid chemical burn injury treatment is skin surface irrigation with copious amounts of water at lower pressure, followed by topical calcium gluconate to bind the fluoride ions before they penetrate into the soft tissues. This will neutralize the burn reaction, bind the fluoride ions, and help with pain control.

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Mafenide acetate is an appropriate topical antiseptic for non-chemical burns, but will not neutralize hydrofluoric acid.

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5. A 65-year-old woman presents to the office with an ulcer on the right chest wall. She underwent right-sided mastectomy and adjuvant external beam radiation therapy for advanced breast cancer 5 years ago. Physical examination shows a 2-cm ulcer with surrounding radiation-damaged skin and no signs of acute infection. Which of the following is the most appropriate next step in management?

A) Biopsy of the wound

B) Excision of all radiation-damaged tissue and coverage with vascularized tissue

C) Excision of the ulcer and coverage with vascularized tissue

D) Hyperbaric oxygen therapy

E) Negative pressure therapy

The correct response is Option A.

Radiation causes production of reactive oxygen species, which causes injury to tissues and progenitor cells. Cytokine release results in chronic inflammation and ongoing tissue damage. Radiation therapy can cause soft-tissue ulcerations, osteoradionecrosis, and radiation-induced sarcomas. If a patient presents with a late ulcer after radiotherapy, malignancy needs to be ruled out. A biopsy of the ulcer edge should be performed.

Once malignancy has been ruled out, excision of all radiation-damaged tissue, rather than just the ulcer, will result in more durable reconstructive outcomes. Osteoradionecrosis of the chest wall presents as full-thickness chest wall ulcers and the involved ribs should be resected. The underlying pleura and lung may be adherent and, thus, limited lung resection may need to be performed. Reconstruction is performed with well-vascularized tissue, either local pedicled flaps or free flaps.

Negative pressure therapy utilizes subatmospheric pressure for local wound care. It provides local wound care by controlling exudate and, thus, keeping the wound clean. It is thought to promote wound healing by inducing cellular proliferation and increasing capillary blood flow. Malignancy in the wound is a contraindication to negative pressure therapy. Therefore, if suspected, malignancy should be ruled out prior to initiation of negative pressure therapy.

Hyperbaric oxygen is the administration of 100% oxygen in a pressurized chamber. This results in high tissue concentrations of oxygen, which promote neovascularization and wound healing. Hyperbaric oxygen has been shown to improve healing in soft-tissue radionecrosis and osteoradionecrosis. It can be used as an adjunct, especially when radical excision and reconstruction of radiation damaged tissue is not possible.

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6. A 63-year-old man with a BMI of 35 kg/m^2 presents with an incisional hernia. The patient underwent a midline exploratory laparotomy for trauma one year ago. Primary fascial closure was achieved with a running polypropylene suture that was performed at the time of the initial operation. CT scan shows intact rectus muscles, and the hernia defect is measured to be 10 cm at the widest, which is in the supraumbilical region. Which of the following is the most effective treatment to prevent hernia recurrence following repair?

A) Component separation with bridging mesh repair

B) Component separation with overlay mesh repair

C) Component separation with primary fascial closure

D) Component separation with retrorectus mesh repair

E) Primary fascial closure

The correct response is Option D.

Hernia repair is associated with a high rate of recurrence, approaching 20% in many studies. Recurrence rates are lowest when primary fascial closure of the abdominal wall is reinforced with mesh placement as an underlay.

Primary fascial closure alone or with component separation results in a higher recurrence rate than primary fascial closure with mesh reinforcement. In this example, it is unlikely that primary fascial closure would be possible, given a 10-cm hernia defect. With regard to mesh placement, there are multiple planes at which the mesh can be placed. Using a bridging repair, the mesh is used to bridge across a fascial defect and is associated with the highest rates of recurrence. In a retrorectus repair, the mesh is placed deep to the rectus (Rives-Stoppa technique) or below the transversus abdominis (transversus abdominis release technique). This is performed underneath a primary fascial closure. Conversely, in an overlay repair, the mesh is secured superficial to the abdominal wall repair. Retrorectus placement of a mesh is associated with a significantly lower recurrence rate than placement of the mesh in another position.

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7. A 45-year-old man presents for reconstruction of a 6 × 11-mm defect involving the nasal alar margin after excision of basal cell carcinoma utilizing Mohs micrographic surgery. The defect involves the skin, cartilage, and nasal lining just lateral to the nasal soft triangle. Photographs are shown. Which of the following reconstructive options is most appropriate?

A) Composite auricular graft

B) Dorsal nasal flap

C) Full-thickness skin graft

D) Nasolabial flap

E) Primary closure

The correct response is Option A.

Alar rim defects present a challenging reconstructive problem. The primary reconstructive goals are to reestablish structural support, provide nasal lining if necessary, and provide external skin of similar color and texture. Complications of alar rim reconstruction include poor scars, alar notching, nasal obstruction, and narrowing of the nostril. Several choices are available, but a composite graft from the ear will often obtain an excellent cosmetic result. Skin along the alar rim, soft triangle, and columella is quite thin and firmly attached to the lower lateral cartilages. Likewise, skin along the helical rim is firmly attached to the underlying cartilage and useful for replicating the delicate topography of the columella, soft triangle, and nostril margin. Composite grafts are typically harvested from the helical root, but can be harvested from throughout the ear.

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Composite cartilage grafts only interface with the recipient bed around the graft's perimeter. As a result, their size should be limited to defects less than 1.0 to 1.5 cm in maximal diameter. It is recommended that no portion of the graft be greater than 1.0 cm from the wound edge. Additionally, the wound bed should be well vascularized, and the patient should be a non-smoker. Composite cartilage grafts follow a predictable healing pattern: white, blue, and then progressively pink/red as revascularization improves. Perioperative strategies recommended by some authors to increase graft take include steroids, hyperbaric oxygen, and cooling of the graft with iced compresses.

Primary closure would lead to a poor result and distortion of the alar rim. Dorsal nasal flap, nasolabial flap, and a full-thickness skin graft do not provide cartilage support, which would result in likely alar notching and potential collapse. Additionally, the skin from these donor sites would be too thick to replace the thin skin that normally inhabits this location.

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8. An otherwise healthy 35-year-old woman, gravida 3, para 3, presents for abdominoplasty. When combined with non-opioid analgesics and/or NSAIDs, which of the following is the most appropriate pain management for this patient?

A) Administration of epidural anesthetic

B) Infiltration of wound with liposomal bupivacaine

C) Intraoperative dexamethasone administration

D) Intraoperative ketamine infusion

E) Intraoperative lidocaine infusion

The correct response is Option B.

Enhanced recovery after surgery (ERAS) protocols are multimodal, multidisciplinary perioperative care pathways designed to achieve rapid recovery after surgery. These pathways include consensus recommendation for postoperative analgesia. In addition, improved postoperative pain control can be obtained with emphasis on the use of procedure-specific pain management. Some procedures have a higher propensity for persistent postoperative pain which generally are neuropathic in origin, ie: mastectomy, thoracotomy, hernia repair, abdominal wall surgeries. The primary goal of an optimal pain therapy is to provide "dynamic" pain relief (pain relief during movement) that would allow early ambulation while reducing opioid consumption. The ideal multimodal analgesic technique would include a local/regional analgesic (wound infiltration or peripheral nerve block) as the principal component because they provide excellent dynamic pain relief. Liposomal bupivacaine (Exparel) allows delivery of bupivacaine for 96 hours with a single local administration. There can be significant pain relief with the combination of wound infiltration with liposomal bupivacaine acetaminophen and NSAIDs or COX2 inhibitors as multimodal analgesic regimens. Epidural analgesia, dexamethasone, lidocaine and ketamine infusions all have demonstrated postoperative pain relief and reduction in opioid requirements to varying degrees. But local/regional analgesia (wound infiltration) should be used as the first-line analgesic therapy, which should be combined with acetaminophen, NSAIDs or COX1 inhibitors.

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9. A 46-year-old man presents with a midline 18-cm-wide ventral hernia 1 year after undergoing midline exploratory laparotomy for a bowel resection and right end ileostomy. Medical history includes significant weight loss through diet and exercise. His weight has been stable for 2 years. BMI is 29 kg/m^2. He undergoes bilateral component separation with biologic mesh bridged between the rectus muscles and concomitant panniculectomy. Which of the following clinical characteristics will most likely increase the likelihood of hernia recurrence?

A) BMI greater than 24.9 kg/m^2

B) Bridged biologic mesh hernia closure

C) Concomitant panniculectomy

D) Presence of an end ileostomy

E) Prior abdominal surgery

The correct response is Option B.

The patient presents after significant weight loss with a wide midline ventral hernia, right end ileostomy through his rectus muscle, and an abdominal pannus. Given the 18-cm waist of the hernia defect, he is being counseled that only a bridged repair with a biologic mesh will be possible rather than total muscular coverage for the midline defect. Hernia recurrence is a major problem for patients and can be associated with specific characteristics. When the technique of bilateral component separation and inlay biologic mesh repair is being performed, the most important predictor of recurrence is whether the rectus muscle and fascia will be able to be closed at midline, creating a total submuscular repair, or whether the mesh will be bridged. A bridged repair is associated with a 33% chance of recurrence at 3 years compared to 6.2% for total muscle coverage with fascial closure at midline.

With a BMI of 29 kg/m^2, the patient remains overweight despite his prior stable weight loss. Surgical site occurrences are increased in the overweight patient with a 26.4% incidence versus 14.9% in patients with BMI less than 24.9 kg/m2. Similarly, skin dehiscence is significantly increased in the overweight patient (19.3% versus 7.2%), while hernia recurrence rates are not statistically significant (11.4% versus 7.7%). Concomitant panniculectomy was associated with an increase in surgical site occurrences and skin dehiscence, but hernia recurrence rates were not affected.

Similarly, patients with existing ileostomies or stomas complicated by parastomal hernias do have a significantly increased surgical site occurrence rate (34.1% with parastomal and

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midline hernia versus 18.7% with midline hernia only) but hernia recurrence rates are not affected. Prior abdominal surgery will be in the clinical history of all incisional hernia patients.

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10. A 6-month-old female infant is referred by the pediatrician for management of a skin lesion on the right parietal scalp that was noticed at birth. The lesion is a 2 × 1-cm yellow plaque that is devoid of hair and has grown in proportion with the child. She is otherwise healthy and is doing well. Which of the following is the most appropriate recommendation for the child's parents?

A) Biopsy to rule out malignancy

B) CO_2 laser therapy prior to puberty

C) Excision due to high risk of malignant transformation

D) MRI to evaluate for brain abnormalities

E) Continued observation because of anesthetic risk

The correct response is Option E.

These clinical features are typical of nevus sebaceous. They present as yellow-orange flat plaques, occurring most commonly on the scalp (60%) or face (30%). They are usually present at birth but may appear in the first few years of life. They are hamartomas, arising from the pilosebaceous units of the skin. They occur due to mutations in the RAS pathway. Maternal transmission of genetic material from the human papilloma virus to the fetus has been implicated as a causative factor.

Excision of nevus sebaceous is performed because of the cosmetic concerns and risk of secondary tumors. The most common neoplasia is trichoblastoma, which is a benign tumor, although more than 40 types of secondary tumors have been described. The most common malignant tumor is basal cell carcinoma. Initial studies reported the risk of malignant transformation to be 10%, however, more recent studies indicate that this number is 1%. The risk of malignant transformation increases with age; it is extremely rare in childhood and has not been reported in children younger than 5 years of age. The risk of malignant transformation is, thus, very small and in the absence of any morphologic change in the lesion, biopsy is not indicated.

Nevus sebaceous lesions undergo change in appearance during puberty and become thick and verrucous, presumably due to hormonal influence. Most practitioners thus recommend definitive treatment prior to puberty. Surface ablative therapies like electrodessication, curettage, dermabrasion, photodynamic and CO_2 laser have been proposed to improve the appearance of these lesions. However, nevus cells can be left behind in the deeper layers, with the risk of developing secondary tumors and potentially making future detection of neoplastic change more difficult.

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The definitive treatment of nevus sebaceous is full thickness skin excision. In December of 2016, the Food and Drug Administration (FDA) issued a warning that "repeated or lengthy use of general anesthetic and sedation drugs during surgeries or procedures in children younger than three years or in pregnant women during their third trimester may affect the development of children's brains." The FDA modified the warning in April of 2017, stating "consideration should be given to delaying potentially elective surgery in young children where medically appropriate."

Most of the data that lead to these warnings came from animal studies that showed learning and behavioral problems after exposure to anesthetics that block N-methyl-D-aspartate (NMDA) and gamma-aminobutyric acid (GABA). Research in humans is not conclusive, with some studies indicating neurotoxicity with multiple exposures, but not with a single exposure. However, the duration of a "brief exposure" has not been well-defined. There are ongoing studies that will hopefully shed further light on the matter. In view of this, it may be prudent to delay elective procedures in children if this will be not detrimental to the child's health or final outcome.

Numerous syndromes are associated with nevus sebaceous. These mostly involve the central nervous and ocular system, but can also involve other organs. There does not appear to be a correlation between size of skin lesions and risk of nervous system involvement, but large lesions and centrofacial location have been suggested as having higher risk. Small isolated nevus sebaceous lesions in the absence of any other systemic manifestations do not warrant central nervous system imaging or systemic work up. The vast majority of nevus sebaceous are isolated lesions.

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11. A 42-year-old woman suffers a dog bite injury to her lower lip. Following adequate debridement, the patient is left with a full-thickness, total lower lip defect, up to the lateral commissure bilaterally. The surrounding tissue is uninjured. Which of the following is the most appropriate method of reconstruction?

A) Abbe (lip switch) flap

B) Bernard-Webster (lip-cheek advancement) flap

C) Cervicofacial rotation advancement flap

D) Estlander (lateral lip switch) flap

E) Karapandzic flap

The correct response is Option B.

Complete lower lip defects can result from cancer resection or trauma. Reconstruction of lip defects relies primarily on local flaps, although free tissue transfer may be necessary in total lip reconstructions or if the surrounding tissue is unsuitable for flap transfer. In lower lip defects with a defect size greater than two thirds of the lip, bilateral lip-cheek advancement flaps are required for reconstruction.

Lip switch flaps are useful for one- to two-thirds lip defects that are centrally located, whereas lateral lip-switch flaps can similarly be used to address lateral defects involving the commissure. Although these flaps can be combined with lip-cheek advancement flaps for reconstruction of the lower lip, they are not sufficient alone for total lip reconstruction. Karapandzic flaps can be used for reconstruction of central defects with up to two-thirds of the lip being absent, but cause significant microstomia in lip defects with greater than two-thirds of the lip absent. Cervicofacial rotation advancement flaps are usually used for cheek reconstruction.

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12. A 56-year-old woman is evaluated 6 hours after undergoing bilateral breast reconstruction with a deep inferior epigastric perforator (DIEP) flap. Doppler examination shows strong arterial signals in both flaps. The right breast appears bluish with a capillary refill time of 1 second compared to 3 seconds on the left side. Which of the following is the most appropriate next step?

A) Administration of tissue plasminogen activator

B) Application of leeches

C) Application of nitroglycerin ointment

D) Exploration in the operating room

E) Observation

The correct response is Option D.

The patient described has evidence of venous congestion. The reported incidence of venous congestion in free tissue breast reconstruction ranges from 2 to 20%. Causes include venous thrombosis, inadequate perforator selection, and superficial venous system dominance with lack of sufficient communication to the deep system. Signs of venous compromise include the following: cyanotic/blue color, brisker than normal capillary refill, increased tissue turgor, cooler temperature compared to normal skin (greater than 2 degrees), rapid bleeding of dark blood with pinprick, and absence of continuous venous Doppler signal. The most appropriate course of action in this scenario is emergent exploration in the operating room to assess the vascular pedicle for thrombosis, compression from hematoma, kinking, or superficial system dominance. Flap salvage rate is directly tied to timing of exploration, with higher salvage rates in flaps explored within 6 hours of identification of compromise.

Early recognition and rapid exploration of compromised flaps are the most important factors predicting flap salvage, so observation would be unacceptable. Tissue plasminogen activator is useful if diffuse clotting is suspected within the flap, but should only be given locally within the flap. Leeches can be a useful adjunct postoperatively after employing the other maneuvers described above, but would not resolve the underlying problem in this case. Application of topical nitroglycerin can improve venous congestion in random skin flaps, but has no role in the management of acute microvascular thrombosis.

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13. A 45-year-old woman presents with right breast cancer and is planning a nipple-sparing mastectomy and tissue expander placement. She is specifically interested in a carbon dioxide–based expander. Which of the following is a disadvantage of this device compared with a saline tissue expander?

A) Extrusion

B) Inability to deflate

C) Increase in wound dehiscence

D) Increase in wound infection

E) Possible device dislocation

The correct response is Option B.

The carbon dioxide-based tissue expander (AeroForm) is a fixed-volume device and has an inability to deflate the expander.

In a prospective, multicenter, randomized controlled trial comparing carbon dioxide–based expanders and saline tissue expanders, there were no statistically significant differences in rates of wound infection, extrusion, device dislocation, or wound dehiscence. Advantages of the carbon dioxide–based expander include a more rapid expansion process and a shorter time to implant exchange. The device is self-contained and patient-controlled, so there are no needles required and possibly fewer physician office visits.

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14. A 3-year-old child with pectus excavatum deformity is evaluated for surgical correction of the chest wall. The child has experienced mild respiratory insufficiency. Which of the following is the optimal timing of treatment for this patient?

A) Surgical correction between ages 2 and 5

B) Surgical correction between ages 6 and 12

C) Surgical correction between ages 13 and 17

D) Surgical correction at skeletal maturity

The correct response is Option B.

Pectus excavatum is the most common congenital chest wall deformity, occurring in approximately 1 in 400 live births. The condition is more common in males, and there is a positive family history in 30 to 40% of patients. The etiology is thought to be multifactorial and associated with increased incidence of congenital cardiac abnormalities, connective tissue disorders (e.g., Marfan and Ehlers-Danlos syndromes), and scoliosis. Treatment options have shifted from the traditional open technique involving sternal osteotomy and resection of abnormal costal cartilage to minimally invasive options such as the Nuss procedure and minimally invasive technique for repair of excavatum (MIRPE), which utilizes thoracoscopy and placement of intrathoracic retrosternal support bars to reposition the sternum and allow gradual remodeling over a period of 2 to 4 years. The ideal timing of repair is mid-adolescence, usually between ages 6 and 12.

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15. A 35-year-old woman presents with unilateral swelling that has developed over the past 3 months. She underwent bilateral nipple-sparing mastectomy with immediate implant reconstruction with textured, round silicone gel implants 8 years ago. Ultrasound confirms periprosthetic seroma without any masses. Which of the following is the most appropriate next step in the management of this patient?

A) Core needle biopsy

B) Fine-needle aspiration

C) Implant removal and capsulectomy

D) MRI

E) Positron emission tomography (PET) scan

The correct response is Option B.

The clinical scenario is concerning for breast implant–associated anaplastic large-cell lymphoma (BIA-ALCL). Aspiration of the fluid seen on ultrasonound and pathologic evaluation is necessary to confirm the diagnosis. Following the National Comprehensive Cancer Network guidelines, initial workup of an enlarged breast should include ultrasound evaluation specifically for a fluid collection, a breast mass, or enlarged regional lymph nodes (axillary, supraclavicular, and internal mammary).

MRI is appropriate for cases where ultrasound is indeterminate or requires further confirmation. This patient does not have an identifiable mass amenable to core biopsy. Positron emission tomography (PET) scan is beneficial in confirmed cases to identify associated masses, chest wall involvement, regional lymphadenopathy, and/or metastasis. Implant removal and capsulectomy is appropriate once the diagnosis is confirmed.

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16. A 76-year-old man sustains a right mandibular body fracture after a mechanical fall. He states that he lives independently and is active. On examination, the patient is noted to be edentulous. A CT scan demonstrates a comminuted fracture mesial to the angle without evidence of any other injuries. Which of the following is the most appropriate treatment of this deformity?

A) Closed reduction and external fixation

B) Intra-oral incision and miniplate fixation along external oblique ridge

C) Maxillomandibular fixation

D) Mechanical soft diet for four weeks

E) Submandibular incision and reconstruction bar fixation

The correct response is Option E.

In edentulous patients, mandibular atrophy can make it difficult to achieve appropriate reduction. Mandibular body fractures are common in these patients following blunt trauma, such as a fall. Regarding the management of a mandible fracture in an edentulous man, open reduction and internal fixation is necessary to provide long-term stability and an accurate restoration of previous anatomy, possibly due to poor osteogenic capacity and ability to load-bear of an atrophic mandible.

Intra-oral and extra-oral incisions are both acceptable exposure methods. Similarly, miniplates or reconstruction bars can both be utilized, although some prefer the added stability of a reconstruction bar. Submandibular incision and reconstruction bar fixation is the most correct initial management, as it involves open reduction and internal fixation of the fracture.

Mechanical soft diet is not appropriate treatment for a comminuted mandibular body fracture and will result in malunion or nonunion. Similarly, the use of maxillomandibular fixation, with or without dentures, does not accurately reduce the fracture in an edentulous mandible with intrinsic loss of osteogenic potential and can lead to higher complications, such as pneumonia, in elderly patients. Miniplate fixation along the external oblique ridge is a treatment for noncomminuted angle fractures, but is not the appropriate treatment for a comminuted body fracture.

External fixation is usually reserved for injuries with significant soft tissue deficit. It does not provide accurate anatomic alignment.

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17. In women undergoing prosthetic breast reconstruction complicated by an expander/implant infection, which of the following is the most common gram-negative bacteria isolated from cultures?

A) *Escherichia coli*

B) *Klebsiella*

C) *Proteus*

D) *Pseudomonas*

E) *Serratia*

The correct response is Option D.

Tissue expander/implant-based breast reconstruction remains the most common form of reconstruction after mastectomy. One of the most potentially devastating complications of this form of breast reconstruction is an implant infection with need for removal of the expander/implant. The mean reported incidence of implant infection after breast reconstruction is 8%, with a range of 1 to 35%. When cultures are obtained, the most common causative bacteria on microbiology examination are gram-positive organisms (41 to 83%), specifically, *Staphylococcus* species (56 to 76.5%). Gram-negative bacteria accounted for 15.3 to 28.6%, with *Pseudomonas* (10.7 to 14%) being the most common gram-negative bacteria present on microbiology examination.

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18. A 32-year-old Caucasian woman presents with multiple (>50) brown lesions on her arms and lower legs. They appear to be in areas of sun exposure. On examination, many of these lesions are well circumscribed, even in color, and less than 5 mm in size. The patient has a family history of melanoma. There are too many lesions to excise. Which of the following findings in one of these lesions would prompt an excisional biopsy?

A) Asymmetry

B) Clearly demarcated borders

C) Dark coloration

D) Waxy surface

The correct response is Option A.

In this patient with multiple melanocytic nevi, lesions should be treated with excisional biopsy if there is a high suspicion for melanoma. As there are more than 50 lesions, clearly there are too many to excise. These lesions should be evaluated for asymmetry, border irregularity, variable color, diameter greater than 6 mm, and evolution. Any of these signs in a lesion should lead to an excisional biopsy with a suspicion of melanoma, especially given the patient's family history.

Lesions with a waxy surface are seborrheic keratoses and commonly found in an elderly population in sun-exposed areas. Dark coloration does not lead to a suspicion of melanoma.

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19. A 23-year-old African-American man presents with a raised thickened scar on his anterior chest that he complains is pruritic and unattractive. It was removed by another provider 4 years earlier and has slowly recurred over the past year. On examination, the lesion extends beyond the initial borders of the scar and is firm and hyper-pigmented. On review of his prior pathology report, which of the following histologic characteristics is most likely?

A) Greater ratio of type III to type I collagen

B) Multitude of myofibroblasts and smooth muscle actin

C) Parallel collagen bundles

D) Thick, wavy, and randomly oriented collagen fibers

The correct response is Option D.

In patients with abnormal or excessive scar tissue formation, treatment and prognosis will be driven by the correct diagnosis of a keloid versus a hypertrophic scar. This patient presents with a recurrent keloid of the chest. His clinical history supports this diagnosis by recurrence after resection, growth extending beyond the original border of the lesion, late recurrence after several years, and continued growth over several years without regression or improvement. Hypertrophic scars are less likely to recur, contained within the original boundaries of the lesion, often regress somewhat within a year, and recur earlier in the postoperative period if they are to recur. Both hypertrophic scars and keloid scars can be pruritic.

Pathologic analysis of keloids reveals more type I collagen than type III collagen, similar to normal skin. Hypertrophic scars will exhibit increased type III collagen and pro-fibrotic collagen cross-linking. Keloid growth is thought to be impacted by cell-signaling between keratinocytes and fibroblasts, but hypertrophic scar production requires an abundance of myofibroblasts expressing smooth muscle actin. While hypertrophic scars have parallel collagen fibrils and bundles, keloids are characterized histologically by thick, randomly oriented collagen fibrils that are not organized into bundles.

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20. A 5-year-old boy presents to the emergency department 4 hours after he sustained an amputation of his left index finger when it was slammed in a door. The parents brought the amputated digit in a plastic bag on ice. The amputation is at the level of the mid proximal phalanx. Which of the following is the most important reason to attempt replantation?

A) The amputation is proximal to the flexor digitorum superficialis insertion

B) The cold ischemia time is less than 6 hours

C) It is the index finger

D) It is a single-digit amputation

E) The patient is a child

The correct response is Option E.

Digital replantation should almost always be attempted in a child, except when the amputated part is severely crushed or there are other life-threatening injuries that preclude surgery. Replantation in children is technically more challenging due to the smaller size of the vessels. However, functional outcomes are more superior than in adults. The replanted parts have better sensory return and can have normal growth. Amputations through joints also exhibit remarkable joint remodeling.

A single digit amputation, especially proximal to the flexor digitorum superficialis (FDS) insertion is considered a contraindication to replantation. Digit replantations proximal to the FDS insertion have a poor range of motion as compared to amputations distal to the FDS insertion. This is, thus, an important landmark when making decisions about amputation versus replantation. Multiple digit amputations are an indication for replantation as the functioning deficit with loss of multiple digits is great. The thumb is responsible for 40% of the function of the hand and should always be replanted, if possible. Even if it is stiff and insensate, a replanted thumb will act as a post for opposition.

Index finger amputations at or proximal to the proximal interphalangeal joint are considered by many to be an indication for amputation. A stiff and painful index finger is likely to be excluded by the patient; amputation will result in better global hand function.

Digits tolerate longer ischemia times than more proximal level amputations, due to absence of muscle. Amputated digits tolerate warm ischemia times of 6 to 12 hours and cold ischemia times of 12 to 24 hours. Digital replantation has been reported with warm ischemia time of 33

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hours and cold ischemia time of 94 hours. Cold ischemia time is thus not a major consideration in the decision-making process for amputation versus replantation.

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21. A 20-year-old otherwise healthy individual who has a diagnosis of gender dysphoria would like to undergo masculinization of the chest for female-to-male transition. According to the World Professional Association for Transgender Health (WPATH) Standards of Care, which of the following criteria should be fulfilled before the patient can be cleared for such a procedure?

A) The patient should be at least 21 years of age

B) The patient should have completed 12 months of hormone therapy

C) The patient should have health insurance coverage

D) The patient should have lived 12 months in a male gender role

E) The patient should have one letter of support from a mental health professional

The correct response is Option E.

The World Professional Association for Transgender Health (WPATH) Standards of Care (SOC) lists having one letter of support from a qualified mental health professional as a prerequisite for female-to-male (FTM) chest surgery. As for all of the SOC, the criteria for initiation of surgical treatments for gender dysphoria were developed to promote optimal patient care. While the SOC allow for an individualized approach to best meet a patient's health care needs, a criterion for all breast/chest and genital surgeries is documentation of persistent gender dysphoria by a qualified mental health professional. For some surgeries, additional criteria include preparation and treatment consisting of feminizing/masculinizing hormone therapy and one year of continuous living in a gender role that is congruent with one's gender identity. Based on the available evidence and expert clinical consensus, different recommendations are made for different surgeries. For FTM chest surgery, the criteria are as follows:

1. Persistent, well-documented gender dysphoria
2. Capacity to make a fully informed decision and to consent for treatment
3. Age of majority in a given country (if younger, follow the SOC for children and adolescents)
4. If significant medical or mental health concerns are present, they must be reasonably well controlled
5. Hormone therapy is not a prerequisite
6. One referral

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For male-to-female breast surgery, it is recommended to have completed 1 year of hormonal therapy, although it is not a specific criterion according to WPATH SOC. For genital surgery, it is recommended to have two referrals, be on 1 year of hormonal therapy, and to have lived in the gender role congruent with their gender identity for at least 1 year. Insurance coverage is not part of any WPATH SOC.

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22. During elevation of the anterolateral thigh flap, the dominant vascular supply most commonly originates from which of the following branches of the lateral circumflex femoral artery?

A) Ascending

B) Deep

C) Descending

D) Oblique

E) Transverse

The correct response is Option C.

The anterolateral thigh flap (ALT) has become a workhorse flap throughout the body, particularly in the head and neck. The ALT flap is a musculo-fasciocutaneous flap. The dominant pedicle is the descending branch of the lateral circumflex femoral artery in the majority of flaps. The arterial pedicle along with its two venae comitantes pass obliquely along with the nerve to the vastus lateralis in a groove between the rectus femoris and vastus lateralis muscles. The flap can be raised as a sensate flap by including the anterior branch of the lateral cutaneous nerve of thigh. Perforators to the ALT flap are either septocutaneous (passing between the rectus femoris muscle and the vastus lateralis muscle) or musculocutaneous (passing through the vastus lateralis muscle). Septocutaneous perforators are found in 19.8% of people, while in 1.8% of cases no perforators are found.

The majority of the time, the descending branch of the lateral circumflex femoral artery originates from the lateral circumflex femoral artery, but it can have a variable origin. It can arise from the deep femoral artery (6.25 to 13%) or the common femoral artery (1 to 6%).

The dominant perforator supply to the ALT flap:
- Descending branch of the lateral circumflex femoral artery: 57 to 100%
- Oblique branch of the lateral circumflex femoral artery: 14 to 43%
- Transverse branch of the lateral circumflex femoral artery: 4 to 35%
- Ascending branch of the lateral circumflex femoral artery: 2.6 to 14.5%

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23. A 55-year-old man presents with a 5 × 5-cm open wound on the medial lower leg with healthy granulation tissue. A split-thickness skin graft from the upper thigh is planned. Which of the following dressings would result in the highest degree of pain at the donor site?

A) Alginate

B) Hydrocolloid

C) Hydrofiber

D) Petrolatum gauze

E) Semipermeable

The correct response is Option D.

Petrolatum-based dressings, such as Adaptic or Xeroform, are considered nonmoist dressings. Moist dressings include semipermeable (Tegaderm or OpSite), hydrofiber (Aquacel), alginate, or hydrocolloid (DuoDERM).

In a recent meta-analysis from 2018, 41 articles with 35 prospective randomized trials found that moist dressings at a skin graft donor site are associated with less pain as compared to nonmoist dressings. When examining various time points in recovery, it was found that moist dressings showed improved pain control at every time point (postoperative days 1 to 4, 4 to 7, greater than 8).

With regard to wound healing, this finding was not universal, although most studies showed that moist dressings demonstrated improvements in re-epithelialization rate and quality of healing. Infection and cosmetic outcome were also not significantly different with variable results.

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24. A 24-year-old woman undergoes facial rejuvenation with hyaluronic acid gel filler in the glabellar region. Several hours later, she develops skin discoloration and discomfort across the central forehead. She presents to the office for evaluation 2 days later. On physical examination, skin blanching with decreased temperature and paresthesias are confirmed. Which of the following is the most effective intervention to treat this patient?

A) Administer aspirin 325 mg

B) Administer injection of hyaluronidase

C) Apply topical nitroglycerin

D) Apply warm compress and massage

E) Offer reassurance and observation

The correct response is Option B.

This clinical scenario depicts acute arterial vascular compromise following injection of hyaluronic acid into the glabellar region. The symptoms of painless blanching and decreased sensation suggest early ischemic changes. Both arterial and venous structures can be injured from filler injections through direct injury, embolic occlusion, or a combination of the two. Although rare, this complication requires prompt recognition and treatment to reverse the ischemic process and prevent tissue necrosis. In a retrospective review, Park et al. identified two areas that are particularly susceptible to necrosis because of lack of collateral circulation: the glabella and the nasolabial fold near the alar subunit.

Reassurance and observation are not appropriate for evolving tissue necrosis. Application of warm compresses and topical nitroglycerin will cause vasodilation, which will help improve local blood flow, but the most appropriate treatment is injection of hyaluronidase, an enzyme that cleaves the peptide bonds of long chain proteins within hyaluronic acid, thereby increasing the permeability of the filler and facilitating dispersion and absorption. Aspirin has not been shown to provide any benefit.

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25. A 45-year-old African American woman who underwent cardiac surgery 6 months ago seeks cosmesis of the surgical scar. Physical examination shows a raised, thick keloid scar that is pruritic. Which of the following nonsurgical treatments is likely to produce the most rapid improvement in the scar with the fewest adverse effects?

A) Intralesional 5-fluorouracil

B) Intralesional triamcinolone

C) Radiation therapy

D) Silicone sheeting

E) Topical triamcinolone

The correct response is Option A.

Injection of 5-fluorouracil demonstrates similar efficacy to intralesional corticosteroid therapy (triamcinolone) and has the advantage of a lower risk of hypopigmentation.

Silicone sheeting is effective for hypertrophic scars but requires serial application and is slower in visible effect. Topical corticosteroids are not as effective as intralesional treatment. Radiation carries the risk of adjacent tissue toxicity and also includes the risk of skin pigmentation changes.

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26. Which of the following is the most consistent finding seen in aging skin?

A) Decreased sweat glands

B) Increased melanocytes

C) Loss of dermal papillae

D) Thicker dermis

E) Thicker epidermis

The correct response is Option C.

The most consistent finding in aging skin is the loss of dermal papillae and the flattening of the dermo-epidermal junction. Physiologic changes in aged skin include structural and biochemical changes as well as changes in neurosensory perception, permeability, response to injury, repair capacity, and increased incidence of some skin diseases. The most consistent structural change in aged skin is a flattening of the dermo-epidermal junction by more than a third, which occurs as a result of the loss of dermal papillae as well as a reduced interdigitation between layers. This flattening, observable by scanning electron microscopy beginning in the sixth decade, results in less resistance to shearing forces and an increased vulnerability to insult.

Although the number of cell layers remains stable, the skin thins progressively over adult life at an accelerating rate. The epidermis decreases in thickness by about 6.4% per decade on average. Enzymatically active melanocytes decrease at a rate of 8 to 20% per decade, resulting in uneven pigmentation in elderly skin. Although the number of sweat glands does not change, sebum production decreases as much as 60%. Dermis thickness decreases with age; thinning is accompanied by a decrease in both vascularity and cellularity. Aging is inevitably associated with a decrease in collagen turnover (due to a decrease in fibroblasts and their collagen synthesis) as well as elastin.

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27. A 57-year-old woman undergoes microsurgical breast reconstruction using a muscle-sparing transverse rectus abdominis musculocutaneous (MS-TRAM) flap. Near-infrared spectroscopy (NIRS) is used to monitor the flap in the postoperative setting. NIRS measures which of the following parameters?

A) Arterial oxygen saturation (SaO_2)

B) Mixed venous oxygen saturation (SvO_2)

C) Partial pressure of oxygen (PaO_2)

D) Peripheral oxygen saturation (SpO_2)

E) Tissue oxygen saturation (StO_2)

The correct response is Option E.

Near-infrared spectroscopy (NIRS) is a noninvasive modality that allows continuous monitoring of tissue oxygenation and perfusion. It measures relative changes in the concentration of oxygenated and deoxygenated hemoglobin. Tissue oxygen saturation (StO_2) is the percentage of hemoglobin in tissue that is oxygenated. Since StO_2 measures oxygen saturation in the vascular bed of tissue, it measures both venous and arterial saturation and, thus, reflects both oxygen delivery and consumption. This provides a good surrogate for tissue perfusion. Peripheral capillary oxygen saturation (SpO_2), measured by pulse oximetry, measures arterial oxygen saturation, which may not reflect perfusion. Arterial (SaO_2) and mixed venous oxygen saturation (SvO_2) as well as the partial pressure of oxygen (PaO_2) are measured directly from blood and are indicative of systemic rather than local tissue oxygenation.

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28. A 63-year-old man presents to the office with a 4 × 4-cm heel defect. A local podiatrist has debrided the calcaneus, and there is healthy granulation tissue present. After extensive discussion with the patient, it is decided to proceed with a distally based sural fasciocutaneous flap for coverage. Which of the following risk factors is associated with the highest rate of flap-related complications?

A) Coronary artery disease

B) Diabetes mellitus

C) Hypertension

D) Obesity

E) Venous insufficiency

The correct response is Option E.

A recent meta-analysis of 61 papers showed that venous insufficiency is associated with a nine-fold increase in risk of developing a complication in a distally based sural flap. Other risk factors, such as peripheral vascular disease, diabetes, obesity, and hypertension, have been associated with increased rates of complications previously in the literature, but venous insufficiency is associated with the highest rate of complications. The pooled data from this series showed a 26% complication rate, a 3.2% flap loss rate, and a 15.3% partial flap loss rate. As the design of the sural flap is distally based, the physiology of the flap requires reversed flow through the venous system.

Advanced age is also associated with an increased complication rate and there is literature to suggest a delay procedure in this patient population. Other papers have found smoking to have a higher risk of complications as well. There is still much debate over which patients should undergo a delay procedure or venous supercharging, but in general, high-risk patients with multiple comorbidities should be considered for this additional surgery. Coronary artery disease has not been found to be associated with increased risk of flap-related complications.

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29. To reconstruct a traumatic soft-tissue defect of the hand, a lateral arm fasciocutaneous flap is chosen for free tissue transfer. The vascular pedicle for this flap is located between which of the following structures?

A) Brachioradialis and brachialis

B) Lateral head of the triceps and biceps

C) Lateral head of the triceps and the brachialis

D) Lateral head of the triceps and the extensor carpi radialis longus

E) Lateral head of the triceps and the humerus

The correct response is Option C.

The lateral arm flap is a reliable fasciocutaneous flap used for reconstruction of small to medium size soft-tissue defects of the forearm and hand. It provides thin tissue of excellent quality and a satisfactory aesthetic outcome with the ability for primary closure of the donor site.

The dominant pedicle is the posterior radial collateral artery. This vessel originates from the radial collateral artery which is a branch of the brachial artery in the upper arm and emerges between the brachialis muscle anteriorly and the lateral head of the triceps posteriorly to supply the skin and soft tissue of the lateral arm.

In addition, the anatomic relationships between the vascular pedicle and radial nerve are important to understand when dissecting this flap. The radial nerve courses posterior to the humerus before wrapping around the lateral aspect of the humerus from posterior to anterior. The antebrachial cutaneous nerve of the forearm branches from the radial nerve to join the vascular pedicle (posterior branch of radial collateral artery). This cutaneous nerve can be preserved with careful dissection and helps to identify the radial nerve proximally during flap elevation. Segmental perforating vessels emerge within the septum separating the triceps and brachialis muscles.

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30. A 52-year-old woman presents to the clinic desiring body contouring surgery. She underwent gastric bypass surgery 2 years ago and has excess skin involving the arms, thighs, breasts, and abdomen. Circumferential body-lift and mastopexy using barbed sutures for dermal closure are planned. Which of the following outcomes is an advantage of using running barbed sutures compared to traditional interrupted suture techniques in this patient?

A) Decreased major postoperative complications

B) Decreased operative time

C) Improved scar aesthestics

D) Improved scar strength

The correct response is Option B.

Barbed sutures are available today from several manufacturers and in several styles. They have gained popularity due to advantages over traditional suture techniques.

Several studies utilizing barbed suture versus traditional closure have demonstrated decreased length of surgery leading to overall decreased operative time and improved surgeon satisfaction. Barbed suture itself is more expensive, but overall cost savings may be noted due to shorter total duration of surgery.

There are no studies demonstrating significant differences in tensile strength of the scar. Several studies have demonstrated scar aesthetics are equivalent. Overall, major complication rates are similar; although studies have suggested higher rates of suture extrusion and minor wound healing complications.

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31. A healthy 5-year-old boy is scheduled to undergo a staged expansion to remove a large congenital melanocytic nevus. Which of the following anatomical regions of the body has the highest risk for complications during the expansion process?

A) Head

B) Lower extremity

C) Neck

D) Torso

E) Upper extremity

The correct response is Option B.

The anatomic region associated with the most complications is the lower extremity. Huang et al. conducted a 20-year meta-analysis and systematic review to come to this conclusion:

- The pooled odds ratio for lower limb complications as compared with other anatomical sites was 2.80 (95% confidence interval, 1.14 to 6.86; p = 0.17).
- The pooled odds ratio for head and neck complications versus other anatomical sites was 1.31 (95% confidence interval, 0.95 to 1.80; p = 0.1).
- The pooled odds ratio for upper limb complications was 1.24 (95% confidence interval, 0.60 to 2.55).
- The pooled odds ratio for trunk complications was 0.78 (95% confidence interval, 0.45 to 1.33).

The results indicated that the lower limb was more likely to develop complications than other anatomical sites, whereas the trunk was the safest site on which to perform tissue expansion. This conclusion has also been reported by prior studies. There are certain anatomical and physiologic differences between the extremities and other areas. The extremities tend to be in frequent motion, resulting in compressive and disruptive forces exerted by the regional musculature. Scarring can limit the availability of local flaps because the flaps themselves require a complex geometry in terms of distance and orientation to effectively encompass a curvilinear biconvex surface. The creation of a pocket from a distance, around a curve, or in a cylindrical extremity can be quite challenging.

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32. A 50-year-old woman presents to the clinic to discuss breast reconstruction after bilateral mastectomy. She is interested in free tissue transfer. She has a diagnosis of systemic lupus erythematosus treated with chronic steroid therapy and wants to know if she is an appropriate candidate for free flap reconstruction. Which of the following statements best describes the surgical risks for this patient with lupus compared with the general population?

A) Higher rate of free flap failure

B) Higher risk of a thromboembolic event

C) Similar rate of hernias after abdominally based free flaps

D) Similar rates of infection

The correct response is Option B.

The statement which best describes the surgical risks for a patient with lupus undergoing free tissue transfer for breast reconstruction is that the patient has a higher risk of a thromboembolic event than the average patient.

The rate of free flap failure in patients with lupus is similar to patients without lupus. Chronic steroid use increases the risk of wound healing complications in patients with lupus, rather than increases the risk of free flap failure. Additionally, patients with lupus have an increased risk of abdominal wall bulge and hernia after abdominally based free flaps compared with the average population. Chronic steroid use also suppresses the immune system, predisposing patients treated with steroids to increased rates of infection compared to patients not taking steroids.

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33. A 7-year-old boy presents with a chief complaint of multiple wide and thin scars from skin lesion excisions. The patient's mother reports a history of late walking, hypermobile joints, and easy bruising. On the basis of these complaints, which of the following is the most likely diagnosis?

A) Capillary fragility syndrome

B) Cutis laxa

C) Ehlers-Danlos syndrome

D) Marfan syndrome

E) Osteogenesis imperfecta

The correct response is Option C.

Ehlers-Danlos syndrome (EDS) is the only diagnosis listed which encompasses all of the mentioned patient complaints. EDS encompasses a range of connective tissue disorders that share joint hypermobility, skin hyperextensibility, and tissue fragility. The different types of EDS have varying modes of inheritance and a variety of identified genetic mutations in collagen formation. Classical EDS is caused by an autosomal dominant mutation involving the COL5A1 or COL5A2 genes, which are involved in collagen type V synthesis. Common symptoms include skin hyperextensibility, widened atrophic "cigarette paper" scars, generalized joint hypermobility involving three or more joints, and easy bruising. Vascular EDS carries major risks, including arterial (aortic) dissection, rupture, or aneurysm. Cutis laxa is not associated with easy bruising. Capillary fragility syndrome typically does not present with late walking. Osteogenesis imperfecta and Marfan Syndrome are not associated with atrophic scarring.

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34. A 68-year-old woman who underwent a three-vessel coronary artery bypass grafting (CABG) 7 weeks ago presents to the office with a 6-mm indurated lesion at the manubrium of the healed sternotomy incision. She also has two draining lesions 1 and 1.5 cm lateral to the sternotomy incision. The patient says that these two lesions began draining approximately 3 weeks ago. The CABG included harvest of the left internal mammary artery. CT scan of the chest demonstrates a sinus tract leading to a 4 × 6-cm fluid collection in the substernal region. After removal of sternal wires and debridement of necrotic bone and cartilage, which of the following is the most appropriate reconstructive option?

A) Bilateral pectoralis major advancement flaps

B) Bilateral pectoralis major turnover flaps

C) Left rectus abdominis muscle flap

D) Omental flap

E) Right latissimus dorsi flap

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

The correct response is Option A.

The most common and potentially devastating complication of median sternotomy is infection resulting in wound breakdown. Other complications seen less frequently are mechanical breakdown of the wound secondary to inadequate wiring technique, poor bone quality, and chronic obstructive pulmonary disease (COPD) associated with uncontrolled, severe coughing. Before the use of muscle flap closure of the sternal defect, mortality was in the 50% range. Subsequent to the development of muscle flap techniques, this has been dramatically reduced to the 15 to 30% range and even lower in many institutions (< 5%).

