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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



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

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Of the 30 credits, 4 have been identified as being applicable to Patient Safety.

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for the

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Section 1: Comprehensive

1. A 34-year-old machinist undergoes repair of the flexor tendon of the index finger as the result of a work-related injury. Which of the following is the main rationale for performing early motion exercises after surgical repair?

- A) Decrease adhesions
- B) Decrease postoperative pain
- C) Improve strength of repair
- D) Increase synovial fluid flow
- E) Prevent rupture

The correct response is Option A.

The main rationale for performing early motion exercises is to decrease adhesion formation. During the early phases of tendon healing, large amounts of collagen are deposited and form early scarring. Although this scarring is crucial for the healing of the repaired tendon, scarring will also occur in the tendon sheath and, if allowed to progress, can lead to stiffness in the involved digit. Early passive- and active-motion protocols assist in breaking apart early scarring of the tendon to the surrounding sheath.

Early motion has not shown to increase the final strength of the repair and is more likely to cause rupture. Although synovial fluid flow might be increased with tendon excursion, it does not improve outcomes. Postoperative pain is likely increased with therapy.

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2. Vucekovich K, Gallardo G, Fiala K. Rehabilitation after flexor tendon repair, reconstruction, and tenolysis. *Hand Clin*. 2005 May;21(2):257-265.

2. A 34-year-old woman undergoes laser-assisted liposuction of the abdomen, hips, and inner and outer thighs using a tumescent technique. A total of 2500 mL of aspirate is removed. Postoperative recovery is uneventful, and the patient is discharged home the same day. She comes to the emergency department 4 days later with intense pain over the lower abdomen and flanks. Temperature is 101°F (38.3°C). Physical examination shows the skin has well-demarcated erythema, induration, and bullae forming at multiple sites. Her incisions are seeping clear, grey fluid. Which of the following is the most appropriate management?
- A) Exploratory laparotomy for presumed bowel perforation
 - B) Intravenous administration of antibiotics and local burn care
 - C) Intravenous administration of antibiotics only
 - D) Oral administration of antibiotics
 - E) Surgical debridement of the involved tissue

The correct response is Option E.

Necrotizing fasciitis is a rapidly progressive soft-tissue infection characterized by necrosis of the fascia and subcutaneous fat with subsequent necrosis of the overlying skin. Although complication rates associated with liposuction are not unduly increased, infection is a major concern, and cases of prolonged inflammation, septic shock, and infections have been documented. Likewise, cases of necrotizing fasciitis following liposuction have been reported on several occasions and, according to data reported in the literature, the overall incidence of necrotizing fasciitis is equal to 0.4 per 100,000 patients.

There are two common forms that are reported: infections caused by *Streptococcus pyogenes* and mixed infections caused by a variety of microbes, including *Escherichia coli*, *Proteus*, *Serratia*, and *Staphylococcus aureus*. A detailed case of necrotizing fasciitis sustained by *Mycobacterium chelonae* after a combined procedure of liposuction and lipofilling has also been described. The progressive necrosis of the tissues typically involves the superficial fascia and the subcutaneous layer, but is limited in extension to the skin; the extent of the gangrene at the fascial layer is usually more severe and greater than at the skin level.

Necrotizing fasciitis is virtually unnoticeable in the first 48 hours with nonspecific symptoms. In the days that follow, an extensive, hardened region forms, which is often dark in the center. Severe pain and necrosis follow at the level of the infection.

Drainage of “dishwater fluid” is often pathognomonic. Metabolic changes occur, ending with respiratory distress, oliguria, acidosis, increased troponin concentrations, and sepsis. Diagnosis and treatment consist of surgical exploration and debridement that reveal necrotic, edematous, subcutaneous fat. Bacteriologic analysis of exudate, cultures, and histologic evaluation complete the diagnosis.

Early diagnosis is imperative to avoid a fatal outcome. Treatment is based on immediate and aggressive surgical debridement with combined antibiotic therapy. Because necrotizing fasciitis is a progressive, rapid infection, the wound typically is left open for a planned “second-look” operation and additional debridement if necessary. The mortality rates are increased and range up to 70% but decrease to 4.2% after immediate surgical intervention. Delay in debridement increases mortality.

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2. Anwar UM, Ahmad M, Sharpe DT. Necrotizing fasciitis after liposculpture. *Aesthetic Plast Surg*. 2004 Nov-Dec;28(6):426-427. Epub 2004 Dec 2.

3. A 5-year-old boy is brought to the emergency department 45 minutes after accidentally injecting his palm with epinephrine from an auto-injector (EpiPen). On physical examination, the ring finger is soft and pale, and capillary refill time is poor. A small puncture mark is noted on the flexor surface of the palm just proximal to the metacarpophalangeal (MCP) joint. Which of the following is the most appropriate next step in management?

- A) Application of a hot pack
- B) Emergent operative exploration
- C) Subcutaneous injection of nifedipine
- D) Topical nitroglycerin paste
- E) Observation

The correct response is Option E.

Accidental self-injection of epinephrine with an EpiPen occurs in 1 in 50,000 syringes. There have been no documented cases of digital necrosis following injection, and observation is indicated in this case. The effect of epinephrine's vasoconstriction lasts for approximately 90 minutes and will likely resolve on its own.

Phentolamine has been described as a reversal agent for epinephrine and has shown clinical efficacy, but there has been no study to show that there are better outcomes with phentolamine injection compared with observation. Also, the added volume of injection with phentolamine could cause pressure necrosis and the timing between EpiPen injection and definitive treatment would usually be outside of the 90 minutes it would take for the epinephrine to wear off on its own.

Topical nitroglycerin paste and subcutaneous injection of calcium channel blockers such as nifedipine have not shown to be viable treatment modalities. Application of a hot pack can lead to increased tissue damage and burns and is not indicated. Emergent exploration is indicated for compartment syndrome and is not indicated in this case where the finger is soft.

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1. Greene AK. Management of epinephrine injection injury to the digit. *Plast Reconstr Surg*. 2005 May;115(6):1800-1801.

2. Chowdry S, Seidenstricker L, Cooney DS, et al. Do not use epinephrine in digital blocks: myth or truth? Part II. A retrospective review of 1111 cases. *Plast Reconstr Surg*. 2010 Dec;126(6):2031-2034.
3. Khairalla E. Epinephrine-induced digital ischemia relieved by phentolamine. *Plast Reconstr Surg*. 2001 Nov;108(6):1831-1832.
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4. An otherwise healthy 65-year-old man is evaluated because of a 2-month history of a nonhealing wound to the back of the left heel. He has a history of smoking 50 packs of cigarettes yearly but quit 1 year ago. Physical examination shows a clean wound with exposed bone and palpable distal pulses in the lower extremities. Coverage with a distally based fasciocutaneous sural flap is planned. Because of the patient's history of smoking, a "delay" procedure is performed first. Division of which of the following is required for this procedure?

- A) Distal greater saphenous vein
- B) Distal lesser saphenous vein
- C) Perforator 5 cm proximal to the lateral malleolus
- D) Proximal greater saphenous vein
- E) Proximal lesser saphenous vein

The correct response is Option E.

The surgical step required as part of the "delay" procedure in a distally based sural flap is division of the proximal lesser saphenous vein. The distally based sural flap is a neurofasciocutaneous flap used to reconstruct ankle, heel, and foot defects. The classically described and possibly most important arterial supply to the distally based sural flap is provided by septocutaneous perforators arising from the peroneal artery. The most distal of these is located 4 to 7 cm proximal to the lateral malleolus. However, there are at least three other sources described: fasciocutaneous perforators from the posterior tibial artery, venocutaneous perforators from the lesser saphenous vein, and neurocutaneous perforators from the sural nerve. The skin and fascia of the flap are drained primarily by the lesser saphenous vein. The lesser saphenous vein contains numerous valves that prevent retrograde blood flow. There are, however, one or more smaller collateral veins that run parallel to the lesser saphenous vein. These veins have anastomotic connections to the lesser saphenous vein, which can allow blood to bypass the valves of the lesser saphenous vein and flow in a retrograde fashion.

In attempts to redirect blood flow and decrease the risk of flap necrosis and other complications, several authors have described sural flap delay procedures. Two distinct delay procedures have been described. In one, the flap is first elevated without completely incising the proximal edge of the skin island. A powder-free glove is then placed between the elevated fascia and the gastrocnemius muscle, and the skin is closed. Two weeks later, the flap is completely elevated and transferred

into the defect site. This procedure has the goal of redirecting blood flow in a longitudinal direction before complete elevation of the flap. In the other technique, the flap is raised in its entirety and then sutured back into its donor site. The flap is then transferred into its recipient site as a second procedure. This technique allows the flap to become viable on its distal vascular pedicle before causing the additional trauma of transferring the flap, which can potentially compromise that pedicle.

Division of the greater saphenous vein is not indicated because it is not in the vicinity of the flap. Similarly, division of the perforator 5 cm proximal to the lateral malleolus is not appropriate because this is the major pedicle supplying the flap.

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1. Follmar KE, Baccarani A, Baumeister SP, et al. The distally based sural flap. *Plast Reconstr Surg*. 2007 May;119(6):138e-148e.
2. Kneser U, Bach AD, Polykandriotis E, et al. Delayed reverse sural flap for staged reconstruction of the foot and lower leg. *Plast Reconstr Surg*. 2005 Dec;116(7):1910-1917.

5. A 35-year-old woman is scheduled to undergo low-volume liposuction of the lower abdomen in an office setting. Intravenous sedation, in addition to local and tumescent anesthesia, is planned. Which of the following is essential to have in the operative suite according to the Guidelines for Office-Based Anesthesia?

- A) Central venous catheter kit
- B) Electrocautery unit
- C) Intubation equipment
- D) Tracheostomy set
- E) Warming blanket

The correct response is Option C.

To ensure patient safety during office-based procedures, a system of quality care needs to be established in each facility, emphasizing maintenance of the appropriate facilities, equipment, personnel, protocols, and procedures.

When administering anesthesia of any kind in an office setting, the surgeon should follow the American Society of Anesthesiologists' "Guidelines for Office-Based Anesthesia," and "Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists."

The facility should be outfitted with the appropriate medical equipment, materials, and drugs necessary to provide anesthesia, recovery administration, cardiopulmonary resuscitation, and provisions for potential emergencies. Anesthesia equipment should include suctioning apparatus, appropriately sized airway equipment, including laryngoscope blades, means of positive-pressure ventilation, intravenous equipment, pharmacologic antagonists, basic resuscitative medications, and, in the event of deep sedation, defibrillator equipment.

Additional equipment, such as a central venous catheter kit, electrocautery unit, warming blanket, and tracheostomy set may be desirable based on the type of patients and/or cases being performed, but are not considered essential in the case of the patient described.

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1. Horton JB, Reece EM, Broughton G, et al. Patient safety in the office-based setting. *Plast Reconstr Surg*. 2006 Apr;117(4):61e-80e.
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6. A 32-year-old man with a history of self-inflicted gunshot wound is evaluated because of significant facial deformity despite multiple complex reconstructive procedures. Composite tissue allotransplantation is performed. One episode of rejection is successfully treated 4 weeks postoperatively. Three months postoperatively, the patient develops recurrent swelling and hyperemia of the facial skin. Which of the following is the most likely cause of this condition?

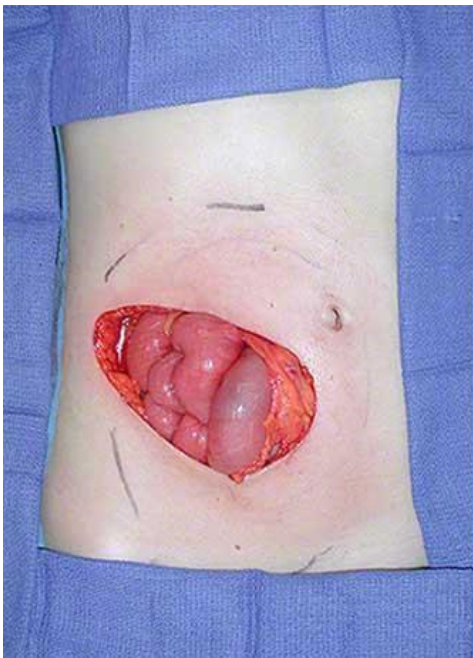
- A) ABO incompatibility
- B) Acute rejection
- C) Antibody incompatibility
- D) Chronic rejection
- E) Hyperacute rejection

The correct response is Option B.

The most likely diagnosis is acute rejection, because this patient is still in the early postoperative period when acute rejection is most likely to occur (0 to 3 months). ABO incompatibility and antibody incompatibility would result in hyperacute rejection, which is mediated by the humoral immune system and occurs within minutes of transplantation. Chronic rejection occurs after years and is characterized by vasculopathy and fibrosis.

REFERENCES:

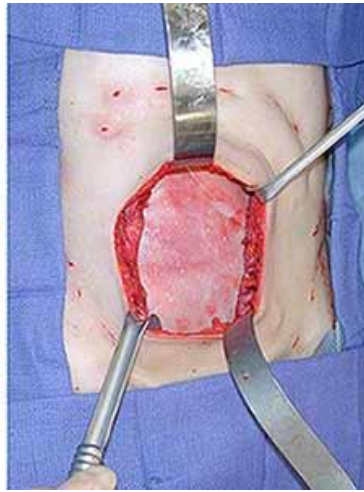
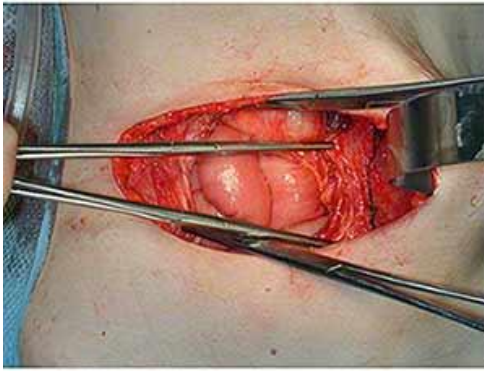
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2. Sarhane KA, Tuffaha SH, Broyles JM, et al. A critical analysis of rejection in vascularized composite allotransplantation: Clinical, cellular and molecular aspects, current challenges, and novel concepts. *Front Immunol*. 2013 Nov 25;4:406. eCollection 2013.



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

7. A 27-year-old woman is evaluated for a recurrent abdominal desmoid tumor. CT scan shows a mass that occupies the full-thickness right musculofascial abdominal wall, involving the rectus abdominis muscle and oblique muscles, including lateral to the semilunar line. Resection is performed. Photographs of the defect are shown. Which of the following is the most appropriate management?
- A) Bilateral component separation, primary skin closure with incisional topical negative pressure wound therapy, adjuvant chemotherapy
 - B) Left component separation, bridging wide intraperitoneal underlay biologic mesh, primary closure skin
 - C) Pedicled right anterolateral thigh flap with rectus femoris, no mesh
 - D) Placement of a bridging inlay of biologic mesh with primary split-thickness skin grafting and negative pressure wound therapy
 - E) Placement of a bridging inlay of uncoated heavyweight polypropylene mesh with adjuvant radiation therapy

The correct response is Option B.



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

The lesion in this patient is a recurrent desmoid tumor, also known as aggressive fibromatosis. It is a benign tumor, usually found in younger patients between 10 and 40 years of age, and is locally aggressive. It is often associated with pregnancy and previous surgery and can frequently recur. Management is en bloc, full-thickness, wide local excision (usually with frozen section confirmation of negative margins). An aggressive full-thickness abdominal wall resection is standard of care, making reconstruction more challenging.

The more durable and functional reconstruction entails complete restoration of the abdominal wall, especially musculofascial components, in a primary reapproximation. However, depending on the size of the tumor and resultant defect, this may not be possible. Basic principles, after obtaining proper margins after resection of the tumor, would then be reduction in defect size to the maximal extent possible and wide bridging underlay of mesh with at least 4- to 5-cm margins in all directions. Bridging inlay, whereby a mesh is simply sewn to the margins of the defect, has clearly been shown to be inferior in terms of recurrence rates.

Mesh choice can be either synthetic or biologic, although if significant contamination exists, if soft-tissue coverage is tenuous, or if one desires to decrease the amount of adhesion formation when placing mesh directly against the bowel, one should consider placement of biologic mesh, accepting the fact that there is a higher incidence of postoperative bulges using these materials, especially in the large.

In this case, only a left component separation is possible, given that the tumor has invaded the right rectus muscle and obliques, precluding their use for myofascial advancement.

There is no role for chemotherapy or radiation therapy in the treatment of these tumors.

Coverage with a right anterolateral thigh flap, with or without rectus femoris, can reconstruct the soft-tissue defect, but avoiding the use of mesh in a defect over 4 cm has a significantly higher chance of a recurrent hernia and would not be standard of care.

Primary skin grafting on top of a nonvascularized thick piece of acellular dermal matrix will not “take,” even with use of negative pressure wound therapy.

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1. Berri RN, Baumann DP, Madewell JE, et al. Desmoid tumor: current multidisciplinary approaches. *Ann Plast Surg*. 2011 Nov;67(5):551-564.
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4. Itani KM, Rosen M, Vargo D, et al. Prospective study of single-stage repair of contaminated hernias using a biologic porcine tissue matrix: the RICH Study. *Surgery*. 2012 Sep;152(3):498-505. Epub 2012 Jul 3.

8. A 35-year-old woman with a history of hypertension is evaluated for body contouring. Physical examination shows generalized abdominal adiposity and moderate infraumbilical pannus. The patient undergoes abdominoplasty and large-volume liposuction after induction of epidural anesthesia. A super-wet technique is used and a total volume of 5500 mL is removed. Which of the following factors poses the greatest risk of death for this patient?

- A) Abdominoplasty
- B) Epidural anesthesia
- C) Hypertension
- D) Liposuction volume
- E) Super-wet technique

The correct response is Option A.

The cumulative effect of multiple procedures performed during a single operation increases the potential that complications may develop. Large-volume liposuction, combined with other procedures such as abdominoplasty, can cause serious complications. Death associated with isolated lipoplasty is rare (0.0021%, or one per 47,415), but mortality increases significantly when lipoplasty is combined with other procedures. When combined with non-abdominoplasty procedures, lipoplasty mortality increases to one per 7314; when combined with abdominoplasty, with or without other procedures, the lipoplasty mortality increases to one per 3281. The presumed benefits of combined procedures must thus be weighed against potential untoward events.

Studies indicate that epidural anesthesia combined with the infusion of anesthetic infiltrate provides patients with a consistent intraoperative comfort level. Data from the few anesthesia studies that have specifically assessed patients undergoing liposuction confirm the safety of general anesthesia, epidural anesthesia, spinal anesthesia, moderate sedation, and local anesthesia for this procedure. It should be noted, however, that epidural anesthesia and spinal anesthesia can cause vasodilation and hypotension, thereby necessitating the administration of excess fluid and increasing the risk of fluid overload.

Based on the patient's history, physical examination, review of systems, laboratory testing, and/or a medical specialist's evaluation, the physician should select the patient's American Society of Anesthesiologists (ASA) physical classification rating:

Type 1: A normal healthy patient;

Type 2: A patient with mild systemic disease;

Type 3: A patient with severe systemic disease;

Type 4: A patient with severe systemic disease that is a constant threat to life.

ASA Type 1 and Type 2 patients are candidates for ambulatory and office-based surgery. The patient described is a Type 2 patient, a classification rating that represents patients who have any of the following conditions that are under control without systemic compromise: diabetes mellitus, hypertension, asthma, gastroesophageal reflux disease, peptic ulcer disease, hematologic disorders, arthritis, and neuropathy

Large-volume liposuction is defined as the removal of 5000 mL or greater of total aspirate during a single procedure. A review of the scientific literature shows that there are no scientific data available to support a specific volume maximum at which point liposuction is no longer safe.

The super-wet technique, introduced in the mid-1980s, uses larger volumes of subcutaneous infiltrate, whereby 1 to 2 mL of solution is infused for each 1 mL of fat to be removed. The infiltrate solution consists of saline or Ringer's lactate with epinephrine and, in some cases, lidocaine. Using this method, blood loss generally decreases to less than 1 to 2% of the aspirate volume.

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9. An otherwise healthy 35-year-old woman is brought to the burn unit because of severe scalding injury to 50% of the total body surface area. Physical examination shows circumferential full-thickness burns to the right upper extremity, and absent distal pulses. Capillary refill time in the fingers is more than 3 seconds. Appropriate airway control and fluid resuscitation are initiated. Emergent right upper extremity escharotomies are performed. Despite surgical intervention, the blood flow to the distal extremity remains poor based on capillary refill time and Doppler flows. Which of the following is the most appropriate next step in management?
- A) Additional escharotomies
 - B) Administration of an intravenous fluid bolus
 - C) Angiography
 - D) Elevation of the extremity and reexamination in 45 minutes
 - E) Fasciotomy of the upper extremity

The correct response is Option E.

The most appropriate next step in management is to proceed with urgent fasciotomies of the upper extremity. Indications for emergency extremity escharotomy are the presence of a circumferential eschar with impending or established vascular compromise of the extremities or digits. Progressive flow reduction by Doppler ultrasound is the primary indication for escharotomy. When evaluating upper extremities, it is advised to Doppler ultrasound the palmar arch, not the wrist, so as to evaluate distal blood flow. Other indications include decreased capillary refill time (more than 2 seconds), cyanosis, and/or relentless deep pain progressing to numbness (in awake patients). Neurovascular integrity should be monitored frequently and in a scheduled manner. Capillary refill time, Doppler signals, pulse oximetry, and sensation distal to the burned area should be checked hourly. After the escharotomy, any continued increase in capillary refill time, decrease in Doppler signal, or change in sensation should lead to immediate further decompression via fasciotomy. A carpal tunnel release is vital during the fasciotomy.

Escharotomies typically are performed at bedside under sterile conditions with intravenous sedation using electrocautery. The aim is to make surgical incisions through burned eschar to allow expansion of underlying tissues. In extremity escharotomies, full-thickness incisions along medial and lateral mid-axial lines should be made. Escharotomies should be carried to just beyond the area of the full-

thickness burn. Digital escharotomies are performed along the mid-axial line between neurovascular bundle and extensor apparatus. The ideal side to perform escharotomy allows for preservation of pinch: thumb requires radial incision only, and the index finger, long finger, ring finger, and little finger require ulnar incisions only.

In the scenario described, further fluid boluses, escharotomies beyond the standard releases, and management would not be appropriate next steps, and would increase the risk of local complications like further ischemia, tissue necrosis/gangrene, or systemic complications like hyperkalemia, metabolic acidosis, and renal failure.

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

10. A 4-month-old male infant is brought to the office because of a rapidly enlarging mass in the eyebrow region. The patient's mother says she first noticed the lesion at 1 month of age and that it was not present at birth. A photograph is shown. Treatment with administration of propranolol is planned. Which of the following adverse effects is most likely in this patient?
- A) Adrenal failure
 - B) Decrease in height
 - C) Hypertension
 - D) Hypoglycemia
 - E) Spastic diplegia

The correct response is Option D.

First-line treatment of a small problematic infantile hemangioma is intralesional corticosteroid (triamcinolone 3 mg/kg). If the tumor is too large to inject, then oral

corticosteroid (prednisolone 3 mg/kg daily) or propranolol is initiated. Interferon is no longer used to treat infantile hemangioma because it may cause spastic diplegia when administered to infants.

The common side effects of propranolol include gastrointestinal effects (vomiting, diarrhea, and constipation), rash, fatigue, and hypersomnia. Severe side effects may include bradycardia, hypotension, chest pain, shortness of breath, bleeding, bronchospasm, and glaucoma. In pediatric patients, propranolol has been associated with hypoglycemia that may occur without the characteristic jitteriness.

Proliferating hemangiomas should not be treated with pulsed-dye laser therapy because accelerated involution does not occur, and patients are at risk for ulceration, pain, bleeding, hypopigmentation, and scarring. The pulsed-dye laser is indicated, however, to treat residual telangiectasias after the tumor has involuted.

Corticosteroid complications (e.g., adverse neurodevelopment, aseptic necrosis of the femoral head, diabetes mellitus, osteoporosis, adrenal insufficiency, cataracts, glaucoma, infection, gastric irritation) have not been observed in patients treated with corticosteroid for infantile hemangioma. Although increased blood pressure has been observed, the clinical significance of this is unclear, and no adverse effects have been reported. Twenty percent of infants develop a temporary cushingoid appearance that disappears during tapering of the medication. Approximately one third of infants exhibit decreased gain in height but return to their growth curve by 24 months of age.

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11. A 14-year-old boy sustains a laceration of the distal forearm. Physical examination and wound exploration suggest flexor carpi ulnaris tendon and ulnar nerve involvement. The patient undergoes immediate microsurgical nerve repair with a nerve graft. Which of the following factors is most likely to predict a satisfactory outcome in this patient?