The treatment options for sternal wound closure include unilateral pectoralis major muscle turnover flap, the unipedicle pectoralis major muscle rotation advancement flap, the rectus abdominal muscle flap, bilateral myocutaneous pectoralis major muscle flaps, latissimus dorsi muscle flap, and the omental flap. Pectoralis major advancement flaps based on the thoracoacromial vessels are the first line option for coverage of sternal wounds. The left internal mammary artery has been harvested in this case, compromising the vascularity to the left pectoralis major turnover flap and the left rectus abdominis flap. The latissimus dorsi flap is a second line choice the presence of other reconstructive options. Omental flap is used when a large mediastinal dead space needs to be filled.

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Sternal wounds are divided into three categories: acute (those occurring within the first 2 postoperative weeks of sternotomy), subacute (those occurring between the second and fourth postoperative weeks), and chronic (those occurring any time thereafter).

Although chronic wounds may present with all of the life-threatening symptoms of the acute or subacute wounds, they usually present as wounds with a small amount of drainage, commonly from several sites. Osteomyelitis, a feature of many of the sternal wounds, is common to this group. Often this occurs at sites of wire placement. These wounds are treated in a similar fashion to the subacute wounds, requiring wire removal with thorough debridement including involved bone and cartilage prior to muscle or omental flap coverage.

The preoperative incision and drainage of the sternal wound, even as little as 48 hours before definitive repair, reduced the reinfection rate from 15% early in the Lenox Hill series to 5% later in the series. The authors' strategy was to prepare the opened wound for final closure with intense local wound care with wet to dry dressings every 6 hours or with wound vac therapy. They found reinfection could be minimized if surgery was avoided in the presence of frank purulence.

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35. A 38-year-old African American man presents with multiple purulent tunneling lesions in bilateral axillae and his right groin. Which of the following surgical treatments will result in the lowest likelihood of recurrence?

A) Deroofing

B) Electrosurgical peeling

C) Incision and drainage

D) Skin-tissue-saving excision

E) Wide excision

The correct response is Option E.

Hidradenitis suppurativa (HS) is an inflammatory skin disease with a characteristic clinical presentation of recurrent or chronic painful or suppurating lesions in the apocrine gland-bearing regions. HS should be differentiated from infections such as furuncles, carbuncles, and abscesses (due to infectious agents and response to antibiotics), cutaneous Crohn disease (often concurrent with gastrointestinal Crohn, which has "knife-cut" ulcers and no comedones [whiteheads or blackheads]), and acne (distributed on the face and upper truncus, whereas HS predominantly affects intertriginous areas).

Surgery is required to definitively treat the tunnels and scars associated with chronic HS. Although surgery is commonly recommended, the literature supporting surgical treatment is anecdotal, composed mostly of large case series or retrospective study reports. A systematic review by Mehdizadeh et al. concluded that a lower recurrence rate was found in procedures with wide excision (overall, 13%; primary closure, 15%; using flaps, 8%; grafting, 6%) compared with local excision (22%) or deroofing (27%). These operations can be disfiguring, and despite the removal of significant amounts of tissue, do not necessarily protect against disease recurrence.

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36. A healthy 55-year-old woman underwent bilateral breast reconstruction with free deep inferior epigastric perforator (DIEP) flaps. Tissue oximetry-based flap monitoring is used. Which of the following is the main advantage of this technique over a hand-held Doppler with clinical assessment?

A) Direct blood flow measurement

B) Ease of use

C) Improved flap salvage rate

D) Less expensive modality

E) Operator must be bedside

The correct response is Option C.

The main advantage of using tissue oximetry-based monitoring is that it improves flap salvage rates. Tissue oximetry, or near-infrared spectroscopy, is increasing in popularity among microsurgeons and has been shown to be the third most commonly used technique after clinical examination and hand-held Doppler. Rather than directly monitoring flow, tissue oximetry uses infrared light to measure the relative concentrations of oxygenated and deoxygenated hemoglobin. By measuring oxygenation rather than flow, the probe is relatively unaffected by movement artifacts. Recent studies emphasize its value in identifying flap compromise before clinical signs of arterial or venous thrombosis. In a 2011 study, Lin et al. reported an increased flap salvage rate at their institution with the use of near-infrared spectroscopy, from 57.7 to 93.8% ($p = 0.015$), despite no significant increase in their rate of reexploration, attributing this improvement to earlier recognition of vascular compromise. In a recent small prospective cohort study, Lohman et al. followed 38 free flaps with physical examination and five technologies, including handheld Doppler, implantable Doppler, and tissue oximetry. Although primarily a descriptive study, they concluded that tissue oximetry was the first technology to record signs of flap compromise.

Though tissue oximetry-based flap monitoring is easy to use, so is a hand-held Doppler, so that is not the main advantage. It does have a higher financial investment to buy the system, but over time it could be argued it more than pays for itself given the improved flap salvage rates. Unlike the hand-held Doppler, this modality has a continuous read on the monitor, the examiner need not be in the presence of the patient, and, in fact, can visualize the readings on a smart phone through an app.

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37. A 15-year-old boy sustained a traumatic amputation of the left index finger at the proximal interphalangeal joint level from a sharp injury. Replantation of the digit is performed, with vein grafting of the radial digital artery and vein. The distal tip of the digit appears congested, so medicinal leeching is instituted. Which of the following antibiotics is the most appropriate prophylaxis for this patient?

A) Amoxicillin and clavulanic acid

B) Ampicillin

C) Cephalexin

D) Ciprofloxacin

E) Vancomycin

The correct response is Option D.

The antibiotic choice that constitutes the best prophylaxis for this patient undergoing leech therapy is ciprofloxacin. Hirudo medicinalis is the most common leech species used in medicine, and its gut flora includes Morganella, Rikenella, and Aeromonas isolates. These bacteria are all sensitive to ciprofloxacin. Doxycycline or ceftriaxone are alternative treatments for Aeromonas prophylaxis.

Animal toxicology data available with the first quinolone compounds revealed an association with inflammation and subsequent destruction of weight-bearing joints in canine puppies. This observation limited further development or large-scale evaluation of this class of antibiotic agents in children at that time. However, there continued to be increased use of fluoroquinolones for pediatric patients over the past 30 years with data on the lack of toxicity when used in children. In 2004, ciprofloxacin became the first fluoroquinolone agent approved for use in children 1 through 17 years of age.

Cephalexin (Keflex) is a first-generation cephalosporin that is used to treat respiratory tract, middle ear, skin, bone, and urinary tract infections. Most Aeromonas strains are resistant to penicillin, ampicillin, carbenicillin, and ticarcillin. And most Aeromonas and Morganella strains have complete or intermediate resistance to amoxicillin and clavulanic acid (Augmentin). Vancomycin is a macrolide antibiotic, and has limited effectiveness for Aeromonas strains with high levels of antibiotic resistance.

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38. A 50-year-old woman with type 2 diabetes mellitus is scheduled to undergo ligament reconstruction tendon interposition (LRTI) surgery for trapeziometacarpal joint arthritis. The procedure is expected to last 90 minutes. Which of the following is the most appropriate antibiotic prophylaxis for this patient?

A) Oral antibiotics for 3 days following surgery

B) Single dose intravenous antibiotic within 1 hour of surgery

C) Single dose intravenous antibiotic within 1 hour of surgery and oral antibiotics for 24 hours following surgery

D) Single dose intravenous antibiotic within 1 hour of surgery and oral antibiotics for 3 days following surgery

E) No antibiotic prophylaxis is indicated

The correct response is Option E.

Multidrug resistant bacterial infections continue to rise and antimicrobial overuse is the leading cause for antibiotic resistance. There is growing evidence that prophylactic antibiotic use is not necessary for clean plastic surgery cases, aside from breast surgery cases. Despite consensus guidelines, the use of prophylactic antibiotics for elective *Hand Surg*ery cases continues to increase. Level I evidence exists that demonstrates prophylactic antibiotics are not necessary for clean *Hand Surg*ery cases lasting less than 2 hours. Although there has been concern regarding diabetes and surgical infection risk, this has not been demonstrated in larger studies with multivariate analyses.

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39. A 74-year-old woman presents with biopsy-proven Merkel cell carcinoma involving the left cheek and no palpable lymphadenopathy. The most appropriate treatment involves wide local excision with 2-cm margins and which of the following?

A) Adjuvant radiation and immunotherapy

B) Adjuvant radiation only

C) Cervical lymphadenectomy

D) Sentinel lymph node biopsy and adjuvant radiation

E) No additional intervention is needed

The correct response is Option D.

Merkel cell carcinoma is a rare and aggressive neuroendocrine cutaneous malignancy with a propensity for lymph node and distant metastasis and high mortality. It typically presents as an asymptomatic erythematous papule or nodule in the head and neck region. Surgical treatment includes wide local excision of the primary lesion with 1- to 2-cm margins to achieve histologically clear margins. Sentinel lymph node biopsy has become standard of care and helps determine prognosis and may guide additional adjuvant therapy. Negative sentinel node biopsy correlates with longer disease-free survival, especially in early stage disease. Adjuvant radiation has been shown in improve local-regional control and increase survival. Cervical lymphadenectomy would only be indicated in the setting of clinically positive lymph nodes and is insufficient as the sole adjuvant therapy.

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40. A 48-year-old man presents with an asymptomatic, slowly growing violaceous nodule overlying his right scapula. Dermoscopy shows a delicate pigmented network, vessels, and structureless light brown areas. Biopsy identifies the lesion as a dermatofibrosarcoma protuberans. To minimize recurrence, surgical excision should include which of the following?

A) Bone

B) 6-cm margin

C) Deep fascia

D) Frozen sections

E) Periosteum

The correct response is Option C.

Dermatofibrosarcoma protuberans (DFSP) is a rare neoplasm of intermediate malignancy. Taylor first described it in 1890, but Darier is credited with establishing DFSP as a distinct clinicopathological entity in 1924, and finally, Hoffman established the term in 1925.

Most DFSPs occur on the trunk (42%), followed by the upper extremities (23%), lower extremities (18%), then the head and neck (16%). The reason for recurrence is that microscopic projections are not removed adequately or assessed satisfactorily; the wider the margin, the higher the probability the tumor will be removed completely. Using 1-cm margins around the primary tumor leaves residual microscopic tumor in more than 70% of patients, 2-cm margins in 20 to 40% of patients, 3-cm margins in 9 to 15.5% of patients, and 5-cm margins in 5% of patients. Peripheral margins of 5 cm have a close to 0% recurrence rate. Wide resections may also not be practical in patients with tumors located in critical areas like the head and neck, and intraoperative frozen section assessments have not been reliable for determining margin status. Deep margins should always include excision of the deep fascia. The complete resection of the tumor requires excision of the external outer table in the cranium; muscle in trunk and extremities; peritoneum in thin patients with DFSP located on the abdomen, sternum, and clavicles; and vertebral apophysis when located on the thorax.

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41. A healthy 20-year-old woman presents with a deep abrasion injury of the left volar forearm that she sustained in a bicycle accident. Physical examination of the forearm shows exposed flexor tendons. The wound is debrided, and no vital nerves or vessels are exposed. The wound is approximately 4 × 4 cm. A bilaminate acellular dermal regenerative matrix is used to reconstruct the defect. The application of negative-pressure therapy is most likely to result in which of the following outcomes in this patient?

A) Increase in matrix take

B) Increase in timing to definitive skin graft

C) Negative-pressure therapy is not indicated

D) No change in matrix take

E) No change in timing to definitive skin graft

The correct response is Option A.

The application of negative-pressure therapy results in an increase in matrix take. Dermal regeneration matrix (DRM) (clinical example is Integra) is a mesh-bilayered acellular matrix composed of a cross-linked bovine tendon collagen and glycosaminoglycan dermal equivalent, and a semipermeable polysiloxane (silicone) epidermal equivalent. It is a biodegradable matrix that acts as a scaffold for fibroblast and endothelial invasion and capillary growth. DRM has been approved by the FDA (Federal Drug Administration) for use in partial- and full-thickness wounds, pressure ulcers, venous leg ulcers, surgical wounds, chronic vascular ulcers, second-degree burns, and draining wounds.

The combination of DRM with fibrin glue and postoperative negative-pressure therapy versus DRM alone in acute and chronic wounds increased the take rate from 78 to 98%. Moreover, the interval between DRM and skin transplantation was decreased from 24 to 10 days, thus decreasing the length of hospital stay (Level II evidence).

The other options are therefore incorrect. Negative-pressure therapy is commonly used in these clinical scenarios.

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42. A 55-year-old diabetic woman with a history of breast cancer is scheduled to undergo autologous breast reconstruction with a pedicled transverse rectus abdominis musculocutaneous (TRAM) flap. The surgeon is planning to ligate the inferior epigastric vessels in advance of the breast reconstruction. Which of the following mechanisms best describes how the delay phenomenon augments blood flow?

A) Decreased levels of prostaglandin E_2

B) Increased levels of prostaglandin F_2

C) Ischemia-induced dilation of blood vessels

D) Ischemia-induced hyperplasia and hypertrophy of blood vessels

E) Reorientation of choke vessels along the short axis of the flap

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

The correct response is Option D.

The delay phenomenon is also known as ischemic preconditioning. Essentially a flap is rendered partially ischemic, which results in neovascularization over a period of time. This can promote flap survival, increase the length-to-width ratio in random pattern flaps, and ensure the reliable transfer of larger volumes in axial pattern flaps.

Vascular delay causes hyperplasia and hypertrophy of the vessel walls during the first 48 to 72 hours of ischemia. Transected sympathetic nerves release norepinephrine into the tissue during early ischemia. This leads to a hyperadrenergic state, which causes vasoconstriction for up to 30 hours and augments early ischemia. The choke vessels reorient along the long axis of the flap, which enhances blood supply to the distal regions of the flap tissue. These tend to be the areas most prone to necrosis. There is an increase in prostaglandin E_2 (a vasodilator) and a decrease in prostaglandin F_2 or thromboxane (a vasoconstrictor) during late ischemia. This minimizes ischemia and enhances flap survival.

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43. Which of the following comorbidities is associated with the highest risk of digital replant failure?

A) Alcohol abuse

B) Chronic obstructive pulmonary disease

C) Diabetes mellitus

D) Psychotic disorders

E) Tobacco use

The correct response is Option D.

In a study looking at all amputation injuries and digital replantations captured by the National Inpatient Sample from 2001 to 2012, the comorbid conditions associated with the highest risk of replant failure were psychotic disorders, peripheral vascular disease, and electrolyte imbalances. The risk of replant failure increased 79% in a patient with a psychotic disorder. Alcohol abuse increased the risk of replant failure by 16%, tobacco use by 7%, diabetes by 3%, and chronic obstructive pulmonary disease by 1%. Interestingly, age in and of itself was not associated with a higher chance of replant failure in this and other studies.

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44. A 30-year-old woman comes to the office to discuss surgical augmentation of the chin. Which of the following outcomes is most likely in this patient if a porous polyethylene prosthesis is used instead of a solid silicone rubber prosthesis?

A) Increased incidence of bone resorption

B) Increased incidence of infection

C) Increased ingrowth of tissue

D) Increased likelihood of malposition

E) Reduced resorption of the implant

The correct response is Option C.

Porous polyethylene implants have enough rigidity to resist soft-tissue deforming forces but enough flexibility to facilitate placement. The pore size (diameter of 100 to 250 μm) of porous polyethylene used in facial augmentation procedures is sufficient to allow fibrous tissue ingrowth and relative incorporation of the prostheses. This avoids the capsule formation intrinsic to smooth-surface implants which is the result of the host's foreign body response. This superficial tissue integration makes porous polyethylene facial prostheses less likely to migrate after implantation than solid silicone prostheses, but it also makes their explantation more difficult compared with solid silicone prostheses.

Silicone rubber has a smooth surface and is relatively flexible, making implant placement and removal beneath the soft-tissue envelope easier.

Neither porous polyethylene nor silicone prostheses are resorbed after implantation. Two recent studies reported on a total of 53 patients undergoing chin augmentation with silicone implants. The authors found 55% of those patients experienced underlying bone resorption during the 20 month follow-up period based on lateral radiographs.

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45. A 76-year-old woman presents with a diagnosis of recurrent adenocarcinoma of the rectum after chemotherapy and radiation. The planned oncologic surgical treatment will be an abdominoperineal resection to include the rectum, anus and posterior wall of the vagina, and left end colostomy. She has had a prior laparoscopic bowel resection, but no open abdominal surgeries. Which of the following is the most appropriate surgical management for her planned perineal wound?

A) Bilateral pudendal flaps

B) Omental flap and skin graft

C) Primary perineal closure

D) Right gracilis myocutaneous flap

E) Right vertical rectus abdominis myocutaneous flap

The correct response is Option E.

Abdominoperineal resection and pelvic exenteration in previously irradiated patients create a large-volume non-collapsible dead space in the pelvis that can lead to large persistent perineal wounds. Meta-analysis reviews of existing patient series report that primary perineal closure is associated with twice the rate of perineal wound formation as flap closure. When compared with thigh-based flaps, such as the gracilis flap and gluteal-based flaps, the vertical rectus abdominis myocutaneous flap is associated with lower perineal wound and flap complication rates.

With prior abdominal surgery, the omentum may not be available or of sufficient volume for reconstruction. A skin graft is often applied to the omentum for sternal wound reconstruction, but would not be appropriate for resurfacing of the posterior wall of the vagina in concert with an omental flap.

Bilateral pudendal flaps would be in the previously irradiated field, increasing the potential for wound healing trouble with this flap selection. Additionally, pudendal flaps would not bring the bulk necessary to address an abdominoperineal resection defect.

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46. Cutaneous squamous cell carcinoma arises from which of the following epidermal layers?

A) Stratum basale

B) Stratum corneum

C) Stratum granulosum

D) Stratum lucidum

E) Stratum spinosum

Upon further review, this item was rekeyed to option E. Additionally, the rationale was revised as shown below.

The correct response is Option E.

Squamous cell carcinoma arises from keratinocytes in the stratum spinosum. The epidermis comprises four layers, from deep to superficial: stratum basale, stratum spinosum, stratum granulosum, and stratum corneum. Glabrous skin has an additional layer between the stratum granulosum and stratum corneum called stratum lucidum. The stratum basale consists of basal cells. These are stem cells that differentiate into keratinocytes. These keratinocytes then migrate upwards. In the stratum spinosum the keratinocytes form intercellular connections via desmosomes. In the stratum granulosum, the keratinocytes have keratohyalin granules. In the stratum corneum, the cells are compact and surrounded by a lipid layer, thus giving the skin its barrier function.

Melanocytes and Merkel cells are found in the stratum basale. Langerhans cells are found in the stratum spinosum, stratum granulosum, and the dermis. Basal cell skin cancers arise from the stratum basale.

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47. A 66-year-old, 132-lb (60-kg) woman presents to the emergency department with a deep second-degree, 20% total body surface area burn, with a small area of surrounding first-degree burn. This happened in an open space when she fell backwards onto a fire pit. Her burns are isolated to her buttock and back. She reports no hoarseness or difficulty breathing. She receives 9600 mL of Ringer's lactate within the first 24 hours. Based on her fluid resuscitation, she is at highest risk for which of the following?

A) Abdominal compartment syndrome

B) Conversion of the burn to full-thickness

C) Deep venous thrombosis

D) Digit ischemia

E) Poor engraftment of autologous skin grafts

The correct response is Option A.

Numerous formulas regarding burn resuscitation have been developed to avoid under-resuscitation. This was based on previous literature suggesting that under-resuscitation was associated with significant end organ damage secondary to ischemic injury. Inadequate resuscitation was similarly associated with the potential for hemodynamic collapse, resulting in death. Weight-based resuscitation programs and establishment of urine output guidelines have largely limited under-resuscitation at burn centers. However, burn patients now suffer from the consequences of over-resuscitation, in which patients receive even more fluid than recommended by the Parkland formula. These patients suffer from increased rate of burn infections, the development of acute respiratory distress syndrome, and abdominal compartment syndrome.

In the clinical case presented, the Parkland formula would suggest that the patient receive approximately 4800 mL of resuscitation (4 × TBSA burn [20] × weight in kilograms [60]) within the first 24 hours. This patient received approximately double the amount.

Regarding engraftment, there is no evidence that over-resuscitation worsens autologous skin graft engraftment. Conversion of burn injuries to deeper injuries is usually associated with under-resuscitation, as is end organ or digit ischemia. Deep venous thrombosis does not have any reported correlation with burn resuscitation.

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48. A 35-year-old affirmed male (birth-assigned female) presents to the office requesting top surgery for a more masculine chest appearance. On examination, the patient has a large C-cup breast, grade 2 ptosis, and a nipple-to-inframammary fold distance of 11 cm. Which of the following surgical options is the most appropriate?

A) Circumvertical reduction mammaplasty

B) Liposuction alone

C) Mastectomy with free nipple graft

D) Periareolar reduction mammaplasty

E) Wise pattern reduction mammaplasty

The correct response is Option C.

The most appropriate surgical procedure in this patient is a subcutaneous mastectomy with free nipple graft due to breast size and ptosis. Top surgery, or excision of the female breast tissue and shaping of the male chest, is often the first surgical procedure for female-to-male transgender patients. This marks the beginning of their surgical transition into a masculine phenotype and is associated with profound and impactful psychological and aesthetic benefits for the individual. The goal of top surgery is to produce a normal-appearing male chest. This is achieved by removing the breast parenchyma, obliterating the inframammary fold, reducing the areolar size, and positioning the nipple-areola complex into the appropriate position.

There are numerous studies demonstrating excellent results and high patient satisfaction with subcutaneous mastectomy and free nipple grafts in patients with large and ptotic breasts. Additionally, patients with a BMI over 27 kg/m2 and a nipple-to-inframammary fold distance greater than 7 cm demonstrate better outcomes with fewer complications. Periareolar breast reduction also demonstrates excellent results when limited to patients with smaller breasts, minimal ptosis, and a smaller skin envelope.

Liposuction alone will not achieve the goals above and will result in residual breast tissue and excess skin. Additionally, liposuction will not address areolar size or position. Liposuction is useful when combined with other techniques to help feather tissue thickness and contour the edges of the chest. Both Wise pattern and circumvertical reduction mammaplasty will leave behind too much breast tissue and will not create the desired masculine chest appearance.

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49. Which of the following is associated with the use of pressure garments in the management of burn scars?

A) Decreased scar strength

B) Increased synthesis of tissue proteinases

C) Larger and less densely packed collagen fibers

D) Reduced differentiation of fibroblasts to myofibroblasts

The correct response is Option D.

Significant differences in scar contraction were observed between scars receiving pressure garment therapy and control burns that received no pressure. Pressure garments exert compressive forces perpendicular and parallel to the surface of the scar. These forces oppose the direction of contracture. One hypothesis is that wound tension acts upon integrins by stretching them, which leads to phosphorylation of focal adhesion kinase and upregulation of smooth muscle actin and collagen production. When compression is applied to incisional wounds perpendicular to the wound tension, scarring is minimized. This suggests that the mechanical forces applied to the scar can assist in reducing differentiation of fibroblasts to myofibroblasts, decreasing scar contraction and collagen deposition.

Scar strength was improved with pressure garment therapy compared with controls, with a 34% increase in ultimate tensile strength. Pressure garment therapy scars were also found to be composed of smaller, more densely packed collagen fibers.

Increased synthesis of tissue proteinases is a mechanism of corticosteroids.

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50. A 43-year-old man presents with a recurrent 6-mm skin lesion on his upper lip. It is characterized by an erythematous papule surrounded by scale and crust. Biopsy shows nests of poorly differentiated cords of spindle cells of keratinocyte origin. Which of the following is the most appropriate treatment?

A) Cryosurgery

B) Electrodessication and curettage

C) Mohs micrographic surgery

D) Radiation therapy

E) Standard surgical excision

The correct response is Option C.

The patient's histology is consistent with squamous cell carcinoma. Mohs micrographic surgery (MMS) has the highest cure rates for both primary and recurrent squamous cell carcinoma. For locally recurrent tumors, the 5-year cure rate for MMS is 90% compared with 76.7% for standard surgical excision. Because MMS is a tissue-sparing technique, smaller surgical margins are taken, and scarring and functional impairment are minimized compared with standard surgical excision and electrodessication and curettage. Tumor removal and reconstruction are usually performed on the same day, using local anesthesia in an office-based setting. Recurrence rates after cryosurgery and radiation therapy are not as favorable as for MMS.

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Section 2: Hand and Lower Extremity

51. A 57-year-old woman presents with inability to extend the right thumb at the interphalangeal joint for the past 3 months. The patient reports a dull aching of the right wrist for several weeks before the sudden loss of thumb function. On physical examination, she cannot lift her right thumb when her palm is placed on a flat surface. Seven months ago, she was treated in a cast for a non-displaced right distal radius fracture; the fracture healed uneventfully. Which of the following is the most appropriate treatment to restore thumb function in this patient?

A) Arthrodesis of the interphalangeal joint

B) Lengthening of the flexor pollicis longus

C) Posterior interosseous neurolysis

D) Primary repair

E) Tendon transfer

The correct response is Option E.

This patient has sustained a rupture of the extensor pollicis longus (EPL) tendon. Tendon transfer, using the extensor indicis proprius (EIP) tendon, is the most appropriate way to restore function to the thumb. Although head-to-head comparison studies do not exist, the other options listed would not be expected to restore the patient's function, based on the clinical scenario presented.

EPL rupture is not uncommon after a distal radius fracture. Although it may not be intuitive, EPL ruptures are actually more common following non-displaced fractures than displaced fractures. The cause of rupture is thought to be ischemic damage leading to attritional rupture of the tendon within the tight fibro-osseous tunnel where the EPL routes around the dorsal tubercle of the radius (Lister tubercle). Because this is an attritional rupture, primary tendon repair is usually not feasible, especially not 3 months after the rupture has occurred.

Tendon grafting is possible but has the disadvantage of requiring two separate tenorrhaphies and a graft donor site. Both tendon transfer and/or tendon grafting may be done under local anesthesia to possibly help set tension more accurately. An interphalangeal (IP) joint arthrodesis might help stabilize an unstable IP joint if no tendon reconstruction is possible. However, this procedure is not indicated in most EPL ruptures as it does not restore the missing function(s).

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Flexor tendon lengthening is not indicated; this patient does not have a tight or contracted flexor tendon. Posterior interosseous nerve (PIN) neurolysis may be indicated in cases of PIN compression (gradual or insidious onset, pain in forearm, weakness of multiple muscles), but the patient described in this scenario does not have these complaints.

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52. A 26-year-old man sustains a laceration to the left palm with a hunting knife. Injury to the flexor digitorum superficialis (FDS) of the ring finger is suspected. Which of the following maneuvers performed on this patient is the most reliable method to examine FDS tendon function?

A) Flexion of the distal interphalangeal (DIP) joint with the other fingers held in extension

B) Flexion of the DIP joint with the ring finger metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints in extension

C) Flexion of the DIP joint with the ring finger MCP joint and PIP joints in flexion

D) Flexion of the PIP joint with the other fingers held in extension

E) Flexion of the PIP joint with the ring finger MCP joint in extension

The correct response is Option D.

The most reliable method for examining flexor digitorum superficialis (FDS) tendon function is with flexion of the proximal interphalangeal (PIP) joint while the other fingers are being held in extension. Each finger contains two different flexor tendons, FDS and flexor digitorum profundus (FDP). The FDS inserts into the middle phalanx and primarily flexes the finger at the PIP joint. The FDP inserts into the distal phalanx and can flex both the PIP and distal interphalangeal (DIP) joints.

Flexion at the DIP joint is performed by the FDP tendon, so this tendon can be tested by stabilizing the metacarpophalangeal (MCP) and PIP joints in extension, while observing for DIP flexion. Flexion of the PIP joint can arise from both FDS and FDP tendon functions, regardless of whether the MCP joint is in extension or flexion.

Testing for FDS function requires eliminating the contribution of the FDP tendon in order to isolate the FDS. This can be done by stabilizing the other fingers in extension. The FDP has a common muscle belly, so holding the other fingers straight will prevent the FDP from firing. The resultant flexion of the PIP joint will be due to the FDS tendon alone. The FDS tendon has independent muscle bellies. Increased flexion of the DIP joint when the MCP and PIP joints are in flexion is seen in cases of intrinsic tightness.

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53. A 17-year-old boy presents with a mass of the left forearm that has been enlarging over the past 3 months. A photograph is shown. Biopsy of the mass is consistent with spindle cell sarcoma. MRI shows a well-encapsulated mass that does not infiltrate neurovascular structures. CT scan of the chest shows no evidence of metastatic lesions. Which of the following is the most appropriate next step in management?

A) Amputation at the midforearm

B) Chemotherapy only

C) Excision and chemotherapy

D) Excision and radiation therapy

E) Radiation therapy only

The correct response is Option D.

Soft tissue sarcomas are rare malignant tumors representing less than 1% of all malignancies, with only 25% occurring in the upper extremity. The diagnostic workup generally includes a biopsy, magnetic resonance imaging scan to assess the extent of the tumor and its relationship to adjacent structures, and a computed tomography scan of the chest. This combination allows for appropriate clinical staging of the patient. The role of sentinel lymph node biopsy in the workup of soft tissue sarcomas is controversial. Treatment consists of wide excision, primary reconstruction, and radiation therapy (adjuvant or neoadjuvant). The tumor must be completely removed with a cuff of normal tissue (at least 1 cm); violation of the tumor decreases 5-year survival from 87 to 47%. More than 90% of extremity sarcomas can be managed with a limb-sparing resection.

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Chemotherapy is rarely indicated and is never used as the only treatment for soft tissue sarcoma. Primary amputation is considered when the tumor infiltrates major neurovascular structures and resection would result in the sacrifice of more than one major peripheral nerve. Additional indications for amputation include involvement of the interosseous membrane, advanced disease with extensive loss of functional tissues, and severe comorbidities limiting reconstructive options.

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54. A 32-year-old man presents to the emergency department for evaluation of a laceration of the right wrist sustained when he punched a glass window 1 hour ago. Physical examination shows a 2-cm transverse laceration of the volar ulnar wrist crease. Wound exploration shows complete laceration of the ulnar nerve. On physical examination of motor function, LOSS of which of the following functions is most likely in this patient?

A) Adduction of the thumb carpometacarpal joint

B) Extension of the metacarpophalangeal joint of the ring and small fingers

C) Extension of the thumb interphalangeal joint

D) Flexion of the interphalangeal joint of the index and middle fingers

E) Flexion of the interphalangeal joint of the ring and small fingers

The correct response is Option A.

The ulnar nerve is the terminal branch of the medial cord of the brachial plexus. It enters the forearm between the two heads of the flexor carpi ulnaris (FCU). In the forearm, the ulnar nerve innervates the FCU and flexor digitorum profundus of the small and ring fingers. It courses distally under the FCU to enter Guyon's canal at the wrist. The dorsal cutaneous nerve, which gives sensation to the dorsoulnar hand, arises approximately 5 to 7 cm proximal to the ulnar styloid. In Guyon's canal, the ulnar nerve splits into a deep motor and a superficial sensory branch. The deep motor branch innervates the hypothenar muscles (abductor digiti minimi, opponens digiti minimi, and flexor digiti minimi), as well as the lumbricals to the ring/small fingers, dorsal and palmar interossei, flexor pollicis brevis (deep head), palmaris brevis, and adductor pollicis. The superficial sensory branch in the palm innervates the small finger and the ulnar aspect of the ring finger.

Adduction of the thumb is controlled through activation of the ulnar-innervated adductor pollicis muscle. In the small and ring fingers, extension of the metacarpophalangeal (MCP) joint is performed through activation of the radially innervated extensor digitorum communis and extensor digiti minimi muscles. In the index, middle, ring, and small fingers, flexion of the proximal interphalangeal (PIP) joint is performed through activation of the median-innervated flexor digitorum superficialis.

While flexion of the ring and small finger distal interphalangeal (DIP) joints is produced by the ulnar-nerve innervated FDP tendons to the ring and small finger, the ulnar nerve provides branches to this muscle proximal to this patient's injury. Extension of the thumb MCP joint is via the radial nerve innervated extensor pollicis brevis muscle.

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55. A 29-year-old man undergoes evaluation for nonunion of a scaphoid fracture. Reconstruction with a vascularized osseous flap is planned, and a medial femoral condyle flap is chosen. During harvest, the vascular pedicle for this flap runs between which of the following structures?

A) Anterior to the tensor fascia lata and posterior to the vastus lateralis

B) Anterior to the vastus medialis and anterior to the adductor tendon

C) Anterior to the vastus medialis and posterior to the rectus femoris

D) Posterior to the rectus femoris and anterior to the vastus lateralis

E) Posterior to the vastus medialis and anterior to the adductor tendon

The correct response is Option E.

The medial femoral condyle osseous free flap has become a useful option for reconstruction of bony defects in the extremities, particularly of the scaphoid waist and proximal pole. The vascular supply to this flap is from the descending geniculate artery in the distal medial aspect of the thigh. To explore and identify the pedicle for this flap, the vastus medialis is reflected anteriorly, and the adductor tendon is found posterior to the vessels. The rectus femoris is located anterior to the dissection for this flap.

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56. A 2-year-old female infant presents with a 3 × 3-cm red, firm, raised mass on the dorsum of the right hand. Physical examination shows a red mass with a smooth surface, and a rim of decreased pigmentation. The patient's mother reports that the mass has not changed in size, appearance, or coloration since birth. An ultrasound and MRI at age 3 months showed a well-defined, homogenous mass with high-blood flow characteristics. Which of the following is the most likely diagnosis in this patient?

A) Dermatofibrosarcoma protuberans

B) Infantile hemangioma

C) Lymphatic malformation

D) Non-involuting congenital hemangioma (NICH)

E) Venous malformation

The correct response is Option D.

Non-involuting congenital hemangioma (NICH) is a rare form of hemangioma that is present at birth, is stable in size over time (ie, does not involute), and often has a white-grey rim. It is histologically and radiographically similar to infantile hemangioma except that it stains negative for glucose transporter protein 1 (GLUT1).

Venous malformation and lymphatic malformation are low-flow and do not fit the clinical description: they are typically darker in color, amorphous in form, and are compressible. Dermatofibrosarcoma protuberans is rare in children, begins more like a flat scar, and grows over time. It is not a high-flow lesion.

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57. A 32-year-old woman presents to the emergency department with a transverse laceration over the volar nondominant small finger. Physical examination shows full active flexion and extension but pain on resisted flexion. Exploration shows a 20% flexor profundus laceration. Which of the following are the most appropriate joint positions for splinting this patient's wrist**,** metacarpophalangeal (MCP) joints, proximal interphalangeal (PIP) joints, and distal interphalangeal (DIP) joints?

A) Wrist extension, MCP joint extension, PIP joint extension, DIP joint extension

B) Wrist extension, MCP joint flexion, PIP joint extension, DIP joint extension

C) Wrist extension, MCP joint flexion, PIP joint flexion, DIP joint extension

D) Wrist flexion, MCP joint extension, PIP joint extension, DIP joint extension

E) Wrist flexion, MCP joint flexion, PIP joint flexion, DIP joint flexion

The correct response is Option B.

The correct position in which to immobilize the hand is intrinsic plus position. This is also known as the safe position that helps to prevent joint stiffness and joint contractures. This goal is to have the collateral ligaments of the wrist, metacarpophalangeal (MCP) joint, proximal interphalangeal (PIP) joint, and distal interphalangeal (DIP) joint at full tension. The wrist is placed between 0 to 30 degrees of extension, the metacarpophalangeal (MCP) joints in 70 to 90 degrees of flexion, and both the PIP and DIP joints into full extension. Since the patient has only a partial-thickness flexor tendon injury, there is no need to consider flexion other than at the MCP joint.

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58. A 37-year-old man who works as a laborer sustains a saw injury to the non-dominant left hand. X-ray studies are shown. Which of the following is the most appropriate functional option for reconstruction of this thumb defect?

A) Metacarpal lengthening

B) Osteoplastic reconstruction

C) Pollicization

D) Prosthesis

E) Toe transfer

The correct answer is Option C.

The x-ray study shows a carpometacarpal-level amputation of the thumb. Toe transfer, osteoplastic reconstruction, and metacarpal lengthening require part or most of the thumb metacarpal to be present. A thumb prosthesis would have limited functionality and be insensate.

Pollicization would potentially allow a sensate, functional index finger to accomplish some of the functions of the thumb. It is, however, not without its drawbacks because it is technically demanding and has a high likelihood of requiring secondary procedures. For a carpometacarpal-level amputation, pollicization provides the best option for function.

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59. A 56-year-old woman with a traumatic defect of the upper third of the tibia undergoes open reduction and internal fixation with tibial nail. Soft tissue coverage with a gastrocnemius flap is planned. Which of the following arteries provides the dominant blood supply for this flap?

A) Anterior tibial

B) Peroneal

C) Popliteal

D) Posterior tibial

E) Sural

The correct response is Option E.

Each head of the gastrocnemius muscle is supplied by the sural artery: either the medial sural or lateral sural artery for medial and lateral gastrocnemius, respectively. The arteries arise from the popliteal artery about 3-4 cm above the head of the fibula and enter the medial and lateral heads of the gastrocnemius at about the level of the head of the fibula. The flap can be rotated to cover soft-tissue defects of the anterior distal aspect of the knee. The flap ranges from 5 to 9 cm in width and from 13 to 20 cm in length. It provides a vascular bed for a skin graft and improves the delivery of oxygen and systemic antibiotics. The other listed arteries do not supply the gastrocnemius muscles.

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60. A 9-month-old boy presents for evaluation of unilateral preaxial polydactyly. X-ray studies show triphalangism of the accessory thumb. Which of the following is the most likely Wassel classification in this patient?

A) Type II

B) Type III

C) Type IV

D) Type V

E) Type VII

The correct response is Option E.

Preaxial polydactyly describes patients with thumb duplication. In 1969, Wassel (as the fellow of Adrian Flatt) described a categorization system for radial polydactyly corresponding to the level of skeletal duplication. There have been many subsequent modifications of this classification system, but this remains the most commonly used. Type IV (duplicated proximal and distal phalanges) is the most common duplication, followed by Type II (duplicated distal phalanx). A Type VII duplication involves a triphalangeal thumb and is the only deformity in which there is triphalangism.

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61. A 65-year-old woman presents with severe osteoarthritis of the proximal interphalangeal (PIP) joint of the nondominant left middle finger. Medical history includes chronic pain and an angular deformity of the joint. Range of motion of the PIP joint is 30 to 60 degrees. Silicone implant arthroplasty is planned. Which of the following is the principle benefit of this procedure?

A) Correction of angular deformity

B) Improved cosmesis

C) Improved range of motion

D) Increased grip strength

E) Pain relief

The correct response is Option E.

Expected outcomes for small joint implant arthroplasty are pain relief with similar range of motion to preoperative values. The procedure involves excision of the arthritic proximal phalanx head and middle phalanx base and replacement with a silicone stemmed implant. The implant acts as a spacer for development of a scar capsule.

Although angular deformity is corrected with this procedure, and many patients report satisfaction with the improved appearance of the alignment of the finger, the primary goal of the procedure is pain relief from underlying arthritis. Outcome studies have not demonstrated improved grip strength or range of motion. Long-term outcome studies show 90% implant survival at 10 years, high patient satisfaction, and a low revision rate despite a relatively high incidence of implant fracture or deformity over time.

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62. A 6-year-old boy presents with a supracondylar fracture sustained during a fall on an outstretched hand. A splint with the elbow flexed less than 90 degrees is placed. The patient is screaming in pain. Examination shows the affected hand has a 3-second capillary refill. Which of the following is the most appropriate next step in management?

A) Closed reduction

B) Continued observation and application of ice packs

C) Elevation of the arm

D) Exploration of the brachial artery

E) Replacement of the current splint with an elbow extension splint

The correct response is Option A.

Supracondylar fractures are one of the most common traumatic fractures seen in children. It occurs most commonly in children 5 to 7 years of age with similar male and female incidence. The mechanism is usually from a fall onto an outstretched hand. The fracture can lead to severe forearm edema, then ischemia leading to Volkmann's contracture.

Immobilization would be long arm casting with the elbow flexed at less than 90 degrees. Arm elevation would decrease tissue perfusion and would therefore be contraindicated. Immediate bedside closed reduction by gentle traction and elbow flexion to 20 to 40 degrees would be indicated in this case as a next step. If the closed reduction is unsuccessful or ischemia persists after reduction or recurs, urgent operative closed reduction with percutaneous pinning is required. Pins are placed to prevent recurrence. Brachial artery exploration could be required if ischemia has not resolved even after successful reduction, but not initially.

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63. A 40-year-old woman presents with small, non-healing ulcers of the right index and middle fingertips. Medical history includes limited scleroderma diagnosed 5 years ago, chronic pain, and color changes of the fingers in cold temperatures. The patient's symptoms have not improved with administration of nifedipine. Angiography shows diffuse vascular narrowing without any focal lesions. Which of the following is the most appropriate intervention for pain relief and ulcer healing in this patient?

A) Cervical sympathectomy

B) Continuous brachial plexus blockade

C) Digital bypass

D) Onabotulinum toxin A

E) Stellate ganglion block

The correct response is Option D.

This patient has Raynaud's phenomenon associated with scleroderma. The pathophysiology of Raynaud's is thought to be related to sympathetic hyperactivity, elevated plasma endothelin, increased peripheral alpha-2 receptors, and possibly abnormal platelet and red cell function. Botulinum toxin type A has been shown to improve digital perfusion on laser Doppler, decrease pain, and result in ulcer healing. In a series of 33 patients injected with 50 to 100 U of onabotulinum toxin A, all patients had ulcer healing by 60 days postinjection. Pain relief typically occurred within 5 to 10 minutes of injection and complication rates were low and limited to injection site reactions. A prospective, randomized, placebo-controlled trial showed patients with limited scleroderma and shorter duration of disease had the best response to onabotulinum toxin A.

Stellate ganglion blocks have been shown to have only variable success for Raynaud's with only short-term symptom relief and no effect on ulcer healing. Stellate blocks may not disrupt all sympathetic input to the extremity. Brachial plexus blocks may help with perfusion temporarily but are advocated mainly in patients undergoing microvascular surgery. Their use is not recommended in this setting. Surgical bypass to the superficial palmar arch has been shown to increase blood flow to the hand and improve ulcer healing. However, bypass to the digital vessels would not be indicated as the distal target vessels are often diminutive without adequate flow.

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64. A 40-year-old man presents to the emergency department because of severe pain after sustaining a crush injury to the left lower extremity from a forklift. On physical examination, the lower leg is tense and swollen circumferentially. Sensation to the foot is diminished. Distal pulses are palpable. X-ray study does not show any fractures. Which of the following is the most appropriate next step in management?

A) Ace wrap compression

B) CT angiography

C) Emergent fasciotomy

D) MRI

E) Observation and leg elevation

The correct response is Option C.

The patient displays the signs and symptoms of acute compartment syndrome, a surgical emergency requiring emergent fasciotomy. Acute compartment syndrome requires prompt diagnosis and expeditious treatment in order to minimize morbidity.

Compartment syndrome can occur following a substantial soft tissue crush injury, even in the absence of a fracture, such as in this clinical scenario. Severe pain is usually the presenting complaint. It may be out of proportion to the injury and unresponsive to analgesics. The presence of paresthesias can signify nerve hypoxia from elevated compartment pressures. Pallor, paralysis, and pulselessness are very late signs. Nerve and muscle do not tolerate long periods of ischemia and may undergo irreversible damage if surgical decompression is delayed.

Compartment syndrome is primarily a clinical diagnosis, but measurement of compartment pressures can provide additional information especially if the diagnosis of compartment syndrome is less obvious. If compartment pressures are greater than 30 mmHg or if the differential pressure (difference between diastolic blood pressure and compartment pressure) is less than 30 mmHg, then fasciotomy is recommended.

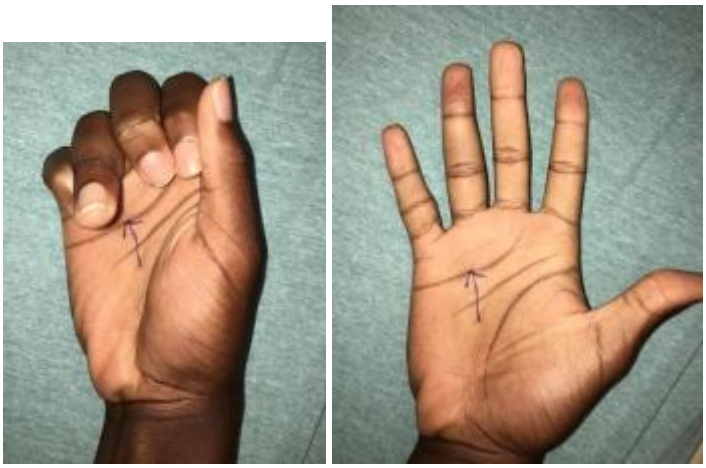
Observation and leg elevation would not be appropriate management in the setting of acute compartment syndrome. CT angiography would not be indicated in this case, where there is a low suspicion of vascular injury. MRI has been used in the diagnosis of chronic exertional compartment syndrome but has little value in the setting of acute trauma.