- A) Age
- B) Gender
- C) Immediate repair
- D) Ulnar nerve involvement
- E) Use of nerve graft

The correct response is Option A.

Multiple studies have evaluated outcomes of median and ulnar nerve repair after transection injury. A meta-analysis by Ruijs et al. confirmed that younger age, specifically under 16 years old, was associated with the highest chance of satisfactory recovery of motor function in both median and ulnar nerve injuries. Patient gender was not found to be a statistically significant factor in outcome. In the same analysis, median motor nerve injuries were found to have a better chance of recovery than ulnar motor nerve injuries. Timing influenced outcome, with delay of repair adversely affecting prognosis, and although the ideal window for repair was not able to be defined by this review, there is some evidence that immediate repair may result in worse outcomes. The use of nerve grafts did not significantly predict motor recovery in these injuries.

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12. A 57-year-old woman undergoes resection of a squamous cell carcinoma of the vagina, resulting in a defect of the posterior two thirds of the vaginal vault from the introitus to the dome. A small portion of the rectum is involved in the resection and primarily repaired. The patient has a history of pelvic radiation therapy and tobacco use. Which of the following is the most appropriate approach for closure of this defect?

- A) Bilateral gracilis muscle flaps
- B) Deep inferior epigastric artery perforator flap
- C) Primary repair of the vaginectomy defect
- D) Split-thickness skin grafting with obturator
- E) Vertical rectus abdominis musculocutaneous flap

The correct response is Option E.

In the clinical scenario described, the vertical rectus abdominis musculocutaneous (VRAM) flap is the most appropriate choice. This approach can provide enough tissue to resurface the vaginal vault and fill dead space.

For posterior defects of the vaginal vault, abdominal-based flaps are usually preferable. They can provide a large amount of vascularized tissue that rotates easily into the defect. Bilateral gracilis muscle flaps alone would offer less soft tissue, and mucosalization in a radiated field is unpredictable. A deep inferior epigastric artery perforator flap is far more complicated than a VRAM flap, and the donor site is problematic in patients with a history of smoking.

Primary closure of a large vaginal defect would likely cause significant stenosis and poor healing because of previous radiation. A skin graft with obturator is not likely to be successful given her radiation and tobacco history and violation of the rectum.

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13. An otherwise healthy 65-year-old man comes to the clinic because of a 3-cm ulcerated lesion of the scalp. There are no palpable regional lymph nodes. Chest x-ray study shows no abnormalities. A punch biopsy is performed and a diagnosis of well-differentiated squamous cell carcinoma is made. Wide local excision of the lesion is planned. Which of the following is the recommended minimum surgical margin in this patient?

- A) 1 mm
- B) 2 mm
- C) 4 mm
- D) 6 mm
- E) 12 mm

The correct response is Option D.

The most appropriate surgical margin recommended for the clinical scenario described is 6 to 10 mm.

Cutaneous squamous cell carcinoma (cSCC) is the second most common skin cancer after basal cell carcinomas. They are broadly categorized into low- and high-risk lesions depending on size, location, depth of invasion, recurrence, and patient factors such as immunosuppression. A 4-mm margin of healthy tissue is recommended for lower-risk lesions. This category includes well-differentiated tumors smaller than 2 cm in diameter that do not occur on the scalp, ears, eyelids, lips, or nose, and do not involve subcutaneous fat. Therefore, simple excision is most valuable in the treatment of small primary squamous cell carcinomas on the trunk, extremities, or neck, where tissue sparing is less essential. The recurrence rate after the excision of low-risk lesions ranges from 5 to 8%.

A 6-mm margin of healthy tissue is recommended for lesions that are larger than 2 cm, invasive to fat, or in high-risk locations (i.e., central face, ears, scalp, genitalia, hands, feet). Given the cosmetic and functional impact of these wider margins, tumors in this latter category are often removed via Mohs micrographic surgery to achieve high cure rates while sparing healthy tissue. The depth of an excision should always include a portion of the subcutaneous fat.

Cure rates following simple excision of well-defined T1 lesions may be as high as 95 to 99%. The generally accepted 5-year cure rate for primary tumors treated with

standard excision is 92%; this rate drops to 77% for recurrent cSCC. No large randomized studies have addressed the issue of appropriate margin size in cSCC, as has been done for melanoma. The recommendations for margin size should be taken only as rough guidelines, with the understanding that large, aggressive lesions frequently have substantial extension beyond the apparent superficial boundary. Therefore, a surgeon's experience and judgment when planning surgical margins is paramount to the successful treatment of cSCC.

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14. Based on the code of ethics of the American Society of Plastic Surgeons, which of the following actions, if committed by a member, can be cause for disciplinary action?
- A) The board-eligible surgeon chooses to advertise in an airline magazine
 - B) The member chooses to place patient testimonials on his or her Web site
 - C) The member participates in a charity raffle, fund-raising event, contest, or other promotion in which the prize is nonsurgical facial rejuvenation
 - D) The member uses his or her own before-and-after photos on the Web site
 - E) The out-of-network member charges wholly disproportionate fees for emergency care

The correct response is Option E.

Disciplinary actions can be taken for charging exorbitant fees, particularly of a non-contractual nature (e.g., emergency care). Fees are exorbitant when they are wholly disproportionate to the services rendered. The reasonableness of fees depends upon the novelty and difficulty of the procedures involved, the skill required to provide proper care, the time and labor required, the fee charged for similar services by similarly situated peers, and whether or not the patient had agreed in advance to the fee. Except in instances of emergencies or urgent and life-threatening disease or injury, nothing in this principle shall be construed to prohibit a member from requiring prepayment of professional fees for all elective surgical operations.

Sanctions can be taken if the member participates in a charity raffle, fund-raising event, contest, or other promotion in which the prize is any procedure defined as a medical service that requires an incision. Examples of services that require an incision include, but are not limited to, rhytidectomy, augmentation mammoplasty, blepharoplasty, and liposuction. Examples of medical services that would not be considered procedures include, but are not limited to, injections (botulinum toxin, hyaluronic acid), microdermabrasion, and other skin surface treatments. Nonsurgical means do not fall under this category.

Sanctions can be taken if the Web site contains a testimonial pertaining to the quality and efficacy of medical care if the experience of the endorser does not represent the typical experience of other patients or if, because of the infrequency and/or complexity of such care, results in other cases cannot be predicted with any degree of accuracy. Also, sanctions may be taken if it contains a testimonial or endorsement

pertaining to the quality of the member's medical care or the member's qualifications if the endorser has been compensated by the member or a third party retained by the member for making such testimonial or endorsement. Honest, well-represented, unbiased, uncoerced testimonials are allowed.

Disciplinary actions can be taken if the Web site contains photographs, images, or facsimiles of persons who falsely or deceptively portray a physical or medical condition, injury, or disease, including obesity, or recovery of relief therefrom; or if it contains photographs, images, or facsimiles of persons who have received the services advertised, but who have experienced results that are not typical of the results obtained by the average patient, without clearly and noticeably disclosing that fact; also, if it contains photographs, images, or facsimiles of persons before and after receiving services, which use different light, poses, or photographic techniques to misrepresent the results achieved by the individual.

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15. A 24-year-old woman is evaluated because of a slow-growing subcutaneous mass of the scalp. An excisional biopsy is performed, and pathologic examination shows keratin and its breakdown products. Which of the following is the most likely origin of this lesion?

- A) Adipocyte
- B) Capillary
- C) Hair follicle
- D) Mechanoreceptor
- E) Sebaceous gland

The correct response is Option C.

Pilar cysts, also known as trichilemmal cysts, originate from the outer root sheath of the hair shaft. They present as firm, slow-growing subcutaneous nodules, and may be difficult to differentiate clinically from epidermoid cysts. They are commonly found on the scalp where they are the most common cutaneous cyst. They are lined by stratified squamous epithelium, which undergoes keratinization. In some cases, these lesions can demonstrate aggressive biologic behavior (proliferating trichilemmal tumors, malignant proliferating trichilemmal tumors), in which case they should be completely excised.

Lesions that originate from adipocytes include lipomas and angiolipomas.

Lesions of vascular origin include cherry angiomas and pyogenic granulomas.

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16. A 28-year-old woman with a traumatic lower extremity wound undergoes free tissue transfer reconstruction. Venous anastomosis is completed with a 3-mm coupler device. Which of the following is the proven benefit of using a coupler device?

- A) Decreased anastomosis time
- B) Decreased thrombosis
- C) Decreased twisting of vessels
- D) Ease of use
- E) Improved kinking

The correct response is Option A.

The only reliable information gleaned from available data is that the use of a coupler for venous anastomoses does decrease the operative time in performing the vascular technique. Most studies point to an improved patency rate in venous anastomoses as well, but this remains open to interpretation.

All the available published data point to one factor with the greatest influence on patency rates: adherence to sound and well-established microvascular technique principles. There is no proof that end-to end, end-to-side, running or interrupted, eversion or mattress, etc., has any superiority over other techniques in patency rates.

At the present time there are no adequate reliable data regarding use of sutureless techniques and their long-term outcomes in a clinical setting.

Other options have not been proven as benefits of a coupler device over other techniques.

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17. A 35-year-old man undergoes a 90-minute rhytidectomy procedure with intravenous sedation. The patient smokes 10 cigarettes daily, but is otherwise healthy. Which of the following factors most likely places this patient at increased risk for postoperative nausea and vomiting?

- A) Duration of procedure
- B) Gender
- C) History of cigarette smoking
- D) History of postoperative nausea and vomiting
- E) Type of anesthesia

The correct response is Option D.

Risk factors for postoperative nausea and vomiting include: female gender, nonsmoking status, prior history of postoperative nausea/vomiting/motion sickness, use of volatile anesthetics/general anesthesia, opioid/narcotic use, facial rejuvenation procedures, and long duration of surgery.

Several measures can be taken to decrease postoperative nausea and vomiting. A thorough history with identification of risk factors can aid stratification of patients preoperatively. Use of long-acting local anesthetic agents, nonsteroidal anti-inflammatory drugs (NSAIDs), and cyclooxygenase-2 selective inhibitors can decrease the need for postoperative opioid use. Avoidance of nitrous oxide, especially in combination with fentanyl and volatile inhalational gases, and multimodal use of serotonin antagonists combined with other antiemetic agents can also decrease postoperative nausea and vomiting.

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18. A 1-year-old female infant is evaluated for a 12 × 12-cm macrocystic lymphatic malformation of the posterior trunk that has been enlarging and causing infections for the past 6 months. The lesion involves the skin, subcutaneous tissue, and muscle. Which of the following is the most appropriate next step in management?

- A) Embolization
- B) Prednisolone therapy
- C) Propranolol therapy
- D) Resection
- E) Sclerotherapy

The correct response is Option E.

First-line intervention for a large, symptomatic, macrocystic, lymphatic malformation is sclerotherapy. Sclerotherapy is the injection of an anti-inflammatory substance (e.g., doxycycline) into a lesion, which causes endothelial damage, fibrosis, and shrinkage of the malformation. Sclerotherapy is more effective and less morbid than resection. Propranolol and prednisolone are treatment options for a problematic infantile hemangioma, but they have no efficacy for vascular malformations. Embolization is first-line intervention for an arteriovenous malformation, and is not a treatment option for lymphatic malformation. Resection is second-line therapy for a large macrocystic, lymphatic malformation. Extirpation can cause significant morbidity (i.e., bleeding, nerve injury, infection, wound breakdown). In addition, excision leaves a cutaneous scar, and recurrence is common because a lymphatic malformation can rarely be completely removed.

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19. A 39-year-old woman successfully undergoes immediate bilateral breast reconstruction with coverage with free deep inferior epigastric artery perforator free flaps. Postoperative flap monitoring is planned. Vascular compromise is most likely to occur during which of the following time periods postoperatively?

A) 0–1 days

B) 2–3 days

C) 4–5 days

D) 6–7 days

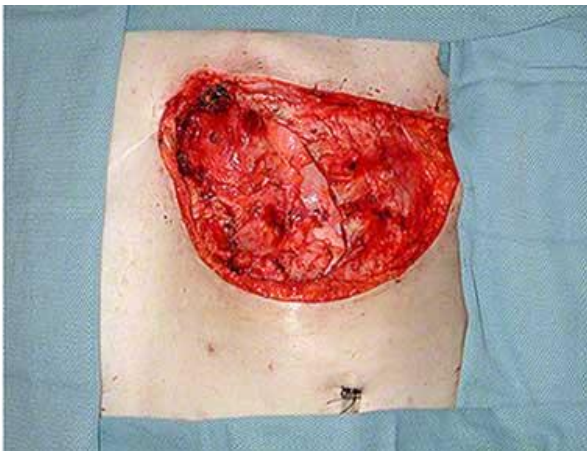
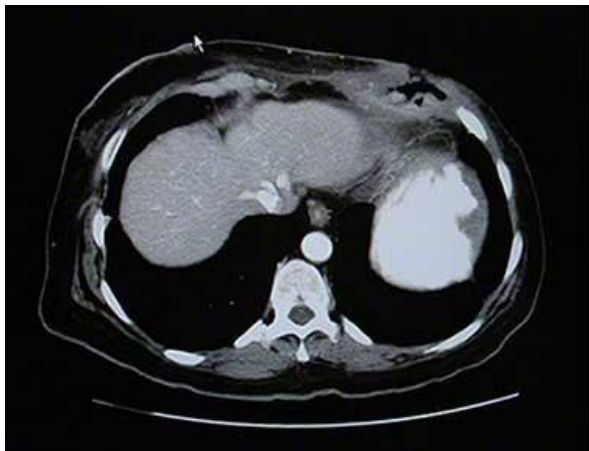
E) 8–9 days

The correct response is Option A.

Free flaps can be monitored by several different modalities in the postoperative period. The main reason for monitoring free flaps postoperatively is to detect vascular complications in a timely fashion, before permanent injury to the flap occurs, and to maximize the possibility of flap salvage. Reviews of large consecutive series of free flaps indicate that the most likely time period for a vascular compromise is early on, usually within the first 24 hours after successful transfer from the operating room. Therefore, postoperative monitoring protocols should be designed to closely follow flap perfusion during this period of time. Vascular events leading to issues with flap perfusion do occur at later times, but such events are generally infrequent and more difficult to salvage.

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

20. A 62-year-old woman presents with a new-onset draining sinus of the left thoracic cage with associated indurated skin. Medical history includes bilateral breast cancer that was managed with bilateral radical mastectomy with radiation therapy 27 years ago. On CT scan, the image (shown) is consistent with osteoradionecrosis. Resection of affected skin, soft tissue, and thoracic cage produces a 35 × 20-cm soft-tissue defect and a skeletal defect spanning five ribs. A photograph of the defect is shown. The thoracic cage is fibrotic and noncompliant because of previous radiation. Which of the following approaches is most appropriate for reconstruction?

- A) Free omental flap with skin graft over titanium mesh and reconstruction plates
- B) Left latissimus dorsi muscle flap with skin graft over acellular dermal matrix
- C) Left rectus abdominis turnover flap with skin graft over methyl methacrylate sandwich
- D) Reverse abdominoplasty advancement over ePTFE patch
- E) Right pectoralis muscle turnover flap over polypropylene mesh

The correct response is Option B.



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

The most appropriate option for this patient is a left latissimus dorsi muscle flap with skin graft over acellular dermal matrix, given the alternatives listed. Basic principles of thoracic reconstruction include: debridement of devitalized tissue, removal of foreign bodies, establishment of healthy wound bed, restoration of stability/structure (generally reconstruction of skeleton if more than four ribs or a greater than 5-cm-diameter defect is involved), restoration of normal respiratory mechanics, protection of vital structures/organs, obliteration of dead space, provision of durable coverage, and delivery of an aesthetic result. However, if a patient has been previously irradiated, and therefore loses compliance of the thoracic cage because of radiation-induced fibrosis, skeletal reconstruction may not be

mandatory if there is no paradoxical motion of the thoracic cage upon respirations and there is preservation of respiratory efficiency. Such is the case with this patient.

A left rectus turnover flap would not be a good option for two reasons: 1) as can be seen in the image, the left internal mammary artery has been harvested, thereby compromising the superior epigastric vessel on which this flap would be based, and 2) it is insufficient to provide enough soft-tissue coverage of a defect this size. Furthermore, as indicated above, methyl methacrylate would not be mandatory in this patient.

A right pectoralis turnover flap is insufficient to cover a defect this size.

A free omental flap can be used to reconstruct this defect (as can a pedicled omental flap), but again, thoracic skeletal reconstruction would not be mandatory in this previously irradiated patient; furthermore, even if it were, titanium mesh and reconstruction plates would not be utilized.

A reverse abdominoplasty flap (Ryan procedure) would not be able to cover a defect this size.

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21. A 37-year-old man, who is American Society of Anesthesiologists (ASA) Class 2, comes to the office for evaluation and treatment of human immunodeficiency virus (HIV)–associated lipodystrophy. The patient has a CD4 count of 100 cells/mm³. Autologous fat grafting is planned. Which of the following factors is most likely to increase this patient's risk of postoperative complications?

- A) ASA Class
- B) CD4 cell count
- C) HIV seropositivity
- D) Percutaneous surgery

The correct response is Option B.

Higher American Society of Anesthesiologists (ASA) class has been identified as a risk factor for postoperative complications in HIV-positive patients in multiple studies. A patient who is ASA Class 2 has only mild systemic disease. Increasing class number indicates increasing severity of disease (Class 3 – severe systemic disease, Class 4 – severe systemic disease that is a constant threat to life).

Acquired immunodeficiency syndrome (AIDS) is diagnosed when the CD4 count is <200 cells/mm³ or with acquisition of an AIDS-defining illness. An absolute CD4 count of <200 cells/mm³ has been associated with increased risk of complications including wound infections.

HIV seropositivity alone has been found not to be an independent risk factor for postoperative complications.

Percutaneous surgery, such as fat grafting, has not been associated with increased risk of infection in HIV patients, nor has skin incisional surgery. Transoral mucosal incisional surgery has been found to be associated with a significantly greater risk of wound infection in HIV patients.

A viral load greater than 10,000 copies/mL suggests that antiretroviral therapy is no longer effective and has been identified as an independent risk factor for complications.

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22. A 41-year-old woman comes to the office for follow-up examination after undergoing reconstruction of the left breast with an implant. She has an upper pole contour depression and desires correction. She has been preauthorized for fat grafting from the abdomen to the upper pole; 25 mL is injected into the upper pole. Which of the following is the most appropriate Current Procedural Terminology (CPT) code?

CPT code	Description
11954	subcutaneous injection of filling material (e.g., collagen) over 10.0 mL
15877	suction-assisted lipectomy; trunk
19380	revision of reconstructed breast
20926	tissue grafts, other (e.g., paratenon, fat, dermis)

- A) 15877 and 11954
B) 15877 and 19380
C) 19380
D) 20926
E) 20926 and 19380

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

The correct response is Option D.

Similar to skin grafting, fat grafting involves a donor site as well as graft and recipient preparation. Fat is harvested, and donor site is closed and dressed. Fat graft is processed and injected into the recipient site. Fat grafting is reported with code 20926 (tissue grafts, other [e.g., paratenon, fat, dermis]) and includes the following:

- Harvest of the fat graft material by any method (e.g., syringe, suction-assisted lipectomy, incision)
- Closure of the donor site, if indicated, with appropriate dressing
- Processing of fat graft material
- Injection of fat graft into recipient site
- Dressing of recipient site

- 90 days of routine postoperative care

Code 20926 is not anatomical site-specific, nor is it volume dependent. Thus, both the injection of 50 mL of fat into the cheek concavity and injection of 500 mL of fat into the thigh for correction of contour irregularities are coded as 20926. This code is used for each anatomical area injected; thus, if both breasts had fat grafting, the Current Procedural Terminology (CPT) codes would be 20926 and 20926-59, because the second breast is recognized as a separate and distinct procedure.

Code 15877 (suction-assisted lipectomy; trunk) is not coded separately because harvest of the graft by any method is included in 20926.

Subcutaneous injection codes (11950–11954) describe the injection of “off the shelf” products such as collagen. These do not involve the harvest of tissue, and hence neither donor site nor postoperative care is involved.

Code 19830 (revision of reconstructed breast) may be appropriate if a large area or multiple areas of a reconstructed breast are grafted, because it may be better described as a “revision of the reconstructed breast.” Currently, however, there is no uniform established minimum volume to be considered sufficient to warrant use of code 19830 instead of 20926. Preauthorization for insurance reimbursement should be done for all fat grafting procedures, because not all payers will cover them, since there is no “functional improvement.”

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23. A 56-year-old man is evaluated for a ventral hernia after undergoing midline laparotomy for diverticulitis. BMI is 38 kg/m². Physical examination shows midline fascial defect measuring 20 × 15 cm; there is no evidence of infection and skin coverage is stable. Repair with rectus advancement and polypropylene mesh is planned. Placement of mesh between which of the following planes is most likely to decrease this patient's risk of hernia recurrence?

- A) Anterior rectus sheath and rectus muscle
- B) Internal and external oblique muscles
- C) Medial edges of rectus muscle
- D) Rectus muscle and posterior sheath
- E) Skin and anterior rectus sheath

The correct response is Option D.

Although recurrence rates are generally very high for large ventral hernias, placement of mesh in the retrorectal position appears to have the most decreased rate of recurrence compared with other methods. Placement above the plane of the rectus muscle requires division of vascular perforators that traverse the rectus muscle and perfuse the overlying skin flaps. These perforating branches of the epigastric circulation are most dense in the periumbilical zone. Preservation of the perforators has been shown to be beneficial in a number of case series reports. Placement of mesh between the oblique muscles in this case would not provide support for the midline hernia because these muscles are more lateral.

Hernia recurrence rates are generally more increased in the presence of infection, with large defects when the rectus muscles cannot be advanced back together in the midline, in obese patients, and in patients with multiple medical comorbidities. Patients with several risk factors can expect recurrence rates in the range of 20 to 40%, whereas patients with few risk factors have recurrence about 5% of the time.

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"separation of parts" hernia repairs. *Plast Reconstr Surg*. 2002 Jun;109(7):2275-2280; discussion 2281-2282.

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

24. A 43-year-old woman is evaluated 6 hours after undergoing delayed breast reconstruction with deep inferior epigastric artery perforator flaps. On Doppler examination, arterial signals are present. Capillary refill time is 3 seconds on the right and 1 second on the left. A photograph is shown. Which of the following is the most appropriate management of the left breast?

- A) Administration of systemic heparin
- B) Administration of systemic tissue plasminogen activator
- C) Application of leeches
- D) Return to the operating room
- E) Observation

The correct response is Option D.

The most appropriate management is exploration of the left flap to assess anastomotic patency and pedicle orientation. This flap is hyperemic with brisk capillary refill and present arterial signals. These are all signs of venous insufficiency, and emergent exploration is indicated to assess the vascular pedicle

for kinking or thrombosis. Application of leeches will drain excess blood from the flap but will not address the underlying problem. Observation is unacceptable because there are signs of venous insufficiency, and this requires urgent intervention. Systemic heparin will prevent further clot formation but will not dissolve an acute clot or resolve pedicle kinking. Systemic tissue plasminogen activator would greatly increase this patient's risk of bleeding. This agent should only be used within a flap.

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2. Blondeel PN, Arnstein M, Verstraete K, et al. Venous congestion and blood flow in free transverse rectus abdominis myocutaneous and deep inferior epigastric perforator flaps. *Plast Reconstr Surg*. 2000 Nov;106(6):1295-9.

25. A 60-year-old man undergoes sigmoid resection and colostomy for management of ruptured diverticulitis. The patient has smoked one pack of cigarettes daily for the past 35 years. BMI is 36 kg/m². After colostomy reversal, he has an abdominal wound infection and fascial dehiscence. Reconstruction with a bridging human acellular dermal matrix is planned. Compared with traditional polypropylene mesh repair, which of the following complications is more likely with the planned approach?

- A) Abdominal bulge
- B) Fistula
- C) Hematoma
- D) Infection
- E) Skin necrosis

The correct response is Option A.

Acellular dermal matrices (ADM) have been advocated for the past decade as an important adjunct in the complex field of abdominal wall reconstruction. Many studies have verified the use and general safety of ADM in abdominal wall reconstruction, but conclusive evidence of its advantages over other techniques is still lacking. What can be inferred is its advantage over prosthetic mesh in contaminated fields. Polypropylene mesh would be contraindicated in the infected wound in this example. After adequate debridement and appropriate antibiotics in an optimized patient, ADM can be used for hernia repair or reconstruction along with component separation. Postoperative infections can be as common as 40%, but conservative management measures often suffice, rather than reoperation and graft explantation, which are required with prosthetic mesh.

One recognized drawback in the stretchable nature of dermal matrix grafts is that they can often stretch under tension to 50% or more of their initial dimensions. Postoperative bulging without true herniation is common. Strategies for prevention include suturing the graft under maximal stretch and use of porcine dermal grafts rather than human grafts.