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65. A 19-year-old right-hand–dominant man presents with an injury to the right ring finger sustained when he hung on the basketball rim after slam dunking a basketball 1.5 weeks ago. Photographs are shown. X-ray studies are unremarkable. Which of the following is the most appropriate next step in management?

A) Fusion of distal interphalangeal joint in 20 degrees of flexion

B) Primary repair

C) Staged tendon reconstruction

D) Tenodesis

E) Observation

The correct response is Option B.

This patient has an avulsion of the flexor digitorum profundus (FDP) tendon from its insertion at the volar base of the distal phalanx (Zone 1), also known as a jersey finger. The ring finger is involved in 75% of cases of this type due to its prominence during grip (longer than adjacent fingers during grip in most patients). Leddy and Packer classify jersey finger injuries as Types 1 through 5:

Type 1: Avulsion with retraction into the palm with disruption of the vincular blood supply,
Type 2: Retraction to the level of the proximal interphalangeal (PIP) joint,
Type 3: Associated fracture fragment holds tendon at distal interphalangeal (DIP) joint lever,
Type 4: Fracture with tendon avulsion from bony segment,

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Type 5: Fracture, avulsion, with distal phalangeal comminution.

Since there was no bony fragment on x-ray study, this is either a Type 1 or 2 and an attempt at primary repair up to 3 weeks after injury is almost invariably achievable. This offers the best possible outcome versus the other options, which are either salvage or not practical. Observation is a poor alternative as the loss of the FDP can result in DIP joint hyperextension and can adversely affect the ring finger mobility and function. Fusion is a salvage procedure and should not be considered when repair is possible. Staged repair could be considered in a more chronic injury but is tedious and has variable outcomes. It is unnecessary in this patient. Tenodesis is another salvage procedure that has been described in unrepairable injuries.

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66. A 12-year-old boy presents with warts on his fingers. His parents report that the warts have persisted despite application of a variety of topical treatments. Which of the following viruses is the most likely cause of this patient's condition?

A) H1N1

B) Hepatitis C

C) Herpes simplex

D) Human immunodeficiency

E) Human papilloma

The correct response is Option E.

The cause of warts is the human papilloma virus (HPV). There are more than 100 known types of HPV. Types 2 and 4 are the most common cause of warts on the hands, as in this patient. People whose occupations expose their hands to wet environments, such as meat, poultry, and fish handlers and veterinary surgeons have higher risk of developing warts. The virus can be transmitted on shared clothing or public spaces, such as showers, and then gain entry through breaks in the skin. The virus is then able to alter the squamous epithelium to produce a cauliflower-like growth. Warts can be present in single lesions or multiple lesions. They are often painless and are usually not cancerous but can be a source of embarrassment for the patient. Warts are generally self-limited and will resolve spontaneously within months or years. Spontaneous resolution appears to occur in 50% of children within 1 year and 90% within 5 years.

There are many treatments for warts. Home remedies include topical salicylic acid, duct tape, and cold treatments. Clinical treatments have shown topical acids and cryotherapy to be equally effective. Intralesional injections and topical antivirals, as well as immunologic stimulators of interferon, have been tried with some success, including purified candida; measles, mumps, and rubella; and tuberculin (PPD) protein. Chemical ablation with silver nitrate has been shown to resolve almost half of warts a month after a 9-day treatment protocol. Mechanical removal can be performed with direct excision with good success. Pulsed dye and CO2 lasers have been successfully used to ablate warts but can be painful, expensive, and leave scars. Periungal warts can be particularly difficult to treat topically and may require a more invasive treatment method. A patient's ability to eradicate a wart can be reduced by a compromised immune system. Multiple progressive warts in immunosuppressed patients may need to be biopsied as these warts may transform into squamous cell carcinoma.

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Human immunodeficiency virus (HIV), H1N1, hepatitis C, and herpes simplex are all viruses that affect humans but do not cause lesions on the fingers. Herpes simplex virus is the cause of cold sores around the mouth and genital herpes. Hepatitis C is a virus that causes inflammation of the liver. HIV decreases the effectiveness of the immune system. H1N1 is an influenza virus and known cause of the "swine flu" outbreak in 2009.

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67. A 41-year-old woman who is a dentist comes to the office because she has had intense burning and pruritus of the dominant index finger for the past 6 days. The patient reports a small vesicular rash on the finger that has since progressed to form a small blister. She has had intermittent fever and malaise. Which of the following is the most appropriate management?

A) Incision and drainage of the bullae

B) Intravenous administration of cefazolin

C) Oral administration of acyclovir

D) Topical application of silver sulfadiazine

E) Observation only

The correct response is Option E.

The patient has a history and physical findings consistent with herpetic whitlow. This is a viral infection caused by herpes simplex virus and is more common in medical and dental personnel. Tzank smear or antibody titers can confirm a diagnosis but are unnecessary in the management of this patient. Treatment is primarily nonoperative and involves observation, as the course of the illness is self limiting with resolution in 1 to 3 weeks. Intravenous antibiotics would not treat this viral infection. Incision and drainage is unnecessary and may lead to a bacterial superinfection or systemic dissemination of herpes simplex virus. Acyclovir or valacyclovir may shorten the duration of symptoms, but must be started within 2 to 3 days of onset. Topical application of an antimicrobial would provide no benefit in this case. Surgical drainage of the bullae should not be performed because it may increase the risk of spreading the herpes virus and may also lead to bacterial superinfection.

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68. A 53-year-old African American man is referred for evaluation of a 3-mm-wide pigmented streak of the left index fingernail. A full-thickness biopsy of the nail matrix confirms the diagnosis of melanoma. Which of the following factors is most pertinent in determining prognosis and 5-year survival in this patient?

A) Mitotic rate

B) Tumor free resection margins

C) Tumor location

D) Tumor stage

E) Width of the lesion

The correct response is Option D.

This patient has acral lentiginous melanoma (ALM) based on the clinical description of a dark-skinned man with a tumor on the fingernail presenting as a pigmented streak. The prognosis for ALM is typically worse than other melanoma subtypes. The poor survival rate of these patients may be due to a delay in diagnosis. As in other melanoma subtypes, tumor thickness is the most important prognostic indicator. Overall, 5-year survival for ALM is 80 versus 91% for all melanomas. Acral lentiginous melanoma is the least common subtype of melanoma, however, it makes up the highest percentage of cutaneous melanomas in dark-skinned patients. ALM is predominantly found on the palms, soles, and nail beds. This is in contrast with other melanoma subtypes that typically occur in sun-exposed areas. However, the location of the tumor does not directly influence the prognosis. It is more correlated to diagnosis at a later stage.

Mitotic rate and other pathologic characteristics such as microscopic ulceration, lymphatic, or nerve involvement can upstage the tumor. However, it is not the primary determinant of tumor stage, and mitotic rate is no longer considered as part of staging in early melanomas.

Achieving adequate resection margins in ALM may be difficult, especially in tumors involving the nail unit. Amputation at the next most proximal joint is often recommended. Regardless of the status of the margins, prognosis is still determined by depth at diagnosis. Thicker tumors have a higher incidence of nodal involvement and metastatic disease. In later stage disease, surgical resection of the primary tumor is for diagnostic purposes, local control, and occasionally palliative care.

Pigmented lesions of the nails greater than 2 mm have a higher likelihood of being invasive melanoma, but width of the lesion is not involved in tumor staging or prognosis.

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69. In a transhumeral amputee, targeted muscle reinnervation can be utilized to improve control in a myoelectric prosthesis. Which of the following nerve transfers can be performed to provide intuitive prosthetic control for hand closure?

A) Median nerve to short head of biceps

B) Musculocutaneous nerve to long head of biceps

C) Radial nerve to lateral head of triceps

D) Radial nerve to long head of triceps

E) Ulnar nerve to lateral head of triceps

The correct response is Option A.

Targeted muscle reinnervation (TMR) utilizes a set of nerve transfers in order to allow intuitive prosthetic control for upper extremity amputees. Functioning nerves that no longer have their distal muscle target can be transferred to intact proximal muscles and generate a novel electrical signal that can be picked up by a myoelectric prosthesis. Another benefit of TMR is the potential to prevent or treat painful neuromas.

In the case of a transhumeral amputee, elbow flexion myoelectric prosthetic control is maintained by preserving musculocutaneous innervation to the long head of the biceps muscle. The distal remnant of the median nerve is transferred to the motor nerve of the biceps short head to create a signal for prosthesis hand closure. Elbow extension signals are maintained with radial innervation of the long head of the triceps. Signals for prosthesis hand opening are created with transfer of the distal radial nerve to the motor nerve of the triceps lateral head.

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70. A 2-year-old male infant presents with a congenital deformity of the ring finger. A photograph and x-ray study are shown. The patient's parents report that the condition limits his ability to make a full fist but is otherwise painless. Which of the following is the most likely diagnosis in this patient?

A) Amniotic band syndrome

B) Camptodactyly

C) Congenital trigger finger

D) Macrodactyly

E) Syndactyly

The correct response is Option A.

Amniotic band syndrome (ABS) has an incidence of 1/1200 to 1/15,000 births. Some congenital anomalies have been associated with ABS including cleft palate, imperforate anus, equinovarus, and body wall defects.

The etiology of ABS has two theories. The intrinsic defect theory endorses genetic abnormalities which lead to mesenchymal hypoplasia and scarring. The extrinsic theory endorses amniotic tissue which entangles fetal parts leading to constriction.

Constriction varies leading to a spectrum of clinical manifestations from skin dimpling to digital amputation. Neurovascular injury can manifest as peripheral nerve palsy, lymphedema and arterial insufficiency. Syndactyly is common, and acrosyndactyly is pathognomonic of ABS. The Patterson classification system has four subtypes. The first is a simple constriction ring. The second has a constriction ring that affects the digit distal to the ring, with or without lymphedema. The third consists of constriction rings with acrosyndactyly. The fourth is characterized by amputation at any level.

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Camptodactyly is defined as a painless and progressive non-traumatic contracture of the proximal interphalangeal (PIP) joint. It affects around 1% of the population and the great majority of the cases are extremely mild and asymptomatic. The cause of the contracture is controversial. There have been descriptions of malformations of the superficial flexor of the fingers, lumbrical muscles, and the transverse and oblique retinacular ligaments. There may also be alterations to the configurations of the PIP joint.

Congenital trigger finger differs from congenital trigger thumb. Congenital trigger finger is rare and presents more commonly in the ulnar digits with associated malformations of the superficial and deep flexors. It presents with sporadic locking. Release of the A1 pulley alone is not adequate, with tenoplasty of the chiasm and partial opening of the A2 pulley generally necessary.

Syndactyly is a variable fusion between two adjacent fingers, and is one of the most common congenital
deformities, occurring in 1:2000 live births.
Classification includes:
Simple: fusion only through the skin
Complex: bone connection.
Complete: the entire commissure is involved, including the nail bed
Incomplete: the nail bed is not involved.
Complicated: involvement of vascular tissues, tendons or nerves.

It can occur separately or as a manifestation of a syndrome, such as Streeter, Apert or Poland, in which the severity of the syndactyly is more significant.

Macrodactyly is a congenital overgrowth disorder and represents 0.9% of upper extremity congenital anomalies. Digital enlargement involves all tissue types and maintains patterns of growth and anatomic relationships within the affected portion of the hand.

The term “macrodactyly” is reserved for nonsyndromic, congenital enlargement of a digit or digits that occurs in isolation without associated limb hemihypertrophy or vascular anomaly.

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71. In patients with rheumatoid arthritis, the inciting event in development of a boutonniere deformity is which of the following?

A) Central slip attenuation

B) Intrinsic tightness

C) Lateral band volar subluxation

D) Oblique retinacular ligament contracture

E) Proximal interphalangeal (PIP) joint synovitis

The correct response is Option E.

Rheumatoid arthritis is a chronic autoimmune disease characterized by inflammation and deterioration of the joints. Synovial proliferation is the hallmark of rheumatoid arthritis and is often seen early in the course of the disease. There is a progression to synovial pannus formation, periarticular bone demineralization, cartilage destruction, and subchondral osseous erosions. This process is mediated by synovial infiltration of activated T lymphocytes, which promote chronic synovial inflammation.

The boutonniere deformity is extremely common in patients with rheumatoid arthritis. It is characterized by flexion of the proximal interphalangeal (PIP) joint with hyperextension of the distal interphalangeal (DIP) joint.

The causative event of boutonniere deformity in rheumatoid arthritis is synovitis and synovial pannus formation within the PIP joint. This causes the joint capsule to distend, resulting in attenuation of the central slip. Central slip insufficiency results in loss of PIP joint extension and subsequent volar translocation of the lateral bands, which further accentuates the deformity by providing a flexion force across the PIP joint. Extension forces are transferred to the DIP joint. Contraction of the oblique retinacular ligament is associated with a fixed deformity.

Intrinsic tightness would cause the PIP joint to be unable to be flexed when the MP is in extension.

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72. A 23-year-old man presents with painful, red swelling over the dorsum of the right middle finger metacarpophalangeal (MCP) joint 3 days after he punched someone in the face during a bar fight. The patient reports decreasing range of motion of the hand and inability to grasp objects. He was previously seen in the emergency department the night of the injury and x-ray studies were negative for fracture or foreign body. Which of the following is the most likely causative organism?

A) *Clostridium perfringens*

B) *Eikenella corrodens*

C) *Pasteurella multocida*

D) *Pseudomonas aeruginosa*

E) *Staphylococcus epidermidis*

The correct response is Option B.

Eikenella corrodens is an anaerobic organism present in human oral flora and has been associated with human bite wounds. Group A Streptococcus is also a common pathogen in a fight bite injury like the one this patient has.

This patient has most likely sustained a "fight bite," which results from tooth penetration of the metacarpophalangeal (MCP) joint after striking someone in the mouth with a clenched fist. These injuries can often be underappreciated, as the underlying defect in the extensor hood and joint capsule may not be seen on examination when the fingers are extended during examination in an emergency department. The joint can become contaminated with oral flora. Penetrating injury with high bacterial load can result in a septic joint and lead to destruction of cartilage and osteomyelitis. Recreation of the flexed fist position may help in lining up the structures and assist in identification of the injury. Treatment is aggressive antibiotic therapy and surgical exploration with irrigation and debridement of the joint to remove debris.

Clostridium perfringens is a gram-negative rod associated with gas gangrene, which results in subcutaneous crepitus and can be rapidly progressive. *Pasteurella multocida* is a gram-negative anaerobic bacterium most commonly associated with cat bite infections. *Pseudomonas aeruginosa* is a gram-negative rod that can be associated with diabetic wound infections. And *Staphylococcus epidermidis* is a gram-positive cocci present on the skin. It has been associated with implant infections. None of these pathogens are as likely to be present in a fight bite as *Eikenella corrodens*.

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73. A 30-year-old man presents to the emergency department with acute left wrist pain after falling 10 feet from a ladder. X-ray studies of the left wrist are shown. After failed closed reduction, the patient reports tingling that progresses to worsening and constant numbness of the left index and long fingers over the course of 6 hours. Which of the following urgent interventions is most appropriate?

A) Aspiration of the wrist

B) Carpal tunnel release

C) MRI of the wrist

D) Open reduction of the scaphoid

E) Repeat closed reduction

The correct response is Option B.

This patient has a type IV perilunate dislocation, or a true lunate dislocation. This represents a complete disruption of the ligamentous stabilizers about the lunate. These injuries are high energy and can be ligamentous only (lesser arc injuries) or include fractures (greater arc) and are then termed perilunate fracture dislocations. Mayfield et al described the stages of injury progressing from radial to ulnar in a type IV dislocation, including injury of the scapholunate ligament, disruption of the lunocapitate joint, injury of the lunotriquetral ligament, and dislocation of the lunate from its fossa at the radiocarpal joint volarly into the carpal tunnel.

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On posteroanterior x-ray study of the wrist, there will be disruption of Gilula's lines. On lateral x-ray study, a "spilled teacup" sign is seen.

Closed reduction with relaxation and traction is important, as the lunate needs to be relocated to its fossa to restore relative alignment of the wrist and to decompress the median nerve in the carpal tunnel. Surgical intervention can then be performed for open reduction of the joints and ligament repair after swelling has improved. However, progression in median nerve symptoms in the setting of successful or failed closed reduction is indicative of acute carpal tunnel syndrome and necessitates urgent surgical intervention.

Advanced imaging such as MRI is not required but may be helpful. Repeat closed reduction is likely to fail at this time, may worsen the swelling, and is unlikely to resolve the carpal tunnel symptoms. Open reduction of the scaphoid is not emergent, and the patient does not have a scaphoid fracture. Aspiration of the wrist will not resolve the inciting etiology of the patient's carpal tunnel symptoms.

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74. Resistance to which of the following maneuvers is most likely present in a digit that has intrinsic tightness?

A) Passive extension of the metacarpophalangeal (MCP) joint with the proximal interphalangeal (PIP) joint held in hyperextension

B) Passive extension of the PIP joint with the MCP joint held in hyperflexion

C) Passive flexion of the DIP joint with the PIP joint held in hyperextension

D) Passive flexion of the PIP joint with the MCP joint held in hyperextension

E) Passive flexion of the PIP joint with the MCP joint held in hyperflexion

The correct response is Option D.

The intrinsic muscles (dorsal/palmar interossei and lumbricals) are responsible for much of the fine motor function of the hand. Contractures of these muscles lead to a loss of the delicate and complex balance of the intrinsic and extrinsic muscles and typically results in the clinical picture of an intrinsic-plus hand. The intrinsics attach to the extensor mechanism through the lateral bands and facilitate force transmission from the muscles to the extensor mechanism on the proximal and distal phalanges. Because of their line of pull, the intrinsics are responsible for metacarpophalangeal (MCP) joint flexion and proximal interphalangeal (PIP) joint extension. The intrinsic tightness test (i.e. Bunnell test) requires one to assess passive PIP joint flexion with the MCP joint extended. This is compared with passive PIP joint flexion with the MCP joint in flexion which assesses for extrinsic tightness. If there is a substantial increase in resistance to PIP joint flexion with the MCP joint in extension, then the test is considered positive and indicative of intrinsic tightness or adhesions of the lateral bands.

Trauma is the most common cause of intrinsic muscle contracture. Spasticity from an upper motor neuron lesion (e.g. traumatic brain injury, cerebrovascular accident, cerebral palsy) may also lead to intrinsic contracture. Arthritis may also lead to intrinsic contracture resulting from joint deviation or dislocation.

In trauma, initial treatment is directed at edema prevention and aggressive hand therapy. Patients with spasticity from an upper motor neuron disorder are also initially managed with therapy and splinting. If these modalities are insufficient, surgical release of the intrinsic muscles or tendons (proximal or distal depending on extent of involvement) may improve posture and function. Ulnar motor neurectomy is another option in severely affected individuals to decrease intrinsic muscle tone and improve posture and function, but is only effective in the absence of a fixed MCP joint contracture.

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75. Which of the following failures in embryologic development is most likely to have caused the deformity pictured in the photographs shown?

A) Differentiation of the zone of polarizing activity

B) Formation of the apical ectodermal ridge

C) Inhibition by en-1

D) Longitudinal formation

E) Programmed cell death

The correct response is Option E.

The hand plate initially forms with webbed digits. In order to have separate fingers, the interdigital tissue must undergo programmed cell death/apoptosis. Bone morphogenetic protein (BMP) plays an essential role in this process. A complex interplay creates failure of longitudinal formation (i.e., radial club hand). Removal of the apical ectodermal ridge (AER) results in limb truncation. The zone of polarizing activity (ZPA) is present in the posterior aspect of the developing upper limb and helps direct the

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anteroposterior axis (radial-ulnar axis). Sonic hedgehog (SHH) is the critical signaling factor. ZPA transplantation or excess SHH results in mirror hand deformity. The dorsoventral axis is another pathway critical for appropriate limb development. The WNT7A signaling molecule is expressed in the developing upper limb dorsal ectoderm, activating the LIM homeodomain, resulting in the expression of LMX1B transcription factor from the dorsal mesenchyme, whereas the ventral ectoderm induces the expression of en-1. These signaling factors are necessary for the formation of dorsal versus palmar structures of the hand.

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76. A 35-year-old man presents for evaluation of a laceration to the lateral aspect of the right lower leg 5 cm distal to the knee that he sustained when he fell from a bicycle 2 months ago. Findings on electromyography and nerve conduction studies are consistent with an isolated complete injury of the common peroneal nerve. Which of the following deficits is most likely on physical examination?

A) Dorsiflexion of ankle

B) Plantarflexion of great toe

C) Sensation of lateral foot

D) Sensation of medial foot

E) Sensation of plantar foot

The correct response is Option A.

The common peroneal nerve forms as the sciatic nerve bifurcates at the apex of the popliteal fossa. It then follows the medial border of the biceps femoris muscle and tendon. The nerve then passes over the posterior aspect of the fibular head and winds around the neck of the fibula. The common peroneal then divides into the deep and superficial peroneal nerve branches. The deep branch supplies the anterior muscles of the leg, the dorsum of the foot, and the skin of the first web space. The superficial branch supplies the peroneus longus and brevis muscles and the skin on the distal third of the lower leg and dorsum of the foot. Because of its relatively superficial position, the common peroneal nerve is the most commonly injured nerve of the lower extremity. Transection of the common peroneal nerve results in paralysis of all muscles in the anterior and lateral compartments of the leg (dorsiflexors and ankle evertors). This pattern of injury results in the classic picture of a foot drop. The distribution of sensory loss would include the anterolateral leg and dorsum of the foot.

Sensation of the medial foot is from the saphenous nerve and branches of the medial plantar nerve. Lateral foot sensation is provided by the sural nerve. Sensation of the plantar aspect of the foot is from the terminal branches of the tibial nerve (medial and lateral plantar nerves). All of the muscles of plantar flexion of the ankle and toes (i.e. gastrocnemius, soleus, plantaris, and tibialis posterior, flexor hallucis longus, flexor digitorum longus, and the intrinsic plantar foot muscles) are innervated by the tibial nerve.

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77. A 26-year-old man sustained a crush injury to the tip of the left middle finger with an associated fracture at the dorsal base of the distal phalanx with nail bed injury 6 months ago. No treatment was provided. Examination shows non-union of the distal phalanx. Which of the following is the most likely secondary deformity in this patient?

A) Boutonniere deformity

B) Jersey finger

C) Quadriga

D) Swan neck deformity

E) Trigger finger

The correct response is Option D.

The scenario described involves a bony mallet deformity in which a distal phalanx fracture is associated with disruption of terminal extension at the distal interphalangeal joint. If untreated, the DIP extension loss due to a non-union of a bony mallet injury may progress to a swan neck deformity through compensatory proximal phalangeal hyperextension in the setting of continued and persistent flexion at the distal interphalangeal joint (from unopposed pull of the flexor digitorum profundus tendon). A secondary swan neck deformity may occur because of dorsal subluxation of the lateral bands and attenuation of the volar plate and transverse retinacular ligament at the PIP joint level.

A jersey finger is caused by rupture of the terminal flexor digitorum profundus. A boutonniere deformity can be caused by an injury to the central slip (but not the terminal extensor tendon). Quadriga is due to loss of length of a repaired FDP tendon, causing the finger with the repaired tendon to reach terminal flexion sooner than the other fingers whose FDP tendons are of normal length. A trigger finger does not involve a fracture of the DIP joint.

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78. A 22-year-old man who is a college student sustains a volar oblique fingertip amputation while chopping vegetables. Examination shows involvement of the hyponychium, but the nail is undamaged. The wound measures 1 × 1.5 cm, and no exposed bone is noted. Which of the following is the most appropriate treatment to encourage healing by secondary intention?

A) Apply negative pressure wound therapy

B) Apply povidone iodine to the wound daily and cover with dry gauze

C) Cover wound with semiocclusive dressing and change weekly

D) Leave wound open to air

E) Soak wound in hydrogen peroxide daily and cover with moist gauze

The correct response is Option C.

Fingertip or thumb tip amputations that result in small wounds (less than 1.5 cm2) and minimal exposed bone are best managed with healing by secondary intention. The only exception to this might be a laborer anxious to get back to work with a healed wound sooner than 3 to 4 weeks. Mennen reported a series of 200 such injuries treated with a semi-occlusive dressing, and average healing time was 20 days.

A semiocclusive dressing is semi-permeable and transparent, allowing air to pass through the dressing, but providing a barrier to moisture. Commonly available semipermeable dressings are marketed under brand names like Tegaderm (3M) and OPSITE (Smith & Nephew). These dressings maintain a moist wound environment, which speeds healing. If dressings are changed every 5 to 7 days, manipulation of the wound is minimized and, therefore, healing is less disrupted.

Leaving a wound open to air would allow tissues to dry out, which would delay healing. Likewise, the use of povidone-iodine and/or hydrogen peroxide would slow down healing due to drying of the wound. Although these topical agents are effective at eliminating bacteria from dirty or infected wounds, prolonged use will interfere with normal wound healing. Finally, a wound of this small size would not warrant negative pressure wound therapy. Even the small, intrinsically-powered negative pressure wound therapy devices would not offer any advantages over a semiocclusive dressing and would increase cost substantially.

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79. When a pedicled sural flap is raised to the heel, which of the following is the origin of the arterial blood supply?

A) Descending genicular artery

B) Lateral sural artery

C) Medial femoral circumflex artery

D) Medial plantar artery

E) Peroneal artery

The correct response is Option E.

The reverse sural flap is a fasciocutaneous flap often used for ankle or heel wounds. The blood supply of the flap can be from a median superficial artery or the arterial plexus that travels with the sural nerve; the origin is a lower peroneal perforator located approximately 5 cm proximal to the lateral malleolus.

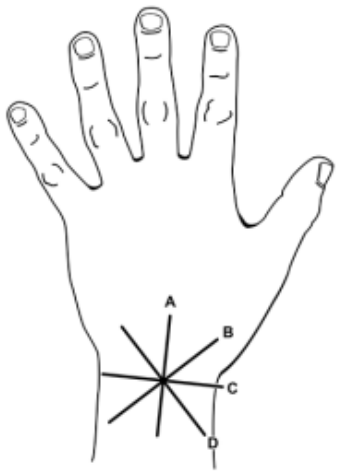
The lateral sural artery would be the appropriate blood supply for perfusion of a pedicled lateral gastrocnemius flap. The gracilis flap blood supply derives from the medial circumflex artery. The descending genicular artery provides the blood supply of the medial femoral condyle flap. The medial plantar artery is the blood supply for the medial plantar artery flap.

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80.



A 44-year-old man presents with a 20-degree extension deformity of his wrist because of burn scarring. Z-plasty for contracture release is planned. Which of the following (A-D) is the most appropriate placement of the central limb for this procedure in this patient?

A)

B)

C)

D)

The correct response is Option A.

Z-plasty is a fundamental and common reconstructive technique used to elongate scars or contractures, narrow scars, rearrange tissues into relaxed skin tension lines, camouflage scars, or releasing tension. This is a form of rotation and advancement whereby a central limb of the Z-plasty is drawn parallel to the line of maximal tension, and subsequent limbs are drawn anywhere from 30 to 90 degrees from this. Wider angles give greater scar elongation at the expense of greater transverse tension.

In this scenario, the line of maximum tension is longitudinal, creating an extension deformity. Maximal contracture release will occur with a central limb of the Z-plasty drawn longitudinally.

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81. A 42-year-old man presents with a painful subungual glomus tumor of the index finger. Definitive treatment should consist of which of the following?

A) Chemotherapy

B) Complete surgical excision

C) External beam radiation therapy

D) Immunotherapy

E) Intralesional steroid injection

The correct response is Option B.

Glomus tumors include approximately 1 to 5% of soft tissue tumors of the hand. The majority are subungual. Presentation is typically a raised blue or pink nodule that can discolor or deform the nail. Love's pin test is performed by applying pressure to the area with a pinhead, causing exquisite pain. Diagnosis can be aided with plain film and MRI. Treatment includes complete surgical excision. There is no role for radiation, chemotherapy, immunotherapy, or steroid injections in definitive treatment.

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82. A 37-year-old woman presents for evaluation of a laceration to the mid humerus that she sustained in a motor vehicle collision. On examination, the patient is unable to extend the wrist, fingers, or thumb. Surgical exploration shows complete radial nerve transection; the median/ulnar nerves are intact. Direct neurorrhaphy is performed after debridement and mobilization of the nerve ends. Which of the following is the last muscle to be reinnervated during nerve recovery?

A) Abductor pollicis brevis

B) Abductor pollicis longus

C) Brachioradialis

D) Extensor carpi radialis brevis

E) Extensor indicis proprius

The correct response is Option E.

Radial nerve injuries may occur in the setting of humeral fractures, and transection is most common in the setting of an open injury. The most important components of functional recovery following radial nerve injury include wrist, finger, and thumb extension. The order of reinnervation of the radial-innervated muscles is most commonly brachioradialis, extensor carpi radialis longus, supinator, extensor carpi radialis brevis, extensor digitorum communis, extensor carpi ulnaris, extensor digiti quinti, abductor pollicis longus, extensor pollicis longus, extensor pollicis brevis, and extensor indicis proprius. The abductor pollicis brevis is innervated by the median nerve via the thenar motor branch.

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83. A 37-year-old woman presents with sharp lateral elbow pain sustained when lifting a garbage bag out of a can at work. Which of the following muscles is the most likely cause of this patient's pain?

A) Anconeus

B) Brachioradialis

C) Extensor carpi radialis brevis

D) Extensor carpi radialis longus

E) Extensor carpi ulnaris

The correct response is Option C.

The common extensor tendon attaches the extensor carpi radialis brevis (ECRB), extensor digitorum communis (EDC), extensor digiti minimi, and extensor carpi ulnaris to the lateral epicondyle. Among these forearm extensor muscles, pathology found in the attachment of ECRB and EDC at the lateral epicondyle (LE) is commonly cited as a reason for pain at the LE. While the extensor carpi radialis longus (ECRL) is a wrist extensor and may be a source of lateral elbow pain with strain, it does not originate from the lateral epicondyle. The ECRL muscle was observed to originate from the distal aspect of the supracondylar ridge mainly as a muscular attachment. The brachioradialis is an elbow flexor and originates off of the lateral column of the distal humerus. It is not involved with lateral epicondylitis. The anconeus is a small muscle which originates off of the lateral epicondylitis and its main function is to assist with elbow extension.

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84. A 28-year-old man sustains acute wrist extension during a fall on an outstretched arm. Examination shows snuffbox tenderness. A scaphoid fracture is suspected. Which of the following imaging studies should be performed first to identify this patient's injury?

A) Bone scan

B) CT scan

C) MRI

D) Plain x-ray studies

E) Ultrasonography

The correct response is Option D.

The correct answer is plain x-rays. Negative x-rays in scaphoid fractures are up to 30%. Cost effectiveness of obtaining x-rays first is shown by the positive finding in 70%. The predictive value of clinical examination is 13-69% with an average of 21%. Depending on clinical suspicion and whether the patient needs to avoid immobilization if the absence of fracture can be confirmed, additional imaging studies may be obtained.

For MRI, the estimated sensitivity is 97.7% and the specificity is 99.8% with 96% accuracy. For a CT scan, estimated sensitivity is 85.2 to 94% and the specificity is 96 to 99.5% with 98% accuracy. Bone scintigraphy is 96 to 97.8% and 89 to 93.5%, respectively, with 93% accuracy. For follow-up x-ray studies, 91.1 and 99.8%, respectively. MRI is therefore the best test for ruling in scaphoid fractures where the other tests are better at ruling out scaphoid fractures. Cost effectiveness of MRI for patients with suspicion for scaphoid fracture with negative x-rays is shown by getting patients out of unnecessary splints sooner.

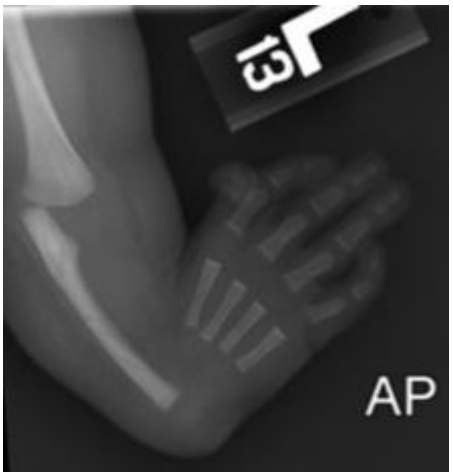
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85. A 6-month-old male infant presents with bilateral radial longitudinal deficiency and thumb hypoplasia. X-ray study is shown. Which of the following studies is most likely to rule out Fanconi anemia in this patient?

A) Bone marrow biopsy

B) Chromosomal breakage testing

C) Complete blood count with differential

D) Peripheral blood smear

E) Renal ultrasonography

The correct response is Option B.

All children with radial longitudinal deficiency (RLD) should undergo a thorough physical examination because of the frequency of associated syndromes. Common conditions associated with RLD include thrombocytopenia-absent radius (TAR) syndrome, Holt-Oram syndrome, VACTERL syndrome and Fanconi anemia.

Thrombocytopenia-absent radius (TAR) syndrome is an autosomal recessive disorder characterized by an absent radius with a relatively normal thumb. Holt-Oram syndrome is an autosomal-dominant disorder in which RLD is accompanied by either an atrial or ventricular cardiac septal defect. Fanconi anemia is an autosomal-recessive pancytopenia, once invariably fatal, that is now routinely treated with bone marrow transplantation. One should consider further screening with spinal x-ray studies, cardiac echocardiography, renal ultrasonography, and complete blood count.

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Because children with Fanconi anemia often do not manifest aplastic anemia on routine blood testing until after age 3 years, it is also recommended that patients with RLD undergo a chromosomal breakage test for earlier detection of this potentially fatal disease. Routine genetic counseling is also recommended.

A peripheral blood smear and bone marrow biopsy would not be helpful in making this diagnosis.

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86. A 43-year-old man presents for reconstruction of a soft tissue deficit of the antecubital fossa with a reverse lateral arm pedicled flap. Which of the following arteries is the blood supply for this flap?

A) Anterior interosseous

B) Persistent median

C) Posterior interosseous

D) Radial recurrent

E) Ulnar

The correct response is Option D.

Although the lateral arm flap has predominantly been used in free tissue transfer for distant defects based on the posterior radial collateral artery, transfer as a pedicled reverse-flow flap based on the radial recurrent artery has been both anatomically and clinically proven. Occasionally, it is performed with a delay procedure at an intermediate stage.

The anterior and posterior interosseous arteries can provide circulation to perforator flaps. The ulnar artery has been occasionally used for an ulnar artery based fasciocutaneous flap. The persistent median artery passes through the carpal tunnel and runs with the median nerve.

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87. A 19-year-old man is brought to the emergency department because of an injury to the right heel sustained during a lawn mower accident. After serial debridement is performed, there is a 2 x 2-cm soft tissue defect with exposed calcaneus. Which of the following innervated flaps is most appropriate for coverage of this defect?

A) Anterior lateral thigh flap with anterior femoral cutaneous nerve

B) Medial plantar artery flap with division of posterior tibial nerve

C) Radial forearm flap with superficial branch of the radial nerve

D) Reverse sural artery flap with saphenous nerve

E) Ulnar forearm flap with deep branch of ulnar nerve

The correct response is Option B.

Heel reconstruction is a difficult surgical problem with limited local options, relatively poor vascularity in the region, and weight-bearing requirements. Flap options include a variety of local flaps including transposition or rotation flaps, fasciocutaneous flaps (e.g., medial plantar); local muscle flaps (e.g., abductor hallucis, flexor digitorum brevis, and abductor digiti minimi); reversed fasciocutaneous flaps (e.g., sural); and free flaps. Although innervated (and therefore potentially sensate) free flaps can be performed, these are less predictable than local options. From the above answer choices, the best option is a local flap based on the medial plantar artery, which had sensation from the medial plantar nerve, a branch of a division of the posterior tibial nerve. Another advantage of the medial plantar artery flap is that it covers the heel with glabrous skin, which may better be able to withstand weight-bearing. The other options are not correctly matched with flaps and nerves. Correct pairings of flap and cutaneous innervation are:

Anterior lateral thigh flap - lateral femoral cutaneous nerve
Ulnar forearm flap - medial antebrachial cutaneous nerve
Radial forearm flap - lateral antebrachial cutaneous nerve
Reverse sural artery flap - sural nerve

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88. An 18-month-old male infant with an isolated Blauth Type IV thumb (floating) is scheduled to undergo pollicization of the index finger. A photograph is shown. The index finger metacarpal head becomes which of the following structures in the pollicized thumb?

A) Articular surface of the carpometacarpal (CMC) joint

B) Distal articular surface of the proximal interphalangeal (PIP) joint

C) Proximal articular surface of the PIP joint

D) Scaphoid

E) Trapezoid

The correct response is Option A.



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Thumb pollicization is a challenging yet functionally rewarding procedure. It is indicated for Blauth Type IIIB or higher thumbs. If done correctly, this technique can greatly enhance the function of the hand and provide a strong, stable thumb analog for grip and pinch. The procedure involves many stages and is technically demanding. Although beyond the scope of this description, the procedure requires shortening of the index finger metacarpal and repositioning of the metacarpal head in hyperextension against the preserved metacarpal base. Thus, the index metacarpal phalangeal joint becomes the new thumb's carpometacarpal joint, the index proximal interphalangeal joint becomes the new thumb's metacarpophalangeal joint, and the index distal interphalangeal joint becomes the new thumb's interphalangeal joint.

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89. A 35-year-old woman presents for examination of a mass of the right volar radial wrist. The patient reports that the mass spontaneously appeared 6 weeks ago and occasionally gets bigger or smaller. On physical examination, the mass transilluminates. Which of the following joints is the most likely origin point of the mass?

A) Lunotriquetral

B) Metacarpotrapezial

C) Radioscaphoid

D) Scapholunate

E) Scaphotrapezial

The correct response is Option C.

Ganglia are benign soft tissue tumors that are most commonly encountered in the wrist but may occur in any joint.

Sixty to 70% of ganglion cysts are found in the dorsal aspect of the wrist and communicate with the joint via a pedicle. This pedicle usually originates at the scapholunate ligament but may also arise from a number of other sites over the dorsal aspect of the wrist capsule.

Thirteen to 20% of ganglion cysts are found on the volar aspect of the wrist, arising via a pedicle from the radioscaphoid, scapholunate interval, scaphotrapezial joint, or metacarpotrapezial joint, in that order of frequency. Neither dorsal nor volar ganglion cysts typically originate from the lunotriquetral ligament.

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90. A 65-year-old man presents after sustaining an injury to the dominant index finger from a table saw accident 4 weeks ago. The patient did not seek medical attention at the time of injury because of a lack of health insurance. Medical history includes poorly controlled type 2 diabetes mellitus. He smokes two packs of cigarettes daily. Examination shows a 1-cm wound that appears to be down to the tendon, and the tendon sheath is visible at the edges of the wound. He is unable to actively flex the proximal or distal interphalangeal joints, but full passive mobility of the joints is noted. The patient has normal two-point discrimination on the ulnar side of the finger but diminished sensibility on the radial side; there is good capillary refill. Single-stage, flexor reconstruction with tendon graft is CONTRAINDICATED because of which of the following clinical findings in this patient?

A) Absence of ipsilateral palmaris longus tendon

B) Injury to both flexor digitorum profundus and superficialis

C) Medical comorbidities

D) Radial digital nerve injury

E) Soft tissue injury over the proximal interphalangeal joint

The correct response is Option E.

Flexor tendon reconstruction with tendon grafting is a complex operation that also involves a significant postoperative therapy commitment from the patient. Early treatment of flexor tendon injuries decreases the need for grafting. With delayed presentation (usually greater than 3 weeks), the cut ends of tendon degenerate and muscles shorten under myostatic contraction, and it is difficult or impossible to perform a primary repair of flexor tendon injuries. Therefore, in delayed presentations, flexor tendon reconstruction may require the use of tendon grafting, which is done in either single or multiple stages depending on the need for reconstruction of pulley sheaths or other ancillary procedures like release of contracted joints. There are many relative contraindications to perform a reconstruction with a tendon graft, and these should all be considered together in determining appropriate candidates for these operations. Any patient who will not participate in postoperative therapy is not a candidate for reconstruction, either single or multiple stage. Patients without adequate soft tissue coverage are not candidates for single stage reconstruction, and this is the contraindication for single-stage reconstruction in this patient.

Successful reconstruction with tendon grafting requires early postoperative mobilization, while soft tissue coverage options (e.g., cross finger flap) require a period of immobilization

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that will result in significant adhesion formation and a poor outcome. Although an insensate digit is a relative contraindication for salvage, repair of the digital nerves in this patient may improve that variable, and this is not the best answer. Injury to both flexor tendons is not a contraindication to reconstruction. Medical comorbidities are considerations to improve outcomes, but are not considered absolute contraindications. Several tendon graft options are available including the palmaris longus tendon, however, absence of this tendon is not a contraindication to reconstruction. Passive immobility of interphalangeal joints is another contraindication to flexor reconstruction and joint release should be done beforehand, followed by a period of hand therapy to maintain joint mobility.

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91. A 35-year-old man presents 3 months after sustaining a Zone II flexor tendon injury of the middle finger. The patient has been compliant with therapy since the early postoperative period. Examination shows the finger is mildly edematous. A 30-degree-flexion contracture at the proximal interphalangeal (PIP) joint is noted, and active and passive motion is 30 to 50 degrees. Which of the following is the most appropriate next step in management of this patient?

A) Continued hand therapy

B) Contracture release

C) Flexor tenolysis

D) Tendon transfer

E) Two-stage flexor tendon reconstruction

The correct response is Option A.

In this scenario, the patient has developed joint stiffness and tendon adhesions following a Zone II flexor tendon injury and surgical repair. The most appropriate next step is to continue therapy until passive and active range of motion is optimized. The timing until maximal improvement or until one may consider secondary tendon surgery is controversial and recommendations range from 3 to 12 months. The timing is usually individualized to each patient. Flexor tenolysis has been shown to be a useful and successful surgery for restoring motion after flexor tendon repair. The indications for this procedure are generally as follows: adequate soft tissue coverage, resolution of edema, passive motion greater than active motion, adequate joint motion, adequate muscle strength, and a compliant patient. In this scenario, the patient has equivalent active and passive motion as well as poor joint motion overall. In this case, the joint contracture is likely in part related to flexor tendon adhesions, and the indications for secondary surgery would not change. Contracture release by itself would not improve finger motion and may be contraindicated as anything that would cause additional scarring or barriers to tendon gliding should be avoided. The presence of edema in this patient also indicates that the finger has not reached maximal improvement with therapy. Flexor tenolysis should be considered a substantial surgery with inherent risks, and all patients should be consented for a two-stage flexor tendon reconstruction at the time of surgery. However, one would not advocate a staged reconstruction if the primary repair was felt to be intact clinically and salvageable, as in this case. Tendon transfers may be considered for a tendon reconstruction in certain instances, but this patient does not meet these criteria at this time.

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92. A 40-year-old man sustained traumatic amputation of all fingers of the dominant hand 3 months ago. Tripod pinch reconstruction is planned with a double second toe transfer. Which of the following arteries is most likely to be the dominant blood supply to the second toe transfer in this patient?

A) First dorsal metatarsal artery

B) First plantar metatarsal artery

C) Lateral plantar artery

D) Medial plantar artery

E) Third plantar metatarsal artery

The correct response is Option A.

The first dorsal metatarsal artery (FDMA) is the dominant blood supply (to the great toe and second toe) in approximately 70% of cases. The first plantar metatarsal artery (FPMA) is the dominant blood supply in 20% of cases. The FDMA and the FPMA have a similar vessel caliber in the remaining 10% of cases.

The dominant vascular pattern can be evaluated by careful retrograde dissection that begins at the dorsal aspect of the first web space. The junction of the lateral digital artery of the great toe and the medial digital artery of the second toe can be identified just above the intermetatarsal ligament. Proximal dissection continues dorsally and plantarly to evaluate the FDMA and FPMA.

If the FDMA is the larger caliber vessel or of similar caliber to the FPMA, then the toe transfer can be based on the FDMA. Proximal dissection of the FDMA to obtain length is relatively straightforward. In the setting of a plantar dominance, dissection of the FPMA is carried out proximally, which can be more challenging. Plantar proximal dissection is typically limited to the mid metatarsal level to avoid additional morbidity. If additional length is required on the FPMA pedicle, a vein graft can be used. It is important to note that in bilateral second toe transfers, the dominant vascular pattern can be asymmetric in 20% of patients.

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93. A 66-year-old man presents with a mass along the ulnar margin of the index finger proximal phalanx. The patient reports that over the past year, the mass has grown in size. Physical examination shows the mass is now interfering with digital flexion. X-ray studies show bony erosion into the cortex of the middle phalanx. Excisional biopsy demonstrates a tan, multilobulated mass that has surrounded the digital nerve and invaded the bone cortex. Which of the following is the most likely diagnosis in this patient?

A) Chondrosarcoma

B) Epidermal inclusion cyst

C) Giant cell tumor of tendon sheath

D) Retinacular cyst

E) Schwannoma

The correct response is Option C.

Giant cell tumors of the tendon sheath are the second most common hand masses. They are slow-growing and painless, and affect the volar surfaces of the index, middle and ring finger, at the PIP or DIP joints. They usually appear tan or yellow, lobulated, and well-circumscribed. Bony erosion secondary to long-standing pressure may be observed on x-ray studies. Treatment is excision, with recurrence rates ranging from 0 to 44 percent. High recurrence rates are associated with satellite lesions, poor encapsulation, distal locations,

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intraosseous involvement, concurrent degenerative joint disease, or involvement of the adjacent joint/tendon. Radiotherapy following surgical excision has shown recurrence rates as low as 4 percent.