Hernia recurrence in the complex abdominal wall reconstruction remains a common event, regardless of technique. Although some studies assert a strong advantage with ADM, others report a similar or increased recurrence rate. As successful operative

techniques become more standardized, perhaps more uniform success will be demonstrated in future studies.

Skin necrosis and hematoma are common surgical complications that should not vary between choice of graft material.

Fistula rates are decreased with ADM versus prosthetic mesh reconstruction.

REFERENCES:

1. Janis JE, Nahabedian MY. Acellular dermal matrices in surgery. *Plast Reconstr Surg*. 2012 Nov;130(5 Suppl 2):7S-8S.
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26. A 45-year-old woman is evaluated because of a 1-year history of skin abnormalities. Physical examination shows areas of thickened skin involving the forearms and hands. Telangiectasias are seen on the face and oral cavity. A review of systems discloses symptoms of heartburn and dysphagia. Which of the following is the most likely diagnosis?

- A) Amyloidosis
- B) Dermatomyositis
- C) Hypothyroidism
- D) Scleroderma
- E) Systemic lupus erythematosus

The correct response is Option D.

The scleroderma spectrum of disorders includes localized scleroderma and systemic sclerosis, both of which are characterized by thickened sclerotic skin. Localized scleroderma involves only the skin, whereas systemic sclerosis is associated with extracutaneous involvement and is subcategorized into limited and diffuse forms. Limited cutaneous systemic sclerosis is restricted to the hands, distal forearm, face, and neck. Limited scleroderma is sometimes referred to as CREST syndrome, which is an acronym for the following features: calcinosis, Raynaud syndrome, esophageal dysmotility, sclerodactyly, and telangiectasia. Diffuse cutaneous systemic sclerosis includes truncal involvement (chest, abdomen, upper arms, shoulders).

In most patients with systemic sclerosis, there is gastrointestinal involvement. Symptoms are present in more than half of patients and most commonly are related to gastroesophageal reflux disease, resulting in symptoms such as heartburn and dysphagia. Other findings in systemic sclerosis include: diarrhea, mucocutaneous telangiectasia of the face/lips/oral cavity/hands, dyspnea on exertion/interstitial pulmonary disease, and digital infarctions/pitting.

Amyloid infiltration of the skin may produce thickening and stiffness. Telangiectasias are not a feature of amyloidosis. Gastrointestinal involvement with amyloid typically does not cause esophageal reflux or heartburn.

Dermatomyositis is an idiopathic inflammatory myopathy characterized by skin and muscle abnormalities. Cutaneous involvement manifests in the form of distinct rashes, such as of the upper eyelids (heliotrope rash), hands (Gottron sign), and chest

and shoulders (shawl sign). However, thickened skin of the trunk and limbs, and telangiectasias are not features of dermatomyositis.

Hypothyroidism can result in cutaneous and dermal edema (myxedema). Other findings include fatigue, cold intolerance, weight gain, constipation, dry skin, myalgia, and menstrual irregularities. It is not associated with telangiectasias.

Systemic lupus erythematosus (SLE) is a chronic inflammatory disease that can affect the skin, joints, kidneys, lungs, nervous system, serous membranes, and/or other organs of the body. Mucocutaneous changes include butterfly rash, erythematous plaques (discoid lesions), and ulcers. SLE is not associated with telangiectasias.

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2. Clarke JT, Werth VP. Rheumatic manifestations of skin disease. *Curr Opin Rheumatol*. 2010 Jan;22(1):78-84.
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27. An otherwise healthy 59-year-old woman is scheduled to undergo resection of recurrent squamous cell cancer of the right temporal area 5 years after initial resection, superficial parotidectomy, limited upper cervical lymphadenectomy, skin grafting, and adjuvant radiation therapy. The anticipated defect will be 6 × 8 cm, involving the skin and subcutaneous tissues. The superficial temporal vessels cannot be identified. Which of the following is the most appropriate method of wound closure?

- A) Lateral arm flap
- B) Parascapular flap
- C) Radial forearm free flap
- D) Scalp rotation flap
- E) Split-thickness skin grafting

The correct response is Option C.

The most appropriate method for wound closure is a radial forearm free flap, as it matches the thin skin and subcutaneous tissue of the temporal area and has a long pedicle that can reach recipient vessels in the neck. With a patient history of radiation therapy and superficial parotidectomy, the superficial temporal vessels are unlikely to be suitable recipient vessels. With a patient history of upper neck dissection, it is possible that suitable recipient vessels will only be found inferiorly, and thus, it is best to use a flap with a long, reliable pedicle. A split-thickness skin graft will likely fail in a radiated wound bed. A scalp rotation flap will likely include tissue in the radiation field, bring hair-bearing tissue into a non-hair-bearing area, and require a split-thickness skin graft for closure of the donor site. It could be considered in a patient who is not a candidate for free tissue transfer. The lateral arm flap and parascapular flap are slightly thicker than the radial forearm flap, but the principal reason to avoid these flaps in this patient is that their pedicle lengths are relatively short and may not reach the recipient vessels in the neck.

REFERENCES:

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28. According to the Health Insurance Portability and Accountability Act's Security Rule, which of the following is the basic requirement for storing patient photographs on a personal computer?
- A) De-identification of patient names in files
 - B) Encryption using an approved process
 - C) Institutional review board approval
 - D) Password protection of the personal computer
 - E) Storage of patient photographs is not permitted on personal devices

The correct response is Option B.

According to the U.S. Department of Health and Human Services, “the Health Insurance Portability and Accountability Act (HIPAA) Security Rule establishes national standards to protect individuals’ electronic personal health information (ePHI) that is created, received, used, or maintained by a covered entity. The Security Rule requires appropriate administrative, physical and technical safeguards to ensure the confidentiality, integrity, and security of electronic protected health information.” To this end, HIPAA requires that ePHI be protected using encryption processes that have been tested by the National Institute of Standards and Technology and judged to meet this standard.

Password protection can prevent access to electronic devices but does not allow for data on a device to be deleted in the event of a breach. De-identification of file names does not change the electronic information that is stored within a file and, therefore, is inadequate in protecting ePHI. Institutional review boards are primarily responsible for reviewing and monitoring research that involves human subjects and are generally separate from HIPAA-related regulations.

REFERENCES:

1. U.S. Department of Health & Human Services. Summary of the HIPAA Privacy Rule. Available at: <http://www.hhs.gov/ocr/privacy/hipaa/understanding/summary>. Accessed April 7, 2014.
2. Indiana University. HIPAA Guidance – Safeguarding Patients’ Photographs and Recordings. Available at: <http://www.iub.edu/~vpgc/docs/Compliance/HIPAA->

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29. A 45-year-old man undergoes excision of a basal cell carcinoma of the mid cheek. A 3.6×4.7 -cm oval skin defect with exposed subcutaneous fat is present. Skin grafting is planned. Which of the following is most likely to minimize long-term scar contracture?
- A) Choosing a donor site with appropriate color match
 - B) Defatting of the skin graft
 - C) Harvesting with a mechanical dermatome
 - D) Immobilizing with negative pressure wound therapy
 - E) Including the entire dermis

The correct response is Option E.

The defect is a full-thickness skin defect with exposed subcutaneous fat. Coverage with a local flap and skin graft are possible reconstructive options. If skin grafting were to be performed, then a full-thickness skin graft would minimize the amount of long-term contracture (secondary contracture). A skin graft can be either split- or full-thickness. Split-thickness grafts can be harvested with a mechanical dermatome, or free hand with a scalpel. Split-thickness skin grafts do not include the entire thickness of the dermis and have less initial contracture at the time of harvest (primary contracture). Full-thickness skin grafts contain both the epidermis and the dermis and would have less long-term contracture.

Harvesting with a mechanical dermatome is useful for obtaining split-thickness skin grafts. Typical thicknesses may range from 8/1000th of an inch to 14/1000th of an inch.

Adequate immobilization of a skin graft is critical for “take” of the graft. Negative pressure wound therapy can be employed to promote adherence of the graft to the wound bed.

Defatting of the skin graft in the case of a full-thickness graft is important to optimize graft “take” in the early postoperative period.

Obtaining skin from a donor site with a close color match to the recipient site is an important aesthetic consideration, but does not affect long-term contracture.

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30. A 50-year-old man with paraplegia and diabetes mellitus is evaluated because of an ischial stage 4 pressure ulcer. Optimizing the patient's nutrition and diabetic control is attempted, and aggressive resection of the ulcer and underlying bone with a locoregional flap closure is planned. Which of the following characteristics places this patient at increased risk for late recurrence of the ulcer?

- A) Age greater than 45 years
- B) Defect size greater than 20 cm²
- C) Hemoglobin A_{1c} of less than 6%
- D) Location of ulcer
- E) Osteomyelitis confirmed by bone biopsy

The correct response is Option D.

The risk factor in this patient associated with the greatest risk of late recurrence is ischial ulcer location.

The treatment of pressure ulcers remains a difficult problem for medical practitioners and plastic surgeons. In a recent study, risk factors were identified as predictors of flap failure after resection and reconstruction with a flap. Factors associated with dehiscence include age less than 45 years, history of previous same-site surgery failure, albumin concentration of less than 3.5 mg/dL, and poor diabetic control (hemoglobin A_{1c} of more than 6%). Factors associated with recurrence include ischial wound location, previous same-site surgery failure, and poor diabetic control. Osteomyelitis confirmed by bone biopsy and size of defect were not associated with dehiscence or recurrence. Patients with multiple risk factors showed a dramatic trend toward dehiscence and flap failure.

Other studies corroborate the finding that ischial ulcer location is difficult for achieving coverage. This is most likely secondary to the high pressure over the ischial tuberosities in the seated position. Pressure maps have shown that, when seated, the pressure exceeds 80 to 100 mmHg compared with supine sacral pressures of 60 mmHg.

REFERENCES:

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2. Foster RD, Anthony JP, Mathes SJ, et al. Flap selection as a determinant of success in pressure sore coverage. *Arch Surg*. 1997 Aug;132(8):868-873.
3. Lindan O, Greenway RM, Piazza JM. Pressure distribution on the surface of the human body. I. Evaluation in lying and sitting positions using a “bed of springs and nails”. *Arch Phys Med Rehabil*. 1965 May;46:378-385.

31. A 36-year-old man with traumatic injuries, who is intubated and sedated in the intensive care unit, is noted to have extravasation of concentrated calcium solution from a peripheral access intravenous line. The consult is made immediately after extravasation. Which of the following is the most appropriate management of this injury?

- A) Intravenous administration of dexrazoxane
- B) Local injection of hyaluronidase
- C) Phentolamine infiltration
- D) Topical application of dimethyl sulfoxide
- E) Topical application of heat

The correct response is Option B.

Hyaluronidase is an enzyme that breaks down hyaluronic acid, a mucopolysaccharide that is a normal component of the interstitial fluid barrier. It has been shown to increase the rate of absorption of an injected substance by facilitating diffusion of the substance over a large area. When injected locally within 1 hour of extravasation, it breaks down hyaluronic acid and decreases the viscosity of the extracellular matrix, and facilitates absorption and dispersal of the extravasated chemical.

The ischemic effects of extravasated vasoconstrictive agents such as norepinephrine and dopamine may be reversed with local infiltration of phentolamine, which is an alpha-blocking agent. Topical heat application has been recommended in vinca alkaloid extravasation to promote local circulation and speed up clearance of the extravasated agent. Topical cooling in animal models has been demonstrated to increase ulcer formation.

Dexrazoxane has been shown to antagonize the effects of several topoisomerase II poisons such as anthracycline agents, including doxorubicin. Recent clinical trials in Europe have demonstrated its efficacy in minimizing tissue damage from anthracycline extravasation if administered intravenously within 6 hours of extravasation. It is now the recommended initial treatment of anthracycline extravasation, especially in light of its FDA approval in 2007.

Dimethyl sulfoxide (DMSO) is a free radical scavenger and an effective solvent. It may also have antibacterial, anti-inflammatory, and vasodilatory properties. Its

topical application is effective in preventing ulcerations caused by doxorubicin extravasation.