Schwannomas are benign peripheral nerve tumors derived from Schwann cells, that can involve the nerves of the hand. They are well encapsulated and slow growing, and typically arise over flexor surfaces. They present as a soft, nontender mass that is mobile and may cause associated paresthesias. Magnetic resonance imaging may be helpful to evaluate for malignant characteristics. These tumors can often be shelled out because they involve the nerve sheath instead of individual fascicles, with little risk of postoperative neurologic deficits. Malignant transformation is rare. Epidermal inclusion cysts are painless, firm, keratin-filled cysts developing from traumatic implantation of epithelium into the subcutaneous tissue. Typical locations include the volar palm and digits. No risk of malignant transformation has been reported, but cortical destruction can be observed, raising suspicion for a neoplastic process. There is a low rate of recurrence with surgical excision. These masses can be differentiated from giant cell tumors of the tendon sheath, in that they are cystic structures filled with keratin and not mutilobulated, solid masses.

Ganglions are usually solitary and occur in specific locations in the hand and wrist. The most common ganglion locations are the dorsal and volar wrist regions. They also occur in the digital flexor tendon sheath (retinacular cyst), arising from the A1 pulley. There is no consensus regarding the preferred treatment of a flexor tendon sheath ganglion. Historically, the large number of therapeutic options described suggests that a predictable treatment approach could not be agreed upon. Recent literature indicates that there are two acceptable treatment options: cyst aspiration or surgical excision.

Chondrosarcomas are the most common primary malignant bone tumors of the hand, most frequently affecting the proximal phalanx. They may arise de novo or from malignant transformation of benign cartilaginous lesions such as enchondromas. At imaging, it may often be difficult to distinguish chondrosarcomas from their benign chondroid counterparts such as enchondromas. Phalangeal chondrosarcomas are locally aggressive and, unlike chondrosarcomas of other skeletal structures, rarely metastasize.

Cortical breakthrough, irregular cortical thickening, and a soft-tissue component are all suggestive of chondrosarcoma rather than benign tumors such as enchondroma. Recurrence rates with intralesional excision are historically high, such that wide excision or amputation had previously been the mainstay of surgical treatment. Recent literature, however, advocates intralesional excision with close follow-up for low-grade lesions or phalangeal tumors in circumstances where amputation will result in significant functional loss. No role for irradiation or chemotherapy has been described.

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94. Which of the following open tibia fractures is considered a Gustilo Type IIIA?

A) Comminuted, segmental fracture with 5-cm laceration without gross contamination

B) Concomitant posterior tibial artery laceration with pulseless foot

C) Extensive soft tissue degloving with periosteal stripping and gross contamination

D) Spiral fracture with 3-cm laceration without gross contamination

E) Transverse fracture with 10-cm laceration without gross contamination

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

The correct response is Option A.

The Gustilo classification system, created by Gustilo and Anderson, is used to describe open fractures of the tibial shaft. Although there remains significant interobserver variation in classification of injury, it is a commonly accepted manner by which to communicate the severity of an open fracture.

The Gustilo classification is as follows:

1. I: clean wound less than 1 cm in length;
2. II: clean wound greater than 1 cm in length without extensive soft-tissue damage, flaps, or avulsions;
3. IIIA: adequate soft-tissue coverage despite extensive soft-tissue damage, flaps, or high-energy trauma irrespective of the wound size;
4. IIIB: inadequate soft-tissue coverage with periosteal stripping, often associated with massive contamination;
5. IIIC: arterial injury requiring repair.

Type III injuries are uniformly high-energy wounds. These are subdivided into types A, B, and C. Type IIIA injuries have extensive soft-tissue damage secondary to high-energy trauma but have adequate soft-tissue coverage. Type IIIB injuries exhibit severe periosteal stripping and bone exposure, often associated with massive contamination. The patient with type IIIB injury may require treatment with soft-tissue coverage procedures. Open injuries with a concomitant vascular injury are classified as IIIC regardless of bone or soft tissue injury.

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Injuries classified as Type IIIA are based either upon the nature of the soft tissue damage or the severity of the bony injury. High-energy trauma resultant in a significant fracture pattern is classified as IIIA regardless of the overlying soft tissue adequacy.

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95. A 36-year-old man presents with weakness of the left wrist and limited finger extension 2 days after he underwent surgery for a closed fracture of the right humerus that he sustained in a motor vehicle collision. At the time of surgery, the radial nerve was found to be intact without any significant signs of trauma. On examination, the patient is unable to extend his wrist or digits but elbow extension is intact. Which of the following histopathologic features seen in neurapraxia (Sunderland Type 1) injury is most likely in this patient?

A) Disruption of perineurium

B) Endoneurial fibrosis

C) Increased axonal transport

D) Segmental demyelination

E) Wallerian degeneration

The correct response is Option D.

Peripheral nerve injuries can be classified into three main categories: Neurapraxia, axonotmesis, and neurotmesis. These groups have been further classified by several different classification systems, which include those by Seddon and Sunderland, among others.

Neurapraxia (Sunderland type 1) is an injury to the myelin sheath only, while axons are preserved. In trauma, these injuries are most frequently caused by compression or stretching. Although segmental demyelination occurs (leading to conduction block), there is no Wallerian degeneration of the nerve, and a full recovery can be expected within days to weeks. Axonotmesis (Sunderland type 2, 3 or 4) involves damage to axons, and is characterized by Wallerian degeneration. Sunderland type 2 injury involves only the axons, and usually there will be a full recovery without intervention, while types 3 and 4 involve injury to the endoneurium and perineurium respectively and fail conservative management. Neurotmesis (Sunderland type 5) is a complete disruption of a peripheral nerve. MacKinnon and Dellon described a type 6 injury that involves mixed Sunderland type injuries along the length of a damaged nerve. Axonal transport is not a relevant histopathological feature.

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96. A healthy 11-year-old boy is brought to the emergency department because of worsening redness and pain around the site of an injury to the middle finger of the left hand. The patient sustained the original injury 3 weeks ago while wrestling with his brother. The patient had swelling and pain of the finger, but the pain resolved quickly, so no medical care was sought. The patient's mother reports that she noticed a small bump on the dorsum of the finger since then. However, the patient developed redness and pain 2 days ago at the same site, both of which have worsened. An image and x-ray studies are shown. Which of the following is the most likely cause of this patient's symptoms?

A) Biting of nails

B) Exposure to *Pasteurella* species

C) Flexor tendon avulsion

D) Immunocompromised state

E) Trapped germinal matrix

The correct response is Option E.

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This patient has a Seymour fracture—a juxta-epiphyseal open fracture—of the distal phalanx as evidenced by the eponychial disruption and fracture pattern on x-ray study. These are open fractures traditionally frequently with associated nail bed transection. Unfortunately, secondary to delay in treatment, the patient developed osteomyelitis.

These patients often present with a mallet-appearing deformity from flexion of the distal fracture segment, the nail may be disrupted (with the distal nail bed) and lay superficial to the eponychial fold, while the transected nail bed proximally (germinal matrix) becomes entrapped within the fracture, making closed reduction prone to failure. Acute treatment in the emergency department or operating room consists of nail plate removal, reduction of the trapped nail bed, irrigation and debridement of the fracture site, reduction of the fracture, nail bed repair, nail plate replacement, and immobilization. Instability or inadequate reduction warrants operative intervention and may require Kirschner wire fixation. Inadequate reduction and/or delayed treatment are critical influences of infection rates. In a study by Reyes and Ho in the Journal of Pediatric Orthopaedics, investigators reviewed acute appropriate reduction, acute partial treatment, and delayed treatment. No infections occurred in the acute appropriately managed group, whereas 15% of the patients developed infections in the partially treated group, and 45% of the delayed treatment group developed infections. Biting of nails has been associated with nontraumatic paronychial infections. There is no history of immunocompromised state, and healthy children can acquire infections with these injuries. This patient sustained the injury wrestling his brother as opposed to from an animal bite. Pasteurella is not the most frequent bacteria associated with infections in patients who have sustained Seymour fractures. Flexor tendon avulsions, also known as jersey fingers, are traditionally closed and would demonstrate lack of flexion of the distal interphalangeal joint.

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97. A 50-year-old woman previously diagnosed with left forearm compression neuropathy of the superficial radial nerve comes to the office for examination. The patient has not responded to 7 months of conservative management which consisted of NSAID therapy, steroid injection, a trial of splinting, and activity modification. Operative treatment is planned. Fascial release between which of the following two tendons is most appropriate in this patient?

A) Abductor pollicis longus and extensor pollicis brevis

B) Brachioradialis and extensor carpi radialis longus

C) Extensor carpi radialis longus and extensor carpi radialis brevis

D) Flexor carpi radialis and abductor pollicis longus

E) Flexor carpi radialis and brachioradialis

The correct response is Option B.

Superficial radial nerve compression of the forearm occurs most frequently at the posterior border of the brachioradialis where the nerve transitions from a deeper, subfascial position to a more superficial, subcutaneous location. Also known as Wartenberg syndrome, patients may present with pain, numbness, or tingling over the dorsal radial hand radiating to the dorsal thumb and index finger.

Symptoms of superficial radial nerve compression may be confused with symptoms of de Quervain's tenosynovitis. In addition, both conditions may coexist simultaneously.

Patients diagnosed with superficial radial nerve compression are initially treated conservatively since this approach is successful in relieving symptoms in the majority of cases. Conservative management consists of rest, splinting, removal of external compression source (such as a tight wristwatch band, bracelet, or handcuffs), and nonsteroidal anti-inflammatory medications.

Surgery is indicated when conservative measures fail. Surgical decompression involves release of the fascia between the brachioradialis and extensor carpi radialis longus tendons. It is at this interval that the nerve transitions from deep to superficial and prone to compression. The other responses do not reflect the correct surgical anatomy of this condition.

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98. A 29-year-old man presents with nail pitting, leukonychia, and crumbling of the nail plate. A photograph is shown. Which of the following is the most likely diagnosis in this patient?

A) Arsenic toxicity

B) Human immunodeficiency virus

C) Lichen planus

D) Psoriatic arthritis

E) Subungual melanoma

The correct response is Option D.

Psoriatic arthritis often presents with auto-fusion of the small hand joints and diffuse fusiform swelling of the digits. This psoriatic dactylitis or "sausage digit" is caused by inflammation of periosteum, tendon, and tendon insertions. Nail deformities include pitting, leukonychia, nail crumbling, and onycholysis (separation of nail plate from bed). Nail deformities affect approximately 80% of patients with psoriatic arthritis, and 50% of patients with psoriasis.

Nail lichen planus (NLP) is characterized by thinning, longitudinal ridging, and distal splitting of the nail plate. NLP is usually resistant to topical corticosteroid therapy, but successful treatment has been reported with intralesional or systemic administration of corticosteroids.

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Characteristic skin lesions of arsenic poisoning include hyperkeratosis and Mees' lines. Mees' lines are prominent transverse white lines in fingernails or toe-nails due to arsenic deposition in keratin-rich tissues.

Subungual melanoma has distinct cutaneous nail manifestations such as brown or black streaks in the nail without any known injury, streaks on the nails that increase in size, or a "bruise" on the nail that will not heal or move up as the fingernail grows. One of the key indications of subungual melanoma is known as "Hutchinson's sign." This is when a person has a streak that extends from the tip of the nail down to the nail bed and into the eponychium.

Nail disorders in HIV-infected patients include clubbing, splitting of the nails, or discoloration (black or brown lines going either vertically or horizontally).

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99. A 16-year-old boy with a Gustilo Type IIIB open tibial fracture underwent wound coverage with an anterolateral thigh (ALT) flap including muscle. Which of the following is the most likely muscular complication in this patient?

A) Weakness of knee extension

B) Weakness of knee flexion

C) Weakness of thigh abduction

D) Weakness of thigh adduction

E) Weakness of thigh flexion

The correct response is Option A.

An understanding of the actions of donor muscles is necessary when using muscle flaps for reconstruction. A knowledge of the specific muscles, which are included as part of specific flaps also helps one understand what donor deficits may be produced when using a particular flap.

The anterolateral thigh (ALT) flap perforators often traverse part of the vastus lateralis muscle, and the muscle may need to be dissected and therefore can be injured during flap harvest. It is rare that any long-term sequelae, such as weakness, are noted without muscle harvest. If the muscle is taken, as is often necessary for the filling of a dead space, weakness of knee extension may be noted as the vastus lateralis is a large part of the quadriceps muscle of the thigh, which is primarily responsible for knee extension.

Thigh abduction is accomplished by the tensor fascia lata and sartorius muscles. The pectineus, adductor longus and brevis, gracilis, and adductor magnus are responsible for thigh adduction. Thigh flexion is achieved by the pectineus, adductor brevis, and adductor magnus. Knee flexion is done primarily by the hamstrings-semitendinosus, semimembranosus, and biceps femoris muscles.

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100. A 21-year-old woman presents for follow-up evaluation of an injury to the right middle finger that occurred when a leash wrapped around her finger while she was walking her dog. X-ray studies were negative for fracture, but there was a volar dislocation of the proximal interphalangeal (PIP) joint. Despite reduction of the dislocation, the patient continues to have inability to fully extend the finger, and a boutonniere deformity has developed. Splint treatment is planned. Which of the following is the most appropriate position for splinting?

A) Distal interphalangeal (DIP) joint extended, PIP joint extended

B) DIP joint flexed, PIP joint flexed

C) DIP joint flexed, PIP joint free

D) DIP joint free, PIP joint extended

E) DIP joint free, PIP joint flexed

The correct response is Option D.

This patient has sustained a central slip disruption of the right middle finger after volar proximal interphalangeal (PIP) joint dislocation, resulting in an acute boutonniere injury. Volar dislocations at the PIP joint are rare and can be irreducible if there is interposition of the lateral band or central slip in the joint. It is important to test for range of motion following reduction and check for stability of the joint. In cases of significant soft tissue injury and instability, the patient may show inability to extend at the PIP joint, and the finger can take on an acute boutonniere deformity. Boutonniere deformities demonstrate flexion at the PIP joint and hyperextension at the distal interphalangeal (DIP) joint. The extensor tendon (central slip) is detached from its insertion at the base of the middle phalanx, with decreased ability to extend the finger at the PIP joint. As a result, the lateral bands fall volar to the axis of rotation at the PIP joint, changing their force from extension to flexion at the PIP joint. The extensor force of the lateral bands is directed toward the terminal tendon at the DIP joint, resulting in hyperextension of the DIP joint. If missed, this injury can progress to fixed contracture.

By splinting the PIP joint in extension and leaving the DIP joint free to flex, the central slip is held in place and allowed to heal back to the middle phalanx. Flexion of the DIP joint through movement will prevent volar migration of the lateral bands and will tend to cause them to migrate dorsally, reversing the effect of the boutonniere deformity. When the lateral bands move dorsal to the axis of rotation at the PIP joint, their extensor force is restored at the PIP, and the DIP joint hyperextension resolves.

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Splinting both DIP and PIP joints in extension will not encourage the dorsal migration of the lateral bands. Splinting of the DIP joint in extension with the PIP joint free is performed in zone 1 extensor tendon injuries (mallet finger). Splinting with the PIP joint in flexion will not reverse the extensor tendon lag, and will allow the deformity to persist. This position may be used in unstable dorsal dislocations to prevent redislocation (extension block splinting).

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Section 3: Craniomaxillofacial

101. A 2-day-old female newborn is evaluated in the neonatal intensive care unit. Physical examination shows epicanthal folds, a flat nasal bridge, and a wide U-shaped cleft palate. She has micrognathia with 12 mm of overjet, substernal and costal retractions and desaturations while supine, and is not able to feed orally. Ophthalmologic evaluation shows bilateral cataracts. Which of the following metabolic abnormalities is most likely responsible for this patient's condition?

A) Abnormal cellular response to fibroblast growth factor

B) Abnormal formation of collagen II

C) Abnormal regulation of craniofacial bone and suture embryogenesis

D) Dysregulation of embryogenesis caused by a multi-gene deletion on chromosome 22

E) Inadequate production of surfactant by the lungs

The correct response is Option B.

The neonatal patient described in the vignette has clear signs of respiratory distress in the setting of micrognathia and glossoptosis, also known as Pierre Robin sequence (PRS). PRS can be isolated or associated with a broad metabolic disturbance, the most common of which is Stickler syndrome. Stickler syndrome is a disruption of the formation of collagen, which can lead to multiple congenital anomalies including a flat nasal bridge, hearing loss, cleft palate, limb anomalies, micrognathia, and ophthalmologic issues including cataracts.

Mutations in the fibroblast growth factor receptor can lead to syndromic forms of craniosynostosis such as Apert, Crouzon, or Pfeiffer syndromes. Disruption of suture embryogenesis is caused by a mutation in the TWIST1 gene and gives rise to Saethre-Chotzen syndrome. Deletion of the small arm of chromosome 22 leads to 22q11.2 deletion syndrome, previously known as DiGeorge syndrome or Velocardiofacial syndrome. Lack of lung surfactant is most often caused by prematurity and is not associated with PRS.

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102. A 60-year-old man presents with a palate mass. Biopsy of the lesion shows a minor salivary gland malignancy. He is referred from his dentist for definitive treatment. Which of the following is the most appropriate next step in management?

A) Radiation therapy followed by chemotherapy

B) Repeat biopsy

C) Surgical resection and postoperative chemotherapy

D) Surgical resection and postoperative radiation therapy

E) Observation only

The correct response is Option D.

The most common location of both benign and malignant minor salivary gland tumors is in the palate. Approximately 50% of minor salivary gland tumors are malignant. Surgery is the preferred modality (if the tumor is resectable) and may include neck dissection. Postoperative radiation therapy may be used to control local disease. Chemotherapy has not been shown to improve rates of disease-free or overall survival.

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103. An otherwise healthy 3-day-old term female infant is brought to the clinic for evaluation of a prominent ear deformity. The parents are interested in nonsurgical options, and they would like to pursue ear molding but are concerned about the complications associated with molding devices. The parents should be advised that the most common complication of such devices is which of the following?

A) Chondritis

B) Otitis media

C) Overcorrection

D) Sensorineural hearing loss

E) Skin ulceration

The correct response is Option E.

Although all of the answers are potential complications of treatment with ear molding, the most common complication is skin ulceration. In a recent study, skin ulceration occurred at a rate of 7.6%. Other studies have reported the rate of skin ulceration around 3%. Although chondritis and allergy to adhesives are complications, their rates were lower than 3 to 7.6%. Since this is an external system, it should not impact eustachian tube dysfunction. Ear molding does not contribute to hearing loss. Overcorrection is not likely with molding alone.

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104. A 7-year-old patient with a history of submucous cleft palate and persistent severe velopharyngeal insufficiency after Furlow palatoplasty undergoes video nasoendoscopy. An abnormal closure pattern is observed, with excellent movement of the velum and Passavant's ridge but poor lateral wall motion. On the basis of these findings, which of the following is the most appropriate treatment for this patient's velopharyngeal insufficiency?

A) Inferiorly based pharyngeal flap

B) Palatal lift appliance

C) Speech therapy

D) Sphincter pharyngoplasty

E) Superiorly based pharyngeal flap

The correct response is Option D.

With a "bow tie" pattern seen on the nasoendoscopy, the patient is an ideal candidate for sphincter pharyngoplasty, which will bring the lateral walls in more centrally, so the velum and pharynx can close off the velopharyngeal port.

Pharyngeal flap surgery is ideal for patients who have a large central gap or sagittal closure pattern caused by palatal hypotonia or shortened palatal length. Palatal soft tissue augmentation is ideal for patients with a very small central gap following adenoidectomy. A palatal lift appliance is typically used in patients with adequate palatal length, but inadequate motor function. The patient described in this scenario has excellent motor function of the velum, but poor lateral wall motion.

Speech therapy does not correct the anatomic deficiency in this patient population.

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105. A 26-year-old man sustained complete right-sided unilateral facial nerve transection and paralysis from a circular saw 3 years ago. He is now seeking surgery to improve resting symmetry and to recreate a dynamic smile. Which of the following is the most appropriate surgical procedure to achieve these results?

A) Cross-facial nerve graft and delayed free functional muscle transfer

B) Fascial suspension

C) Hypoglossal nerve to facial nerve transfer

D) Ipsilateral nerve graft

E) Nerve repair

The correct response is Option A.

Three years after complete facial nerve transection and paralysis, the facial muscles are nonviable and incapable of reinnervation. Cross-facial nerve grafting and delayed free functional muscle transfer using the gracilis muscle is the procedure of choice in this situation.

Nerve repair, ipsilateral nerve graft, and hypoglossal nerve to facial nerve transfer require viable facial muscles. Static reconstruction, such as a fascial suspension, would not be indicated in a young person when facial reanimation is possible. Static reconstruction is not indicated because facial reanimation with cross-facial nerve grafting and delayed free functional muscle transfer is possible and has not been attempted yet. Static reconstruction is the procedure of choice for elderly patients with multiple comorbidities and a poor prognosis or for patients who have failed facial reanimation surgery.

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106. A 24-month-old infant is evaluated because of a mass on the lower lip that her parents first noticed 1 month ago. Physical examination shows a mucosal lesion of the right lower lip that is round, clear, translucent, soft, and measures approximately 0.5 cm in diameter. Which of the following is the most appropriate next step in management?

A) CT scan of the face without contrast

B) Excisional biopsy

C) Fine-needle aspiration

D) MRI of the face with contrast

E) Ultrasonography of the lesion

The correct response is Option B.

The lesion described is a mucocele, which is a type of cyst likely caused by minor salivary gland mucin seepage. They are most frequently on the lower lip mucosa away from the midline, but they can present anywhere there is oral mucosa. A minority of these resolve on their own, therefore, the majority of the time an excisional biopsy is recommended.

Imaging is not indicated for this type of lesion. Fine-needle aspiration is not indicated.

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107. A 2-week-old female infant is evaluated because of a prominent ear deformity. Which of the following is the most appropriate early management to address this deformity?

A) Cartilage grafting

B) External molding

C) Injection of hyaluronidase

D) Otoplasty

E) No intervention at this time

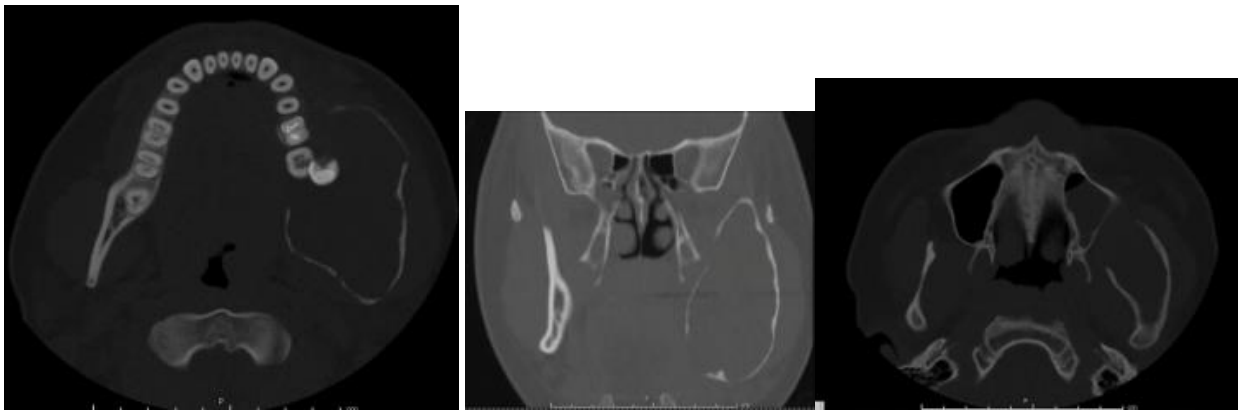
The correct response is Option B.

External molding is the early treatment of choice for a prominent ear deformity. Ideally, this is started by 2 weeks of age, but improvement has been seen in patients up to 3 months of age and is worth trying. Splinting is a shorter therapy used for Lop ear and Stahl ear deformation. Injectable chondroplasty using hyaluronidase is still in the trial phase, but if effective, would allow molding to be used in children older than 3 months of age. Otoplasty at 6 years of age is the alternative if molding therapy is unsuccessful.

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108. A 17-year-old boy is referred for evaluation of an ameloblastoma of the mandible. CT scans are shown. Which of the following is the most appropriate management?

A) Curettage and grafting

B) Radiation therapy followed by resection

C) Resection and autologous reconstruction

D) Resection and hemimandibular prosthesis placement

E) Observation

The correct response is Option C.

Ameloblastoma is a rare, benign odontogenic tumor that usually starts near molars. This tumor can enlarge and is often locally invasive, as observed in this patient. Its incidence peaks in the third to fourth decade of life, and the male to female ratio is 1:1. Eighty percent of these tumors arise in the mandible and the other 20% arise in the maxillary region. It originates from the residual epithelium of the tooth germ. There are several subtypes of ameloblastoma, including multicystic, extraossesous, desmoplastic, and unicystic. The unicystic subtype has a mean age of 15 years. Treatment is usually by wide local excision and reconstruction. Due to the locally aggressive nature of the lesion, observation is not a viable option. Curettage with or without bone grafting has been described, but would be ineffective for a lesion this size and has a very high rate of recurrence. Radiation therapy is unnecessary for these benign tumors and may stimulate malignant transformation.

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This patient had extensive involvement up to the condylar head and required resection of the entire hemimandible. Given the patient's age, reconstruction with vascularized bone is the best option. This patient had reconstruction using a contoured free fibula graft, fascial lining of the temporomandibular joint (TMJ), and has near-normal mouth opening at 1 year postoperatively. This approach also allows placement of osseointegrated dental prostheses. Although hemimandibular prosthesis is a possible alternative, this is a less accepted option in a young patient because of the inevitable failure of the prosthesis over time.

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109. A 24-year-old man presents following a motor vehicle collision. There is a 16-cm vertical laceration extending from the right cheek to the temporal region. The wound is explored surgically. The frontal branch of the facial nerve should be intact provided that the wound does not extend deep into which of the following structures?

A) Deep temporal fascia

B) Pericranium

C) Temporalis muscle

D) Temporoparietal fascia

E) Zygoma

The correct response is Option D.

Knowledge of the course of the frontal branch of the facial nerve is important in craniofacial and neurosurgery, repair of traumatic lacerations, and facial rejuvenation surgery. The frontal branch of the facial nerve emerges from the anterior-superior border of the parotid gland and travels roughly along a line starting from a point 0.5 cm below the tragus, a point 1.5 cm above the lateral extremity of the eyebrow (Pitanguy's line). The structures of the temporal region from superficial to deep include: skin and subcutaneous fat, temporoparietal fascia (also known as superficial temporal fascia), a loose areolar plane (also known as the innominate fascia), deep temporal fascia (which comprises a superficial and a deep layer that envelop the superficial temporal fat pad above the arch of the zygoma), temporalis muscle, pericranium, and calvarium. There is some controversy as to whether the frontal branch of the facial nerve travels within or deep to the temporoparietal fascia within the innominate fascia. Nevertheless, if the wound described does not penetrate the temporoparietal fascia, the frontal branch should be intact.

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110. A 3-year-old boy requires reconstruction of the large cranial defect shown in the photograph. The most appropriate reconstructive method will use which of the following materials?

A) Autologous bone

B) Homologous banked bone

C) Polyetheretherketone (PEEK)

D) Porous polyethylene

E) Titanium mesh with bone substitute

The correct response is Option A.



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Pediatric cranial reconstruction is best done with autologous bone for a variety of reasons. The cranium in younger children is still expanding. Autogenous bone will grow and expand with the cranium, while alloplastic reconstruction will not and can become unstable. There is a risk for infection and exposure with alloplastic prostheses that in some studies, is higher than with autogenous bone, although others refute this. Lastly, autologous bone is significantly less costly than most alloplastic reconstructive methods.

Homologous banked bone has been described as an effective method of reconstruction for a defect such as the one described in the clinical scenario, but the cost and potential risk for infection are simply not justified in most pediatric patients. The use of porous polyethylene, polyetheretherketone (PEEK), and titanium mesh have been described in the pediatric population, although these authors concede that these methods are indicated when autologous reconstruction cannot be achieved.

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111. The permanent canine (cuspid) teeth most commonly erupt between which of the following ages?

A) 7 to 8 years

B) 9 to 10 years

C) 11 to 12 years

D) 16 to 17 years

E) 20 to 22 years

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

The correct response is Option C.

The permanent teeth erupt in this order:

First molars 7th year
Median incisors 8th year
Lateral incisors 9th year
First premolars 10th year
Second premolars 11th year
Canines 11th to 12th year
Second molars 13th to 14th year
Third molars 17th to 40th year

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112. A 3-year-old boy with minimal levator excursion of the left eyelid (2 mm) is scheduled to undergo ptosis repair. Which of the following materials has the lowest long-term recurrence and complication rate?

A) Autologous fascia lata

B) Polypropylene suture

C) Polytetrafluoroethylene (PTFE) strand

D) Silicone rod

The correct response is Option A.

Although all of the modalities listed have been used for congenital ptosis repair, autologous fascia lata (AFL) grafts have the lowest long-term recurrence rate and complication rates. Although studies have shown GORE-TEX to have a low recurrence rate compared to AFL, the complication rate of infection is higher with GORE-TEX. Grafting with irradiated fascia lata has a lower donor-site morbidity profile since it is allogenic tissue, but the long-term recurrence rate has been reported to be 50%. Polypropylene suture can be useful for temporary ptosis repair until AFL but has been plagued by recurrence secondary to slippage. Finally, silicone rods have been shown to have increased ease of adjustability since they do not incorporate, but they yielded higher complication rates than AFL.

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113. A 15-year-old girl with a history of a bilateral cleft lip and palate is evaluated because she is concerned about her nasal-sounding speech. On examination, she has a wide and poorly projected nasal tip, a bilateral cleft lip scar with a whistle deformity, mid face hypoplasia, persistent alveolar clefts with a protrusive premaxilla, a large fistula at the incisive foramen, and a straight line scar on the palate. Which of the following is the most appropriate first step in addressing her multiple cleft-related problems?

A) Alveolar bone graft

B) Fistula closure with premaxillary setback

C) Lip revision

D) Maxillary advancement

E) Rhinoplasty

The correct response is Option B.

Patients with cleft palate who are late-presenting and have undergone previous procedures that were performed out of the preferred sequence can be especially challenging cases. This patient, with a bilateral cleft lip and palate, has only had her lip and palate repaired. Yet she has significant speech, skeletal, and soft tissue sequelae of her cleft including unrepaired anterior hard palate fistulae and alveolar fistulae, inadequate central lip fullness (whistle deformity), a wide and poorly projected nose, mid face hypoplasia, and velopharyngeal insufficiency.

Sequencing procedures to address these issues is crucial to having favorable surgical outcomes. Addressing speech is the patient's main concern and should be performed first. This includes closing of the oronasal fistula along with a premaxillary setback followed by a pharyngoplasty, if necessary. Alveolar bone grafts should be performed to stabilize the maxillary dental arch and minimize tooth injury. This should be followed by a lip revision to establish the lip-tooth relations prior to undergoing Le Fort I advancement. Finally, a rhinoplasty can be performed once the maxilla has been advanced.

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114. A 5-year-old girl has craniosynostosis, a low-set hairline, ptosis, and 4th/5th-digit syndactyly of both hands. Genetic testing is most likely to show a mutation in which of the following genes?

A) *EFNB1*

B) *FGFR2*

C) *FGFR3*

D) *MPDZ1*

E) *TWIST1*

The correct response is Option E.

The clinical picture is consistent with Saethre-Chotzen syndrome. It is an autosomal dominant condition defined by a genetic mutation or deletion affecting the *TWIST1* gene or chromosome 7p21. *FGFR2* mutations are predominantly associated with Apert, Crouzon, and Pfeiffer syndromes. *FGFR3* mutations are associated with Muenke syndrome and Crouzon syndrome with acanthosis nigricans. *EFNB1* is associated with craniofrontonasal syndrome. *MPDZ1* is associated with hydrocephalus.

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115. A 33-year-old woman presents to the office for evaluation of facial pain. Physical examination shows that she has facial pain, temporomandibular joint clicking, and an anterior open bite. Which of the following is the most common physical examination finding of temporomandibular joint dysfunction?

A) Dental pain

B) Jaw deviation with mouth opening

C) Malocclusion

D) Masseter hypertrophy

E) Pain on palpation of the muscles of mastication

The correct response is Option E.

The most common age at presentation for temporomandibular disorder (TMD) is 20 to 40 years, and it is more common in women than men. Occlusal abnormalities, such as open bite, have not been shown to be a major cause of TMD, as is evidenced by the lack of response to occlusal correction therapy. Pain on palpation of the muscles of mastication is the most consistent clinical sign seen with TMD. Localized dental pain is not often a feature of TMD. Masseter hypertrophy is associated with bruxism.

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116. A 30-year-old woman with type 1 diabetes mellitus presents with fever, nasal obstruction and drainage, and swelling of the left eye. Nasal endoscopy shows blackish secretions and necrosis of the inferior turbinate and adjacent nasal mucosal tissues. Which of the following is the most likely diagnosis?

A) Candidiasis

B) Epiglottitis

C) Mastoiditis

D) Mucormycosis

E) Necrotizing fasciitis

The correct response is Option D.

Infections of the head and neck should not be ignored, as many of them can evolve into life-threatening emergencies, some of them very quickly. Rhinocerebral mucormycosis is a rare opportunistic infection of the nasal cavity and sinuses that can rapidly spread to the orbits and brain by erosion of bone and invasion of blood vessels. Mucormycosis is caused by saprophytic fungi, and usually affects individuals with diabetes mellitus and those who are immunocompromised. The mainstay of treatment includes reversal of immunosuppression when possible, systemic antifungals, and surgical debridement. Timely treatment is critical and usually dependent on rapid diagnosis by history and physical examination, imaging, and intraoperative biopsy with frozen section pathology, since waiting for cultures causes unnecessary delay in severe cases. Mucormycosis can also present in the oral cavity, lungs, ears, and other sites less commonly.

Epiglottitis is an infection of the supraglottic region causing inflammation and swelling of the epiglottis. It is most commonly caused by *Haemophilus influenzae* type b and has become rare since the introduction of the vaccine against this bacteria. Swelling of the epiglottis can cause airway obstruction. Mastoiditis is infection of the mastoid air cells, which are in continuity with the middle ear. The mastoid process behind the ear is also usually swollen and tender. Infections usually start from untreated otitis media. Risks include spreading to the surrounding structures, including the brain. Necrotizing fasciitis is a soft tissue infection that rapidly spreads through the subcutaneous fat and fascia with necrosis of the overlying skin. In the head and neck, the infection is usually spread from infection of the teeth or pharynx. The plaque-like infection of candidiaisis does not present in this fashion.

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117. A 30-year-old woman presents to the office with new-onset left facial paralysis from Lyme disease. The most appropriate next step in management is administration of which of the following medications?

A) Acyclovir

B) Dapsone

C) Dexamethasone

D) Doxycycline

E) Fluconazole

The correct response is Option D.

Lyme disease is carried by ticks with *Borrelia* bacteria. While a "bull's eye" rash is a common finding, a lack of this rash does not exclude Lyme disease. This patient has new onset facial paralysis brought on by her Lyme disease infection. Neurological manifestations (early disseminated infection) can present as early as a few days to a few weeks after the initial tick bite.

Treatment should be directed to the underlying disease, and doxycycline is the antibiotic of choice unless there are contraindications. There is no role for antivirals.

Surgical treatment is contraindicated at this time unless the patient’s facial palsy becomes permanent.

Early initiation of corticosteroids has been shown to improve outcomes in idiopathic Bell palsy, but it has shown no efficacy for facial palsy caused by Lyme disease (Lyme neuroborreliosis), and in fact, has been associated with worse outcomes.

Antivirals can be used in facial palsy caused by the herpes simplex virus, but they have not been proven to be beneficial alone (antivirals must be used in conjunction with corticosteroids). However, antivirals have not demonstrated efficacy in facial palsy caused by Lyme disease.

Cephalexin is used as a third-line treatment for Lyme disease. Dapsone has been used in post-treatment Lyme disease syndrome.

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118. A 50-year-old man desires correction of his drooping right eyelid. Medical history includes traumatic injury to the eye two years ago. Physical examination shows ptosis of the right eyelid. Levator muscle function is less than 5 mm. No other abnormalities are noted. The most appropriate procedure for correction of the ptosis functions through which of the following mechanisms?

A) Activation of the frontalis muscle

B) En block removal of a portion of the posterior lamella

C) Plication of the levator aponeurosis

D) Release of muscle fibrosis

E) Repositioning of the levator aponeurosis

The correct response is Option A.

Only using muscle outside of the eyelid to power elevation will yield the desired action. This would involve suturing the eyelid, namely the tarsal plate, to the frontalis muscle via either alloplastic material, autogenous fascia, or a biologic product. Activation of the frontalis muscle will then elevate the eyelid independent of the levator apparatus.

In the setting of chronic non-function (two-year history of traumatic eyelid ptosis and less than 5 mm of eyelid elevation), use of local structures would not be warranted. Release, plication, or repositioning of the dysfunctional levator muscle would not be successful in restoring eyelid elevation.

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119. A 17-year-old girl with a history of bilateral cleft lip/palate presents for evaluation. She underwent lip and palate repair as a child, and alveolar bone grafting in mixed dentition. She has hypernasal speech. Physical examination shows severe mid face hypoplasia with 12 mm of negative overjet. On cephalometric analysis, SNA angle is 73 degrees (N 80–82), and SNB angle is 79 degrees (N 79–81). She is concerned about her appearance and her speech. Which of the following is the best initial option to address the patient's concerns?

A) Bilateral sagittal split osteotomy with mandibular setback

B) Combined Le Fort I advancement and mandibular advancement

C) Maxillary distraction

D) Pharyngoplasty

E) Speech therapy

The correct response is Option C.

This patient has severe maxillary retrusion and mid face hypoplasia in the setting of significant velopharyngeal deficiency. These two issues are at odds with one another. Advancing her mid face with a standard Le Fort I will worsen her velopharyngeal dysfunction (VPD), while addressing her VPD with a pharyngeal flap will make advancing her maxilla challenging. Only anterior segmental maxillary distraction will maintain her current velopharyngeal anatomy but allow for improved mid face projection. A pharyngoplasty can be performed relatively easily at a later date or as a secondary procedure. Performing a mandibular setback is not appropriate because she has normal mandibular projection.

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120. A newborn has unilateral facial paralysis. The remainder of the physical examination shows no abnormalities and there is no evidence of birth trauma. Which of the following studies will most likely reveal the cause of facial nerve paralysis in this patient?

A) CT scan of the head

B) Electromyography

C) Electroneurography

D) Stapedius (acoustic) reflex test

E) Ultrasonography

The correct response is Option A.

The most likely cause of unilateral facial nerve paralysis in a newborn with an otherwise normal physical examination is a temporal bone abnormality. A CT scan of the head and temporal bones is the study of choice to identify a temporal bone abnormality.

Electromyography is a neuroelectrophysiological test used to evaluate the function of the facial nerve. Small needles are inserted into certain facial muscles and patients are asked to contract those muscles. Action potentials are seen in muscles undergoing reinnervation. Fibrillation potentials are seen in muscles that are still alive but awaiting reinnervation, and electrical silence is seen with chronically denervated muscles that cannot be reinnervated.

Electroneurography is another neuroelectrophysiological test used to assess the function of the facial nerve. One electrode is placed over the stylomastoid foramen behind the ear and emits an electrical pulse, and one electrode is placed at the ipsilateral nasolabial fold that detects any signal transmitted by the facial nerve. Electromyography and electroneurography assess the integrity of the facial nerve, but would not reveal the cause of the facial nerve paralysis in a newborn baby.

Ultrasonography is the test of choice to look at soft tissues but will not image the skull base adequately for this purpose.

The stapedius or acoustic reflex is an involuntary muscle contraction of the stapedius muscle of the middle ear in response to high intensity sound. The efferent limb of the reflex is the facial nerve, which innervates the stapedius muscle. The rate of return of the stapedius reflex can be used to predict the rate of return of facial nerve function after facial nerve paralysis, but would not identify the cause of facial nerve paralysis.

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121. A 22-year-old woman presents with long vertical facial height, narrow constricted alar bases, and lip incompetence. She has excessive gingival and upper incisor show at rest and while smiling. Which of the following is the most appropriate treatment for correction of the deformity?

A) Advancement genioplasty

B) Le Fort I osteotomy with impaction

C) Le Fort II osteotomy

D) Orthodontic manipulation

E) Sagittal split mandibular osteotomy

The correct response is Option B.

This patient presents with the classic physical finding of vertical maxillary excess, also known as long face syndrome. Patients will have long vertical facial height (especially in the lower third), narrow constricted alar bases, lip incompetence with an excessive interlabial gap, and excessive gingival and upper incisor show at rest and while smiling. They may also have a retruded and vertically long chin and a retrognathic mandible. Cephalometric analysis may show increased lower anterior facial height, SNA and SNB angles that are smaller than normal, and an ANB angle that is larger than normal (greater than 3 degrees).

The surgical treatment generally entails maxillary Le Fort I osteotomy with impaction. If there are mandibular discrepancies, then genioplasty and mandibular osteotomy may be needed. Le Fort II osteotomy would not address the vertical excess. Genioplasty alone, sagittal split mandibular osteotomy alone, and orthodontic manipulation alone would not address the vertical discrepancy.

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122. Which of the following structures contributes to the formation of the mandibular body and ramus?

A) First branchial arch

B) First branchial cleft

C) Second branchial arch

D) Second branchial cleft

The correct response is Option A.

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

The first branchial cleft gives rise to the external auditory canal. The second branchial arch contributes to the formation of the majority of the external ear–the antitragus, remainder of the helix, antihelix, and crura all arise from the second branchial arch. The second branchial cleft is typically obliterated during development, but may persist in the form of a second branchial cleft cyst.

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123. A 22-year-old woman is brought to the emergency department after being hit by a car where she was intubated at the scene. A maxillofacial CT scan performed on admission shows a non-displaced right mandibular parasymphaseal fracture. She is extubated later that day after being cleared by trauma. Upon reevaluation the next morning, significant malocclusion with a step-off between the right mandibular cuspid and lateral incisor is noted. She has a right-sided open bite. Which of the following mechanisms most likely explains the change in physical examination findings after extubation?

A) Delayed disruption of the periodontal ligament

B) Differential pull of muscles on the mandible

C) Dissipation of post-traumatic edema

D) Fibrinolysis of the fracture hematoma

E) Refracture of the parasymphysis

The correct response is Option B.

This patient has a right mandibular parasymphyseal fracture that is in an unfavorable orientation. The right temporalis and pterygomasseteric sling will work naturally to close the mandible while the floor of mouth musculature, including the mylohyoid, work to open the mandible at the level of the symphysis. Because of the orientation of the fracture, these forces distract the fracture, causing it to become more displaced. When this patient was first examined, the paralytic agent

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she received when she was intubated at the scene inhibited those distraction forces and kept her in appropriate occlusion. However, upon extubation, she fell out of occlusion as those muscle groups separated the fracture. While hematoma fibrinolysis and edema reduction occur after mandible fractures, they are not likely to result in displacement of the fracture. The periodontal ligament has no role in fracture displacement.

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124. A 72-year-old, immunosuppressed man presents with a 12-mm squamous cell carcinoma of the mucosal lower lip and no palpable or imageable masses of the neck. On pathology, there is perineural and lymphaticovascular invasion, with a depth of invasion of 11 mm. Which of the following patient characteristics establishes his cancer stage as at least Stage III?

A) Depth of invasion

B) Immunosuppressed status

C) Lymphaticovascular involvement

D) Perineural invasion

E) Tumor size greater than 1 cm

The correct response is Option A.

For squamous cell carcinoma of the skin, perineural invasion, lymphaticovascular involvement, and immunosuppression status are associated with worse outcomes but are not part of the staging manual. A tumor less than 2 cm in diameter is a T1, and without nodal involvement, would be a Stage I. Depth of invasion (DOI) greater than 10 mm upstages the patient to Stage III, according to the new 8th edition American Joint Committee on Cancer (AJCC), and would mandate an elective neck dissection and possible radiation (much more likely with his other negative features of the cancer). DOI is defined as the distance deep to the adjacent normal mucosal basement membrane.

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125. A patient undergoes excision of a low-risk basal cell carcinoma lesion that is 1.5 cm in diameter. According to recommended guidelines, which of the following surgical margins is most appropriate to excise?

A) 1 mm

B) 2 mm

C) 4 mm

D) 6 mm

E) 8 mm

The correct response is Option C.

Basal cell carcinoma (BCC) is the most common cancer in the United States and it is estimated that BCC occurs in close to 2 million Americans annually. This exceeds the incidence of all other cancers combined. Fortunately, the mortality rate is low, but there is certainly significant morbidity because the incidence of this common malignancy is increasing rapidly. BCC is twice as common as squamous cell carcinoma (SCC), which is the second most common type of skin cancer.

The clinical margins chosen by the panel for low risk tumors are based on the work of Wolf and Zitelli. Many other authors and consensus panels have agreed with their recommendation. Higher risk lesions and clinical signs may make it appropriate to increase or decrease this margin control based upon anatomic and systemic considerations.

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126. A 10-year-old boy presents with an ear injury sustained after a picture frame fell onto his head. The injury is shown in the photograph. He never lost consciousness and has no other injury. Microsurgical reattachment is not an option. Which of the following is the most appropriate initial treatment?

A) Debridement and closure

B) Dressing with petroleum gauze

C) Immediate flap reconstruction

D) Reattach as a composite graft

E) Split-thickness skin graft

The correct response is Option D.

While composite grafting of large ear avulsions has a globally poor outcome, the avulsed fragment in this patient is a thin piece of the helical rim that includes only a small piece of the helical rim cartilage. The shape of the defect, minimal cartilage involvement, and the fact that this was a clean injury in a young patient, makes an initial attempt to replace the tissue as a composite graft the best initial option. At worst, the tissue acts to cover the wound until a

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definitive reconstruction can be planned. At best, the tissue survives to some degree and salvages some of the delicate and very hard to replace helical rim contour. This patient described in the clinical scenario had 80% survival of the tissue with this technique and required no further reconstruction.

The exposed cartilage is at risk for infection and may dessicate, so a simple dressing change with petroleum is ill advised. Debridement and closure might be possible if more cartilage was removed, but this further compounds the tissue loss. A split-thickness skin graft contracts and may not take well on exposed cartilage. Immediate flap reconstruction is possible, but a flap can always be done at a later time if the composite graft does not survive.

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127. A 45-year-old woman is noted to have a mass in the parotid gland. She has a history of external radiation therapy for a facial keloid scar in her twenties. Which of the following is the most likely diagnosis?

A) Acinic cell carcinoma

B) Mucoepidermoid carcinoma

C) Pleomorphic adenoma

D) Squamous cell carcinoma

E) Warthin tumor

The correct response is Option C.

Of all adult salivary gland tumors, 75 to 85% occur in the parotid gland, 8 to 15% in the submandibular, and 5 to 8% in the minor salivary glands. Pleomorphic adenoma, or benign mixed tumor, is the most common tumor postirradiation as seen in this clinical scenario.

Mucoepidermoid carcinoma is the most common malignant tumor of the parotid gland. Adenoid cystic tumor is the most common in the submandibular and minor salivary glands. Squamous cell carcinoma in the parotid is usually metastatic from frontotemporal scalp cutaneous skin cancer. It can present as high-grade mucoepidermoid carcinoma. Warthin tumor typically appears in the fifth to seventh decade of life. Metachronous bilaterality is observed in up to 6% of cases and radiation therapy is a well-known predisposing factor.

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128. A 35-year-old man presents after Mohs resection of a basal cell carcinoma at the tip of the nose. The defect is 2.5 cm in diameter and the lower lateral cartilages are exposed. Which of the following is the most appropriate method for closure of the defect?

A) Local transposition flap

B) Paramedian forehead flap

C) Primary closure

D) Radial forearm flap

E) Split-thickness skin graft

The correct response is Option B.

The closure of Mohs defects of the nose is typically guided by subunit reconstruction and using tissue of like quality and color. Small defects can be attempted primarily, but the tip of the nose will usually require a local transposition flap (bilobed, rhomboid), V-Y advancement, or other similar tissue transposition.

Paramedian flaps are reserved for larger defects such as this 2-cm defect that cannot be accommodated by local transfer, especially in a young and healthy patient. The radial forearm is used in complex or complete nasal reconstruction. A full-thickness skin graft is favored by some for its simplicity and it is often used for flap failures. A split-thickness skin graft will not provide a good match for color or tissue thickness for the tip of the nose.

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129. A 25-year-old healthy man presents with a painful clicking when opening and closing his mouth 12 weeks after being involved in a physical altercation. He is able to chew and open and close his mouth normally, but with discomfort. Anteroposterior x-ray study shows no abnormalities. Which of the following is the most likely source of his discomfort?

A) Articular disc subluxation

B) Dynamic condylar subluxation

C) Early arthritis

D) Occult fracture of the condylar head

E) Spasm of the lateral pterygoid muscle

The correct response is Option A.

This patient likely has increased mobility of the articular disc. This can occur as a result of acute trauma (as in this case) or chronic trauma, such as bruxism. At this juncture, the disc is reducing with motion, so there is no obstruction to movement. Nevertheless, symptoms can worsen over time and create a closed-lock wherein the patient cannot open his mouth. An MRI and/or ultrasound can help confirm the pathology. With the limited and nonmechanical symptoms (eg, locking), treatment is conservative.

Arthritis is possible but unlikely in a patient of this age, especially without some other reason, such as infection or a history of juvenile rheumatoid arthritis. Fracture of the condylar head is possible, but this should have healed after 2 months and would be asymptomatic. Subluxation of the condylar head would restrict motion, and spasm of the lateral pterygoid can cause temporomandibular joint pain, but subluxation of the condylar head does not produce the click that is heard.

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130. A 2-year-old boy presents with swelling over the bridge of the nose that has been present since birth. The swelling has been slowly increasing in size and he has hypertelorism. The swelling is soft, compressible, and it transilluminates. There are visible and palpable pulsations, and the mass enlarges when the patient cries. Which of the following is the most likely diagnosis?

A) Encephalocele

B) Glioma

C) Hemangioma

D) Nasal dermoid cyst

E) Nasopharyngeal angiofibroma

The correct response is Option A.

Encephaloceles are neural tube defects that result in sac-like protrusions of the meninges (meningocele) or brain and meninges (meningoencephalocele) in various locations along the cranium, such as between the forehead and nose (including naso-orbital, frontonasal, and nasoethmoidal locations) or on the back of the skull. They tend to be soft, compressible masses that transilluminate that may be sessile or pedunculated. Biopsy may result in a cerebrospinal fluid leak.

Glioma is a mass of ectopic neural tissue that does not transilluminate.

Hemangiomas are benign vascular lesions that are present at birth and characterized by a rapid growth phase around the age of 1 to 6 months, followed by gradual involution over 1 to 12 years. They have no intracranial connection and no cerebral pulsations. Nasopharyngeal angiofibromas, also known as juvenile nasopharyngeal angiofibromas, are benign but locally invasive vascular tumors that occur almost exclusively in adolescent males. They present with unilateral or bilateral nasal obstruction, frequent epistaxis or blood-tinged nasal discharge. Nasal dermoid cyst is a benign cystic lesion that does not pulsate and does not transilluminate.

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131. Which of the following best represents the likelihood that a patient with a frontal sinus fracture would have a concurrent intracranial injury?

A) 1%

B) 15%

C) 30%

D) 55%

E) 90%

The correct response is Option D.

In an acute trauma setting, the recognition of mild traumatic brain injury (mTBI) is a diagnostic challenge as there are often competing diagnoses that take immediate priority. Furthermore, within this cohort, patients with craniofacial fractures have been shown to be at risk for delayed or missed diagnosis for all degrees of TBI, although with a higher likelihood of missed or delayed diagnosis for mTBI compared with moderate to severe TBI. Previously, it was hypothesized that facial fractures buffered the forces transmitted during blunt head trauma, thereby protecting intracranial structures. This conceptual framework has since been questioned as evidence has mounted that individuals with facial fractures are at increased risk for head injury. The biomechanics resulting in different types of facial fractures and the amount of force required to fracture the different components of the facial bony structure have been well described. The nasal bone has the lowest tolerance for fracture at 25 to 75 lbs, while the frontal bone has the highest tolerance at 800 to 1600 lbs. Recent studies have proposed that craniofacial fractures can serve as clinical markers for brain injury and Mulligan et al. suggest that the prevalence of overall head and cervical spine injuries in the setting of facial fractures is high enough to warrant a change in current protocols.

In this context, the prevalence of mTBI and moderate to severe TBI in patients with isolated facial fractures in the National Trauma Databank (NTDB) was evaluated, and further characterized the association of isolated facial fractures with different degrees of TBI in patients with mild, moderate, and severe TBI. Facial fractures can serve as objective clinical markers for the potential presence of mTBI and moderate to severe TBI in trauma patients. As mTBI patients have been shown to benefit from simple, easy-to-administer educational interventions, trauma patients with facial fractures may benefit from automatically receiving education about mTBI and TBI recovery, given the clinically meaningful prevalence of mTBI and TBI in this population. As one moves up the craniofacial skeleton, the forces are transmitted more reliably to the intracranial space. Therefore, a frontal sinus fracture is at extremely high risk (usually a 45 to 65% chance) of having an associated intracranial injury.

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132. Which of the following cranial nerves develops with the first branchial arch?

A) Facial (VII)

B) Glossopharyngeal (IX)

C) Hypoglossal (XII)

D) Trigeminal (V)

E) Vagus (X)

The correct response is Option D.

The first branchial arch is associated with the trigeminal nerve (V), second branchial arch with the facial nerve (VII), third branchial arch with the glossopharyngeal (IX), fourth branchial arch with the superior laryngeal (X), and sixth branchial arch with the recurrent laryngeal (X).

Pharyngeal Arch	**Muscular Structures**	**Skeletal structures**	**Nerve**	**Artery branch**
I	Anterior digastric Mylohyoid Tensor veli palatini	Temporal bone (squamous) Zygoma Maxilla Premaxilla Meckel's cartilage Malleus Incus	Trigeminal nerve	First aortic arch artery
II	Muscles of facial expression Posterior digastric Stylohyoid	Portions of hyoid (lesser cornu / upper body) Stapes	Facial nerve	Stapedial artery
III	Stylopharyngeus	Portions of hyoid (greater cornu / lower body)	Glossopharyngeal nerve	Common carotid artery
IV	Levator veli palatini	Laryngeal cartilaginous	Vagus nerve	Aortic arch

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	Uvula Palatopharyngeus Palatoglossus Pharyngeal constrictors Cricoythyroid Salpingopharyngeus	structures		Right subclavian artery
V	None	None	None	None
VI	Arytenoid muscles Epiglottis muscles	None	Vagus nerve	Aorta Pulmonary artery Ductus arteriosus

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133. A 23-year-old woman with severe progressive hemifacial atrophy that has been stable for 3 years now desires a long-term stable reconstruction. Which of the following is the most appropriate recommendation for reconstruction of this patient's facial asymmetry?

A) Alloplastic bony augmentation

B) Contralateral suction lipectomy

C) Delay reconstruction until it has been stable for 10 years

D) Free tissue transfer

E) Hyaluronic acid injections

The correct response is Option D.

Progressive hemifacial atrophy is also known as Parry-Romberg syndrome. The progression is ultimately self-limiting. Reconstruction 2 years or more after burn out is commonly accepted. For very mild asymmetry, hyaluronic acid fillers can improve symmetry, but require recurrent treatments. For mild to moderate asymmetry, microfat grafting can restore symmetry. Multiple sessions may be required to achieve long-term correction. For severe asymmetry, free muscle flap with parascapular flap or anterolateral thigh flap can provide enough soft tissue bulk for long-term correction.

Alloplastic bony augmentation would correct any potential bony deficiencies, but would not address any soft tissue deficiencies.

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134. A 25-year-old man presents with a diagnosis of bruxism and pain. Which of the following drugs is the most appropriate for treatment?

A) Amitriptyline

B) Botulinum toxin type A

C) Clonidine

D) Escitalopram

E) Fluoxetine

The correct response is Option B.

Botulinum toxin A has shown efficacy in the treatment of pain symptoms from bruxism and, thus, its effects are not limited to improving masseter hypertrophy. It has shown equal efficacy when compared with occlusal splints.

Botulinum toxin A has been shown to be more effective than placebo in decreasing pain from bruxism by a patient report using the visual analogue scale (VAS). However, other pharmacotherapies, such as clonidine and amitriptyline, have demonstrated no improvement in pain relief over placebo.

Bruxism is a reported side effect of selective serotonin reuptake inhibitors such as fluoxetine and escitalopram.

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135. A 15-year-old girl has a 12-month history of pain and fullness in the right supraorbital rim. She has café-au-lait spots, a history of precocious puberty, and a recent pathologic rib fracture. Which of the following is the most likely pathology of the lesion?

A) Dermoid cyst

B) Fibrous dysplasia

C) Neurofibroma

D) Osteoblastoma

E) Rhabdomyosarcoma

The correct response is Option B.

This patient has a classic presentation of McCune-Albright syndrome. Patients with McCune-Albright present with a triad of polyostotic fibrous dysplasia, precocious puberty, and skin pigmentation (eg, café au lait spots). Additionally, they may have hyperfunctioning endocrinopathies such as growth hormone excess. If these patients present with intramuscular myxomas, it is known as Mazabraud syndrome. Malignant degeneration of fibrous dysplasia has been reported in up to 4% of patients with McCune-Albright syndrome. Management depends on the clinical presentation and functional impact of the lesions, and is primarily surgical.

Patients with neurofibroma may have café au lait spots, but not precocious puberty or pathologic fractures. Dermoid cysts generally do not present with pain and are often noted at a much younger age than the patient described.

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136. A patient with Möbius syndrome is referred for facial reanimation with free gracilis muscle flaps. Which of the following donor nerves has the lowest morbidity and is used most often for this type of reconstruction?

A) Contralateral facial

B) Glossopharyngeal

C) Hypoglossal

D) Masseteric

E) Spinal accessory

The correct response is Option D.

In cases of facial palsy where the facial nerve is unavailable for use as a donor nerve, nerve transfers are the best option. Of the local options, the masseteric nerve provides the most appropriate and most commonly used transfer because of its proximity and low morbidity when harvested.

While the hypoglossal nerve is sometimes used as a donor nerve for ipsilateral facial reanimation, the process of harvesting can be associated with considerable oropharyngeal morbidity because of ipsilateral tongue atrophy. In addition, the patient in this scenario requires a bilateral facial reanimation procedure, and harvesting of both hypoglossal nerves would paralyze the tongue.

A cross-facial nerve transfer is not an available option in this scenario because the patient has Mobius syndrome with bilateral facial nerve agenesis. Use of bilateral glossopharyngeal nerves as donors would create significant oropharyngeal function morbidity, and, even in cases of unilateral facial reanimation, is not commonly used. Use of both spinal accessory nerves as donor nerves in this case would create significant morbidity. Even in a case of unilateral facial reanimation, use of the masseteric nerve is a significantly better choice.

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137. A 14-year-old girl with Crouzon syndrome presents with a severe Angle Class III malocclusion, mid face retrusion, and severe sleep apnea. She is scheduled to undergo Le Fort III advancement using distraction osteogenesis. The risk for complications with this procedure is closest to which of the following?

A) 5%

B) 20%

C) 40%

D) 60%

E) 80%

The correct response is Option B.

There are several important advantages of distraction osteogenesis for Le Fort III advancement versus conventional single-stage advancement with bone grafting and these include: less regression, greater advancement distance, and no need for bone grafting. Le Fort III distraction is not without its issues. Major and minor complications have been reported in nearly 20% of patients undergoing this procedure; these complications include bone loss, pin migration, loss of fixation, meningitis, seizures, and cerebrospinal fluid leaks. Several recent reports show that these complications occur in approximately 20% of cases.

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138. A 50-year-old woman has ptosis of the right upper eyelid 4 days after receiving botulinum toxin for cosmetic treatment of corrugator rhytides. Stimulation of which of the following muscles is most likely to improve her eyelid function?

A) Iris sphincter

B) Levator palpebrae superioris

C) Müller

D) Orbicularis oculi

E) Procerus

The correct response is Option C.

Iopidine and phenylephrine are both adrenergic agonists, which selectively increase eyelid elevation in the absence of levator function. They do this by selectively targeting α_2 adrenergic receptors on smooth muscle, which results in the contraction of Müller muscle. This muscle adjoins onto the levator palpebrae superioris muscle and on contraction, causes moderate eyelid elevation. Although it does not have the level of eyelid elevation as the levator muscle, Müller muscle can still give partial improvement and decrease ptosis until the botulinum toxin has dissipated. The orbicularis oculi, procerus, and iris sphincter muscles are not involved in eyelid closure. The levator palpebrae muscle is the injured muscle from the botulinum toxin and there is no reversal drug available.

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139. An 18-year-old man desires correction of a unilateral congenital Stahl ear deformity. Which of the following auricular characteristics is most likely to be observed on physical examination?

A) Accessory third crus of the antihelix

B) Conchal projection secondary to prominent mastoid

C) Enlarged conchal cartilage

D) Hyperplasia of the superior crus of the antihelix

E) Pointed thickening at the junction of the upper and middle third of the helix

The correct response is Option A.

Stahl congenital ear deformity can present with varying degrees of severity and is characterized by the presence of an abnormal third crus of the antihelix. There is also often an associated flattening of the helix, unfurling of the helical rim, a posterosuperior projection of the helical rim, and absence or hypoplasia of the superior crus of the antihelix.

A pointed thickening at the junction of the upper and middle third of the helix is seen in Darwin's tubercle. Conchal projection secondary to prominent mastoid can be seen in mastoid prominence. Enlarged conchal cartilage is seen in prominent ear.

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140. A 35-year-old woman is unhappy with the appearance of her “square face,” especially at the bottom jaw “near the corners,” and she wishes to have a smoother mandible contour permanently. Which of the following is the most appropriate treatment?

A) Alloplastic implant

B) Autologous fat grafting

C) Hyaluronic acid dermal filler

D) Mandible angle and body contouring

E) Suction lipectomy

The correct response is Option D.

Mandible contouring surgery, frequently called mandible angle reduction, is a bony procedure to decrease the angular contours in a “square face” or bottom jaw with “sharp corners.” The term “mandible angle” reduction is a misnomer, as usually both the mandible angle and the mandible body need to be gracefully contoured or resected to result in an aesthetically pleasing, rounder face.

Although fillers, fat grafting, and implants are used in the face, they are not usually used for mandible contouring. Suction lipectomy for a patient with a square jaw would not be successful.

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141. The stylopharyngeus muscle is innervated by which of the following nerves?

A) Facial (VII)

B) Glossopharyngeal (IX)

C) Hypoglossal (XII)

D) Trigeminal (V)

E) Vagus (X)

The correct response is Option B.

The pharyngeal muscles are all innervated by the vagus (X) nerve, except the stylopharyngeus muscle, which is innervated by the glossopharyngeal nerve (IX).

The trigeminal nerve (V) is responsible for facial and oral sensation. The maxillary branch (V2) is responsible for sensation of the upper teeth, upper lip, hard palate, cheeks, and nasopharyngeal mucosa. The mandibular branch (V2) provides sensory fibers for the lower teeth, lower mucosa of the mouth and the anterior two-thirds of the tongue. The facial nerve (VII) provides motor innervation of the muscles of facial expression and the posterior bellies of the stylohyoid and digastric muscles. The vagus nerve (X) provides motor innervation to all of the pharyngeal muscles except the stylopharyngeus muscle. The hypoglossal nerve (XII) provides motor innervation to the intrinsic and extrinsic tongue muscles and also provides motor innervation to the geniohyoid muscle through the ansa cervicalis.

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142. A newborn presents with an asymmetric bilateral cleft lip-nose-palate; the right side is incomplete and the left side is complete. A photograph is shown. Which of the following sequences of repair is most likely to provide the optimal outcome?

A) One-stage repair of the bilateral cleft lip

B) Repair cleft palate at the initial surgery

C) Repair the complete side cleft lip first, then stage incomplete side cleft lip at a later surgery

D) Repair the incomplete side cleft lip first, then stage complete side cleft lip at a later surgery

E) Simultaneous repair of cleft lip and cleft palate

The correct response is Option A.

Bilateral cleft lip repair is more commonly symmetric and is usually repaired as a one-stage repair around 3 to 6 months of age.

Asymmetrical bilateral cleft lip repair can be done in one stage or two stages, and the sequencing has been controversial. However, two recent studies show convincing evidence that even for asymmetrical bilateral cleft lip repairs, a one-stage repair leads to overall better symmetry and cleft lip repair outcomes. Therefore, a two-stage bilateral cleft lip repair is incorrect.

Cleft palate repair is typically performed closer to 9 to 12 months of age, therefore, cleft palate repairs at 6 to 9 months of age are less typical and irrelevant, as the two-stage repair is considered not optimal for this asymmetric bilateral cleft lip scenario.

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143. Which of the following head and neck pathologies does NOT have the potential to transform into an entity that can metastasize?

A) Ameloblastoma

B) Basal cell carcinoma

C) Bowen disease

D) Pleomorphic adenoma

E) Warthin tumor

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

The correct response is Option E.

Warthin tumors are generally located in the parotid gland; they do not transform into a malignant tumor and, thus, remain benign.

Bowen disease is a very early form of skin cancer that is easily treatable and is also referred to as squamous cell carcinoma in situ. The tumor is usually very slow-growing, but there is a small chance it could turn into squamous cell skin cancer if it is left undiagnosed or neglected. There is a known metastatic rate of this cancer.

Carcinoma ex pleomorphic adenoma is a carcinoma that arises from a primary or recurrent benign pleomorphic adenoma. It can metastasize and is highly lethal. Luckily, it is a rare cancer.

Basal cell carcinoma rarely causes metastases. There are now drugs available to treat this disease, such as hedgehog inhibitors.

Ameloblastoma is a rare odontogenic epithelial tumor that represents only approximately 1% of all jaw tumors, but it is the second most common odontogenic tumor. However, a histologically benign-appearing ameloblastoma can metastasize to local lymph nodes or other distant organs, such as the brain, lung, skin, etc.

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144. A 36-year-old patient presents with a slow-growing mass near the angle of the mandible. A CT scan shows a 5-cm cystic mass near the tail of the parotid gland. Which of the following is the most likely diagnosis?

A) Adenocarcinoma

B) Mucinous carcinoma

C) Pleomorphic adenoma

D) Reactive lymph node

E) Warthin tumor

The correct response is Option E.

Warthin tumors (lymphomatous papillary cystadenoma) are the second most common benign tumors (10%) of the parotid gland; the most common being pleomorphic adenoma (80%). Warthin tumor presents as a cystic, multifocal, and often bilateral (15 to 20%) mass in the superficial lobe of the parotid gland. The typical history is slow, painless growth. It can be seen as a cystic lesion with the gland on CT scan.

Reactive lymph nodes and pleomorphic adenomas do not appear cystic on imaging studies. Carcinomas are much less common in the parotid and may involve the facial nerve or deep lobe of the parotid. Differentiation can be done by fine-needle aspiration.

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145. A 40-year-old man presents to the emergency department with a fracture of the mandible. There is concern that he also has a cervical spine injury. Which of the following is an independent risk factor for concomitant cervical spine injury in this patient?

A) Alcohol use as the cause of the injury

B) Chest injury

C) Facial laceration

D) Personal assault as the cause of the injury

E) Symphyseal fracture

The correct response is Option B.

Concomitant cervical spine injuries (CSI) can occur with mandible fractures. CSI with mandible fractures have been reported in 4.4 to 10% of cases. Recently, independent risk factors for concomitant CSI were investigated. Results show that chest injury and ramus-condyle unit fractures are independent risk factors for concomitant CSI. Patients with mandible fractures and associated mid face/head fractures have increased risk for CSI. Additionally, the risk for concomitant CSI is increased if the cause of the trauma was non-craniomaxillofacial injury or motor vehicle collision. Although other items listed are risk factors associated with mandible trauma, they have not been found to be independent risk factors for concomitant CSI.

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146. Which of the following landmarks is most useful for identifying the main trunk of the facial nerve when performing a parotidectomy for tumor resection?

A) Erb's point

B) Infratemporal fossa

C) Mandibular notch

D) Pitanguy's line

E) Tympanomastoid suture

The correct response is Option E.

It is important to be able to identify the main trunk and distal branches of the facial nerve during superficial parotidectomy in order to spare the nerve and preserve facial motor function. Commonly used anatomic landmarks for the facial nerve include the tragal cartilage pointer, the posterior belly of the digastric muscle, the tip of the mastoid process, the stylomastoid foramen, and the tympanomastoid suture. The tympanomastoid suture (or tympanomastoid fissure), located between the mastoid and the tympanic ring of the external ear canal, begins just distal to the suprameatal spine. The facial nerve lies 6 to 8 mm distal to the end point of this suture. When the nerve cannot be located using these landmarks, the mastoid bone can be drilled to expose the mastoid portion of the facial nerve before it exits the stylomastoid foramen, or a distal branch can be traced retrograde to identify the main trunk.

Pitanguy's line is an imaginary line connecting a point 0.5 cm inferior to the tragus to a point 1.5 cm superior and lateral to the eyebrow. It is used to estimate the course of the frontal branch of the facial nerve, not the main trunk. The masseteric nerve, a branch of cranial nerve V3, crosses the mandibular notch between the condyle and coronoid of the mandible to innervate the masseter muscle. Erb's point is located on the posterior border of the sternocleidomastoid muscle and is the location where the four superficial branches of the cervical plexus, including the greater auricular, lesser occipital, transverse cervical, and supraclavicular nerves emerge from behind the muscle. The infratemporal fossa lies anterior and deep to the facial nerve, and is located at the base of the skull. Cranial nerve V3 and its branches, the inferior alveolar nerve, lingual nerve, and buccal nerve, as well as the chorda tympani nerve, and the otic ganglion are contained in the infratemporal fossa.

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147. Which of the following genetic mutations is most likely to be found in a patient with orofacial clefting and popliteal pterygium?

A) Gain-of-function mutation in *FGFR2*

B) Gain-of-function mutation in *NF1*

C) Gain-of-function mutation in *PIK3CA*

D) Loss-of-function mutation in *IRF6*

E) Loss-of-function mutation in *TCOF1*

The correct response is Option D.

IRF6 mutations that result in loss-of-function have been reported in both syndromic Van der Woude syndrome as well as nonsyndromic orofacial clefting; Van der Woude syndrome can include popliteal pterygium.

PIK3CA gain-of-function mutations have been reported with venous malformations and lymphatic malformations. Mutations in *TCOF1* are associated with Treacher Collins syndrome; these patients may have cleft palate, but they do not have lip pits. Gain-of-function mutations in *FGFR2* have been implicated in syndromic craniosynostosis (Apert syndrome, Crouzon syndrome, and others). Mutations in *NF1* result in increased RAS/MAPK signaling and neurofibromatosis type 1.

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148. A 2-month-old infant is referred for evaluation because he has an abnormal head shape. Physical examination shows low-set ears; short, webbed fingers; and duplicate great toes. A CT scan shows sagittal and lambdoid synostosis. A mutation in which of the following genes is most likely responsible for these findings?

A) *FGFR1*

B) *FGFR2*

C) *FGFR3*

D) *RAB23*

E) *TWIST1*

The correct response is Option D.

This child has Carpenter syndrome. This syndrome is caused by a mutation in the *RAB23* gene, which is located on chromosome 6. Carpenter syndrome is inherited in an autosomal recessive manner, but it can also be caused by *de novo* mutation in *RAB23*. In addition to synostosis, symbrachydactyly and preaxial polydactyly are found in patients with Carpenter syndrome.

Mutations in the other genes listed are all associated with syndromic craniosynostoses. Fibroblast growth factor receptor (FGFR) mutations have been associated with several differing syndromes: *FGFR1* mutations cause Pfeiffer syndrome, *FGFR2* mutations cause Apert and Crouzon syndromes, and *FGFR3* mutations cause Muenke syndrome. A mutation of the *TWIST1* gene causes Saethre-Chotzen syndrome.

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149. A 6-month-old girl is evaluated because of facial asymmetry with right cheek enlargement. Imaging confirms an infantile hemangioma of the parotid gland. There is no bleeding, and she is otherwise feeding and developing normally. Which of the following is the most appropriate immediate treatment in this patient?

A) Calcium channel blockers

B) Laser therapy

C) Percutaneous sclerotherapy

D) Surgical resection

E) Observation alone

The correct response is Option E.

Infantile hemangiomas are one of the most common infant tumors. Hemangiomas of the parotid gland often surround the facial nerve and are difficult to resect completely. Luckily many parotid hemangiomas resolve on their own without the need for resection.

Beta-adrenergic blockers can be effective in decreasing the size for symptomatic or large hemangiomas with minimal side effects. The parotid hemangiomas are too deep for significant improvement with laser treatment. After involution, a small portion of children with a history of infantile parotid gland hemangioma have excess skin that requires surgical reduction. Percutaneous sclerotherapy has a role in the management of venous malformations, but not hemangiomas.

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150. A 25-year-old man sustained a laceration to the face from a knife in an altercation 1 year ago. He did not receive treatment at the time of injury and now has complete left unilateral facial nerve transection and paralysis. Placement of an upper eyelid gold weight is necessary for eye protection. Which of the following is the appropriate location for placement of the weight?

A) Between the tarsal plate and conjunctiva

B) Centered over the junction of the central and lateral one-third of the eyelid

C) Deep to the levator aponeurosis and superficial to the tarsal plate

D) Immediately superior to the tarsal plate

E) Superficial to the levator aponeurosis and tarsal plate

The correct response is Option E.

The appropriate location for placement of an upper eyelid gold weight is superficial to the levator aponeurosis and tarsal plate, with the inferior edge of the gold weight within a few millimeters of the lash line. It is placed centered over the junction of the medial and central one-thirds of the eyelid and medial limbus.

Lagopthalmos, or the inability to completely close the eyelids, is a common problem after facial nerve transection. The most common surgical treatment modality of lagopthalmos is placement of an upper eyelid gold or platinum plate to weigh down the upper eyelid, allowing for complete eyelid closure, precluding dessication and corneal damage.

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Section 4: Breast and Cosmetic

151. A 42-year-old woman with no significant medical history comes to the office to request chemical face peeling for facial rejuvenation. Physical examination shows Fitzpatrick Type III skin, moderate photodamage, and mild rhytides. A medium-depth chemical peel using 40% trichloroacetic acid is recommended. Which of the following is the most appropriate level of penetration of the skin layer in this type of peel?

A) Entire epidermis to the basal layer

B) Papillary dermis with or without the upper reticular dermis

C) Part or all of the mid reticular dermis

D) Stratum corneum with stratum granulosum

E) Stratum corneum without stratum granulosum

The correct response is Option B.

Chemical peeling is the application of a chemical agent of a defined strength, resulting in predictable accelerated exfoliation and skin damage. The depth of penetration depends on the acid concentration and the timing of application and is categorized based on the histologic depth of necrosis.

Chemical peel classification is based on the depth of penetration as follows: superficial very light peel (involving the stratum corneum with or without the stratum granulosum), superficial light peel (involving the entire epidermis to the basal layer), medium-depth peel (through the epidermis and papillary dermis with or without the upper reticular dermis), and deep peel (part or all of the mid reticular dermis).

Trichloroacetic acid (TCA) is a self-limited peel that does not require neutralization. The concentration of TCA is most predictive of the depth of peel: 10 to 25% for intra-epidermal effect and 30 to 40% for penetration to the papillary dermis.

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152. A 53-year-old woman is evaluated for left-sided nipple reconstruction after mastectomy. She has scars on the left breast from a previous breast biopsy, as well as from the mastectomy itself. Nipple reconstruction must be designed around the scars. In single-pedicle nipple reconstruction, which of the following provides the blood supply to the pedicle?

A) Internal mammary artery perforators

B) Posterior intercostal arteries

C) Subdermal plexus

D) Superior intercostal artery

E) Thoracoacromial artery perforators

The correct response is Option C.

Single-pedicle nipple reconstructions, which include such techniques as the skate flap, star flap, C-V flap, and opposing tab flaps as well as other variations, create nipples from remaining mastectomy skin through adjacent tissue transfer. The flap derives its blood supply from the subdermal plexus.

The creation of the flap must keep this blood supply in mind. The flap design must avoid previous scars at the flap base and must integrate the subcutaneous fat at the base of the pedicle.

The internal mammary artery supplies the breast itself and the nipple-areola complex, and the thoracoacromial artery supplies the pectoralis muscle and the breast. The posterior intercostal arteries supply the intercostal spaces. The superior intercostal artery arises from the costocervical trunk, off of the subclavian artery, and supplies the intercostal spaces.

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153. A 44-year-old previously healthy woman comes to the clinic because of a 2-week history of a painless mass in the left breast. She initially felt this mass while taking a shower. Her mother was diagnosed with fibrocystic changes. The patient denies alcohol consumption and smoking cigarettes. Examination of the left breast shows a 5-cm mobile, painless mass in the left upper external quadrant without nipple discharge, skin retractions, or color changes. Examination of a specimen obtained on biopsy discloses a phyllodes tumor, and surgical excision of the lesion is planned. Which of the following is the most important factor to prevent local recurrence after surgery?

A) Adjuvant radiotherapy

B) Concurrent axillary node dissection

C) Postoperative chemotherapy

D) Surgical margins less than or equal to 0.5 cm

E) Wide surgical margins

The correct response is Option E.

In a young woman who has no history of breast cancer, presents with a painless mass, and has a mammogram suggestive of fibroadenoma but a core needle biopsy showing stromal hypercellularity with atypical spindle cells and a high mitotic rate, a phyllodes tumor must be suspected.

Phyllodes tumors are uncommon fibroepithelial breast tumors that behave like benign fibroadenomas, although they have a high propensity to recur locally. More aggressive tumors can metastasize distantly. Surgery is the preferred treatment for this condition. In this context, surgical margins greater than or equal to 1 cm have been associated with a lower recurrence rate in borderline and malignant tumors.

Axillary lymph node involvement is rare. Wide local excision or mastectomy with appropriate margins is the preferred clinical intervention.

Based on limited data, the role of systemic chemotherapy in phyllodes tumors is limited. Patients with benign or borderline phyllodes tumors are usually cured with surgery and should not be offered chemotherapy unless they develop unresectable metastases.

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Local recurrence rate is higher after excision with narrower margins than broader ones. The efficacy of postoperative adjuvant radiotherapy for a breast phyllodes tumor is not clear. In clinical practice, the utilization of adjuvant radiotherapy for a phyllodes tumor appears to be modest.

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154. A 17-year-old woman wants improvement of a large dorsal hump, hanging columella, and bulbous tip with vertically oriented lower lateral cartilages. The patient refuses the use of septal cartilage grafts. Which of the following surgical maneuvers will best avoid a dorsal inverted V deformity?

A) Internal silicone splint

B) Lateral crus mattress suture

C) Subdomalgraft

D) Tongue-in-groove tip support

E) Upper lateral spanning sutures

The correct response is Option E.

The inverted V deformity refers to the visibility of the caudal edge of the nasal bones caused by collapse of upper lateral cartilages. Dorsal reduction rhinoplasty removes the structural support provided by the connection of the dorsal septum to the paired upper lateral cartilages. The lateral cartilages have a tendency to then splay, distort, and collapse posteriorly. This can narrow the internal nasal valve and cause airway narrowing as well as aesthetic distortion of the dorsal aesthetic lines. Following takedown of a dorsal hump, upper lateral spanning sutures are used to re-establish the proper relationship of the dorsal medial edges of the upper lateral cartilages and the septum.

Use of spreader grafts will also re-establish this anatomy; however, it requires harvesting cartilage from the septum, more extensive surgery, and increased complications. In patients who require a wider angle at the internal nasal valve, the excess dorsal aspect of the upper lateral cartilages can be folded over on itself to create its own spreader graft, avoiding the need for a septal graft.

Tongue-in-groove refers to overlapping the medial crura onto the caudal septum. With an adequate caudal septum, this replaces the need for a columella graft but it will not effectively prevent inverted V deformity.

A subdomal graft is used to control the shape of the nasal tip. The cartilage removed from the dorsal hump can be used for this purpose without formal septal harvesting but the risk for a dorsal inverted V deformity does not change.

Lateral crus mattress sutures are used to straighten a concave or convex lateral crus.

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Internal nasal splints are used to provide temporary postoperative support of the septum following septoplasty.

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155. During pan-facial chemical peeling with phenol-croton oil, a 63-year-old patient develops premature ventricular contractions that progress into ventricular tachycardia. Which of the following actions would most likely have prevented the arrhythmia in this patient?

A) Addition of hexachlorophene to the peel solution

B) Application of the peel solution over a period of 60 minutes

C) Infusion of intravenous midazolam

D) Nasal administration of oxygen

E) Screening of the patient by age

The correct response is Option B.

The traditional Baker-Gordon chemical peel formula consists of an organic acid, phenol (also known as carbolic acid), capable of coagulating dermal collagen and a powerful vesicant, croton oil. It has been used by lay individuals since the 1930s and by aesthetic plastic surgeons during the last several decades. Among the complications of deep chemical peels, such as the Baker-Gordon formula, are cardiac arrhythmias, which occur in 6.6% of patients, according to one study.

Among the various factors that influence the development of cardiac arrhythmias, none except for the rapidity with which the peel is applied have been found to be significant. If greater than 50% of the face is to be peeled in one session, the solution should be applied zone by zone over a period of 60 minutes. In some instances, the arrhythmia is self-limited and does not require any intervention. In approximately two-thirds of the affected patients, intravenous lidocaine is administered to control the arrhythmia.

Supplemental oxygen, use of intravenous sedation, age of the candidate, and use of surfactants (e.g. Septisol®) in the solution have not been shown to affect the development of arrhythmia.

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156. A 48-year-old man presents with a history of 140-lb (63.5-kg) weight loss and moderate upper extremity adiposity with skin excess. Brachioplasty is performed. One week postoperatively, the patient reports numbness of the area in the image shown. Which of the following nerves is most likely affected in this patient?

A) Inferior lateral

B) Lateral antebrachial

C) Medial antebrachial

D) Posterior antebrachial

E) Posterior brachial

The correct response is Option C.

The medial antebrachial cutaneous nerve represents the sensory distribution shown in the illustration of the arm. This includes the skin of the anterior and medial surface of the forearm as far down as the palmar side of the wrist. This nerve also innervates the medial and posterior sides of the elbow area. Due to its anatomical course, the nerve may become easily injured.

The medial antebrachial cutaneous nerve originates from roots C8 and T1, and it branches from the medial cord of the brachial plexus just distal to the medial brachial cutaneous nerve and just proximal to the ulnar nerve. The nerve descends into the arm anterior and medial to the brachial artery. It lies on the ulnar side next to the biceps muscle as it runs distally. The nerve branches into an anterior and posterior branch just proximal and anterior to the medial epicondyle. The nerve provides sensation to the medial forearm and includes an anterior and a posterior branch. The posterior branch provides sensation to the resting surface of the elbow

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and forearm. The anterior division is expendable for graft material. Injury to this nerve during surgical procedures can lead to sensory loss and painful neuroma formation.

The adjacent sensory distribution includes:
Lateral/anterior: lateral antebrachial cutaneous nerve
Lateral/posterior: posterior antebrachial cutaneous nerve
Distal/anterior: palmar cutaneous branch of ulnar nerve
Distal/posterior: dorsal cutaneous branch of ulnar nerve

The lateral antebrachial cutaneous nerve is incorrect. It originates from C5, C6, and C7 and is the terminal part of the musculocutaneous nerve. It innervates the lateral forearm.

The inferior lateral cutaneous nerve arises from C5 and C6 and branches from the radial nerve to provide sensory and vasomotor innervation to the lower lateral aspect of the arm.

The posterior brachial cutaneous nerve arises from C5, C6, C7, and C8 and branches from the radial nerve to innervate the posterior aspect of the arm.

The posterior antebrachial nerve originates from roots C5, C6, C7, and C8 and branches from the radial nerve just distal to the posterior brachial cutaneous nerve in the axilla. It provides sensation to the posterior cutaneous aspect of the forearm.

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157. A patient with facial skin laxity and rhytides is a candidate for radiofrequency (RF) skin tightening of the face. Which of the following best describes the beneficial rejuvenating effect of RF treatment?

A) Disruption of tissues with sonic vibrations

B) Promotion of collagen contraction and remodeling

C) Reduction of subcutaneous fat without damage to other tissues

D) Scattering of energy by epidermal constituents

The correct response is Option B.

A steadily increasing number of noninvasive tools is being developed and promoted for altering and rejuvenating the face and body. These modalities use various sources of energy, including radiofrequency (RF) energy, ultrasonic waves, laser technology, and cryolipolysis.

RF energy uses high-frequency, alternating electrical currents to alter biological tissue. RF delivers energy deep into the skin, causing collagen remodeling and neocollagenesis through a controlled wound-healing response. It minimizes the scattering of energy by epidermal constituents.

Ultrasonic energy devices disrupt tissues with sonic vibrations. Cryolipolysis reduces subcutaneous fat without damaging other tissues.

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158. A 27-year-old woman who underwent augmentation mammaplasty with 325-mL textured prostheses one year ago comes to the clinic because her breasts look asymmetric and feel hard. Physical examination shows firm asymmetric breasts with palpable capsules. No pain, signs of skin infection, hematoma, or seroma are observed. Hypertrophic scars are seen on the inframammary fold of both breasts. Which of the following factors is the most likely cause of capsular contracture in this patient?

A) Implant size

B) Patient history of hypertrophic scarring

C) Subclinical infection with biofilm formation

D) Submuscular positioning of the implants

E) Textured implants

The correct response is Option C.

On the basis of her clinical presentation, this patient is experiencing Baker Grade III capsular contracture. Capsular contracture is the most common complication after breast implant placement. This is a multifactorial complication; however, only subclinical infection with biofilm formation has a clear correlation with a higher degree of capsular contracture.

Implant size is not directly associated with an increased risk for clinically significant capsular contracture, and it has been established that textured implants are associated with a decreased risk. There is no clear evidence of a relation between a patient's tendency to scar and an increased risk for capsular contracture. It is accepted that submuscular placement leads to lower rates of capsular contracture than the subglandular technique.

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159. A healthy 45-year-old woman presents for consultation for mastopexy. Examination of the breasts shows grade II ptosis, large areolae, and dense breast tissue. No prior surgical scars are noted. An inverted T mastopexy is planned. On the day of surgery, the angle of the vertical limbs has to be marked wider than anticipated because of the large areolae. The large angle of divergence of the vertical limbs most likely increases the risk for which of the following?

A) Lower pole deformity

B) Nipple-areola malposition

C) Nipple-areola slough

D) Parenchymal fat necrosis

E) Pedicle overresection

The correct response is Option A.

For a patient undergoing a full-scar, inverted T skin resection as part of mastopexy, large areolae may require that the vertical limbs diverge more widely than would otherwise be necessary to tighten excess skin. This can create lower pole deformities such as flattening or boxiness.

The position of the nipple-areola complex is usually set at the Pitanguy point—the level determined by transposition of the inframammary crease onto the breast—and is not affected by large areolae in a patient who is a candidate for inverted T mastopexy. Necrosis of tissues such as the nipple-areola complex or breast parenchyma relate to surgical technique and preservation of blood supply to these areas. Pedicle overresection can lead to nipple-areola necrosis and is a result of poor surgical technique in developing the pedicle; pedicle design and resection are independent from the design of skin resection, as seen in this patient.

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160. A 27-year-old woman comes to the office for large-volume liposuction of the abdomen, back, hips, and thighs. She has no history of medical issues. Tumescent liposuction using an infiltrate that contains lidocaine is performed. Thirty minutes into the procedure, the patient is noted to have tremors and a seizure. Several minutes later, the anesthesiologist states that the patient has a ventricular arrhythmia. Administration of which of the following agents is most appropriate for this patient?

A) Dantrolene

B) Flumazenil

C) Lipid emulsion

D) Naloxone

E) Steroids

The correct response is Option C.

The patient is experiencing local anesthetic systemic toxicity related to the lidocaine infiltration. Patients experience nervous system effects and can progress to cardiovascular effects. Early findings associated with lidocaine toxicity include perioral numbness, metallic taste, anxiety, muscle twitching, and seizures. Cardiovascular findings can include tachycardia and hypertension that can progress to ventricular arrhythmias and, ultimately, asystole.

Treatment of lidocaine toxicity includes advanced cardiac life support and administration of a bolus of 20% lipid emulsion.

Dantrolene is used for the treatment of malignant hypothermia. Flumazenil is used as an antidote for benzodiazepine overdose. Naloxone, an opioid antagonist, is used to treat an overdose due to opioids. Corticosteroids have been proposed along with supportive therapy for the treatment of fat embolism.

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161. A 62-year-old woman with no medical or ophthalmologic history is scheduled for cosmetic bilateral upper and lower eyelid blepharoplasty under local anesthesia (1% lidocaine with 1/100,000 epinephrine) with intravenous sedation. The procedure is uneventful. At the end of the procedure, the patient develops new-onset bilateral mild lagophthalmos. Stimulation of which of the following structures is the most likely cause of this lagophthalmos?

A) Corrugator supercilii muscles

B) Levator palpebrae superioris muscle

C) Preseptal orbicularis oculi muscle

D) Superior rectus muscle

E) Superior tarsal muscle

The correct response is Option E.

Eyelid muscles are innervated by the facial nerve (cranial nerve VII), the oculomotor nerve (cranial nerve III), and sympathetic nerve fibers.

Sympathetic fibers contribute to upper eyelid retraction by innervation of the superior tarsal muscle, also known as the Müller muscle. Sympathetic fibers also innervate the inferior tarsal muscle, contributing to lower lid retraction. The superior tarsal muscle was stimulated by the epinephrine of the local anesthesia, causing temporary mild upper lid retraction.

The oculomotor nerve (cranial nerve III) innervates the main upper eyelid retractor, the levator palpebrae superioris muscle, via its superior branch. Oculomotor nerve is one of the four cranial nerves that transmit parasympathetic fibers.