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1. Kao DS, Hijjawi J. Cold and chemical injury to the upper extremity. In: Neligan PC, Song DH, eds. *Plastic Surgery*. Vol 4. Philadelphia: Elsevier-Saunders; 2013:456-467.
2. Reynolds PM, Maclaren R, Mueller SW, et al. Management of Extravasation Injuries: A Focused Evaluation of Noncytotoxic Medications. *Pharmacotherapy*. 2014 Jan 13. 1396. [Epub ahead of print]
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32. A 40-year-old man undergoes ventral hernia repair with biologic mesh and fascial closure at the midline. A bilateral component separation technique with incision of the external oblique fascia and muscle lateral to the linea semilunaris and dissection in the plane between the external and internal oblique muscles, and separation of the rectus muscle off of the posterior rectus fascia is performed. At which of the following levels can the least amount of advancement of the medial fascial edges be expected?
- A) Midway between the umbilicus and pubis
 - B) Midway between the umbilicus and subcostal margin
 - C) Subcostal margin
 - D) Suprapubic
 - E) Umbilicus

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

The correct response is Option C.

The component separation technique can be used to achieve medial transposition of the rectus muscle and overlying anterior fascia. The surgery involves division of the external oblique fascia and muscle lateral and parallel to the linea semilunaris. The plane deep to the external oblique muscle, which is relatively avascular, is then dissected laterally. The rectus muscle is also separated off of the posterior rectus sheath (using access from the medial laparotomy or hernia incision). This allows for medial advancement of the rectus muscle, overlying anterior rectus sheath, internal oblique muscle, and transversus muscle as a unit. The segmental neurovascular bundles course deep to the internal oblique muscle and penetrate into the rectus muscle 10 to 25 mm medial to its lateral margin.

The component separation technique, when performed in the scenario described, can give unilateral advancement toward the midline approximately 10 cm at the level of the umbilicus, which equates to a bilateral advancement of 20 cm. The least amount of advancement is in the subxiphoid and subcostal regions, often making more cranially located defects more difficult to close. Since it was originally reported in 1990, several modifications and variations of this technique have been described in the literature. These include perforator-preserving and/or endoscopic techniques to

methods that describe additional maneuvers to increase mobilization or improve durability with the addition of biologic or prosthetic meshes.

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33. A 62-year-old woman with a history of Stage III breast cancer is scheduled for delayed autologous breast reconstruction from the abdominal donor site. She has no other medical problems. BMI is 30 kg/m². Her mother had a lower extremity deep venous thrombosis in the past. Caprini risk assessment score is 9. Which of the following is the most appropriate method of postoperative VTE risk reduction?

- A) Aspirin therapy
- B) Early ambulation after surgery
- C) Low-molecular-weight heparin therapy
- D) Sequential compression device use
- E) No VTE prevention is indicated

The correct response is Option C.

Venous thromboembolism (VTE) is a disorder with short-term mortality and long-term morbidity. Plastic and reconstructive surgery patients are known to be at high risk for VTE after surgery. Symptomatic VTE occurs with high frequency after post-bariatric body contouring (7.7%), abdominoplasty (5%), and breast or upper body contouring (2.9%). To fully identify VTE risk in surgical patients, individualized patient assessment is advocated. The Caprini risk assessment model (RAM) is a useful and effective tool to stratify surgical patients for VTE risk. For patients with high Caprini scores, a significantly greater likelihood of VTE events is observed. Approximately 11% of patients with Caprini score >8 will have a VTE within 60 days after surgery.

Based upon recommendations from the ASPS VTE Task Force, patients undergoing elective plastic and reconstructive surgical procedures who have Caprini RAM score of 7 or more should have VTE risk reduction strategies employed, such as limiting operating room times, weight reduction, discontinuation of hormone replacement therapy, and early postoperative mobilization. Patients undergoing major plastic and reconstructive operative procedures performed during general anesthesia that last longer than 60 minutes should receive VTE prevention. For patients with Caprini score of 3 to 6, the use of postoperative low-molecular-weight heparin (LMWH) or unfractionated heparin (UH) should be considered. For patients with Caprini score of 3 or more, use of mechanical prophylaxis throughout the duration of chemical prophylaxis for non-ambulatory patients should be considered. For patients with Caprini score of 7 or more, the use of extended LMWH postoperative prophylaxis should be strongly considered.

Aspirin does not decrease the risk of VTE and may increase the risk of perioperative complications.

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2. Murphy RX Jr, Alderman A, Gutowski K, et al. Evidence based practices for thromboembolism prevention: summary of the ASPS Venous Thromboembolism Task Force Report. *Plast Reconstr Surg*. 2012 Jul;130(1):168e-175e.

34. A 29-year-old woman is evaluated because of a bump that developed on the nasal dorsum 6 months after she underwent reconstruction with an onlay auricular cartilage graft to treat a post-traumatic nasal deformity. Which of the following is the most likely cause of this patient's complication?

- A) Infection
- B) Ossification
- C) Rejection
- D) Resorption
- E) Warping

The correct response is Option E.

Warping is one drawback of auricular cartilage grafts. They can curl over time. Warping is more common when the perichondrial layer is left on the graft. Pure cartilage grafts tend to warp less often. Auricular cartilage and pure cartilage warping would occur gradually over a period of weeks or months.

Cartilage is a versatile graft material that is useful for providing structural support or treating contour problems. The rib, nasal septum, and ear are the most common donor sites. Grafts are primarily composed of hyaline and elastic cartilage, with only a 1 to 10% volume of cells, so they can easily survive transplantation. Graft nutrition relies on diffusion of nutrients through the matrix of proteoglycans, interstitial fluid, and chondrocytes.

Early contour deformities could result from malposition or shifting of the graft. In this clinical case, the deformity occurs at 6 months postoperatively, when the graft should be stable in the soft-tissue envelope. Rejection is not likely with autologous cartilage and would likely occur with extrusion or fluid drainage. Rejection or failure to incorporate would typically be associated with an inadequately vascularized soft-tissue envelope or infection, and these complications would be expected within the first few weeks.

Resorption can occur gradually but is uncommon. A contour indentation would be more likely to result than a protruding bump. Ossification of the graft is not a known complication.

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1. Randolph M, Yaremchuk M. Repair, Grafting and Engineering of Cartilage. In: Mathes S, ed. *Plastic Surgery*. Vol 1. Philadelphia: Elsevier-Saunders; 2006:622-626.
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3. Sheen JH. The ideal dorsal graft: a continuing quest. *Plast Reconstr Surg*. 1998 Dec;102(7):2490-2493.

35. A 45-year-old woman comes to the office seeking consultation for an abdominoplasty. Physical examination shows diastasis recti and excess skin and fat in the infraumbilical region. Abdominoplasty with undermining of the upper abdominal flap and plication of the diastasis is planned. Decrease in overall sensation in which of the following areas is most likely after more than 3 years postoperatively?

- A) Epigastric
- B) Infraumbilical
- C) Lateral abdominal
- D) Subxiphoid
- E) Suprapubic

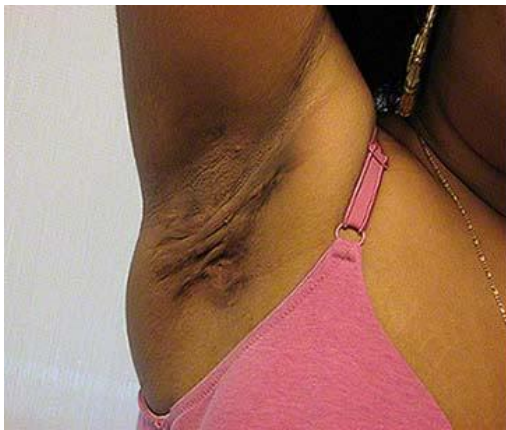
The correct response is Option B.

The area below the umbilicus and above the incision is most likely to have decreased sensation in the long term (after more than 3 years). This is true for superficial touch, superficial pain, temperature (hot and cold), and vibration. The area above the umbilicus recovers sensation to touch, pain, and vibration within 3 years; sensation to hot and cold temperatures recovers beyond 3 years. The suprapubic area has decreased sensation to temperature; however, touch, pain, and vibration recover in the short term. The areas below the xiphoid, at the lateral abdomen, as well as all other areas on the abdomen, have decreased sensation to pressure, although the infraumbilical region had the greatest change.

The anterior nerve branches of the 6th to 12th intercostal nerves travel in a plane between the transversus abdominis and internal oblique muscles. They enter the internal oblique fascia, divide into two branches, and enter the posterior rectus sheath. One branch ascends 3 cm from the lateral edge of the rectus muscle to supply sensation to the skin over the lateral half of the rectus muscle. The other branch travels between the rectus and the posterior sheath before penetrating the linea alba and supplying sensation to the medial half of the rectus muscle. These nerves are divided during undermining from the abdominoplasty.

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

36. A 40-year-old woman with chronic hidradenitis suppurativa of the bilateral axillae is referred for surgical management after 4 years of local wound care, multiple corticosteroid injections, and oral antibiotics failed to improve her symptoms. Physical examination shows multiple inflamed nodules and draining sinuses. Photographs are shown. Which of the following treatment options is most likely to provide long-term resolution of this patient's symptoms?
- A) Axillary lymphadenectomy and coverage with a trapezius flap
 - B) Carbon dioxide laser and silver sulfadiazine
 - C) Fistulotomy and negative pressure wound therapy
 - D) Lesion excision and primary closure
 - E) Total axillary excision and skin grafting

The correct response is Option E.



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

Hidradenitis is a chronic and often disabling skin condition of the apocrine glands. It results in abscesses, inflammatory nodules, and draining sinuses in the axillae, groin, perineum, and occasionally the submammary area. It affects approximately 1 in 300 people, and it is more common in women, people who smoke, and people who are overweight. The axillae are more commonly involved in women, and the perineum more commonly in men.

Early treatment centers around local wound care, oral antibiotics, corticosteroid injections, hygiene, weight loss, and smoking cessation. Decreased estrogen levels may also contribute, and disease often subsides with oral contraceptives and during pregnancy. Unresponsive or extensive disease requires surgical intervention for long-term resolution. Relapse rates are high, and healing is often slow. Although limited excision and closure of solitary lesions is an effective short-term treatment, new lesions are likely to develop. Fistulotomy alone has an unacceptably high recurrence rate.

A long-term resolution in this severely affected patient requires complete excision of the hair-bearing skin of the affected area. The large defect created needs broad skin coverage. The best options include split-thickness skin grafting or grafting with negative pressure wound therapy immobilization. Negative pressure wound therapy followed by healing by secondary intention or coverage with local flaps are additional options, though scar contractures and shoulder stiffness are risks.

Laser treatments are too superficial to treat the deeper apocrine structures. Lymphadenectomy is not necessary for a cure.

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37. A 48-year-old woman is evaluated for immediate bilateral breast reconstruction using coverage with deep inferior epigastric artery perforator free flaps. Which of the following conditions is most likely to be associated with hypercoagulable state?

- A) Celiac disease
- B) Graves disease
- C) Rheumatoid arthritis
- D) Systemic lupus erythematosus
- E) Type 1 diabetes mellitus

The correct response is Option D.

In some cases, patients with systemic lupus erythematosus (SLE) can develop antibodies against platelet membrane phospholipids, increasing adhesion and aggregation of platelets, and producing a state of hypercoagulability. Although not all patients with SLE will develop these antibodies, a history of SLE should raise concern when evaluating a patient for a free flap reconstruction.

All of the other options are autoimmune diseases, but none are typically associated with coagulopathies.

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

38. A 30-year-old woman who underwent uneventful abdominoplasty is evaluated 2 weeks postoperatively because of midline wound dehiscence with tissue necrosis. She reports that she did not stop smoking before surgery as instructed. A photograph is shown. Which of the following mechanisms is the most likely cause of the delayed wound healing?
- A) Decreased catecholamine production
 - B) Decreased hemoglobin concentration
 - C) Decreased leukocyte function
 - D) Increased fibrinogen production
 - E) Increased microvascular vasoconstriction

The correct response is Option E.

Cigarette smoking is a leading cause of preventable death and disability in the United States. Over the past 20 years, several studies have demonstrated an increased risk of postoperative complications following plastic surgical procedures, including rhytidectomy, breast reconstruction, digital replantation, muscle flaps, and body-contouring procedures. Tobacco smoke is a complex mix of particulate matter, volatile acids, and gases. There are over 4000 different compounds in cigarette smoke, many of which are toxic, mutagenic, and carcinogenic. Tobacco-induced vasoconstriction is mediated directly and indirectly by nicotine, a colorless, odorless, and poisonous alkaloid.

Increased cellular levels of nicotine cause direct microvascular vasoconstriction. Indirect pathways of vasoconstriction include the enhancement of thromboxane A₂ and stimulation of catecholamine release. Random skin flaps such as abdominoplasty, rhytidectomy, and mastectomy flaps are predominantly supplied by the subdermal plexus, which is very sensitive to sympathomimetic agonists such as catecholamines.