The facial nerve (cranial nerve VII) innervates the orbicularis oculi, frontalis, procerus, and corrugator supercilii muscles, and supports eyelid protraction. The temporal and zygomatic branches of the facial nerve supply the orbicularis oculi, the main eyelid protractor. The facial nerve also supplies the corrugator supercilii and the procerus, both of which secondarily contribute to upper eyelid protraction.

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162. A previously healthy 13-year-old girl is brought to the clinic because of a painful and progressively enlarging axillary mass. Examination of a specimen previously obtained on biopsy showed hyperplastic glandular tissue without cytological atypia in the reticular dermis and subcutaneous tissue. Which of the following is the most likely diagnosis?

A) Accessory mammary tissue

B) Fibroadenoma

C) Juvenile hypertrophy

D) Juvenile papillomatosis

E) Lipoma

The correct response is Option A.

Accessory breast tissue typically occurs along the embryonic milk line and often enlarges during periods of hormonal stimulation, such as puberty. The rapid enlargement can be associated with pain. Histopathology shows glandular tissue and receptor staining is positive for estrogen and progesterone.

Fibroadenoma presents as a firm, rubbery nodule, usually within the ectopic breast, and histopathology shows epithelial and stromal proliferation.

Juvenile hypertrophy is progressive enlargement of the breasts during puberty, defined as greater than 3% of total body weight or greater than 3.3 lb (1500 g). Histopathology is similar to gynecomastia, with increased stromal collagen and fat.

A lipoma can present similarly to ectopic mammary tissue but histopathology would show mature adipose tissue.

Juvenile papillomatosis ("Swiss cheese disease") was first described in 1980 and presents clinically similar to a fibroadenoma. Papillomatosis and epithelial hyperplasia, as well as sclerosing adenosis and cysts, are characteristic on histopathology. Approximately 10% of patients with juvenile papillomatosis will develop a malignancy. Although it occurs in pediatric patients, it is actually more common in adults.

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163. A 28-year-old woman with history of lipodystrophy of the abdomen and waist is scheduled for suction-assisted lipectomy under general anesthesia. On the day of surgery, the anesthesiologist is planning intravenous fluid management of the patient and requests more information about the volume infusion plan for the wetting solution. The surgeon anticipates 1.5 L of lipoaspirate. For employment of a superwet technique, which of the following is the appropriate amount of fluid for the patient to receive in subcutaneous tissue infiltration?

A) 0 mL

B) 375 mL

C) 750 mL

D) 1500 mL

E) 3000 mL

The correct response is Option D.

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

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

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164. A 58-year-old woman is evaluated one week after undergoing a rhytidectomy with superficial musculoaponeurotic system flap advancement and plication of the platysma. She reports that the right lower ear is completely numb. Physical examination shows ecchymosis over the right sternocleidomastoid muscle. There is no palpable hematoma. Which of the following is the most appropriate next step in management?

A) Corticosteroid injection in the area of ecchymosis

B) Electrodiagnostic examination of the great auricular nerve

C) Exploration and nerve repair

D) Release of superficial musculoaponeurotic system sutures in the neck

E) Observation

The correct response is Option E.

Early transient numbness to the lower ear is common following rhytidectomy. In the vast majority of these patients, spontaneous return of sensation occurs within 6 months. These patients should be observed.

The early numbness to the ear lobule is most consistent with an injury to the great auricular nerve. The etiology of these symptoms may represent a neuropraxia due to manipulation, suture entrapment, axonotmesis, or neurotmesis. The great auricular nerve supplies sensation to the ear lobule, concha, and posterior auricle. If a nerve laceration is identified during surgery, a primary epineural repair should be performed.

Postoperative surgical exploration is indicated for prolonged (longer than 6 months) numbness with allodynia. This pain can be a chronic burning or a localized pain at the point of nerve injury (Tinel sign). The key to minimizing the occurrence of these injuries is to know the anatomy of the great auricular nerve and its possible variations. A useful recommendation is to place all platysma/superficial musculoaponeurotic system suspension and flap sutures posterior to a line drawn from McKinney's point to a point 1.5-cm posterior to the insertion of the ear lobule. McKinney's point refers to the location where the great auricular nerve crosses the mid transverse belly of the sternocleidomastoid muscle at a point 6.5-cm below the caudal edge of the bony external auditory canal.

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Electrodiagnostic studies are not indicated at this early stage of numbness. Surgical exploration and suture release is not indicated because the vast majority of these symptoms will spontaneously resolve. NSAIDs can be tried for prolonged pain; however, corticosteroid injection for early postoperative numbness is not indicated.

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165. A 35-year-old woman with symptomatic macromastia comes to the office to request bilateral reduction mammaplasty. She reports no history of breast biopsy or prior chest surgery. BMI is 25 kg/m^2. Physical examination shows grade II ptosis with loss of upper pole fullness and good skin laxity, thus the decision is made to perform a bilateral reduction mammaplasty using a superomedial pedicle technique. Which of the following is the dominant blood supply to the nipple after this procedure?

A) Acromiothoracic artery

B) Lateral thoracic artery

C) Perforators of the internal thoracic artery

D) Posterior intercostal arteries

E) Superficial thoracic artery

The correct response is Option C.

The major blood supply from a superomedial pedicle to the nipple is the first through fourth perforators of the internal thoracic artery. The perforators originate from the first through fourth interspaces. The second perforating branch is considered the principal vessel.

While these vessels form anastomoses with branches from the lateral thoracic artery, the anastomoses are severed in the process of forming the superomedial pedicle.

The acromiothoracic artery does supply the skin arising along the free lower border of the pectoralis major muscle, but this is not involved in the perfusion of the nipple using the superomedial technique.

The posterior intercostal arteries have not been shown to reliably supply blood to the nipple-areola complex.

Although the superficial thoracic artery is similar in nature to the lateral thoracic artery in the branches supplying the nipple, the vessels are transected in the process of forming a superomedial pedicle.

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166. A 28-year-old man presents with concerns of excess fullness of the lower abdomen and flanks. He is not interested in undergoing any surgical intervention. Noninvasive body contouring with cryolipolysis is planned. Which of the following is the most appropriate description of the mechanism of action of this treatment?

A) Adipocyte apoptosis with inflammatory cell infiltration

B) B cell lymphocytes tissue invasion at 3 months

C) Cellular edema and increased Na-K-ATPase activity

D) Cytosolic calcium level depletion

E) Peak cellular inflammation at 7 days

The correct response is Option A.

Cryolipolysis is one of the most recent forms of noninvasive fat reduction to emerge. "The development behind cryolipolysis stems from the clinical observation of cold-induced panniculitis." In this technique, an applicator is applied to the targeted area and set at a 44 degrees Fahrenheit temperature for a preset period of time. This targets adipocytes while sparing the skin, nerves, vessels, and muscles.

The initial insult of crystallization and cold ischemic injury induced by cryolipolysis is further compounded by ischemia reperfusion injury, causing generation of reactive oxygen species, elevation of cytosolic calcium levels, and activation of apoptotic pathways.

This cold ischemic injury may promote cellular injury in adipose tissue via cellular edema, reduced Na-K-ATPase activity, reduced adenosine triphosphate, elevated lactic acid levels, and mitochondrial free radical release.

Another mechanism proposes that, ultimately, crystallization and cold ischemic injury of the targeted adipocytes induce apoptosis of these cells and a pronounced inflammatory response, resulting in their eventual removal from the treatment site within the following weeks.

Most studies demonstrate an inflammatory response at different stages after cryolipolysis, with inflammatory cell infiltrates peaking at 30 days.

Histologic studies show that within 3 months, macrophages are mostly responsible for clearing the damaged cells and debris.

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167. A 54-year-old woman is evaluated for nipple-areola complex reconstruction after mastectomy and silicone implant-based reconstruction. During discussion of the risks and benefits of a C-V flap, the patient asks about the long-term results of different techniques. Which of the following is the most likely long-term complication of a single-pedicle nipple-areola reconstruction?

A) Atrophic scarring

B) Delayed nipple necrosis

C) Hypertrophic scarring

D) Implant exposure

E) Loss of projection

The correct response is Option E.

Single-pedicle nipple reconstructions, which include techniques such as the skate flap, star flap, C-V flap, and opposing tab flaps as well as other variations, create nipples from remaining mastectomy skin through adjacent tissue transfer. The flaps derive their random-pattern blood supply from the subdermal plexus.

The creation of the flap must keep this blood supply in mind. The surgical technique must avoid previous scars at the base of the flap design and must integrate the subcutaneous fat at the base of the pedicle.

While hypertrophic and atrophic scarring can occur, they are not the most common long-term effects, and are more a function of patient characteristics than flap characteristics.

Implant exposure can occur with scar breakdown, but this is an early rather than a late complication.

Delayed nipple necrosis is technically not correct because the nipple is no longer present, and is not correct of the nipple reconstruction because necrosis of the flaps, if it occurs, usually occurs early.

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168. A patient with a history of breast cancer undergoes nipple-sparing mastectomy of the right breast with immediate implant-based reconstruction. Ten months after surgery, the patient starts to recover sensitivity at the nipple. Which of the following nerves is most likely providing sensitivity to the nipple-areola complex in this patient?

A) Anterior branch of the fourth intercostal nerve

B) Anterior branch of the second intercostal nerve

C) Lateral branch of the fifth intercostal nerve

D) Lateral branch of the fourth intercostal nerve

E) Lateral branch of the second intercostal nerve

F) Lateral branch of the third intercostal nerve

The correct response is Option A.

The nipple and areola of the breast are innervated by both the anterior and lateral cutaneous branches of the third, fourth, or fifth intercostal nerves. The anterior and lateral cutaneous branches of the second and sixth intercostal nerves innervate breast skin only.

In anatomical studies conducted in female cadavers, the fourth intercostal nerve's lateral cutaneous branch supplied the nipples in 93% dissected breasts. The third and fifth intercostal lateral branches were found to innervate the nipple alone in 3.6%. However, the fourth intercostal lateral branch penetrates the deep fascia in the midaxillary line, takes an inferomedial course to reach the midclavicular line, and continues through the glandular tissue towards the posterior surface of the nipple. Thus, when a mastectomy is performed, this lateral branch is the most likely one to be dissected.

On the other hand, the anterior cutaneous branches take a superficial course, as they run in the subcutaneous tissue close to the skin and reach the nipple from the lateral side. According to this, the anterior branch of the fourth intercostal nerve is most likely providing sensitivity to the nipple-areolar complex after nipple-sparing mastectomy.

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169. A 32-year-old woman is evaluated 4 years after undergoing bilateral augmentation mammaplasty with 375-mL, textured, shaped gel implants. She is concerned because over the past 3 months her left breast has grown one cup size larger than her right. On examination, there is no erythema or palpable mass. The left breast is much larger and firmer than the right. The patient started taking an oral contraceptive 6 months ago. Which of the following is the most likely diagnosis?

A) Breast implant–associated anaplastic large cell lymphoma

B) Capsular contracture

C) Double capsule

D) Drug-induced breast hypertrophy

E) Phyllodes tumor

The correct response is Option C.

This patient presents with a late seroma (more than 1 year after surgery) following augmentation mammaplasty with textured implants. The most common reason for this late seroma is a benign process related to the textured implant. A double capsule forms when the textured implant surface breaks away from its attachment to the breast parenchyma and forms a double capsule, which can then fill with blood or fluid. This phenomenon can be caused by a known trauma or in the course of daily living.

The possible etiologies for any late seroma include trauma, infection, inflammation, and malignancy. The first step in evaluation is ultrasound and aspiration of the fluid. The fluid should be evaluated for tumor markers (flow cytometry, CD30 T-cell surface protein) and sent for cytology and bacteriology.

This patient could have breast implant–associated anaplastic large cell lymphoma (BIA-ALCL). BIA-ALCL is rare, and it is highly unlikely that this patient has this lymphoma. Nonetheless, it must be ruled out. All patients presenting with a late seroma (more than 1 year after surgery) need to be evaluated for tumor markers. If the patient tests positive, full oncologic evaluation is needed.

Capsular contracture can cause hardening and deformity of the breast; however, it will not cause breast enlargement. A phyllodes tumor presents as a localized breast mass that can grow rapidly. This patient has no palpable masses.

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Oral contraceptives can cause unilateral breast enlargement, but this patient is presenting with massive breast enlargement 6 months after starting birth control pills.

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170. A 65-year-old woman is evaluated for inferior scleral show appearing 4 weeks after undergoing lower eyelid blepharoplasty. Preoperative examination shows the presence of a positive lower eyelid vector, horizontal lid laxity, and a retropositioned globe. The patient is euthyroid and is treated for open-angle glaucoma. Which of the following findings is most likely to predispose to the development of post-operative lower lid malposition?

A) Euthyroid status

B) Horizontal lid laxity

C) Open-angle glaucoma

D) Positive lower eyelid vector

E) Retropositioned globe

The correct response is Option B.

Complications arising as a result of blepharoplasty can be categorized as early (occurring during the first postoperative week), intermediate (occurring between the first and sixth postoperative weeks), and late (occurring after the sixth postoperative week).

Among the intermediate post-blepharoplasty complications, lower eyelid malposition is the most commonly reported. It results from the imbalance in tension between the anterior and posterior lamellae. Widely regarded predisposing factors include: negative vector in which the orbital rim is retropositioned relative to the vertical plane of the cornea, excessive skin resection, aggressive imbrication of the orbital septum, thyroid ophthalmopathy (e.g. Graves disease) with exophthalmos, excessive and/or persistent edema, and hematoma.

Horizontal laxity of the tarsoligamentous sling is the most likely predictor of lower eyelid malposition after lower eyelid blepharoplasty. It reflects the loss of normal upward, posterior, and superior tension across the lower eyelid margin. When this condition exists, manifested by a "snap test" in which the lid can be manually distracted anteriorly more than 8 mm away from the globe, surgical correction of horizontal eyelid laxity should be addressed during the lower eyelid blepharoplasty. This is accomplished with a tarsal strip procedure or similar form of canthoplasty. The euthyroid status with or without globe retropositioning of this patient confers less risk than hyperfunctioning thyroid conditions such as Graves in which exophthalmos increases the potential for lower eyelid malposition. A retropositioned globe will not affect the lower lid as much as the upper lid. Medical conditions such as glaucoma do not influence lower eyelid position.

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171. A 56-year-old woman presents for a consultation for upper and lower blepharoplasty. She notes that she has a history of dry eyes. Abnormal production of which of the following is the most likely contributor to this patient's condition?

A) Lipids

B) Lymph

C) Mucin

D) Protein

E) Sebum

The correct response is Option A.

The tear film is comprised of three layers: an outer lipid layer, a middle aqueous layer, and an inner mucin layer. The meibomian glands produce the outer lipid layer, which prevents tears from evaporating. Thus, meibomian gland dysfunction can lead to dry eyes. Anatomically, Meibomian glands appear posterior to the tarsal plate with an opening at the eyelid margin. The aqueous layer lubricates the eye and helps clear debris. The mucin layer, closest to the cornea, both nourishes the cornea and allows smooth distribution of tears.

Although sebum is often confused with meibum, or meibomian gland secretions, it is not the same. Sebum blockage of the meibomian glands can cause meibomian gland dysfunction. Thus, sebum is incorrect because while sebum can block the Meibomian glands, it is specifically the Meibomian gland dysfunction which causes the dry eye.

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172. An otherwise healthy 25-year-old woman underwent an augmentation mammaplasty 1 year ago and developed what appeared to be a mild infection on the right side, which initially responded to antibiotics. In the past year, she has returned to the clinic several times with recurrence of erythema which does not respond to antibiotic therapy. Formation of a biofilm is suspected. Bacteria in a biofilm are more resistant to antibiotic treatment because of which of the following factors?

A) Development of intracellular drug efflux systems

B) Expression of enzymes that degrade antibiotics

C) Horizontal transfer of resistance genes

D) Slow bacterial growth rate

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

The correct response is Option D.

The two main mechanisms for antibacterial recalcitrance of biofilm-encased bacteria are antimicrobial tolerance and resistance. There are a host of reasons why bacteria survive once they have secreted and are surrounded by an extracellular polymeric substance (EPS), and one important mechanism is antimicrobial tolerance. This is the ability of bacteria to survive despite a known susceptibility to an antibiotic. Once encased in the EPS, bacterial growth rate and metabolism slow. This decreases the efficacy of antibiotics such as beta-lactam, which depend on rapid bacterial division to function. Also, once encased in the EPS, resident bacteria down-regulate membrane proteins, which antibiotics target.

Antibiotic resistance plays a part in biofilm bacterial survival and has to do with inherent characteristics of bacteria allowing the bacteria to survive in the presence of an antibiotic. This resistance may be enhanced by the horizontal transfer of extracellular DNA in the EPS, or through the expression of enzymes that degrade antibiotics. Also, bacteria may develop drug efflux systems that can decrease the antibiotic concentration in the cell.

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173. A 25-year-old woman comes to the office to discuss gluteal fat grafting. BMI is 27.5 kg/m^2. She is otherwise healthy. Which of the following surgical techniques will most likely minimize this patient's risk for a fatal pulmonary fat embolism?

A) Avoid intramuscular injection of fat

B) Centrifuge fat prior to grafting

C) Inject fat only when the cannula is stationary

D) Use a grafting cannula size greater than or equal to 2 mm

E) Use a long cannula to avoid multiple incisions

The correct response is Option A.

Gluteal fat grafting continues to be a commonly requested operation. There is a significantly higher mortality associated with this operation than any other aesthetic operation. The vast majority of these deaths are caused by a fatal pulmonary fat embolism.

The most common causative mechanism is a mechanical tear of a large gluteal vein followed by either intravascular injection of fat or migration of extravascular fat into an injured vein by a pressure gradient. Avoiding intramuscular fat injection greatly reduces the risk for fatal pulmonary embolism.

Surgical technique recommendations for minimizing fatal pulmonary embolism include avoiding injecting into the muscle, using a single-hole cannula greater than 4.1 mm in diameter, avoiding downward angulation of the cannula, and only injecting when the cannula is in motion.

Long injection cannulas that are narrower than 4 mm may bend and inadvertently perforate the muscle. Whether the harvested fat is centrifuged or decanted will not significantly minimize the risk for death.

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174. A 62-year-old man with a history of pseudoherniation of the lower eyelid fat pad undergoes a bilateral blepharoplasty with a transconjunctival approach to manage the fat compartments and the pinch blepharoplasty technique to manage excess lower eyelid skin. During the procedure, the surgeon notes difficulty in locating the medial fat pad on the right side despite aggressive dissection. Three weeks postoperatively, the patient comes for follow-up and continues to have difficulty with elevating, abducting, and extorting the eye. Which of the following muscles was most likely injured during the procedure?

A) Inferior oblique

B) Inferior rectus

C) Pretarsal orbicularis oculi

D) Superior oblique

E) Superior rectus

The correct response is Option A.

The inferior oblique muscle is a thin, narrow skeletal muscle near the anterior margin of the floor of the orbit. This extraocular muscle is attached at its origin, maxillary bone, and the posterior, inferior, lateral surface of its insertion, and eye. The inferior oblique muscle receives its innervation by the inferior branch of the oculomotor nerve. This muscle moves the eye by extorsion, elevation, and abduction. The primary action of the inferior oblique muscle is extorsion/external rotation; secondary action is elevation; tertiary action is abduction. This muscle serves as the primary partition between the medial and central fat compartments of the lower eyelid. Careful identification and preservation of the muscle is important during lower eyelid surgery. In this case, the surgeon likely injured the muscle when having difficulty with fat resection of the medial fat pad.

The inferior rectus muscle is responsible for depressing, adducting, and extorting the eye. The orbicularis oculi muscle is responsible for closing the eye. The superior oblique muscle is responsible for intorsion, depression, and abduction. The superior rectus is responsible for elevation, adduction, and intorsion.

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175. A patient comes to the office because he is interested in rhinoplasty. He is generally satisfied with the shape of his nose when he is in repose, but he says that his nose becomes distorted when he laughs or talks. Which of the following muscles is the most likely cause of this finding?

A) Corrugator supercilii

B) Depressor septi nasi

C) Levator labii alaeque nasi

D) Orbicularis oris

E) Procerus

The correct response is Option B.

The depressor septi nasi originates on the upper lip and inserts at the base of the nose on both the septum and alae. When this muscle contracts in animation, it may pull the tip of the nose down, decrease the nasolabial angle, and elevate the upper lip. The labii alaeque nasi dilates the nostrils and lifts the upper lip. The procerus muscle lies between the eyebrows and functions to depress the medial eyebrows. Contraction creates the horizontal wrinkle at the nasion. Finally the corrugator supercilii is a pyramidal shaped muscle on the medial part of the supraorbital ridge which, when contracted, moves the eyebrows medially creating vertical wrinkles between the eyes.

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176. A 45-year-old woman is evaluated because of asymmetry of the chest during physical activity. Medical history includes bilateral augmentation mammaplasty with silicone implants approximately 10 years ago. She recently began an aggressive exercise regimen that includes long-distance running and weight training. The patient's major aesthetic concern is that the implants distort the appearance of her breasts during weight training exercises. Which of the following is the best treatment for this patient?

A) Remove and replace the implants with more cohesive silicone gel implants

B) Remove and replace the implants with saline implants

C) Remove the implants and insert them in the subglandular plane

D) Remove the implants and insert them in the subpectoral plane

E) Remove the implants, perform bilateral capsulectomy, and insert new silicone implants

The correct response is Option C.

Muscle contraction deformity and implant displacement are corrected with the removal of the implant and placement into a newly created subglandular plane from the current subpectoral plane. The deformity described is typical in patients involved in heavy weight training in which the pectoralis muscle is repeatedly activated.

Moving the implants from the subpectoral plane into the subglandular plane will compress the subpectoral pocket, thus preventing movement into the previous pocket. In addition, the pectoralis muscle may be resuspended to prevent fluid accumulation.

Removal and replacement of the implants with more highly cohesive implants may improve any rippling that may be seen, but it will not improve the animation deformity. Removal and replacement with saline implants will not make any significant improvements in the muscle-induced deformity. While capsulectomy may improve capsular contraction, it does not address the deformity cause by repeated pectoralis activation.

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177. A 52-year-old woman is scheduled for an oncoplastic reduction mammaplasty for ductal carcinoma in situ. The patient wants to keep the native nipple-areola complex, and the plan is to design the resection to maintain the blood supply to the nipple-areola complex. Which of the following arteries is the most common dominant blood supply to the nipple-areola complex?

A) Internal thoracic

B) Musculophrenic

C) Posterior intercostal

D) Superior intercostal

E) Thoracoacromial

The correct response is Option A.

Multiple cadaver studies have examined the blood supply to the nipple-areola complex (NAC). Most studies have found that the internal thoracic artery is the dominant blood supply, anastomosing with other arteries in the anterior fat.

In a study of diagnostic MRIs ultimately given a Breast Imaging Reporting and Data System (BI-RADS) I classification, review of the blood supply to the NAC demonstrated that 53.9% of the MRIs showed medial blood supply only to the NAC, and 42.30% had multi-zone, medial with lateral blood supply. A fresh cadaver study noted the dominant blood supply branches from the internal and external thoracic arteries, and another cadaver study demonstrated that the internal thoracic arteries are the primary source of NAC perfusion. The intercostal arteries do supply the breast, but have not been shown to be dominant. The thoracoacromial artery, a branch of the axillary artery, has four major divisions: pectoral, acromial, clavicular, and deltoid. The pectoral branch also supplies the breast, and anastomoses with the intercostal arteries and lateral thoracic arteries.

A study of women who underwent nipple-sparing mastectomy with preoperative MRI demonstrated that a dominant medial blood supply occurred 71.3% of the time, and a dual blood supply occurred almost 80% of the time. NAC necrosis was less likely to occur in patients with a dual blood supply to the breasts.

Understanding common anatomy and variants allows the surgeon to plan operative approaches. Intraoperatively, surgeons can verify adequate perfusion to the NAC by using indocyanine green fluorescence angiography or fluorescein infusion.

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178. A 38-year-old woman undergoes abdominoplasty surgery. During the procedure, the surgeon notes significant midline diastasis recti abdominis and opts to repair the defect from the level of the xyphoid process to just above the symphysis pubis. To decrease the pain associated with the procedure, the surgeon decides to administer bupivacaine liposome injectable suspension. For optimal pain control, which of the following planes above the level of the umbilicus is the most appropriate site of injection?

A) At the anterior rectus sheath

B) Between the external abdominal oblique and internal abdominal oblique muscles

C) Between the internal abdominal oblique and transverse abdominal muscles

D) Between the transversalis fascia and preperitoneal fat

E) Between the transverse abdominal muscle and the transversalis fascia

The correct response is Option C.

A recent finding emphasizes the two-wound model after abdominal surgery. The first model is the somatic wound which corresponds to the abdominal wall. The second model is the autonomic wound which corresponds to the peritoneal layer and visceral component.

The intercostal nerves (arising from T6 to T12) and ilioinguinal/iliohypogastric nerves (arising from L1) provide sensation to the abdominal wall. These nerves are easily blocked throughout their course between the abdominal muscles.

After emerging from the paravertebral space, the intercostal nerves are located coursing between the transversus and the internal abdominal oblique muscles. This anatomic plane is called the transversus abdominis plane (TAP). At the anterior superior iliac spine, the ilioinguinal and iliohypogastric nerves, which were previously located in the TAP move to the space between the internal abdominal oblique and external abdominal oblique muscles. These nerves provide sensation to the inguinal region along with the skin around the pubic symphysis.

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179. A 31-year-old woman with micromastia comes to the office to discuss bilateral augmentation mammaplasty. Which of the following surgical plans will most likely minimize the risk for breast implant–associated anaplastic large cell lymphoma?

A) Highly cohesive silicone gel

B) Nipple shields

C) Saline implants

D) Smooth wall implants

E) Subpectoral pocket

The correct response is Option D.

It is extremely rare, if ever seen, to have a diagnosis of breast implant–associated anaplastic large cell lymphoma (BIA-ALCL) in a smooth implant–only case. In those BIA-ALCL cases with smooth wall implants, the patient's past surgical history revealed the use of textured implants (where adequate documentation was available).

Aggressive texturing (macrotexturing) is associated with a higher risk for BIA-ALCL. One theory is related to increased surface area and therefore higher numbers of bacteria.

The most common presentation for BIA-ALCL is a patient presenting with a late seroma (usually greater than one year). Workup requires aspiration of the seroma followed by cytologic evaluation of the fluid and flow cytometry looking for CD30 T-cell surface protein, which is an ALCL tumor marker.

Highly cohesive silicone gel, saline implants, and the type of implant pocket do not significantly impact the incidence of BIA-ALCL.

Nipple shields and antibacterial irrigation can lower the incidence of bacterial contamination and MAY play a part in reducing biofilm, capsule contracture, and possibly BIA-ALCL. This impact on BIA-ALCL is unknown and being investigated. There are multiple documented cases of BIA-ALCL in patients with textured implants who underwent antibacterial irrigation to reduce bacterial contamination. Nonetheless, avoiding textured implants is the most likely strategy for minimizing BIA-ALCL.

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180. A 55-year-old woman with a *BRCA* gene mutation elects to undergo bilateral mastectomy with reconstruction using a deep inferior epigastric perforator flap. BMI is 41 kg/m^2. Physical examination shows both supra- and infraumbilical adiposity with excess skin and a mature cesarean delivery scar. This patient has the highest risk for which of the following early postoperative complications?

A) Abdominal wall bulge

B) Abdominal wall hernia

C) Delayed wound healing of donor site

D) Fat necrosis of the flap

E) Flap failure

The correct response is Option C.

The highest risk is for delayed wound healing of the donor site. Because of the patient's morbid obesity and prior cesarean delivery scar, she has the highest risk for some form of wound breakdown or prolonged wound healing. This risk can be as high as 50 to 60% for morbidly obese patients. These trends are similar in patients following reconstruction with a transverse rectus abdominis musculocutaneous (TRAM) flap.

To reduce these risks, minimal undermining is recommended and only done if necessary. Techniques to preserve all cutaneous perforators will help reduce the risk associated with closure of the donor sites.

While morbid obesity can be associated with increased abdominal wall thickness, there is no correlation with the occurrence of abdominal wall bulge or hernia. The risks for these complications are less than 2%.

Patients with morbid obesity can have shorter operative times, but there is no correlation with overall flap failure, with rates reported to be less than 1%. This is also seen in pedicled and free TRAM flap reconstructions.

Rates of fat necrosis of the flap can be as high as 10 to 15% in patients undergoing reconstruction, but this risk is not affected by body habitus or body mass index and is lower than the risk for delayed wound healing.

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181. Which of the following rhinoplasty techniques is most likely to result in alar rim notching, retraction, or collapse?

A) Cephalic trim of the lower lateral cartilages

B) Failure to place a columellar strut graft

C) Failure to place spreader grafts

D) Inadequate transdomal sutures

E) Migration of a cartilage tip onlay graft

The correct response is Option A.

Of all of the options, the only one that would affect the appearance of the alar rims is the maneuver that affects the lower lateral cartilages. Weakened or overly resected lower lateral cartilages would have a tendency to result in deformities of the alar rims.

Migration of a cartilage tip onlay graft, failure to place a columellar strut graft, and inadequate transdomal sutures would affect the appearance of the nasal tip.

Failure to place spreader grafts would affect the internal nasal valve but have minimal change to the appearance of the nose.

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182. A 39-year-old woman presents for an abdominoplasty. She has a family history of thrombosis. Her only current medication is an oral contraceptive. BMI is 26 kg/m2. Which of the following factors has the largest impact on this patient's risk for deep venous thrombosis?

A) Abdominoplasty

B) Age

C) BMI

D) Family history of thrombosis

E) Oral contraceptive use

The correct response is Option D.

It is recommended that plastic surgeons use the 2005 Caprini scale to assess the risk for deep venous thrombosis. On the basis of this scale, the patient's family history of thrombosis contributes three points to her overall Caprini score.

The patient's age, BMI, and use of birth control pills each contribute 1 point to her score.

Abdominoplasty would be considered a major surgery since the time for surgery is longer than 45 minutes. As a result, this would contribute two points to the patient's Caprini score. While many surgeons consider abdominoplasty to carry one of the highest risks for deep venous thrombosis, this conclusion has not been supported by a review of the literature.

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183. A 64-year-old woman is evaluated because of right-sided epiphora. Examination shows the condition of the patient's eyelids is appropriate for her age. Which of the following is the best diagnostic evaluation to determine if this patient has nasolacrimal duct obstruction?

A) Goldmann tonometry

B) Jones test

C) Optical coherence tomography

D) Seidel test

E) Snap-back test

The correct response is Option B.

The best diagnostic test for nasolacrimal duct obstruction is the Jones test. The Jones I test evaluates lacrimal outflow under normal physiologic conditions. Fluorescein dye is instilled into the conjunctival cornice. The dye is then recovered from the nose after 5 minutes by asking the patient to blow their nose. Absence of dye from the Jones I test could mean a false-negative result, physiologic dysfunction, or anatomic obstruction. A Jones II test is performed following an unsuccessful Jones I test. For the Jones II test, the residual fluorescein is flushed from the conjunctival sac with clear saline. The investigator then asks the patient to expel the drainage from the pharynx and determines the presence or absence of fluorescein in the retrieved saline fluid. Absence of fluorescein indicates a complete nasolacrimal duct obstruction or canalicular obstruction.

The snap-back test is incorrect because it tests horizontal lower eyelid laxity. It is performed by displacing the lower eyelid inferiorly. With normal laxity, it almost immediately snaps back into place against the globe. With increased laxity, the lid will require one or more blinks to resume the normal apposition.

Optical coherence tomography is a noninvasive imaging test that uses light waves to take cross-section pictures of the retina.

The Seidel test can detect leaking aqueous or exposed vitreous. Fluorescein ophthalmic strips are wet with normal saline. The fluorescein is dark orange but becomes bright green under blue light when it comes in contact with aqueous.

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Goldmann tonometry measures intraocular pressure. A prism mounted on the tonometer head is placed against the cornea. When an area of 3.06 mm has been flattened, the opposing forces of corneal rigidity and the tear film are approximately equal and cancel each other out. The intraocular pressure can then be calculated.

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184. A 23-year-old woman comes to the office because she is interested in augmentation mammaplasty. Physical examination shows a right-sided sunken anterior chest wall, hypoplasia of the right breast with a superiorly placed nipple-areola complex, normal pectoralis muscle, and normal sternal position. This patient most likely has which of the following congenital deformities?

A) Amastia

B) Anterior thoracic hypoplasia

C) Pectus carinatum

D) Pectus excavatum

E) Poland syndrome

The correct response is Option B.

Amastia refers to an uncommon developmental condition in which the breast and nipple are absent. Some women are immediately given the diagnosis of Poland syndrome or pectus deformity when they exhibit abnormalities of the anterior chest wall. Poland syndrome involves an abnormal pectoralis muscle while pectus deformities do not. Pectus deformities involve alteration in the appearance or location of the sternum and its costal attachments. Another less commonly realized diagnosis is that of anterior thoracic hypoplasia in which patients share the same characteristics of unilateral sunken anterior chest wall, hypoplasia of the breast, superiorly placed nipple-areola complex, normal pectoralis muscle, and normal sternal position.

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185. Which of the following deformities in a patient with nasal airway obstruction is best treated with a spreader graft?

A) Bulbous tip

B) Dorsal nasal hump

C) External orifice laxity

D) Inferior turbinate hypertrophy

E) Internal nasal valve narrowing

The correct response is Option E.

All of the options can create decreased airflow on inspiration and can be improved with surgical maneuvers. The spreader graft placed between the septum and upper lateral cartilages is used to increase the internal nasal valve angle, thereby increasing inspiratory nasal air flow. Septal deviation could cause airway obstruction, but would best be treated with a septoplasty to remove septal cartilage narrowing the airway on the affected side. Significant inferior turbinate hypertrophy would be treated surgically with either fracture or resection, and external skin laxity or external nasal valve collapse would best be treated with stabilization using a cartilage graft on the lateral alar segment. Placing a spreader graft to widen the internal valve would not improve airflow in any of the other choices. Dorsal nasal hump and bulbous tip are not addressed by this maneuver.

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186. A 30-year-old woman of Nordic heritage is interested in laser hair removal of "peach fuzz" on the upper lip. She has Fitzpatrick Type I skin and is very fair, with light blonde hair and blue eyes. Which of the following is the most appropriate technique for hair removal for this patient?

A) Alexandrite laser (755 nm)

B) Electrolysis

C) Intense pulsed-light

D) Long-pulse ruby laser (694 nm)

E) Nd:YAG laser (1064 nm)

The correct response is Option B.

Laser hair removal targets the melanin in the hair follicle. It is not useful in fair-haired patients who have low levels of melanin in their hair follicles.

Although all the devices listed here have been employed for hair reduction, only electrolysis would be likely to work in this patient.

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187. A 13-year-old girl is brought to the office by her mother who is concerned about the child's patchy hair loss. The mother began to notice the hair loss shortly after she separated from the patient's father. The patient states she often plays with her hair throughout the day. Which of the following is the best course of treatment for this patient's hair loss?

A) Administration of topical minoxidil 5% daily for six months

B) Injections of platelet-rich plasma to areas of baldness

C) Injections of triamcinolone to areas of baldness

D) Referral to a psychiatrist

E) Transplantation of follicular units

The correct response is Option D.

This patient most likely has trichotillomania, an impulse-control disorder. This is likely associated with a change in the patient's social situation, namely the loss of involvement of her father in her life.

The other treatment options do have proven benefits in restoring hair loss, but the best course of treatment is first addressing the underlying cause, and referral to a psychiatrist would be the most appropriate step.

This patient has signs of telogen effluvium, alopecia caused by emotional stress. With appropriate psychiatric or psychological therapy, she should be expected to stop traumatizing her hair, and its growth would return.

The other options can improve thinning hair for various other causes, but they would not be the first course of treatment for this patient.

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188. A 25-year-old woman comes to the clinic to discuss eyebrow reconstruction. She reports that she tweezed her eyebrows several times a day because of perceived asymmetry, and she now has complete loss of eyebrows. She insists on receiving hair transplants and says that she is depressed because of her lack of eyebrows. Which of the following is the most likely DSM-5 diagnosis?

A) Body dysmorphic disorder

B) Borderline personality disorder

C) Excoriation (skin-picking) disorder

D) Major depressive disorder

E) Trichotillomania

The correct response is Option A.

Body dysmorphic disorder is considered an obsessive compulsive and related disorder in the DSM-5. Criteria include preoccupation with perceived appearance flaws for at least an hour a day, repetitive behaviors related to the preoccupation, clinically significant distress as a result of the preoccupation, and exclusion of an eating disorder.

The differential diagnosis includes major depressive disorder, trichotillomania, excoriation disorder, agoraphobia, eating disorders, and dysmorphic concerns. What differentiates body dysmorphic disorder from excoriation disorder and trichotillomania is the underlying preoccupation with symmetry and appearance seen in body dysmorphic disorder. In some cases, patients report a pleasurable sensation during hair pulling in trichotillomania. Thus, patients with body dysmorphic disorder can engage in skin picking and hair pulling, but the underlying motivation is different. Excoriation disorder is a body-focused repetitive behavior, on the obsessive compulsive spectrum, but it is not motivated by perceived asymmetry or appearance as is body dysmorphic disorder.

Depression can coexist with body dysmorphic disorder, but it does not have a preoccupation with appearance as a criterion.

Borderline personality disorder is a Cluster B personality disorder, characterized by unstable emotional responses to stimuli and relationships.

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189. A 45-year-old woman who underwent bilateral breast augmentation mammaplasty returns to the office after a motor vehicle accident with deployment of airbags. Physical examination shows point tenderness over the chest with an obvious "seat belt" sign along the left breast. The immediate diagnostic workup of the implants shows no rupture. Six months later, the patient returns with distortion of the left breast over the implant with a cleft formation. Which of the following is the most appropriate next step in assessing the integrity of the implants?

A) Chest x-ray study

B) CT scan with intravenous contrast

C) Mammography

D) MRI

E) Ultrasound

The correct response is Option D.

The patient has a late presentation of seat belt syndrome, which requires an MRI to assess the integrity of the breast implants. Patients with seat belt syndrome may present with a cleft or a mass. It is important to rule out invasive ductal carcinoma located in the line of the diagonal contracture. An intracapsular seroma can form gradually over time as well. Reconstructive options include unilateral capsulectomy and implant exchange.

Chest x-ray study can be used in a more immediate setting to rule out any bony injury to the chest wall. Mammography is an appropriate choice in patients who have a palpable mass in an initial assessment; however, this does not rule out implant rupture. In the event that there is an expanding breast in the immediate setting, CT scan with intravenous contrast can be used to rule out possible arterial extravasation or pneumothorax. Ultrasound can be used to assess implant or capsule rupture, but MRI is the most definitive investigative study.

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190. A 35-year-old woman is evaluated because of persistent nasal airway obstruction after undergoing nasal airway surgery and rhinoplasty 6 months ago. Physical examination, including anterior rhinoscopy, demonstrates a midline septum and nasal dorsum with no evidence of nasal valve collapse. Which of the following nasal airway procedures is most commonly associated with empty nose syndrome?

A) Inferior turbinate electrocautery

B) Inferior turbinate resection

C) Microdebrider inferior turbinoplasty

D) Radiofrequency ablation inferior turbinoplasty

E) Submucosal resection septoplasty

The correct response is Option B.

The nasal airway procedure most commonly associated with empty nose syndrome is inferior turbinate resection.

Empty nose syndrome is a clinical syndrome characterized by recalcitrant and paradoxical symptoms of nasal obstruction and suffocation despite a widely patent nasal airway. It is encountered as a postsurgical phenomenon associated with the loss of nasal tissues. This condition is also associated with a significant psychological burden. While the etiology of the condition remains unclear, its association with nasal surgeries, particularly with surgical manipulation of the inferior turbinate, is well-documented. Appreciation of this potential clinical syndrome may help nasal surgeons avoid secondary interventions that are potentially low-yield.

While empty nose syndrome has been reported after a great variety of nasal surgeries, it is most commonly associated with over-aggressive resection of the inferior turbinate. Patients with empty nose syndrome have a significantly smaller inferior turbinate volume compared to control groups on CT analysis. While any inferior turbinate surgery could potentially result in empty nose syndrome, it is much less commonly associated with submucosal reductions of the glandular tissue of the inferior turbinate. Microdebrider inferior turbinoplasty, radiofrequency inferior turbinoplasty, and electrocautery inferior turbinoplasty all represent different energy sources to accomplish the submucosal reductions from inferior turbinate hypertrophy.

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All inferior turbinoplasties, compared with inferior turbinate resections, are less commonly associated with empty nose syndrome and maintain the bony structure and mucosal coverage of the inferior turbinate. A recent meta-analysis suggests there are no differences between the two most common techniques, microdebrider and radiofrequency, in overall efficacy for nasal obstruction. Similarly, the risk for complications, including persistent nasal obstruction (including the possibility of empty nose syndrome), between these two techniques is similar. Septoplasty is the most common nasal surgery for nasal obstruction, and the submucosal technique is the most frequently employed. This technique has the advantage of maintaining the nasal mucosa while repairing the structural causes of nasal airway obstruction.

Submucosal resection septoplasty is incorrect because there are limited reports of empty nose syndrome associated with septoplasty.

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191. A healthy 45-year-old woman with a history of breast malignancy underwent bilateral mastectomy and reconstruction with tissue expanders followed by exchange for cohesive silicone gel implants eight years ago with routine postoperative MRI surveillance. She comes to the office to report pain and tightness in the right breast that has gradually increased over the past month. On examination, temperature is 36.8°C (98.2°F), blood pressure is 112/76 mmHg, and heart rate is 68 bpm. The right breast appears fuller than the left breast; otherwise, the right implant is in a symmetric position with the left side. The skin is otherwise normal in appearance, and there is no tenderness on palpation. Which of the following is the most appropriate next step in management?

A) MRI of the right breast to assess the integrity of the implant

B) One week of an oral antibiotic and prednisone taper

C) Operative exploration, culture, and replacement of implant

D) Referral of the patient back to her medical and surgical oncologists

E) Ultrasound of the right breast and fine-needle aspiration of any fluid

The correct response is Option E.

Patients that present with a late seroma should be evaluated for possible Breast implant associated Anaplastic Large Cell Lymphoma (BI-ALCL). A late seroma is usually accepted as occurring 1 year following surgery: however there are cases of BI-ALCL seroma that have presented as early as 4 months.

The first step in evaluation for BI-ALCL is an ultrasound followed by fine needle aspiration is indicated. The fluid requires evaluation beyond routine cell cytology. Immunohistochemistry test for CD30 was the most commonly positive marker for BI-ALCL. Immunohistochemistry stains specific antigens in cells by binding to this antigen in an antibody/antigen reaction. The specific stain can then be seen under light microscopy. CD30 antibody labels anaplastic large cell lymphoma cells. CD30 is a transmembrane cytokine receptor belonging to the tumor necrosis factor receptor family and characteristically stains ALCL cells.

MRI for implant integrity and referral to her Oncologist may be needed but it is not the most appropriate next step. BIA-ALCL needs to be ruled out. Immediate operative exploration is not indicated before fluid aspiration and immunohistochemistry evaluation. Antibiotics and prednisone is not indicated in this patient without evidence of infection or inflammation (red breast syndrome).

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192. A 59-year-old woman is evaluated because of an asymptomatic lesion on her scalp that she reports has been rapidly growing over the past 3 months. History does not include any similar masses. The patient reports no drainage or other symptoms. A dermatologist performed an incisional biopsy, and examination of the specimen identified the mass as a dermatofibrosarcoma protuberans. A photograph is shown. Which of the following is the minimum surgical resection margin needed to achieve the lowest risk for local recurrence?

A) 1 mm

B) 4 mm

C) 1 cm

D) 2 cm

E) 4 cm

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

The correct response is Option E.



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Dermatofibrosarcoma protuberans (DFSP) is a rare type of soft-tissue sarcoma that develops in the deep layers of the skin. Because the histologic margins typically extend beyond the gross margins due to tentacle-like projections, the surgical margins for resection are recommended to be greater than 3 cm.

Post-ablation margins are considered to be adequate when the thickness of the tissue from the tumor bed is at least 2.5 cm. Thus, a marginal resection on less than 2.5 cm can increase the recurrence rate by 50%.

During the course of resection, the deep fascia layers can be removed if involved in the area that is violated. In the setting of head and neck cancer, the goals of wide local excision may require sacrificing neurovascular structures. Patients usually require one surgery; however, reconstruction may be delayed until negative histological margins are achieved.

Reconstructive options include skin grafting or flap procedures depending on the size and location of the defect.

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193. A 63-year-old man undergoes microdermabrasion for scar irregularity following treatment of facial skin cancer. Which of the following intraoperative findings signals the endpoint of treatment?

A) Cobblestoned, yellow adiposity

B) Confluent patches of bleeding lakes on a yellowish background

C) Minimal dermis with visible subdermal plexus

D) Pinpoint, punctate bleeding on a white background

E) Thinned but present epidermis

The correct response is Option D.

When performing microdermabrasion, the most appropriate endpoint is removal of soft tissue into the papillary dermis. The appropriate level in the papillary dermis is visualized as pinpoint bleeding in a white dermal background. Epithelial removal would be insufficient. Removal of tissue into the reticular dermis, either superficial or deep, increases the risk for scarring. The superficial reticular dermis demonstrates a yellowish white coloration and would reinforce the need to discontinue treatment before deeper injury occurs. Furthermore, dermal excisional depth would manifest as confluent red bleeding in a yellowish background of dermis or nearly complete dermal removal with a visible subdermal vascular plexus. If a full-thickness skin removal is performed (into the subcutaneous adipose layer), significant deformity could result. Preservation of adnexal structures to allow reepithelialization is a key tenet in determining the appropriate depth of treatment. Posttreatment changes include thickened epidermis and increased elastin and collagen.