Smoking also increases carboxyhemoglobin levels, which shifts the oxygen-hemoglobin saturation curve to the left. The net result is decreased oxygen-carrying capacity by direct competitive inhibition from carbon monoxide. Other effects caused by smoking include decreased prostaglandin I₂ (prostacyclin) production, increased platelet aggregation and blood viscosity, decreased collagen production, decreased red blood cell deformability, increased fibrinogen production, and decreased leukocyte function (mediated by hydrogen cyanide). The net effect is a prothrombogenic state with impaired inflammation that also contributes to slow wound healing. Although fibrinogen production is increased and leukocyte function is decreased, the primary mechanism by which wound healing is impaired is related to the nicotine-induced vasoconstriction of the subdermal plexus.

Rhytidectomy patients who smoke are 12.5 times more likely to develop skin necrosis compared with patients who do not smoke. One study showed a 47.9% rate of wound-healing problems in abdominoplasty patients who smoked compared with 14.8% in those who did not smoke. Another large study of patients undergoing breast reconstruction using a free transverse rectus abdominis musculocutaneous (TRAM) flap showed no difference in free flap survival in those patients who smoked, but the smoking population had a significantly higher rate of mastectomy skin flap loss, abdominal donor-site complications, and hernias. Current recommendations for smokers who desire elective cosmetic surgery are to avoid smoking and all nicotine products for 4 weeks before and after surgery.

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

39. A 55-year-old woman comes to the office because of a 3-year history of a raised, dark brown lesion on her back. The lesion is not painful and does not bleed. A photograph is shown. An excisional biopsy is performed. Pathologic examination shows proliferation of cells from the basal layer of the epidermis with cystic inclusions. The lesion exhibits hyperkeratosis, acanthosis, and papillomatosis. Which of the following is the most likely diagnosis?
- A) Basal cell carcinoma
 - B) Malignant melanoma
 - C) Nevus sebaceous
 - D) Seborrheic keratosis
 - E) Verrucous carcinoma

The correct response is Option D.

The lesion is a seborrheic keratosis, also known as verruca senilis or pigmented papilloma. Seborrheic keratoses are common benign lesions that may begin to appear during the fifth decade of life. They arise from the basal layer of the epidermis and are composed of well-differentiated basal cells. They often contain cystic “inclusions” of keratinous material called “horn cysts.” Lesions exhibit hyperkeratosis (thickening of the stratum corneum), acanthosis (diffuse epidermal hyperplasia and thickening of the skin), and papillomatosis (skin surface elevation). The growth and depth of pigmentation vary directly with exposure to sunlight. If left untreated, they will enlarge gradually and increase in thickness. Seborrheic keratoses typically do not involute spontaneously. They may appear on the head, neck, and trunk after age 50 years and are often distinctly marked and have a waxy, stuck-on appearance. The surface is soft and oily to the touch. Sizes can range from 1 mm to 5 cm. No treatment is necessary, but these lesions are cosmetically unappealing, and for that reason alone, patients may request to have them removed. It is extremely rare for cutaneous malignancies to develop within seborrheic keratoses.

A verrucous carcinoma is a variant of squamous cell carcinoma. As such, it requires wide local excision with negative margins for treatment.

Nevus sebaceous (Jadassohn nevus) may be described as cerebriform, nodular, or verrucous. It is hairless and can appear on the scalp, face, or neck. When present at birth, it persists throughout life and tends to become more verrucous and nodular during the growth phase associated with puberty. Over time, these lesions are associated with a risk of basal cell carcinoma, which occurs in approximately 15 to 20%. Keratoacanthoma and squamous cell carcinoma may also develop, although with much less frequency than basal cell carcinoma. Because of the risk of malignant transformation, complete excision is generally recommended.

Melanoma results from malignant transformation of the melanocyte; the pigment-producing cell of the body can occur anywhere melanocytes are present, including skin, eye, and the mucous membranes of the upper digestive tract, sinuses, anus, and vagina. The incidence of cutaneous melanoma in the United States has increased steadily over the past 50 years and is now 15 per 100,000. Worldwide, the incidence of melanoma is generally reflective of variation in genetic, phenotypic, and ultraviolet (UV) exposure risk factors. Major risk factors include exposure to UV radiation and genetic predisposition. The exposure risk primarily involves intermittent, damaging exposure to the sun such that history of a severe sunburn (blistering or pain for more than 2 days), even in youth, confers an approximately twofold increase in risk. Patients who have fair skin, blue eyes, red hair, and are

prone to freckling are at increased risk for melanoma. Mutations in two genes are associated with hereditary melanoma predisposition.

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40. A 45-year-old man sustains a facial laceration and develops a keloid scar. Compared with a hypertrophic scar, this patient's scar is most likely to have which of the following characteristics?
- A) Decreased fibroblast density
 - B) Increased fibroblast proliferation rates
 - C) Increased ratio of type III to type I collagen
 - D) Regression of the scar over time
 - E) Smaller and thinner collagen fibers

The correct response is Option B.

Hypertrophic scars generally arise during the first few weeks following the initial scar, grow rapidly, and then regress. On the other hand, keloid scars appear later following the initial scar, and then gradually proliferate, often indefinitely.

Both keloid and hypertrophic scars demonstrate increased fibroblast density.

Keloid scars demonstrate increased fibroblast proliferation rates compared with hypertrophic scars.

Keloid scars demonstrate a decreased ratio of type III to type I collagen. This is not observed in hypertrophic scars.

Keloid scars demonstrate thicker, larger, and more randomly oriented collagen fibers compared with hypertrophic scars.

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1. Al-Attar A, Mess S, Thomassen JM, et al. Keloid pathogenesis and treatment. *Plast Reconstr Surg*. 2006 Jan;117(1):286-300.
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41. A 27-year-old man is brought to the emergency department after sustaining second- and third-degree burns to most of the anterior torso and the upper extremities. Which of the following describes the appropriate amount of Ringer's lactate, according to the Parkland formula, for fluid management of this patient's condition?

- A) 1 mL/% TBSA/kg given over the first 6 hours
- B) 2 mL/% TBSA/kg given over the first 8 hours
- C) 2 mL/% TBSA/kg, half given over the first 8 hours
- D) 4 mL/% TBSA/kg given over the first 6 hours
- E) 4 mL/% TBSA/kg given over the first 8 hours

The correct response is Option B.

The amount of Ringer's lactate (mL) needed for initial resuscitation is formulated by the Parkland formula of 4 mL/kg/% the total body surface area (TBSA) burned, with half this volume infused over the first 8 hours from the time of injury. In other words, for the first 8 hours, the patient should receive 2 mL/% TBSA/kg. All other options are not accurate based on the Parkland formula and this patient's TBSA.

One easy way to determine the hourly rate for the first 8 hours is to multiply the % TBSA and kg, and divide by 4. Because the Parkland formula is 4 mL/% TBSA/kg, with half given over the first 8 hours, the 4 in the Parkland formula can be divided by 16 (2×8) to give a denominator of 4.

It is absolutely critical to perform accurate estimation of the burn size and weight, because overzealous fluid administration can lead to fluid creep, compartment syndromes, and pulmonary complications.

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2. Cinat ME. Acute Burn Management. In: Sood R, ed. *Achauer and Sood's Burn Surgery, Reconstruction and Rehabilitation*. 1st ed. Philadelphia: Elsevier-Saunders; 2006:50-76.

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42. A 26-year-old lineman is brought to emergency department after accidentally grabbing a high-voltage power line. The most severe injury is seen at which of the following anatomical locations?

- A) Chest wall
- B) Neck
- C) Shoulder
- D) Upper arm
- E) Wrist

The correct response is Option E.

Severity of injury is proportional to the cross-sectional area of tissue able to carry current. Thus, the most severe injuries are seen at the wrists and ankles, with decreasing severity proximally. The extremities are the most frequently injured body parts, with the upper extremity predominating.

Most high-voltage injuries occur in workers on the job, so the voltage is known. Temperature increase parallels changes in amperage with tissue temperature being a critical factor in the magnitude of tissue damage. Tissue resistance from lowest to highest is nerve, blood vessels, muscle, skin, tendon, fat, and bone. Deep tissue seems to retain heat so that periosseous tissues, especially between two bones, often sustain a more severe injury than more superficial tissue. The associated macro- and microscopic vascular injury seems to occur nearly immediately and is not reversible. Alternating current (AC) causes tetanic muscle contraction, which may either throw victims away from contact or draw them into continued contact with the electrical source, the latter being more common, given our propensity to grasp at objects and the greater strength in our forearm flexors relative to extensors. This effect is often described as the “no-let-go” phenomenon. Altered levels of consciousness are reported in about half of high-voltage injuries. The tissue injury in electrical burns seems to be a combination of thermal and nonthermal mechanisms. If enough heat is generated, the tissue heats to supraphysiologic temperatures causing denaturation of macromolecules, which is usually irreversible. Electroporation refers to the formation of aqueous pores in lipid bilayers exposed to a supraphysiologic electric field. The applied electric field alters the transmembrane potential, with muscle fibers and nerves being the most susceptible. Subsequent pore formation likely allows calcium influx into the cytoplasm, thereby triggering apoptosis and cell death. Electroporation can therefore induce cell necrosis in the absence of heating.

Transmembrane protein molecules contain polar amino acid residues that can change orientation in an electric field. This effect, known as electroconformational protein degradation, may be irreversible and form yet another mechanism of nonthermal injury.

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2. Pham TN, Gibran NS. Thermal and electrical injuries. *Surg Clin North Am.* 2007 Feb 87(1):185-206.
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43. A 65-year-old man is evaluated for a large mass in a previously irradiated area of the posterolateral chest. Preoperatively obtained ventilation-perfusion scans and pulmonary function testing are within normal limits. A full-thickness chest wall resection to include three ribs and at least 10 cm of each rib is planned. The soft-tissue defect is anticipated to be 20 cm in diameter. Which of the following factors in this patient is most likely to necessitate a rigid chest wall reconstruction?

- A) Posterolateral position of the defect
- B) Previous chest wall radiation therapy
- C) Total area of the chest wall defect
- D) Total number of ribs resected

The correct response is Option C.

The most likely factor to indicate rigid chest wall reconstruction in this very large anticipated chest wall defect is the total area of the bony chest wall that is resected. Generally, reconstruction of the lateral bony chest wall seems necessary if four or more consecutive ribs are resected or if the diameter of the total defect is larger than 5 cm.

Historically, protection of a flail segment of chest wall was based on the pendelluft principle, a phenomenon in which there is airflow back and forth between the lungs, resulting in underventilated segments of lung. This out-of-phase movement of the airway gas between the intact and flail-chest-side lungs was long believed to be the major contributor to respiratory dysfunction in patients with flail chest but has failed to be proven and appears to be a flawed hypothesis.

In patients who have had radiation therapy, larger defects may be tolerated without rigid chest wall stabilization owing to fibrosis. As many as five ribs may be resected in patients who have undergone radiation therapy before reconstruction is considered because increased fibrosis produces chest wall stiffness.

Anterior and posterior defects are typically better tolerated than lateral defects.

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44. A 10-year-old boy underwent removal of a pigmented nevus from his scalp 2 weeks ago with suture closure. The tensile strength of the incision line today is most likely which of the following percentages of its final strength?

- A) 10%
- B) 20%
- C) 40%
- D) 60%
- E) 80%

The correct response is Option A.

The tensile strength of a skin incision 2 weeks following repair is approximately 10%. Classic studies by Madden and Peacock showed that a cutaneous wound achieves 5% of its ultimate strength after 1 week, 10% after 2 weeks, 20% after 3 weeks, 40% after 4 weeks, and 80% after 6 weeks. The scar has its full strength 12 weeks after repair.

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2. Monaco JL, Lawrence WT. Acute wound healing: an overview. *Clin Plast Surg*. 2003 Jan;30(1):1-12.

45. A 35-year-old woman comes to the office for consultation on augmentation mammoplasty. During preoperative workup, she reports that her mother has a history of malignant hyperthermia. The patient has never undergone surgery. Which of the following anesthetic agents is most appropriate for this surgery?

- A) Desflurane
- B) Halothane
- C) Isoflurane
- D) Propofol
- E) Succinylcholine

The correct response is Option D.

Propofol can be safely used in patients with a suspected diagnosis of malignant hyperthermia.

Malignant hyperthermia is a rare, life-threatening inherited skeletal muscle disorder that shows symptoms of hypermetabolic reaction to volatile anesthetic gases and depolarizing muscle relaxants. The incidence is between 1 in 5000 to 1 in 100,000 anesthetic encounters. Mortality rates have decreased from 70% to less than 5% as awareness of this condition has led to accurate diagnosis and treatment.