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194. A post-bariatric surgery patient with excess medial arm skin is scheduled to undergo posteromedial scar-approach brachioplasty. Which of the following is the most likely advantage of this method of brachioplasty compared with other techniques?

A) Hidden location of the surgical scar

B) High mechanical stress on the surgical incision and scar

C) High risk for surgical scar widening and hypertrophy

D) Long surgical scar length

The correct response is Option A.

The brachioplasty or arm reduction approach for this type of patient would entail making a longitudinal excision of skin and subcutaneous fat running the full length of the arm, from axilla to elbow.

Brachioplasty is a body-contouring procedure often done in bariatric surgery patients who demonstrate laxity and tissue excess of the arms following weight loss.

The brachioplasty approach utilizing the posteromedial incision has been shown to minimize tension on the surgical incision, which leads to better scarring and less visibility of the arm scars.

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195. Incomplete involution of the mammary ridge during embryonic development is most likely to result in which of the following?

A) Amastia

B) Gynecomastia

C) Inverted nipple

D) Poland syndrome

E) Polymastia

The correct response is Option E.

The breast develops as the result of bilateral thickening of ectoderm along the milk line, or mammary ridge, from the axillary to the inguinal region. Mammary buds begin to develop as growths within the epidermis and invade the deeper mesenchyme. Much of the ridge disappears as the embryo develops as the result of apoptosis, except for the primary buds in the pectoral regions. Failure of regression of the mammary ridge can result in accessory breasts (polymastia) or accessory nipples (polythelia). Accessory breast tissue occurs in 1 to 2% of live births and commonly occurs in the axillae.

Amastia is the complete absence of the mammary gland. This occurs due to either the failure of the mammary ridge to develop or the complete involution of the mammary ridge.

Gynecomastia is defined as benign enlargement of the male breast. While pathologic cases can exist, it is most typically due to a normal response of the breast tissue to circulating levels of estrogen.

Inverted nipples are due to failure of the mesenchyme to proliferate above the level of the skin.

Poland syndrome can have the following components: hypoplasia of the breast and nipple, absence of the sternocostal portion of the pectoralis major muscle, absence of the pectoralis minor muscle, abnormalities of the chest wall, and anomalies of the upper extremity. Many etiologies have been hypothesized, with the most widely accepted being an interruption of the embryonic blood supply to the upper limb.

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196. A 30-year-old woman comes to the office for follow-up one week after undergoing bilateral reduction mammaplasty. She has no other medical history. Preoperative pregnancy test was negative. On examination, both breasts appear swollen and edematous, and thick, milky discharge is expressed from the nipples. The patient denies fever or malaise. Which of the following laboratory values is most likely to be increased?

A) C-reactive protein

B) Estrogen

C) Human chorionic gonadotropin

D) Prolactin

E) White blood cells

The correct response is Option D.

The postoperative finding of milky discharge from both breasts suggests galactorrhea, a rare but known complication after breast surgery. The etiology of galactorrhea can be multifactorial, with stimulation of prolactin secretion as the pathophysiologic basis of the symptoms. Breast manipulation, periareolar incisions, and irritation of the fourth intercostal nerve have all been implicated as origins of the afferent signals to the pituitary gland, stimulating prolactin secretion. Treatment with bromocryptine is usually undertaken.

Estrogen levels and human chorionic gonadotropin levels would be increased in pregnancy and are less likely to be increased in this recent postoperative patient, assuming a preoperative pregnancy test was negative. The symptoms of pain, edema, and bilateral breast swelling in the absence of fever and redness should alert the surgeon to a diagnosis of galactorrhea; an increased prolactin level would be diagnostic. In the absence of infection, white blood cell count and C-reactive protein levels would be normal.

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197. An otherwise healthy 34-year-old woman who underwent liposuction of the abdomen, flanks, and thighs three days ago is evaluated because of shortness of breath, confusion, and a petechial rash. Temperature is 38.2°C (100.8°F), blood pressure is 110/80 mmHg, heart rate is 100 bpm, respiratory rate is 16/min, and oxygen saturation is 89%. Which of the following is the most likely cause of this patient's symptoms?

A) Drug reaction

B) Fat embolism

C) Lidocaine toxicity

D) Sepsis

E) Thrombocytopenia

The correct response is Option B.

Fat embolism is a rare complication after liposuction that presents with three classical symptoms: respiratory distress, cerebral dysfunction, and petechial rash. Symptoms generally commence 24 to 72 hours after the liposuction procedure and require urgent evaluation and management.

Lidocaine toxicity may have cerebral and respiratory changes, but a petechial rash is not common. Both a drug reaction and thrombocytopenia may manifest as petechial rashes, but neither is usually associated with significant mental changes and respiratory distress. Sepsis could manifest with the clinical symptoms listed, but with normotension and lack of significant fever, this choice is not as likely.

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198. A 43-year-old woman presents with moderately large breasts with mild ptosis, and the surgical plan is a bilateral periareolar mastopexy to minimize the length of surgical scars. Which of the following postoperative complications is most commonly associated with this technique?

A) Areolar spreading

B) Constriction of the lower pole of the breast

C) Loss of nipple-areolar sensation

D) Pseudoherniation of the nipple-areolar complex

E) Synmastia

The correct response is Option A.

Mastopexy is a procedure designed to improve the appearance of the ptotic breast. The goal is to improve breast shape while minimizing visible scars. The periareolar mastopexy is best suited for correcting very minimal degrees of mammary ptosis. When the procedure is used to attempt to correct moderate to severe ptosis, complications can occur. These include flattening of the central breast mound; widening of the areolar diameter; and irregularity, widening, and even hypertrophy of the circumareolar surgical scar. Additionally, recurrent ptosis, or "bottoming out," of the breast can occur.

Areolar spreading is the most common complication of this technique. Loss of nipple-areolar sensation is associated with breast tissue resection. Synmastia is associated with large implants, and pseudoherniation of the nipple areolar complex and constriction of the lower pole of the breast are associated with the tuberous breast deformity.

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199. A 30-year-old Hispanic man reports a gradual increase in size of his lower abdomen after undergoing two rounds of cryolipolysis on that location approximately 8 months ago at another plastic surgeon's office. He states that the large applicator was used for each treatment. His early recovery after the treatments was otherwise uneventful. He is healthy and reports that his weight has not changed significantly. Physical examination shows a well-demarcated zone of adiposity in the treated area. Which of the following factors is most likely unrelated to the patient's risk for this problem?

A) Abdomen as the site of treatment

B) Age less than 35 years

C) Hispanic background

D) Male sex

E) Use of a large applicator

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

The correct response is Option B.

Paradoxical adipose hyperplasia (PAH) is a known complication of cryolipolysis. The incidence has increased in more recent reports, ranging between one per 5000 treatment cycles and one per 500 cycles, both well beyond the manufacturer's quoted figures. Known risk factors include: use of a large applicator, male sex, Hispanic background, and abdominal location of treatment. Age has not been shown to be a factor in the development of PAH.

The treatment for PAH is power-assisted liposuction once the affected area has softened, which normally occurs 6 to 9 months after the initial cryolipolysis procedure.

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200. A 22-year-old woman presents for consideration of aesthetic breast surgery to address asymmetry. Physical examination shows a unilateral hypoplastic breast with a constricted, elevated base and a herniated nipple-areola complex. Which of the following is the most likely diagnosis?

A) Amastia

B) Micromastia

C) Poland syndrome

D) Tuberous breast

E) Virginal mammary hypertrophy

The correct response is Option D.

A tuberous breast is classically defined as hypoplastic with a constricted and elevated base, insufficient inferior skin, and a herniated nipple-areola complex.

Amastia would manifest without a nipple. Poland syndrome is classically described as missing the pectoralis muscle with variable breast and nipple effects. A constricted base and herniated areola are not usually associated with Poland syndrome. Hypertrophy would likely present with a broader base and increased volume. Micromastia would not manifest with a herniated areola.

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Section 5: Core Surgical Principles

201. A 30-year-old woman with a history of Crohn disease undergoes ventral hernia repair. BMI is 31 kg/m^2. Which of the following is the greatest risk factor for postoperative nausea and vomiting in this patient?

A) Elevated body mass index

B) Perioperative fasting

C) Placement of nasogastric tube

D) Supplemental oxygen

E) Young age

The correct response is Option E.

Postoperative nausea and vomiting remains a significant problem after cosmetic and reconstructive plastic surgery. Reported studies on the condition list incidences as high as 56%, whereas a meta-analysis found that the overall incidence was 28.3%.

For many plastic surgery procedures, general inhalational anesthesia and narcotic pain control are required and may predispose patients to postoperative nausea and vomiting (PONV).The effects can be disastrous including hematoma, incisional dehiscence, respiratory compromise, pain, longer hospital stay, slower recuperation, and patient dissatisfaction.

A number of risk factors have been associated with a positive overall incidence of PONV. Patient-specific risk factors for PONV in adults include female sex, a history of PONV, non-smoking status, young age, general versus regional anesthesia, postoperative opioids, and type of surgery.

Other factors have been disproven including placement of a nasogastric tube, peri-operative fasting, obesity, and supplemental oxygen.

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202. Which of the following scenarios represents a medical "near miss" event?

A) A patient consented for a right carpal tunnel release is surgically prepped for a left carpal tunnel release

B) A patient describes breast firmness and asymmetry three months after implant augmentation

C) A patient develops an asymptomatic pneumothorax after central venous catheter placement

D) A patient prescribed hydroxyzine is treated with hydralazine

E) A patient with a penicillin antibiotic allergy is treated with a cephalosporin antibiotic

The correct response is Option A.

This patient has the potential to suffer a wrong site surgery if time-out protocols were not established. The surgical preparation error is a near miss. A "near miss" is an unplanned event that does not result in injury, illness, or damage, but has the potential to do so.

It is within the standard of care to treat patients who report penicillin antibiotic allergies with a cephalosporin antibiotic. Patient with a true penicillin allergy have about a 10% cross-reactivity with cephalosporin antibiotics. Treating a patient prescribed hydroxyzine with hydralazine is a look-alike, sound-alike medication error. Pneumothorax after central venous catheter placement is a complication of the procedure. Breast implant contracture is an inherent risk of breast implant augmentation.

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203. A 1-year-old boy presents with a 3-cm mass on the cheek. Which of the following characteristics is most likely to support a diagnosis of lymphatic malformation in this patient?

A) Firm and rubbery to palpation

B) History of recurrent infections

C) Presence of a bruit

D) Presence of calcified phleboliths

E) Rapid growth followed by involution

The correct response is Option B.

Lymphatic malformations (LM) are benign masses of abnormal lymphatic vessels. There are many historic classifications, such as microcystic and macrocystic, as well as historic terms for specific areas affected, such as cystic hygroma, found in the head and neck. Cystic hygromas may lead to airway compromise in the newborn. LM often fluctuate in size and are frequently associated with recurrent bouts of infection. They tend to be soft and compressible on palpation, not firm and rubbery. LM are present at birth, although they might not become evident until a little later in life, especially in the lower extremities.

However, they do not follow the growth pattern of hemangiomas, specifically rapid growth (proliferation) followed by a period of involution. Treatment of LM may include observation for asymptomatic lesions, surgical resection, sclerotherapy for larger cystic structures, or laser treatment for small, superficial lesions. More recently, a mutation in the PIK3CA gene, which affects a tyrosine kinase cellular signaling pathway, has been linked to lymphatic malformations.

Further elucidation of this genetic link may lead to improved understanding and directed treatments in the future.

The presence of phleboliths is a common finding in venous malformations.

The presence of a bruit suggests the turbulent flow of an arteriovenous malformation.

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204. A plastic surgery intern is reviewing patient's charts for the week's upcoming surgical cases on her service. She realizes that a 55-year-old immediate breast reconstruction patient with diabetes and hypertension, scheduled for surgery in 4 days, was not scheduled for an anesthesia preoperative evaluation and, therefore, had no laboratory studies or electrocardiography scheduled. The intern informs the attending physicians, schedules the appointment, and then calls the patient. She and the scheduler then implement a system by which all patients age 50 years or older who have pre-existing medical problems get an anesthesia preoperative evaluation. This is an example of which of the following core competencies?

A) Interpersonal and communication skills

B) Medical knowledge

C) Patient care and procedural skills

D) Professionalism

E) Systems-based practice

The correct response is Option E.

This is an example of systems-based practice. According to the Accreditation Council of Graduate Medical Education (ACGME) milestones, system-based practice subcompetencies include the ability to:

1. Work effectively in various health care delivery settings and systems relevant to their clinical specialty,
2. Coordinate patient care within the health care system relevant to their clinical specialty,
3. Incorporate considerations of cost awareness and risk/benefit analysis in patient care,
4. Advocate for quality patient care and optimal patient care systems,
5. Work in interprofessional teams to enhance patient safety and improve patient care quality,
6. Participate in identifying systems errors and in implementing potential systems solutions.

In this scenario, the intern is demonstrating the ability to "coordinate patient care within the health care system relevant to their clinical specialty" and "participate in identifying systems errors and in implementing potential systems solutions." The other core competencies are not as relevant as systems-based practice in this scenario.

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205. A 16-year-old girl, who was born with a complete unilateral cleft of the lip, alveolus, and palate, is missing the lateral incisor within the cleft. After secondary bone grafting of the alveolar cleft, which of the following prosthetic treatments is the best option for dental restoration in this patient?

A) Nasoalveolar molding

B) Osseointegrated implant and crown

C) Palatal obturator

D) Removable partial denture

E) Three-unit fixed partial denture

The correct response is Option B.

Patients with cleft lip and palate frequently have absence of teeth in the alveolar cleft or teeth that may be grossly abnormal or that erupt at an inappropriate angle and require removal. The lateral incisors are most commonly affected, although central incisors and canines may also be affected. Alveolar bone grafting during the mixed dentition phase restores adequate bone support for subsequent placement of an endosseous titanium implant, to which a permanent crown may then be attached. Many studies have reported the efficacy and safety of this approach. This has become the dentofacial prosthetic treatment of choice for the replacement of a single tooth due to its appearance, functionality, and longevity. A removable partial denture is one that rests on the surrounding soft tissues of the alveolar ridge and palate. Although aesthetics may be reasonable, it may cause irritation of the surrounding soft tissues and may produce movement during function. It is often a temporary solution at best.

A three-unit fixed partial denture is a prosthesis which spans the gap produced by the missing tooth by anchoring to the adjacent two teeth. However, the abutment teeth often require reduction to permit fixation of the prosthesis. While certainly longer lasting than a removable partial denture, a fixed partial denture will need to be replaced periodically, and therefore would not be the best choice for this young patient.

A palatal obturator is a prosthesis used to treat a residual oronasal fistula by physically blocking air escape during speech. This decreases hypernasality. It rests on the soft tissues of the palate and may anchor to the alveolar ridge or teeth. It does not, however, play a role in dental restoration. Nasoalveolar molding is a prosthesis-based treatment used early in life, typically for wide clefts, prior to repair of the lip and palate, but it is not used for dental restoration.

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206. A multi-institutional clinical trial is gathering data on the ability of a test to determine the number of women who develop a new breast disease, and comparing this with age-matched controls. The specificity of the test is defined as which of the following?

A) The ratio of healthy subjects diagnosed as negative and the total number of healthy patients

B) The ratio of healthy subjects diagnosed as positive and the total number of sick patients

C) The ratio of sick patients diagnosed as negative and the total number of healthy patients

D) The ratio of sick patients diagnosed as negative and the total number of sick patients

E) The ratio of sick patients diagnosed as positive and the total number of sick patients

The correct response is Option A.

	Disease present	**Disease absent**
Test positive	A (true positive)	B (false positive)
Test negative	C (false negative)	D (true negative)

The sensitivity of a test is defined as the ability of a test to correctly classify an individual as diseased (positive in disease).

Sensitivity = a / a + c

The specificity of a test is the ability of a test to correctly classify an individual as disease free.

Specificity = d / b + d

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207. A 31-year-old man presents with a posterior fracture to the body of the mandible involving the alveolus of the first molar sustained during an assault. Open reduction and internal fixation of the fracture is performed. Intraoperatively, the position of the mandibular first molar in the fracture prevents an adequate reduction, and it must be extracted. Removal of how many intact tooth roots is most likely to indicate complete extraction of the mandibular molar in this patient?

A) One

B) Two

C) Three

D) Four

The correct response is Option B.

Anatomy of the mandibular first molar is relatively consistent in that the vast majority will have two roots. Knowledge of the number of roots is important in the setting of extraction to ensure complete removal. If either the injury or the reduction of the mandible fracture had caused a fracture of the tooth root itself, then complete removal of the fractured root would involve either exploration at the time of open reduction and internal fixation or postoperative referral to an oral surgeon. A retained tooth root would place the patient at high risk for abscess formation that could require additional treatment. Incisors, canines, mandibular premolars, and maxillary second premolars usually have one root. Maxillary first premolars and mandibular molars usually have two roots. Maxillary molars usually have three roots.

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208. A 36-year-old woman undergoes frontal bone cranioplasty above the glabella with a polyetheretherketone (PEEK) alloplastic implant 6 months after removal of an infected frontal bone. Medical history includes a motor vehicle trauma, large soft tissue forehead laceration repaired primarily, MRSA infection treated with 6 weeks of intravenous vancomycin, and CSF leak repaired with a pericranial flap at the time of injury. The patient does well initially but presents 2 months later with forehead wound dehiscence and purulent discharge from the previously repaired well-healed laceration. Which of the following is the primary contributing factor of this patient's infection?

A) Implant material

B) Location of cranioplasty

C) Persistent CSF leak

D) Previous soft tissue injury

E) Timing of cranioplasty

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

The correct response is Option B.

The primary factor contributing to this patient's infection is the location of the cranioplasty. The location of injury was the frontal bone which contains the frontal sinus. Failure to properly obliterate the frontonasal ducts and allowing communication between the nasal cavity (contaminated with chronic bacteria) and cranial vault (sterile). In this scenario, the frontal bone above the glabella (location of frontal sinus) is reconstructed with an implant material. Contamination from communication with the nasal cavity would be the most likely scenario of infection. Commonly, a pericranial flap is used to separate these two anatomic cavities; however, in this scenario it was necessary for it to be used to repair a CSF leak making this common technique not possible.

Based on a relatively large group of patients, Kwiecien et al. retrospectively analyzed reinfection after cranioplasty and found that there were three independent factors predictive of infection after alloplastic cranioplasty. These included preoperative chemotherapy (not present in this patient), composite skull and scalp defect (laceration only in this patient), and time interval between removal of infected bone flap and definitive reconstruction (6 months post injury). Preoperative radiation, implant material, cerebrospinal fluid leak were not independent risk factors associated with infection. Based on the author's model, the risk of

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infection decreases by 10% with each month of delay. Therefore, waiting longer between removal of an infected bone flap and definitive reconstruction carries a lower risk of infection. Six months as stated in this scenario would be adequate time to alleviate risk related to surgical timing.

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209. A newborn is noted to have a lesion of the midline of the lower back consisting of a protruding membrane which covers meninges, cerebrospinal fluid (CSF), and neural structures. Which of the following is the primary goal of surgical repair?

A) Hydrocephalus mitigation

B) Increase in lower extremity strength

C) Infection prevention

D) Prevention of tethered cord syndrome

E) Restoration of bowel or bladder function

The correct response is Option C.

Meningomyelocele is the most common neural tube defect. It involves dorsal herniation of the meninges and spinal cord through the vertebrae and may produce motor and sensory nerve deficits. It is often diagnosed prenatally by elevated maternal serum alpha fetoprotein and ultrasonography. Treatment of larger defects often involves both neurosurgery and plastic surgery teams. After repair of the neural placode, the goals of soft tissue reconstruction are to cover and protect the neural element, prevent infection, and avoid any cerebrospinal fluid leak. Ideally this is performed within the first 24 to 48 hours of life. Larger defects are often best reconstructed with muscle flaps, fasciocutaneous flaps, or a combination of both. Many different flaps have been described, but considerations for adequate vascularity (such as inclusion of perforator blood vessels within geometrically designed flaps) and closure without tension are paramount.

While hydrocephalus is a common finding in patients with meningomyelocele, it is treated with cerebrospinal fluid shunting if required.

Meningomyelocele repair does not regain or improve neural abilities that are not present at birth, such as bowel and bladder function, and lower extremity motor and sensory function.

Symptoms related to tethering of the spinal cord may develop as the patient grows in as many as 20 to 50% of children who undergo meningomyelocele repair shortly after birth and many may require surgery to release the scar tissue attached to the cord. However, this condition is not prevented by meningomyelocele repair.

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210. A 32-year-old man undergoes unilateral hand transplantation. Tacrolimus for immunosupression is initiated. On routine evaluation 6 months postoperatively, a chronic increase in creatinine and a reduction in glomerular filtration rate is noted. Which of the following is the most appropriate next step in management?

A) Discontinuation of antihypertensive drugs

B) Discontinuation of dyslipidemia drugs

C) Initiation of oral corticosteroid therapy

D) Reduction of calcineurin inhibitor trough levels

E) Tissue biopsy of the transplanted hand

The correct response is Option D.

This patient is experiencing nephrotoxicity and chronic kidney disease (CKD) from tacrolimus. Calcineurin inhibitor nephrotoxicity is a well-known phenomenon posttransplantation, and close monitoring of kidney function is essential. There are multiple described pathways of kidney damage secondary to calcineurin inhibitors including irreversible damage to all compartments of the kidney (glomeruli, arterioles, and tubule-interstitium).

Krezdorn et al. evaluated 99 recipients of facial or extremity transplantation and concluded that kidney dysfunction represents a major complication posttransplantation in vascularized composite allografts and recommends pretransplant, peritransplant, and posttransplant strategies to reduce kidney damage. These include identifying patients at risk for CKD. Pretransplantation recommendations include treating existing renal conditions, avoiding hypotension and hypertension, limiting nephrotoxic drugs, limiting intravenous contrast, and avoiding hypovolemia. Peritransplantation recommendations include minimizing use of nephrotoxic agents, avoiding hypovolemia, and limiting ischemia time. Postoperative recommendations include minimizing tacrolimus exposure including reduction of trough levels, treating hypertension, treating hyperglycemia, treating dyslipidemia avoiding intravenous contrast, and limiting potentially nephrotoxic drugs such as nonsteroidal anti-inflammatory drugs.

Therefore, in this patient, tacrolimus troughs should be reduced. Initiation of oral corticosteroids is not appropriate. The patient should remain on antihypertensive and dyslipidemia drugs.

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211. A 45-year-old woman with breast cancer is scheduled to undergo bilateral mastectomy. Immediate breast reconstruction with deep inferior epigastric perforator (DIEP) flaps is planned. Which of the following factors is most likely to increase this patient's risk for microsurgical thrombotic complications?

A) *BRCA-2* genetic mutation

B) Caprini Risk Assessment Model score of 5

C) History of prior irradiation following lumpectomy

D) History of prior thrombotic event

E) Sickle cell trait

The correct response is Option D.

Virchow recognized a triad of factors that predispose to intravascular thrombosis. These are stasis in blood flow, endothelial (intimal) damage, and intrinsic hypercoagulability. One recent review identifies a personal history of prior thrombotic event as perhaps the single greatest risk factor of a hypercoagulable state. Other known hypercoagulable disorders that can be identified by specific blood test include Factor V Leiden mutation, prothrombin gene (20210A) mutation, protein C deficiency, protein S deficiency, antithrombin III (AT3) deficiency, lupus anticoagulant, anticardiolipin antibodies, and anti-beta-2 glycoprotein 1 antibodies. These appear to increase the risk of microsurgical thrombotic complications as well. However, the severity of the increased risk for each remains to be fully elucidated. Another published series of 41 patients showed an 80% free flap success rate in patients with identified hypercoagulable states. Therefore, a thorough preoperative evaluation of patients for microvascular procedures may help to identify those at increased risk for thrombotic complications, guiding patient selection and perioperative anticoagulation therapy.

The Caprini Risk Assessment Model (RAM) is used to assess venous thromboembolism (VTE) risk, and its use has been validated in plastic and reconstructive surgery patients. The Caprini RAM score for the patient in this question is 5 (2 risk factor points for major surgery over 45 minutes, 2 points for presence of malignancy, and 1 point for ages 41 to 60). According to the recommendations of the American Society of Plastic Surgeons VTE Task Force Report, one should consider postoperative chemoprophylaxis for VTE for this patient who is at intermediate risk. However, data are lacking, which would support the use of the Caprini Risk Assessment Model as a tool to stratify risk of microvascular thrombotic complications.

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BRCA-2 genetic mutation is a heritable condition that significantly increases lifetime risk for breast and ovarian cancer. However, it has not been shown to play any role in risk for thrombotic events.

Similarly, sickle cell trait (heterozygous carrier of the sickle cell mutation in the hemoglobin-beta gene) has not been shown to increase risk for microsurgical thrombotic complications.

While chest wall irradiation might negatively impact the recipient chest wall vessels for deep inferior epigastric perforator (DIEP) flaps, the impact of radiation following a lumpectomy is very unlikely to be as significant as that of a prior personal thrombotic event.

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212. Which of the following is the most common type/location of salivary gland cancer in the pediatric population?

A) Acinic cell carcinoma/submandibular glands

B) Adenoid cystic carcinoma/submandibular glands

C) Carcinoma ex pleomorphic adenoma/minor salivary glands

D) Cystadenocarcinoma/parotid gland

E) Mucoepidermoid carcinoma/parotid gland

The correct response is Option E.

The most common type/location of salivary gland cancer in the pediatric population is mucoepidermoid carcinoma of the parotid gland. There are three sites of salivary gland carcinoma in this population including the parotid gland, submandibular glands, and minor salivary glands. In a systematic review and meta-analysis, Zamani et al. identified the frequency of various types of salivary cancer in children including the location and type. Their findings indicate that the most common site of salivary gland cancers occur in the parotid gland (72%), followed by the minor salivary glands (21%) and the submandibular glands (8%). The most common types of salivary gland cancers are mucoepidermoid carcinoma, adenoid cystic carcinoma, and acinic cell carcinoma. In all locations, mucoepidermoid cancer is the most common type (53% for parotid, 55% for submandibular gland, and 63% for minor salivary glands).

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213. An otherwise healthy 26-year-old woman undergoes zone 2 wide-awake flexor tendon repair of the right index finger. A solution of 1% lidocaine with 1:100,000 epinephrine is injected into the hand and digit. After surgical repair of the flexor digitorum profundus (FDP) tendon, the patient's finger is still pale without capillary refill. Administration of which of the following classes of drug is most likely to reverse the effects of epinephrine in this patient?

A) Alpha-adrenergic receptor activator

B) Alpha-adrenergic receptor blocker

C) Beta-adrenergic receptor blocker

D) Potassium channel activator

E) Sodium channel blocker

The correct response is Option B.

The medication that is used to reverse the effects of epinephrine is phentolamine, which is an alpha-adrenergic receptor blocker. The wide-awake *Hand Surg*ery is well described by Donald Lalonde and utilizes the effects of local anesthesia to perform a wide variety of hand-surgical procedures without general anesthesia.

An alpha-adrenergic receptor activator, such as epinephrine, could increase vasoconstriction and worsen the scenario, as could a beta-adrenergic receptor blocker. Sodium channel blockers and potassium channel activators are not indicated for reversal of epinephrine effect.

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214. A 25-year-old man presents for consultation for surgical resection of a large abdominal pannus. The patient's mother has a history of malignant hyperthermia. Which of the following best describes the inheritance pattern of this condition?

A) Autosomal dominant

B) Autosomal recessive

C) Mitochondrial

D) X-linked dominant

E) X-linked recessive

The correct response is Option A.

Malignant hyperthermia is an autosomal dominant trait, thus, based on Mendelian Genetics, if one parent has a confirmed diagnosis, their biological children will have a 50% chance of inheritance of the affected gene.

Malignant hyperthermia is a potentially life-threatening condition. Individuals with this inherited myopathy present with a hypermetabolic reaction to potent volatile anesthetic gases, such as halothane, enflurane, isoflurane, sevoflurane, and desflurane. Individuals are also susceptible to the depolarizing muscle relaxant succinylcholine. The preoperative workup for an individual with suspected malignant hyperthermia is the Caffeine-Halothane Contracture Test. In this test, a piece of skeletal muscle is excised, and its contractile properties are determined when exposed to the ryanodine receptor agonist halothane and/or caffeine. Abnormal contractile activity is indicative of susceptibility. Based on basic Mendelian Genetics, the risk of inheritance is 50%.

Given this pattern of inheritance, x-linked, autosomal recessive and mitochondrial inheritance are incorrect answers.

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215. A 24-year-old man who is hearing impaired requests to be evaluated for left cubital tunnel syndrome. The patient currently lives 2 hours away, and his mother, who usually helps interpret for him, is unable to attend the appointment. The office does not have anyone who is capable of interpreting sign language. Which of the following is the most appropriate next step?

A) Arrange a video interpreter to be available during the appointment at the office's expense

B) Decline to schedule an appointment because the office does not offer the language services requested

C) Help the patient arrange for an interpreter to be present at the appointment at his expense

D) Require the patient bring a friend or family member to help interpret during the appointment

The correct response is Option A.

The Americans with Disabilities Act (ADA) requires that reasonable accommodations are provided by businesses and in public areas to allow people with disabilities to participate in daily activities. Public places include doctors' offices. The building and spaces should accommodate all individuals regardless of disability. As a business and a public space, a doctor's office must be in compliance with the ADA. Services cannot be denied to a patient with a disability because of the disability if services could otherwise be provided. Accommodations should be made to examine the patient with a disability as any other.

In this case, treatment for a cubital tunnel syndrome, something offered routinely by this office, cannot be declined based on the patient's hearing deficit. In this case of a patient with a hearing issue, an interpreter must be provided to help with the appointment upon the patient's request. This does not necessarily need to be in-person; a video interpreter can be acceptable. The patient cannot be charged for the interpreter services whether in-person or by video. The health care provider is expected to make a reasonable effort to provide the service. While having the patient bring a friend or family member to the appointment would make the appointment easier for the physician, a patient is not required to bring anyone to help interpret for him/her.

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216. A 48-year-old man presents to the emergency department because of spontaneous progressive pain, swelling, cyanosis, and edema of the left lower extremity for the past 24 hours. A photograph is shown. Medical history includes prophylactic inferior vena cava (IVC) filter placement in the setting of prolonged immobilization secondary to traumatic closed head injury sustained 2 years ago. Physical examination shows no dyspnea. Oxygen saturation is 98% on room air. Venous ultrasonography and CT scan show total left deep femoral thrombosis extending into the lower IVC at the indwelling filter. Which of the following is the most appropriate next step in management?

A) Catheter-directed thrombolysis

B) Femoral vein to IVC vascular bypass

C) Isolated extracorporeal membrane oxygenation (ECMO) support to the affected extremity

D) Open thrombectomy

E) Oral anticoagulation

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The correct response is Option A.

The patient is presenting with extensive acute thrombotic occlusion resulting in clinically evident symptomatic venous insufficiency of the extremity. If the occlusion is left untreated, progressive cyanosis and secondary ischemia followed by gangrene develop. Locally delivered thrombolytic agents via catheter-directed thrombolysis with or without percutaneous transluminal angioplasty is an effective first line of treatment in this scenario where the patient presents within a few days of symptom onset (ie, prior to clot fibrosis) and is not high-risk for bleeding. In patients who are high-risk for bleeding (eg, acute intracerebral hemorrhage, gastrointestinal bleeding), alternative methods of restoring venous outflow include clot retrieval through other percutaneous or open techniques (eg, transluminal aspiration thrombectomy, open inferior vena cava (IVC) thrombectomy with or without temporizing groin arteriovenous fistula creation). Systemic thrombolysis can be considered when other first line therapies are not available but has been associated with high frequency of major bleeding complications in several randomized trials (14% for streptokinase).

Systemic anticoagulation infusion helps prevent progression but does not restore acute compromised ischemic limb secondary to venous outflow obstruction. Oral anticoagulation is not indicated for acute management of a limb-threatening thrombosis. Femoral vein to IVC vascular bypass is not a described procedure for venous insufficiency. Limb-threatening thrombo-occlusive venous insufficiency resulting in a painful swollen blue leg, such as that pictured (also known as “phlegmasia cerulea dolens,” literally "painful blue edema") was first described with heparin-induced thrombocytopenia. It has also been associated with cancer or life-threatening critical illness. More recently, a growing population of patients are at risk due to unretrieved IVC filters. While IVC filter placement may protect the pulmonary vascular bed, it does not lessen thrombotic predisposition or incidence in the lower extremities, and IVC thrombosis with or without phlegmasia cerulea dolens has been reported to occur in 3 to 30% of patients following IVC filter placement. Filter retrieval following its initial indicated need can lessen secondary thrombotic complications, but data suggest that only a fraction of retrievable filters are later removed. In a systemic review, overall retrieval was 34% with a high percentage of nonretrieval occurring for a variety of reasons, including loss to follow up (particularly in trauma centers), limited life expectancy, and/or unresolved underlying conditions.

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217. A 54-year-old woman undergoes abdominoplasty and hysterectomy. Postoperative rivaroxaban is initiated for prevention of deep venous thrombosis. Three days later, she presents for follow-up, and a hematoma requiring drainage is noted. This outcome is most likely related to the fact that rivaroxaban blocks the coagulation cascade in which of the following ways?

A) Binds factors II, VII, IX, and X

B) Prevents conversion of prothrombin to thrombin

C) Prevents degranulation of platelets

D) Prevents thrombin from activating fibrinogen

E) Prevents tissue factor:factor VIIa complex formation

The correct response is Option B.

The direct anticoagulation agent rivaroxaban (Xarelto) is a direct anticoagulant, which acts within the clotting cascade by blocking Factor Xa, which, along with Factor Va, helps convert prothrombin to thrombin. This step in the cascade is where the intrinsic and extrinsic pathways intersect and the common pathway that leads to fibrinogen being cleaved to fibrin and stabilized by factor XIIIa as a cross-linked clot.

Aspirin is a drug that interferes with platelet function. Coumadin affects the vitamin K dependent factors II (prothombin), VII, IX and X. Heparin prevents clot propagation by blocking thrombin-mediated activation of fibrinogen to fibrin. The primary benefits of the direct anticoagulation agents over coumadin include no need for monitoring and equivalence in efficacy across many clinical situations. It is excreted by the kidney, so dosages must be altered or the drug avoided in renal failure. A U.S. Food & Drug Administration–approved reversal agent, recombinant coagulation factor Xa (Andexxa), is now available on the market for life-threatening or uncontrolled bleeding in patients using direct anticoagulants affecting factor Xa, like rivaroxaban. Prior to this, administration of fresh frozen plasma (FFP) was the antidote of choice.

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218. An 85-year-old woman underwent left modified radical neck dissection for stage III metastatic cutaneous melanoma. The procedure and immediate recovery were uneventful. On postoperative day 2, the base of the neck was noted to be erythematous with 300 mL/24 hours output of milky fluid emanating from closed suction drainage. A photograph is shown. Which of the following is the most appropriate next step in management?

A) Bed rest and pressure dressing

B) Dietary modification and octreotide therapy

C) Immediate general surgery consultation for occult esophageal injury repair

D) Initiation of total parenteral nutrition

E) Laparoscopic thoracic duct ligation

The correct response is Option B.

The patient is demonstrating an iatrogenic chyle leak (CL). CL has been reported to occur in 2 to 8% of neck dissections secondary to thoracic duct injury, which frequently goes unrecognized intraoperatively because of the relatively low volume and clear output seen in the immobile and fasted operative patient. Postoperatively, CL manifests as the sudden appearance of creamy white fluid drain output associated with overlying inflammatory skin erythema following resumption of enteral feeds containing fat. Confirmation can be made by testing drain triglyceride levels greater than serum levels, absolute drain triglyceride level greater than 100 mg/dL, or with the presence of chylomicrons.

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The majority of CL occur in the base of the left neck where the thoracic duct is largest and carries up to 75% of the body lymphatic fluid plus protein, electrolytes, and fatty acid-containing chylomicrons formed by breakdown of long-chain fatty acids in the proximal small bowel.

Dietary modification is important to CL management. Patients commonly transition to nonfat/low-fat diets or medium-chain fatty acid diets (which are largely water soluble and absorbed via portal venous circulation rather than small bowel lymphatics), resulting in decreased chyle flow. Coupled with this, for low-output (less than 500 cc/day) CL, octreotide has been shown to be a cost-effective therapy that significantly decreases morbidity, length of stay, and need for further surgical intervention. In a study of low-output leaks, CL typically stopped after 2 to 4 days of octreotide therapy. Octreotide is a somatostatin analogue with a relatively long half life that inhibits chyle production by reducing gastric, pancreatic, and intestinal secretions.

Bed rest may be helpful for CL, as activity encourages chyle return through the thoracic duct. Pressure dressings are of equivocal efficacy and may compromise cervical skin flap perfusion. Both methods are largely nondefinitive without concomitant dietary modification to reduce chyle flow.

Total parenteral nutrition (TPN) can also be employed to decrease chyle production by completely bypassing the fatty acid uptake through the small bowel lymphatic system. However, TPN utilization must be weighed against its need for central venous access, elevated risk of bacteremia, impaired wound healing, metabolic disturbance, and high cost.

For high-output (greater than 1000 cc/day) CL or CL that fails to diminish with octreotide therapy, surgical intervention is frequently indicated. This includes cervical reexploration although success can be variable because of a relatively hospitable operative field secondary to local inflammation generated by extravasated chyle. Alternatively, thoracoscopic ligation of thoracic duct has proven to be successful intervention in high-output leaks through mass ligation of ductal tissue as it travels through the diaphragmatic hiatus between the azygous vein and the aorta.

Iatrogenic esophageal injuries are a significant cause of morbidity and mortality. The patient is not presenting with cervical esophageal injury, which may be associated with dysphonia, hoarseness, cervical dysphagia, and/or subcutaneous emphysema.

There is no indication for empiric broad spectrum antibiotics in the absence of infection or in the routine management of CL.

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219. An otherwise healthy 54-year-old perimenopausal woman is scheduled for a mastectomy for biopsy-proven right-sided grade 2 ductal carcinoma. According to the National Comprehensive Cancer Network (NCCN) guidelines, postmastectomy radiation therapy will be the standard of care for this patient if she has which of the following surgical outcomes?

A) 1-cm surgical margins, four positive axillary lymph nodes

B) 1-cm surgical margins, one positive axillary sentinel node

C) 1-mm surgical margins, no positive axillary nodes

D) 5-mm surgical margins, no positive axillary nodes

E) 5-mm surgical margins, three positive axillary nodes

The correct response is Option A.

Traditionally, the need for radiation therapy has been a contraindication for implant-based reconstruction, and autologous reconstruction is the conservative gold standard for women with advanced cancer needing postmastectomy radiation. More recently, there have been reports of successful implant based reconstruction in the setting of postmastectomy radiation that have similar complication profiles and good oncologic outcomes compared with autologous reconstruction. Protocols vary between those that radiate the expander and then expand, and those that expand and then radiate the permanent implant. Being able to anticipate which patient will require postmastectomy radiation is essential for joint decision making about breast reconstruction with the patient prior to her mastectomy.

By National Comprehensive Cancer Network (NCCN) guidelines, relative indications for postmastectomy radiation therapy include: positive sentinel node with unknown status of other axillary nodes, one to three positive nodes on permanent histology, and close surgical margins (less than 5 mm). Postmastectomy radiation is recommended as the standard of care in the situations of positive surgical margins with the inability to get clear margins and four or more positive lymph nodes.

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220. An 80-year-old woman undergoes excision and direct closure of a nasal sidewall carcinoma. The wound is closed with cuticular nylon suture and dressed with a temporary sterile gauze bandage in an uncomplicated office procedure with immediate discharge home. How long after surgery should this patient be advised to refrain from wetting the suture line with tap water rinses?

A) 48 Hours after surgery

B) 48 Hours after suture removal

C) Until suture removal

D) Until wound edge epithelization is complete

E) No restriction

The correct response is Option E.

Several studies have compared wet, moist, and dry wound healing following skin surgery without demonstrating an increase in infection rate when washing the wound with tap water at any point postoperatively as opposed to keeping the site dry for various lengths of time. This includes a rigorous randomized control trial in which patients with defects following skin lesion removal were divided into groups with tap water wound washing within 12 hours of surgery versus those asked to keep wound dry for 48 hours, where the incidence of surgical site infection in the wash group was not inferior to the dry group. On the other hand, unrestricted wound washing improves patient comfort, and multiple studies have demonstrated that wet or moist wounds promote reepithelialization and result in reduced scar formation with less inflammatory reaction compared to dry wounds.

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221. Which of the following is the primary role of adipose-derived stem cells (ADSC) in wound healing?

A) Assist in chemotaxis of platelets and granulocytes

B) Differentiate directly into fibroblasts and keratinocytes

C) Induce development of hair and sweat follicles

D) Provide a scaffold for deposition of granulation tissues

E) Register and organize pro-collagen fibrils

The correct response is Option B.

Adipose-derived stems cells (ADSC) have had extensive study in vitro and in vivo because there are ready sources of them from adult patients, which bypasses many ethical and regulatory issues of embryonic stem cells.

ADSC have both direct structural and paracrine roles in wound healing. They can directly differentiate into keratinocytes, endothelial cells, and dermal fibroblasts. ADSCs, through paracrine phenomena, are modulators of the inflammatory environment of the wound healing milieu but are not involved in the immediate chemotaxis during the inflammatory period nor do they function as a scaffold during the proliferative phase. Lysyl oxidase is the extracellular enzyme responsible for final alignment of collagen fibrils.

Presence of skin adnexa such as hair follicles and sweat glands are hallmarks of scarless, fetal healing. Hair follicle formation typically only occurs during embryonic development and involves interaction of ectodermal and mesenchymal cells influenced by signaling pathways including Wnt/b-catenin and BMPl but not ADSCs.

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222. A 69-year-old man is scheduled to undergo excision and direct closure of a basal cell carcinoma of the chest. Medical history includes aspirin 81 mg daily for primary prevention of cardiovascular disease. Compared with patients not taking aspirin prophylaxis, this patient is most likely at risk for which of the following complications?

A) Hematoma

B) Worse cosmetic outcome

C) Wound dehiscence

D) Wound infection

E) None of the above

The correct response is Option E.

Systematic review drawing from 30 studies and more than 14,000 patients undergoing minor cutaneous surgery firmly supports continuation of aspirin therapy in all minor cutaneous surgery, as patients on aspirin monotherapy are at no greater risk of hemorrhagic complications than those on no agents. While a case-by-case risk profiling in all patients on aspirin therapy is prudent, the preponderance of evidence favors meticulous hemostasis over aspirin cessation in prevention of bleeding complications in minor cutaneous surgery.

There is no reported association between aspirin utilization and increased risk of wound dehiscence, wound infection, or cosmetic outcome.

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223. Which of these situations is best suited for the use of a topical skin adhesive (polymerizing cyanoacrylate) for closure?

A) Burst laceration along the eyebrow

B) Over an intradermal repair of a vertical forehead laceration

C) Over a suture repaired dog bite of the ear

D) Straight line laceration on the cheek with 4 mm of separation

E) Well apposed lip laceration crossing the vermilion cutaneous border

The correct response is Option B.

Cyanoacrylate skin adhesives are sold as monomers that polymerize by an exothermic reaction on contact with air and fluids. They can be used in conjunction with other skin closure mechanisms such as sutures or as a primary skin closure device. There is evidence across multiple surgical specialties and situations that skin glues can save time in the operating room. When used correctly, the cosmesis is similar or better than external suturing. There are in vitro studies suggesting inhibition of Gram-positive cocci and clinical anecdotal evidence of decreased infection.

There is evidence that when wounds are closed with skin glue as the only closure device that dehiscence rates are increased.

If the adhesive leaks below the skin when applied, it can hold the edges open and delay or prevent healing with increased scarring or poorer cosmesis. Adhesives should be applied to well apposed skin edges only.

The U.S. Food & Drug Administration–approved package insert for a major brand of skin adhesive (eg, Johnson & Johnson, Ethicon Dermabond) specifically indicates use on mucosa and over dirty wounds such as dog bites to be contraindicated.

A burst laceration along the eyebrow and a straight line laceration on the cheek with 4 mm of separation would be contraindicated because of the lack of excellent epithelial continuity. Adhesive over a suture-repaired dog bite of the ear and a well-opposed lip laceration crossing the vermilion cutaneous border are specifically contraindicated on the package insert. Studies across multiple surgical specialties are supportive of cyanoacrylate skin adhesives over an intradermal repair of a vertical forehead laceration.

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224. A 45-year-old man presents with significant closed head injury. Maintenance fluids are initiated because of progressive nausea with reduced oral intake. CT scan of the head shows diffuse cerebral edema. Administration of which of the following solutions is most appropriate in this patient?

A) Dextrose 5% in water

B) Hypertonic (3%) saline

C) Hypotonic (0.45%) saline

D) Physiologic (0.9%) saline

E) Ringer's lactate

The correct response is Option B.

The patient is showing signs of symptomatic progressive intracranial pressure following head trauma. Hypertonic infusion therapy can be used in this scenario to decrease intracranial pressure and curtail progressive cerebral edema. Hypertonic (3%) saline fits into conventional algorithms for treatment of symptomatic acute intracranial hypertension along with hyperventilation, mannitol, diuretics, and surgical decompression. Hypertonic solutions have been shown to decrease intracranial pressure with greater efficiency than mannitol in early stages of trauma for patients with evolving brain injury.

Ringer's lactate and physiologic (0.9%) saline solution would not prevent or counteract progressive cerebral edema following head trauma. Hypotonic solutions (such as dextrose 5% in water and 0.45% saline solutions) are broadly contraindicated in patients who suffer severe traumatic brain injury, because they may lower serum osmolarity and exacerbate cerebral edema.

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225. In a single physician private practice establishment, which of the following descriptions of a Privacy Official meets the US Department of Health & Human Services (HHS) expectations as delineated in the Health Insurance Portability and Accountability Act (HIPAA)?

A) A group of employees who function as a privacy board

B) An individual who functions as the privacy official and office manager for the practice

C) An outside consultant with expertise in HIPAA-related privacy policy

D) A student intern who functions solely as the privacy official for the practice

The correct response is Option B.

The Health Insurance Information Portability and Accountability Act (HIPAA)—also known as the Kennedy-Kassebaum Act—was passed into law in 1996 during the Clinton Administration by the 104th US Congress. HIPAA provides a framework for the security of private health information and how it may be used and shared by health care providers, researchers, payers, and assistants to these entities. There is some scalability built into the law so that large entities such as regional health maintenance organizations (HMOs) and hospital systems have different expectations of how they will accomplish the rules governing privacy compared to a private practice.

According to the U.S. Department of Health and Human Services on its website:

"Responsible health care providers and businesses already take many of the kinds of steps required by the Rule to protect patients' privacy. Covered entities of all types and sizes are required to comply with the Privacy Rule. To ease the burden of complying with the new requirements, the Privacy Rule gives needed flexibility for providers and plans to create their own privacy procedures, tailored to fit their size and needs. The scalability of the Rule provides a more efficient and appropriate means of safeguarding protected health information than would any single standard.

For example, the privacy official at a small physician practice may be the office manager, who will have other non-privacy related duties; the privacy official at a large health plan may be a full-time position, and may have the regular support and advice of a privacy staff or board. The training requirement may be satisfied by a small physician practice's providing each new member of the workforce with a copy of its privacy policies and documenting that new members have reviewed the policies; whereas a large health plan may provide training

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through live instruction, video presentations, or interactive software programs.

The policies and procedures of small providers may be more limited under the Rule than those of a large hospital or health plan, based on the volume of health information maintained and the number of interactions with those within and outside of the health care system."

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226. Which of the following is consistent with the recommendations of The Joint Commission and the Centers for Medicare and Medicaid Services regarding practitioners' orders and patient-related communication?

A) Computerized provider order entry (CPOE) is not an acceptable method for order submission as it allows providers to directly enter orders into the electronic health record (EHR)

B) Health care organizations should allow the use of unsecured text messaging—that is, short message service (SMS) text messaging from a personal mobile device—for communicating protected health information

C) HIPAA compliance is not maintained if all the information is de-identified before it is transmitted

D) The transmission of a verbal order requires real-time, synchronous clarification and confirmation of the order as it is given by the ordering practitioner

The correct response is Option D.

In collaboration with the Centers for Medicare & Medicaid Services (CMS), The Joint Commission developed the following recommendations:

- All health care organizations should have policies prohibiting the use of unsecured text messaging—that is, short message service (SMS) text messaging from a personal mobile device—for communicating protected health information. Organizations are expected to incorporate limitations on the use of unsecured text messaging in their policies protecting the privacy of health information. This policy should be routinely discussed during orientation of all practitioners and staff working in the facility.

- Computerized provider order entry (CPOE) should be the preferred method for submitting orders as it allows providers to directly enter orders into the electronic health record (EHR). CPOE helps ensure accuracy and allows the provider to view and respond to clinical decision support (CDS) recommendations and alerts.

- In the event that a CPOE or written order cannot be submitted, a verbal order is acceptable and it should allow for a real-time, synchronous clarification and confirmation of the order as it is given by the ordering practitioner.

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- HIPAA compliance can also be maintained by deidentifying information before it is transmitted. Under the Safe Harbor Method, health information is no longer linked to an individual when 18 types of patient identifiers have been removed.

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227. A 44-year-old woman presents in evaluation for breast reconstruction with biopsy-proven left breast-infiltrating ductal carcinoma after routine mammography discovered a 7-cm lesion. She has been referred to medical oncology and genetic testing is pending. Her past medical history is significant for hypertension and scleroderma. On examination, she has grade I ptosis and wears a size 34A brassiere. During the consultation, the patient reports a strong preference for lumpectomy and oncoplastic reconstruction over total mastectomy. Which of the following is most likely to increase this patient's chances of qualifying for breast-conserving therapy?

A) Active scleroderma

B) *BRCA-1* gene mutation

C) Multicentric tumor

D) Preoperative chemotherapy

E) Small-sized breasts

The correct response is Option D.

Preoperative chemotherapy could increase this patient's chances of qualifying for locoregional treatment (partial mastectomy or lumpectomy). Studies have shown that breast conservation rates are improved with preoperative systemic therapy, which can also render inoperable tumors resectable. Other potential benefits of preoperative (neoadjuvant) chemotherapy include providing important prognostic information based on response to therapy, minimizing the extent of axillary surgery, and allowing time for genetic testing and reconstructive planning prior to surgery. A small-sized breast would likely provide insufficient uninvolved breast tissue for breast-conserving therapy after resection of a large (7 cm) mass. The same applies to multicentric tumors.

Whole breast irradiation is strongly recommended after lumpectomy, with studies showing a favorable effect in reducing the 10-year risk of recurrence (19% versus 35%) and the 15-year risk of breast cancer death (21% versus 25%). Therefore, patients with (relative) contraindications to radiation therapy, such as lupus or scleroderma (connective tissue disease involving the skin), should ordinarily be offered total mastectomy, particularly if this resolves the need for radiation therapy. While radiation therapy would likely still be considered for this particular patient even after total mastectomy (tumor size greater than 5 cm), the diagnosis of scleroderma itself does not increase her chances of qualifying for breast

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conservation surgery. *BRCA-1* gene mutation and other genetic predispositions to breast cancer are relative contraindications for breast-conserving therapy. These patients may be considered for prophylactic bilateral mastectomy for risk reduction.

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228. A 22-month-old female infant presents with a large mixed micro- and macrocystic lymphatic malformation of the right lower extremity. A photograph is shown. Medical history includes two rounds of sclerotherapy for the macrocystic component at 6 and 12 months of age and repeated infections, requiring a long hospital stay for intravenous antibiotic therapy 4 months ago. Which of the following is the most appropriate therapy for this patient?

A) Amputation

B) Embolization

C) Power-assisted liposuction

D) Repeated sclerotherapy

E) Surgical debulking

The correct response is Option E.

This 22-month-old female has undergone treatment of the macro cystic component of the lymphatic malformation and continues to present with complication secondary to the disease. In addition to difficulty of mobilization, fitting of regular clothes, nutrition problems due to

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repeated infections, there is also significant life threatening risk of severe infection. Even though compression garment and repeated sclerotherapy are potential options, there will be no control of the disease. The best next step is surgical debulking. Embolization is not appropriate for a lymphatic malformation, and amputation is not indicated at this time. Power-assisted liposuction would be indicated for lymphedema, not for a lymphatic malformation.

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229. A 56-year-old woman undergoes bilateral breast reconstruction with deep inferior epigastric artery flaps. On postoperative day one, the patient is emergently transported to the operating room because of poor arterial perfusion of the left reconstructed breast. During surgery, flap salvage is not feasible and a latissimus dorsi flap is harvested to replace it. The operation lasts 8 hours. Two separate reconstructive surgical teams are involved and multiple changes in nursing staff occur. At the end of the procedure, final counts are off by one needle. Which of the following factors most strongly increases the risk of a retained surgical item?

A) Change in nursing staff during procedure

B) Emergency procedure

C) Extended surgery time

D) Incorrect final count

E) Multiple surgical teams

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

The correct response is Option D.

A discrepant final count most strongly increases the risk of a retained surgical item, reportedly between 16 and 113 times.

Unfortunately, because of counting inaccuracy and the relatively low frequency of retained surgical items, the positive predictive value of a discrepant intraoperative count may be as low as 1.6%, potentially leading surgeons and staff to develop a false sense of security over time and to discredit it. Perhaps of greater concern, sensitivity of intraoperative counts has been reported as low as 77%. In one report, 45 of 59 instances of retained surgical instruments occurred with erroneously correct counts. Efforts to enhance manual sponge counting with computer-assisted technologies have been reported, including tagging sponges with barcodes or radiofrequency identification chips.

The other listed factors have all been reported to significantly increase the risk of retained surgical items, although probably to a lesser extent than a discrepant final count.

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230. A 41-year-old woman presents with right breast lobular carcinoma in situ (LCIS) involving a 1-cm area with no palpable axillary nodes. According to the TNM staging system, which of the following is this patient's T classification?

A) Tx

B) Tis

C) T0

D) T1a

E) None; there is no TNM staging for LCIS

The correct response is Option E.

Lobular carcinoma in situ (LCIS) has been removed from the staging classification system in the 8th edition and is no longer included in the pathologic tumor in situ (pTis) category. LCIS is treated as a benign entity with an associated risk for developing carcinoma in the future but not as a malignancy capable of metastases. There is a small subset of LCIS that has high-grade nuclear features and may exhibit central necrosis. This subset has been referred to as pleomorphic LCIS and has histologic features that partially overlap the features of ductal carcinoma in situ (DCIS), including the potential to develop calcifications detectable by mammography. The expert panel debated whether to include this variant of LCIS in the pTis category; however, there are insufficient data in the literature regarding outcomes and reproducible diagnostic criteria for this LCIS variant. Cases exhibiting DCIS and LCIS are classified as pTis (DCIS).

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231. A 27-year-old man sustained multiple facial fractures when he was involved in a motorcycle collision. On arrival to the emergency department, blood pressure is 80/50 mmHg and heart rate is 150 bpm. Significant retropharyngeal bleeding is noted. Trauma workup reveals no other injuries. CT angiography shows active bleeding from the right maxillary artery. Angioembolization is planned and massive transfusion protocol is initiated. Which of the following is the most appropriate intravenous resuscitation in this patient?

A) Fresh frozen plasma (FFP) and packed red blood cells (pRBC) in a 1:1 ratio; discontinuation of crystalloids

B) FFP and pRBC in a 1:1 ratio; crystalloids via rapid transfuser (max rate)

C) FFP and pRBC in a 1:4 ratio; crystalloids at 125 cc/h

D) FFP and pRBC in a 1:4 ratio; discontinuation of crystalloids

E) FFP and pRBC in a 4:1 ratio; crystalloids via rapid transfuser (max rate)

The correct response is Option A.

For initiation of a massive transfusion protocol, transfusing fresh frozen plasma (FFP) and packed red blood cells (pRBC) at a 1:1 ratio and discontinuing intravenous crystalloids is the most appropriate next step in patient management.

Massive Transfusion Protocol guidelines have been set forth by the American College of Surgeons through its Trauma Quality Improvement Program (TQIP). Recommendations for initiating a massive transfusion protocol include:

1. Beginning universal blood product infusion rather than crystalloid or colloid solutions,

2. Transfusing universal pRBC and FFP in a ratio between 1:1 and 1:2 (FFP:pRBC),

3. Transfusing one single donor apheresis or random donor platelet pool for each six units of pRBC.

It is also suggested to deliver PRBC and FFP by a rapid transfuser and through a blood warmer, and that the initial rate of transfusion should restore perfusion while allowing for “permissive hypotension” until the operation or angioembolization to stop the bleeding begins.

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232. A 48-year-old man presents with a painless mass on the left wrist that has been enlarging gradually over the past year. Physical examination shows a 5-cm mass at the wrist flexion crease, deep to the flexor carpi radialis. The mass is firm, smooth, and nonadherent to surrounding structures. The patient denies numbness, and no motor deficits in the median nerve distribution are noted. Tinel sign is present at the site of the mass. Plain-film x-ray studies show no abnormalities. On MRI, a homogeneous mass is noted within the median nerve. Which of the following is the most likely diagnosis?

A) Enchondroma

B) Lipoma

C) Neurofibroma

D) Radial artery aneurysm

E) Schwannoma

The correct response is Option E.

The most likely pathology of this mass is a schwannoma of the median nerve. These benign nerve tumors are typically painless proximal to the wrist. Schwannomas of the digits tend to be painful. Tinel sign can often be demonstrated. Nerve function typically is not disturbed. Because of the size and location, MRI is effective in characterizing and localizing the mass. With magnification, marginal excision of schwannomas is easily performed because they are almost self-extruding from the nerve. Compared with neurofibromas, schwannomas are noninfiltrative. The recurrence rate is approximately 4%. The risk of nerve deficit is higher for excision after recurrence.

An enchondroma would be apparent on a plain x-ray study and would reveal a mass with cortical thinning. A lipoma would likely be present within the carpal tunnel and would not be in continuity with the nerve. It is also unlikely to have positive Tinel sign. An aneurysm of the radial artery presents as a pulsatile mass. Vasospastic or thromboembolic findings may be present. The median nerve may be compressed by the aneurysm.

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233. A 69-year-old woman presents to the emergency department because she has had increasing redness and pain in her left reconstructed breast for the past 24 hours. Blood pressure is 80/40 mmHg, heart rate is 130 bpm, and respiratory rate is 32/min. Initial plasma lactate level is 5.2 mmol/L. Ultrasonography shows no fluid collections within the breast. Intravenous fluid resuscitation is started. Administration of intravenous antibiotics is most appropriate within how many hours?

A) 1

B) 3

C) 6

D) 12

E) 24

The correct response is Option A.

The 2016 Surviving Sepsis Campaign guidelines strongly recommend that administration of intravenous antibiotics be initiated as soon as possible after recognition and within 1 hour for both sepsis and septic shock.

In the presence of sepsis or septic shock, increasing delays in administration of appropriate antibiotics are associated with increasing mortality and detrimental effects on secondary endpoints, such as length of hospital stay, acute kidney injury, acute lung injury, and the Sepsis-Related Organ Assessment score.

Although data suggest that optimal outcomes are achieved by the earliest possible administration of appropriate antibiotics following recognition of sepsis, 1 hour was recommended as a reasonable minimal target, considering multiple patient and organizational factors that may cause delay.

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234. A 30-year-old woman, gravida 1, para 0, who is at 36 weeks' gestation presents to the emergency department after sustaining blunt trauma injury in a motor vehicle collision. Physical examination shows a visible seat belt sign, but she is hemodynamically stable. Secondary assessment is unremarkable. Which of the following is the most appropriate next step?

A) Determine maternal Rh status

B) Discharge with obstetric follow-up

C) Initiate scalp monitoring of the fetus

D) Perform diagnostic peritoneal lavage

E) Perform MRI of the abdomen/pelvis

The correct response is Option A.

Traumatic placental injury can cause maternal-fetal hemorrhage in 10 to 30% of pregnant trauma patients. The majority of these are subclinical, without measurable effects to the fetus. However, as little as 0.001 milliliter of Rh-positive fetal blood can cause alloimmunization of an Rh-negative mother. Therefore, determination of Rh status is mandatory for all pregnant trauma patients and all Rh-negative of these should be given anti-D immune globulin (IgG). A single dose administered within 72 hours from injury may provide protection against sensitization in up to 90% of the cases. Higher doses may be necessary if it is determined that transplacental hemorrhage was in excess of 30 milliliters.

Simply discharging the patient for a future obstetric follow up is not acceptable. At least 4 hours of electronic fetal monitoring should be provided to all pregnant trauma patients with >= 23 weeks gestation.

Internal electronic fetal heart rate monitoring (with an electrode in the scalp) is not indicated at this time. Instead, external monitoring could be done using a dedicated Doppler ultrasound device.

MRI of the abdomen/pelvis and diagnostic peritoneal lavage are not indicated in the scenario described. Radiographic imaging generally indicated for trauma evaluation, including abdominal computed tomography, should not be deferred or delayed due to concerns of fetal exposure to radiation. Ultrasonography (FAST) should be part of the secondary survey in all pregnant trauma patients.

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235. A 65-year-old woman undergoes ventral hernia repair with component separation and mesh placement. On postoperative day two, the patient suddenly becomes unresponsive and has no palpable pulse. Cardiopulmonary resuscitation (CPR) is promptly started and a cardiac monitor is attached. Cardiac tracing is consistent with pulseless electrical activity (PEA). Administration of which of the following drugs is most appropriate in this patient?

A) Adenosine

B) Atropine

C) Diltiazem

D) Dopamine

E) Epinephrine

The correct response is Option E.

Epinephrine is the initial drug of choice in the acute management of this patient with pulseless electrical activity (PEA).

Desirable effects of epinephrine in the treatment of cardiac arrest include vasoconstriction (alpha-1 adrenergic) and increase in cardiac output (beta-1 adrenergic). According to current Advanced Cardiac Life Support guidelines, epinephrine should be administered to a patient in cardiac arrest as soon as the electrocardiographic diagnosis of either PEA or asystole is made. The intravenous dose is 1 mg every 3 to 5 minutes, always followed by a 20 mL normal saline flush. Cardiopulmonary resuscitation should not be halted for drug administration. The drug can also be administered via intraosseous access or through the endotracheal tube.

The other drugs listed are not indicated in the initial treatment of PEA.

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236. A 25-year-old man is being considered as an organ donor after sustaining traumatic brain injury in a motorcycle crash. Which of the following findings is most likely to confirm brain death?

A) Absence of deep tendon reflexes

B) Mild cough with tracheal tube manipulation

C) 1 mm pupillary constriction when tested for pupillary reflex

D) No movement of lid or eyes when touching cornea

E) Nystagmus with caloric testing

The correct response is Option D.

Brain death is a criterion for nonliving organ donation. Absence of all brain stem reflexes needs to be present for brain death to occur. Absence of corneal reflex demonstrates an absence of brain stem reflexes. Presence of pupillary reflex and nystagmus during caloric test demonstrates a positive finding and presence of brain stem reflex. Mild cough or gag during tracheal manipulation demonstrates presence of brain stem reflex. Any respiratory rate during apnea test is seen as a sign of brain stem function. Evaluation of deep tendon reflexes is not part of assessing brain death.

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237. A 9-month-old female infant with severe metopic craniosynostosis requires bifrontal craniotomy and a fronto-orbital advancement. The anesthesiologist is concerned about intraoperative blood loss and the need for blood transfusion. Which of the following drugs administered by intravenous infusion at the time of cranial reconstruction is most likely to reduce both intraoperative and postoperative bleeding?

A) Aprotinin

B) Erythropoietin

C) Fibrinogen

D) Protamine

E) Tranexamic acid

The correct response is Option E.

Acute blood loss and the need for autologous blood transfusions are common in infants undergoing craniofacial procedures. Techniques to limit blood loss and transfusions have been studied extensively in craniosynostosis surgery. Tranexamic acid (TXA) is a synthetic analog of the amino acid lysine, which inhibits the conversion of plasminogen to plasmin when intravenously administered. TXA inhibits the proteolytic action of plasmin, thus inhibiting fibrinolysis. It has been shown in multiple studies to reduce both intraoperative and postoperative blood loss.

Aprotinin is a small protein bovine pancreatic trypsin inhibitor with anti-thrombolytic potential. It was taken off the market in the United States in 2007 as its use was associated with increased complications and death. It has since been reapproved in Canada and Europe but remains banned in the United States. Protamine is a drug used to reduce the effects of heparin toxicity and of no benefit in this clinical scenario. Erythropoietin is a recombinant glycoprotein cytokine that stimulates red cell production. When given preoperatively, it has been shown to reduce the need for blood transfusion (not necessarily acute blood loss) in craniosynostosis surgery. Fibrinogen is not administered intravenously. Fibrin glue does reduce blood loss in craniosynostosis procedures, but it is administered topically, not intravenously.

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238. An otherwise healthy 45-year-old man presents for evaluation of progressive frontal hair loss. He reports his grandfather went bald early in life. He is interested in surgical hair restoration methods but would prefer to avoid long, unsightly scars and prolonged recovery. Which of the following is the most appropriate method for hair restoration in this patient?

A) Follicular unit transplantation

B) Hair-bearing scalp flaps

C) Micrograft unit transplantation

D) Minigraft unit transplantation

E) Tissue expansion

The correct response is Option A.

This patient has androgenetic alopecia. Androgenetic alopecia, or patterned alopecia, is the most common form of hair loss in both men and women and is characterized by a progressive loss of hair diameter, length, and pigmentation. The genetic inheritance of androgenetic alopecia is well known, although the causative genes have yet to be elucidated. In genetically predisposed males and females, androgenetic alopecia is caused by progressive shortening of the anagen stage and an increase in the number of hair follicles in telogen. Follicular unit hair transplantation is the gold standard, because it preserves the natural architecture of the hair units and gives natural results. The follicular unit (FU) was first described by Headington in 1984 and was shown to include 1 to 4 terminal follicles, 1 or 2 vellus follicles, and perifollicular vascular and neural plexi, all surrounded by concentric layers of collagen fibers. Seager later showed that when single-hair micrografts were generated by breaking up larger FUs, their growth was less than when the FUs were kept intact, supporting the concept of the FU as a physiologic entity, rather than just an anatomic one. This gave rise to the FU transplant era, in which grafts are single FU or multi FU (2–3 FU). It was found that peripheral areas such as the hairline naturally have 1- and 2-hair FUs, whereas the more central regions have more 3- and 4-hair FUs.

"Micrografts" (1–2 hairs) and "minigrafts" (3–6 hairs) have been used in the past for hair transplantation but are not quite as effective as follicular unit transplantion and produce less natural appearing results.

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Tissue expansion and scalp flaps are generally reserved for scalp burn wounds or wounds of traumatic nature with significant hair loss. They generally leave long scars and may require multiple stages and prolonged recovery which would likely not be acceptable for this patient.

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239. A 46-year-old woman undergoes a fleur-de-lis abdominoplasty following successful gastric bypass surgery. She has a 94-lb (43-kg) weight loss and current BMI is 28 kg/m^2. To ensure the best outcome for wound healing, which of the following is the recommended postoperative daily intake of protein for this patient?

A) 20 to 30 g/day

B) 40 to 50 g/day

C) 60 to 70 g/day

D) 80 to 90 g/day

E) More than 100 g/day

The correct response is Option C.

Nutritional status in postbariatric subjects is essential in achieving successful healing of surgical wounds. Anatomical changes to the gastrointestinal tract following bariatric surgery can exacerbate nutritional deficiencies and inadequacies. Reduced protein intake has been associated with significantly lower healing rates in massive weight loss patients. It is recommended that postbariatric patients consume 60 to 70 g/day of protein 2 to 4 weeks prior to surgery and for 1 to 2 months postoperatively.

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240. An 8-year-old girl presents with burns on 60% of the total body surface area. Physical examination shows second- and third-degree burns involving her face, neck, and torso. After initial resuscitation, wound care, burn debridement, and skin grafting are performed, rehabilitation protocol is initiated. Administration of which of the following agents is most appropriate for improving bone mineral content (BMC) in this patient?

A) Ascorbic acid

B) Glutamine

C) Insulin

D) Oxandrolone

E) Testosterone

The correct response is Option D.

A randomized clinical trial of safety and efficacy of 1-year oxandrolone administration to severely burned children (over 30% total body surface area burns) demonstrated significant benefits of this medication. Improvements were noted in height, bone mineral content (BMC), cardiac work, and muscle strength, and were statistically higher compared to the control group. Mechanism of action is not totally clear but increase in insulin-like growth factor-1 secretion during the first year after burn injury, and, in combination with exercise, considerable increase in lean body mass and muscle strength has been demonstrated. The maximal effect of oxandrolone was found in children aged 7 to 18 years. No deleterious side effects were attributed to long-term administration.

Oxandrolone, a synthetic oral nonaromatizable testosterone derivative, has only 5% of the virilizing activity and low hepatotoxicity when compared with testosterone administration. Oxandrolone reaches peak serum concentrations within 1 hour and is excreted through the urine. Oxandrolone binds to androgen receptors in the skeletal muscle to initiate protein synthesis and anabolism. Because oxandrolone cannot be aromatized to estrogen, the likelihood of estrogen-dependent bone-age advancement is reduced, making oxandrolone a safe therapeutic approach for growing children.

Testosterone is not currently approved for treatment of burned children due to increased risks of virilization in female patients and aromatization effects among other health risks.

Glutamine and ascorbic acid supplementation can aid in burn recovery; however, it has not shown to have similar effects on bone density as oxandrolone. Several studies support the

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use of enteral glutamine supplements in the adult burn population. Research has also shown that glutamine supplementation is favorable as it has the potential to decrease length of stay and associated costs through improving wound healing and decreasing rates of infection and mortality.

Antioxidant therapies including: ascorbic acid; glutathione; N-acetyl-L-cysteine; vitamins A, C, and E; alone or in combination have been previously shown to protect microvascular circulation, mitigate changes in cellular energetics, decrease tissue lipid peroxidation, and decrease the volume of fluid required for resuscitation.

Insulin is used to treat hyperglycemia and primarily used in diabetic patients. It may have limited use in burn care patients but has not shown to increase bone mineral density.

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241. A 68-year-old woman presents with multiple injuries sustained during a motor vehicle collision that require reconstructive surgery. She will require a stay in a skilled nursing facility following her initial hospitalization. Which of the following parts of Medicare covers this service?

A) Medicare Part A

B) Medicare Part B

C) Medicare Part C

D) Medicare Part D

The correct response is Option A.

Medicare Part A covers services and supplies considered medically necessary to treat a disease. These services include inpatient hospital care, skilled nursing facility care, and hospice environments. In addition, when appropriate, home health services are covered by Part A.

Medicare Part B covers medically necessary services and preventative care services. Physician services, durable medical equipment, and mental health services are included in Part B coverage.

Medicare Part C is also known as Medicare Advantage. Part C allows for a Medicare-eligible individual to select an approved private health insurance plan. Medicare Part D offers prescription drug coverage to original Medicare. Part D can be added to a Medicare Advantage Plan if prescription drug coverage is not included.

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242. A 25-year-old man presents with partial-thickness burns involving 15% of the total body surface area that he sustained during a house fire. The patient is stabilized and resuscitated. Topical 1% silver sulfadiazine cream is applied to the burns. Which of the following properties is most characteristic of this antimicrobial agent?

A) Greatly enhanced efficacy when compounded with thiol chelators

B) Metabolic acidosis

C) Poor capacity for wound bed penetration

D) Poor efficacy against *Candida albicans*

E) Potential for transient leukocytosis

The correct response is Option C.

In the United States, silver is the most commonly used topical antimicrobial. It is available as a liquid solution of AgNO3 or ointments such as silver sulfadiazine (Silvadene). Despite its many advantages, its capacity to penetrate into the wound bed is limited to the surface epithelium, particularly in the presence of eschar because of the binding of silver ions to surface proteins. In this setting, different modalities should be used for optimal effects.

Silver sulfadiazine is not only effective against Pseudomonas species and enteric bacteria, but it also provides coverage against fungi, including Candida albicans, with antimicrobial effects lasting up to 24 hours.

Enhanced efficacy when compounded with thiol chelators is consistent with bismuth compounds, not silver. Bismuth is another heavy metal with antimicrobial properties.

The most commonly used formulation of bismuth for wound care is bismuth subgalactate, found in xeroform (Covidien) gauze. This heavy metal disrupts biofilm formation by inhibiting polysaccharide capsule production in bacteria. Bismuth's antibacterial activity is enhanced when compounded with thiol chelators.

Regarding the potential for transient leukocytosis, silver sulfadiazine has been shown to cause reversible neutropenia, which usually improves within a few days after discontinuation of the agent.

Metabolic acidosis is associated with mafenide acetate use.

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243. A 48-year-old man who sustained severe traumatic brain injury and extensive facial fractures in a motor vehicle collision 2 weeks ago is receiving ventilatory support and enteral nutrition via feeding tube. An indirect calorimetry assessment shows a respiratory quotient (RQ) value of 1.3. This value is most closely associated with which of the following types of metabolism?

A) Carbohydrate oxidation

B) Ketosis

C) Lipid oxidation

D) Lipogenesis

E) Protein oxidation

The correct response is Option D.

Indirect calorimetry measurements, or a metabolic cart, are used to help calculate the resting energy expenditure (REE) and respiratory quotient (RQ) as a means to help determine the caloric needs of a patient as well as optimize the patient's nutrition. Indirect calorimetry measures the amount of oxygen consumed (VO_2) and the amount of carbon dioxide produced (VCO_2) by the patient. REE is calculated by the Weir equation [REE = (3.94 x VO_2) + (1.1 x VCO_2)] while the RQ is calculated as VCO_2 / VO_2. The calculated values of the respiratory quotient are reflections of what fuels are being oxidized by the patient with typical values as follows:

Fat oxidation RQ	0.7
Protein oxidation RQ	0.8
Carbohydrate oxidation RQ	1.0
Lipogenesis RQ	1.3

Optimal values of RQ for nutrition assessment are between 0.8 and 0.9, representing a balance between lipid and glucose oxidation. Values below 0.8 suggest underfeeding, while values greater than 1.0 suggest overfeeding. A value of 1.3 in this patient suggests significant overfeeding and lipogenesis and the enteral nutrition should be adjusted based on the current energy expenditure obtained from indirect calorimetry.

Ketosis is not measured by RQ.

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244. A 67-year-old man undergoes rhytidectomy with platysmaplasty combined with upper blepharoplasty. Medical history includes well-controlled chronic hypertension. Approximately 6 hours postoperatively, the patient reports significant pain, firm swelling, and bruising of the left cheek. Which of the following is the most likely cause of the swelling in this patient?

A) Excessive intraoperative infusion of intravenous fluids

B) Failure to take antihypertensive medications

C) Increased nausea from excessive opioid use

D) Ketorolac administration

E) Poor postoperative pain control

The correct response is Option B.

Hematoma is the most common early complication following rhytidectomy. Resorption of adrenalin in the early postoperative period can lead to rebound hypertension and subsequent hematoma. The incidence of hematoma after rhytidectomy in nonhypertensive patients is approximately 3%, but the incidence rises approximately 8% in hypertensive patients and, in male patients, the risk seems to be even greater. The most common cause of hematoma is related to uncontrolled acute postoperative hypertension (defined by values of systolic hypertension greater than 190 mmHg with or without a diastolic blood pressure greater than or equal to 100 mmHg in at least two consecutive measurements, reported in the postsurgery time).

Patients who preoperatively have a history of hypertension should be instructed to take their blood pressure medications on the morning of surgery. As an adjunct, oral clonidine (0.1 to 0.3 mg) or a transdermal patch (0.1 to 0.2 mg) can be administered preoperatively or intraoperatively, respectively, to keep blood pressure low in the perioperative period, especially as the injected adrenalin absorbs. Intraoperative hypertension should be well controlled, and maintenance of postoperative systolic blood pressure below 140 mmHg is desirable.

Injected adrenalin from the local anesthetic solution is slowly absorbed, such that postoperative hematomas usually occur 4 to 10 hours after surgery. Postoperatively, blood pressure can be controlled with beta blockade (100 mg of oral labetalol) or an alpha agonist (0.1 to 0.3 mg of clonidine).

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Increased intraoperative fluid could account for increased postoperative blood pressure but is less likely than inadequate preoperative treatment of blood pressure. Nausea and poor pain control can also certainly contribute to increased blood pressure and hematoma but are less likely the cause in this particular patient who has baseline hypertension.

Multiple studies have shown no increased risk for postoperative hematoma with use of ketorolac.

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245. A 45-year-old man presents with Fournier gangrene of the perineum and scrotum that developed over the past 24 hours. Medical history includes uncontrolled type 1 diabetes and hypertension. Examination shows fever and hypotension. Laboratory studies show increased white blood cell count, elevated C-reactive protein, and hyperkalemia. Which of the following is the most likely electrolyte abnormality in this patient?

A) Hypercalcemia

B) Hypernatremia

C) Hypocalcemia

D) Hypoglycemia

E) Hyponatremia

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

The correct response is Option E.

Fournier gangrene is a necrotizing fasciitis of the scrotum and perineum that is common in uncontrolled diabetics. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was first described by Wong et al in 2004 as a robust indicator of determining the severity of necrotizing fasciitis and distinguishing between less severe skin infections. Patients with an LRINEC score of less than 6 are likely to have necrotizing fasciitis with higher scores associated with greater severity and mortality.

The routine lab values that are used to calculate the LRINEC include the total white blood cell count (WBC), hemoglobin, sodium, glucose, serum creatinine, and C-reactive protein. Patients with necrotizing fasciitis are more likely to present with elevated WBC, glucose, creatinine and C-reactive protein as well as low hemoglobin and hyponatremia. Calcium is not used in the LRINEC score and abnormalities in this electrolyte are not routinely associated with necrotizing fasciitis.

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246. A newborn is diagnosed with a hypoplastic thumb and an anorectal malformation. These findings are most likely associated with which of the following conditions?

A) Fanconi anemia

B) Fetal alcohol syndrome

C) Holt-Oram syndrome

D) Thrombocytopenia-absent radius syndrome

E) VACTERL association

The correct response is Option E.

Radial longitudinal deficiency may present as an isolated condition but is often associated with an underlying syndrome. The frequency of association with a syndrome has been reported to range from 33 to 44%. Hypoplastic thumb can be present in isolation or in combination with any radial deficiency. Hypoplastic thumb is the second most frequently encountered thumb anomaly. Commonly associated syndromes with radial longitudinal deficiencies include Holt-Oram, Fanconi anemia, thrombocytopenia-absent radius, and VACTERL association (a sporadic collection of anomalies consisting of the vertebral deformity, anal atresia, cardiac anomalies, tracheoesophageal fistula, renal agenesis, and limb deformities).

Holt-Oram is a syndrome passed in an autosomal dominant fashion and presents with both radial longitudinal deficiency and a cardiac anomaly, most commonly a ventricular septal defect.

Both thrombocytopenia-absent radius syndrome and Fanconi anemia are transmitted in an autosomal recessive pattern. Thrombocytopenia absent radius syndrome consists of thrombocytopenia that manifests itself during infancy and can be fatal; however, it usually resolves spontaneously with age. In contrast, Fanconi anemia presents after 3 years of life, commonly around 8 to 9 years, with aplastic anemia. Historically this condition was fatal, with no method of altering the course of the anemia. Recently, however, bone marrow transplants have been performed successfully to treat the anemia and prolong the life expectancy of these patients. Lastly, the final condition seen commonly with radial longitudinal deficiency is VACTERL association. Anorectal malformations (ARM) often co-occur with upper limb anomalies, mainly of pre-axial origin. ARM patients with a major upper limb anomaly—with or without other congenital anomalies—have a twofold greater chance of a genetic disorder than have non-isolated ARM patients without upper limb anomalies. Not all upper limb anomalies in ARM patients are part of the VACTERL association.

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Fetal alcohol syndrome causes brain damage and growth problems, however it is not associated with thumb hypoplasia.

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247. A 48-year-old man with a 5-month history of traumatic paraplegia presents with a large grade IV right ischial pressure ulcer. The patient undergoes operative excision of the pressure ulcer and coverage with an inferior gluteal rotation flap. On induction of anesthesia, the patient has onset of cardiac arrhythmia with peaked T-waves, ventricular tachycardia, and hypotension. Pulse oximetry is 100% with normal end-tidal CO_2. Temperature is 37.0ºC (98.6ºF). It is discovered that the patient was given succinylcholine for rapid sequence intubation. Which of the following laboratory abnormalities is most likely associated with this patient's condition?

A) Hyperkalemia

B) Hypernatremia

C) Hypocalcemia

D) Hypoglycemia

E) Hypomagnesemia

The correct response is Option A.

Perioperative complications arising from intravenous paralytics and inhalational anesthetics may have devastating outcomes including death. Rapid and accurate diagnosis is essential for efficient treatment and maximizing successful outcomes. The paraplegic patient presented in this clinical vignette has developed acute hyperkalemia from the use of succinylcholine. Hyperkalemia after succinylcholine administration may result in paraplegics or any patients with upper or lower motor neuron injury, severe burns, crush injuries, or conditions causing rhabdomyolysis. This phenomenon results from the upregulation of nicotinic acetylcholine receptors in denervated or traumatized muscle.

Initial treatment of acute hyperkalemia causing cardiac compromise involves antagonizing the effects of potassium on cardiac conduction and shifting potassium from the extracellular space back into intracellular fluid. Calcium directly antagonizes the hyperkalemia-induced depolarization of resting membrane potential by increasing the threshold potential to stabilize the membrane. Sodium bicarbonate and glucose combined with insulin will promote cellular uptake of potassium. Acidosis enhances the release of potassium from the cell and can be reversed with sodium bicarbonate. In addition, alkalization of plasma decreases levels of ionized calcium permitting the more liberal use of calcium in the treatment of acute hyperkalemia.

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While hypomagnesemia, hypoglycemia, hypernatremia, and hypocalcemia can all result in electrocardiography changes including tachycardia, prolonged QT interval, shortened PR interval, and ST depression, these electrolyte abnormalities are not the most likely to be associated with the clinical scenario.

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248. A 62-year-old woman with non-insulin-dependent diabetes mellitus is undergoing lower extremity angiogram to determine her suitability for forefoot reconstruction. Which of the following is the most appropriate therapy for the prevention of contrast-induced nephropathy in this patient?

A) Ascorbic acid

B) Intravenous saline

C) *N*-acetylcysteine

D) Simvastatin

E) Sodium bicarbonate

The correct response is Option B.

Contrast-induced nephropathy (CIN) is a significant problem in patients undergoing procedures that require contrast administration. The mechanism is believed to be an ischemic injury to the renal medulla. It is the third most common cause of hospital-acquired renal failure. Independent of renal failure, the development of even mild CIN is associated with increased rates of morbidity and mortality. The major risk factor for developing CIN is pre-existing renal dysfunction. This is particularly associated with patients with diabetes and those who have a creatinine clearance less than 60. The best method of prevention is appropriate risk stratification, intravenous hydration with normal saline and withholding of nephrotoxic medications. Intravenous fluid hydration with normal saline is the mainstay of practice in the prevention of CIN. It is low-risk, carries few side effects, and is cost-effective. Randomized trials have found intravenous hydration with normal saline to be consistently effective. The administration of intravenous fluids increases intravascular volume, promotes diuresis, diminishes the overall intravascular contrast load and supports vasodilation. Although intravenous administration of sodium bicarbonate has also gained popularity in the prevention of CIN, recent publications have demonstrated mixed results. The use of N-acetylcysteine, statin drugs and ascorbic acid are not recommended for the prevention of CIN.

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249. A study is conducted to evaluate the association between diabetes and postoperative infection in patients undergoing implant-based breast reconstruction with acellular dermal matrix. Which of the following statistical tests is most appropriate to supply the data for this study?

A) Analysis of variance (ANOVA)

B) Linear regression analysis

C) Pearson's chi-squared test

D) Unpaired T test

E) Wilcoxon rank-sum test

The correct response is Option C.

Selecting an appropriate statistical test is critical for accurate data analysis. Determining the optimal method for a given data set must take into account several factors including the limitations and distributional properties of the variables under study.

Statistical variables may be defined as either categorical or numerical. Categorical variables typically represent qualitative observations (eg, postoperative infection, diabetes, obesity) while numerical variables refer to quantitative observations (eg, body mass index, HgbA1c). Additionally, it is important to distinguish between independent (predictive) and dependent (predicted) variables. These variables can also be categorical or numerical. Dependent variables are typically the measured endpoints of the study (eg, postoperative infections – categorical versus operative times – numerical) while independent variables are hypothesized to have an influence over the measured endpoints (eg, diabetes/obesity – categorical versus HgbA1c / BMI – numerical).

Studies, such as this one examining only categorical variables (diabetes and postoperative infection), are best analyzed using Pearson's chi-squared test. In contrast, a study evaluating only numerical variables is best analyzed using regression analysis.

The unpaired T test and analysis of variance (ANOVA) are best used as statistical tests to analyze independent numerical and dependent categorical data. The tables shown help to provide a general outline for statistical test selection based on the different types of statistical variables being studied including categorical or numerical variables, independent or dependent variables, number of groups being studied, and whether the variables are normally distributed or not.

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These statistical tests make assumptions of the parameters of the population distribution and are considered parametric tests. Non-parametric tests, including the Wilcoxon rank-sum and Kruskal-Wallis tests, are used when the data does not meet the assumptions required for parametric tests.

Statistical Test Selection

Data Type	**Statistical Test**
Categorical	Chi squared or Fisher's exact test
Numerical	Correlation or regression analysis
Independent numerical and dependent categorical	Discriminant analysis

Analysis of Independent Numerical and Dependent Categorical Data

Number of Independent Variables	Normally Distributed?	
	Yes	No
One 2 groups		
Dependent	t-test (paired)	Wilcoxon (paired)
Independent	t-test (unpaired)	Mann-Whitney U
> 2 groups	ANOVA	Kruskal-Wallis
Multiple	ANOVA	Kruskal-Wallis

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250. A 10-year-old boy with osteosarcoma is undergoing resection of 8 cm of proximal tibia. Reconstruction with a vascularized bone flap is planned. Which of the following arteries is the primary blood supply for this flap?

A) Anterior tibial

B) Dorsalis pedis

C) Peroneal

D) Popliteal

E) Posterior tibial

The correct response is Option C.

The peroneal artery is adjacent to the fibula. It arises from the tibioperoneal trunk, immediately distal to the takeoff of the anterior tibial artery. It perforates the interosseous membrane. The peroneal artery also gives perforators to the skin of the lower leg. The length of the pedicle is usually short, but can be increased substantially by dissecting the peroneal artery from the fibula and using the distal bone for reconstruction.

The popiteal artery is proximal to the other arteries mentioned. After crossing the knee, it branches into the anterior and posterior tibial arteries. The posterior tibial artery then gives off the peroneal artery.

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102	(A)	(B)	(C)	(D)	(E)	
103	(A)	(B)	(C)	(D)	(E)	
104	(A)	(B)	(C)	(D)	(E)	
105	(A)	(B)	(C)	(D)	(E)	
106	(A)	(B)	(C)	(D)	(E)	
107	(A)	(B)	(C)	(D)	(E)	
108	(A)	(B)	(C)	(D)	(E)	
109	(A)	(B)	(C)	(D)	(E)	
110	(A)	(B)	(C)	(D)	(E)	
111	(A)	(B)	(C)	(D)	(E)	
112	(A)	(B)	(C)	(D)		
113	(A)	(B)	(C)	(D)	(E)	
114	(A)	(B)	(C)	(D)	(E)	
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)		
121	(A)	(B)	(C)	(D)	(E)	
122	(A)	(B)	(C)	(D)		
123	(A)	(B)	(C)	(D)	(E)	
124	(A)	(B)	(C)	(D)	(E)	
125	(A)	(B)	(C)	(D)	(E)	
126	(A)	(B)	(C)	(D)	(E)	
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)	(E)	
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)	(E)	
146	(A)	(B)	(C)	(D)	(E)	
147	(A)	(B)	(C)	(D)	(E)	
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)		
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)	(E)	
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)	(E)	(F)
169	(A)	(B)	(C)	(D)	(E)	
170	(A)	(B)	(C)	(D)	(E)	
171	(A)	(B)	(C)	(D)	(E)	
172	(A)	(B)	(C)	(D)		
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)	(E)	
185	(A)	(B)	(C)	(D)	(E)	
186	(A)	(B)	(C)	(D)	(E)	
187	(A)	(B)	(C)	(D)	(E)	
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)	(E)	
194	(A)	(B)	(C)	(D)	(E)	
195	(A)	(B)	(C)	(D)	(E)	
196	(A)	(B)	(C)	(D)	(E)	
197	(A)	(B)	(C)	(D)	(E)	
198	(A)	(B)	(C)	(D)	(E)	
199	(A)	(B)	(C)	(D)	(E)	
200	(A)	(B)	(C)	(D)	(E)	
201	(A)	(B)	(C)	(D)	(E)	
202	(A)	(B)	(C)	(D)	(E)	
203	(A)	(B)	(C)	(D)	(E)	
204	(A)	(B)	(C)	(D)	(E)	

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205	(A) (B) (C) (D) (E)
206	(A) (B) (C) (D) (E)
207	(A) (B) (C) (D)
208	(A) (B) (C) (D) (E)
209	(A) (B) (C) (D) (E)
210	(A) (B) (C) (D) (E)
211	(A) (B) (C) (D) (E)
212	(A) (B) (C) (D) (E)
213	(A) (B) (C) (D) (E)
214	(A) (B) (C) (D) (E)
215	(A) (B) (C) (D)
216	(A) (B) (C) (D) (E)
217	(A) (B) (C) (D) (E)
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219	(A) (B) (C) (D) (E)
220	(A) (B) (C) (D) (E)
221	(A) (B) (C) (D) (E)
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246	(A) (B) (C) (D) (E)
247	(A) (B) (C) (D) (E)
248	(A) (B) (C) (D) (E)
249	(A) (B) (C) (D) (E)
250	(A) (B) (C) (D) (E)

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