Malignant hyperthermia is genetically transmitted through an autosomal dominant inheritance pattern with variable penetrance. In obtaining a medical history, it is important to document family history of adverse outcomes to general anesthesia. If it is reported that a first-degree relative has had a malignant hyperthermia crisis or susceptibility, then the patient should not be exposed to triggering agents. Anesthetic agents that trigger malignant hyperthermia include: halothane, enflurane, isoflurane, desflurane, sevoflurane, and succinylcholine. Nitric oxide can be used if the anesthesia machine is “vapor-free” and contains no traces of volatile gas. Other safe agents include nondepolarizing muscle relaxants (such as vecuronium, rocuronium, and pancuronium), all ester and amide local anesthetics, ketamine, propofol, etomidate, barbiturates, opiates, and benzodiazepines.

Although it is safe to undergo minor procedures with administration of a topical or local anesthetic agent, patients undergoing complex procedures with intravenous sedation, general anesthesia, or major conduction blockade should be referred to an accredited ambulatory surgical center or hospital. If symptoms are recognized in the

operating room (high temperature, increased end-tidal CO₂, muscle rigidity), rapid treatment with dantrolene sodium is the highest priority. Acute episodes may require stopping the procedure and transfer to an intensive care unit.

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46. A 42-year-old woman, with a history of anaphylactic reaction to procaine, comes to the office for consultation regarding augmentation mammoplasty. Anesthetics that contain which of the following should be avoided in this patient?

- A) Acetaldehyde
- B) Epinephrine
- C) Iodine
- D) Methylparaben
- E) Para-aminobenzoic acid

The correct response is Option E.

True allergic reactions to local anesthetics are rare. Type I hypersensitivity reactions may include anaphylaxis, and are modulated by immunoglobulin E. Both ester-based local anesthetics, such as procaine, and amide-based local anesthetics may induce an allergic response. The most likely allergen is para-aminobenzoic acid (PABA). This compound consists of a benzene ring substituted with an amino group at the 4-position (leading to the analogous label of 4-aminobenzoic acid) as well as a carboxyl group. Preservatives such as methylparaben have also been shown to cause allergic reactions to local anesthetics, but are less likely than allergic reactions caused by PABA.

Epinephrine can induce vasoconstriction and increase the safe dosage of administered local anesthetic, though it would not be expected to cause an allergic response itself. Iodine and acetaldehyde should not be found in local anesthetic mixtures.

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47. A 56-year-old man who is an active smoker sustains a degloving injury of the left foot from a motorcycle collision. The heel was avulsed from the calcaneus by a deep posterior laceration but has normal capillary refill. No tissue is missing, but the wound is heavily contaminated and the calcaneus has an abrasion that is imbedded with grit. After irrigation and debridement in the operating room, which of the following is the most appropriate next step in management of this wound?

- A) Coverage with a free gracilis muscle flap
- B) Healing by secondary intention
- C) Layered closure over a drain
- D) Negative pressure wound therapy and skin grafting
- E) Serial debridement and delayed closure

The correct response is Option E.

The most appropriate management of this wound is serial debridement and delayed closure. With such a high level of contamination of both the soft and hard tissues, layered closure after the initial debridement will very likely lead to infection, especially in a patient with a history of smoking. It would be a mistake to perform a free tissue transfer in a highly contaminated wound. Furthermore, there is no missing or ischemic tissue. Negative pressure wound therapy followed by skin grafting would not be appropriate for a deep wound with bone exposure when local tissues are available for closure; this would be more appropriate for a superficial wound with missing skin. Healing by secondary intention is an option; however, serial debridement and delayed closure will take less time, is less painful, and avoids scar formation in the heel.

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48. A 65-year-old woman comes to the office for consultation on blepharoplasty and rhytidectomy. She notes that her eyelid creases are asymmetric, with the right upper crease higher than the left. She also has difficulty seeing out of her right eye when she is tired. She notes that these symptoms have worsened progressively over the past 5 years. She has levator function of 11 mm with the brow and frontalis muscle in neutral position. This patient most likely has which of the following types of ptosis?

- A) Involutional
- B) Mechanical
- C) Myogenic
- D) Neurogenic
- E) Traumatic

The correct response is Option A.

The most likely diagnosis is involutional or senile ptosis. In evaluating a patient requesting a blepharoplasty, one must also evaluate for blepharoptosis. If a blepharoplasty is performed without correction of ptosis, the patient will have continuing ptosis and potentially be dissatisfied.

The most common type of blepharoptosis is involutional or senile ptosis. A thorough history and physical examination should assess ophthalmologic and neurologic causes. On physical examination, there is a characteristic high skin crease (greater than 7 mm), thinned upper eyelid, and lid drop on downward gaze. The levator function (amount of lid excursion with the brow and frontalis muscle held in neutral position) should be assessed. Normal function is greater than 10 mm, moderate function is 5 to 10 mm, and poor function is less than 5 mm.

The etiology of ptosis can be classified into neurogenic (oculomotor nerve palsy, Horner syndrome, Marcus Gunn jaw-winking syndrome), myogenic (myasthenia gravis, myotonic dystrophy, mitochondriopathy), mechanical (edema or tumors), traumatic (birth trauma, muscle or nerve damage), congenital, or neurotoxic (such as in envenomation, snake bites, or botulism). None of these are likely, considering this patient's history and physical examination.

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

49. A 9-year-old girl is evaluated because of an 8-month history of alopecia of the scalp caused by a skin graft over the periosteum. A photograph is shown. Which of the following is the most appropriate method to correct this patient's alopecia?
- A) Coverage with a latissimus dorsi musculocutaneous free flap
 - B) Follicular hair transplantation
 - C) Full-thickness skin grafting from hair-bearing scalp
 - D) Serial excision of the skin graft
 - E) Tissue expansion

The correct response is Option E.



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

Tissue expansion effectively expands hair-bearing scalp that can then be rotated, advanced, and/or transposed over the area of alopecia to correct the deformity. A latissimus dorsi musculocutaneous free flap does not contain hair, and thus, would cause a similar area of alopecia. Follicular hair transplantation would not be efficacious for a large area of alopecia, and the split-thickness graft over periosteum would be insufficient tissue to accept the grafts. Serial excision of the skin graft is not possible because of the large defect and absence of normal scalp tissue on either side of the defect. A full-thickness graft from the hair-bearing scalp would cause a similar area of donor site alopecia.

REFERENCES:

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2. Leedy JE, Janis JE, Rohrich RJ. Reconstruction of acquired scalp defects: an algorithmic approach. *Plast Reconstr Surg*. 2005 Sep 15;116(4):54e-72e.
3. Ridgway EB, Cowan JB, Donelan MB, et al. Pediatric burn-related scalp alopecia treated with tissue expansion and the incidence of associated facial burn injuries. *J Burn Care Res*. 2010 May-June;31(3):409-413.



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

50. A 55-year-old woman comes to the office for a second opinion because she is displeased with the results of a recent bilateral mastectomy and breast reconstruction with 800-mL high-profile silicone implants. A photograph is shown. BMI is 35 kg/m². She repeatedly shows pictures of models with augmented breasts and says that she wants her breasts to be “perkier.” She requests augmentation/mastopexy. Which of the following is the most appropriate next step in management?
- A) Augmentation/mastopexy
 - B) Implant exchange
 - C) Mastopexy
 - D) Reassurance
 - E) Referral to a psychiatrist

The correct response is Option D.

The most reasonable approach in this patient is to offer reassurance and reset her expectations. A patient with a BMI of 35 kg/m² who undergoes mastectomy and implant reconstruction will never look like a model with augmented breasts. This patient clearly has misguided expectations. Any surgical intervention is unlikely to produce the result she is looking for, when in fact she has a very acceptable result as is. Referral of this patient to a psychiatrist will likely upset the patient and undermine her trust.

REFERENCES:

1. Pusic AL, Klassen AF, Snell L, et al. Measuring and managing patient expectations for breast reconstruction: impact on quality of life and patient satisfaction. *Expert Rev Pharmacoecon Outcomes Res.* 2012 Apr;12(2):149-158.
2. Snell L, McCarthy C, Klassen A, et al. Clarifying the expectations of patients undergoing implant breast reconstruction: a qualitative study. *Plast Reconstr Surg.* 2010 Dec;126(6):1825-1830.

Section 2: Hand and Lower Extremity

51. A 20-year-old man is evaluated after falling on his outstretched hand. Physical examination shows tenderness of the snuffbox. X-ray studies of the wrist show no fracture. Which of the following is the most appropriate initial step in management?
- A) Application of a sugar-tong splint
 - B) Application of a thumb spica splint
 - C) Application of a volar wrist splint
 - D) Application of an ulnar gutter splint
 - E) No treatment is necessary

The correct response is Option B.

The patient described may have a scaphoid fracture that is not apparent on initial x-ray studies. Prudent management involves placement of a thumb spica splint until definitive diagnosis can be made. Repeating x-ray studies in 2 weeks or obtaining further radiologic studies, such as CT scans, can make the definitive diagnosis. Casting would be suboptimal in an acute injury such as this because soft-tissue swelling can cause constriction. Surgical exploration is not warranted at this time. A wrist-control, sugar-tong, or ulnar gutter splint would not adequately immobilize the scaphoid, and therefore, would not be adequate management.

Acute scaphoid fractures can often be missed on initial x-ray studies, with reported sensitivities ranging from 84 to 98%. When clinical suspicion of a scaphoid fracture is high and plain films are negative, the traditional recommendation is for these patients to be immobilized in a thumb spica splint or cast with repeat x-ray studies after about 2 weeks.

Even on the repeated x-ray study after 10 to 14 days propagated by many clinicians in cases of occult fracture, a scaphoid fracture is often missed since the additional sensitivity is low, although in a case of sclerosis, an x-ray study could confirm the suspected diagnosis. Further studies that may confirm the diagnosis include CT scan, MRI, and bone scan.

A hand-based opponens splint, by not crossing the wrist joint, would not adequately immobilize a scaphoid fracture.

REFERENCES:

1. Ring D, Lozano-Calderón S. Imaging for suspected scaphoid fracture. *J Hand Surg Am.* 2008 Jul-Aug;33(6):954-957.
2. Beeres FJ, Rhemrev SJ, den Hollander P, et al. Early magnetic resonance imaging compared with bone scintigraphy in suspected scaphoid fractures. *J Bone Joint Surg Br.* 2008 Sep;90(9):1205-1209.
3. Tiel-van Buul MM, van Beek EJ, Borm JJ, et al. The value of radiographs and bone scintigraphy in suspected scaphoid fracture. A statistical analysis. *J Hand Surg Br.* 1993 Jun;18(3):403-406.
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52. A thin 40-year-old woman has an 8 × 5-cm skin defect in the distal third of the anterior leg extending to the dorsum of the foot, with tibia denuded of periosteum and exposed tendon, after undergoing stabilization of the fracture with internal hardware 3 days ago. The distal posterior tibial artery was ligated before surgery at the distal third of the leg. There are no signs of infection or osteomyelitis. Which of the following is the most appropriate method of reconstruction?

- A) Application of bilaminate neodermis (Integra) and negative pressure wound therapy
- B) Coverage with a dorsalis pedis flap
- C) Coverage with a free anterior lateral thigh (ALT) flap
- D) Coverage with a free tranverse rectus abdominus myocutaneous (TRAM) flap
- E) Coverage with a reverse sural flap

The correct response is Option C.

A free anterior lateral thigh flap is large enough to close the defect, can be thinned for aesthetics and shoe wear, and may allow for primary closure of the donor site. Although free tranverse rectus abdominus myocutaneous (TRAM) flap coverage is a possibility, the potential complications of taking muscle and unpredictable control of the final contour make them less ideal options. The reverse sural flap is not an option because of the ligation of the posterior tibial artery. In addition to having severe donor site morbidity, the dorsalis pedis would remove the remaining blood supply to the foot. The vascular nature of the defect's wound bed makes bilaminate neodermis (Integra) and negative pressure wound therapy a less optimal choice.

REFERENCES:

1. Heller L, Levin LS. Lower extremity microsurgical reconstruction. *Plast Reconstr Surg*. 2001 Sep 15;108(4):1029-1041; quiz 1042.
2. Demirtas Y, Kelahmetoglu O, Cifci M, et al. Comparison of free anterolateral thigh flaps and free muscle-musculocutaneous flaps in soft tissue reconstruction of lower extremity. *Microsurgery*. 2010;30(1):24-31.

53. A 3-month-old male infant is brought to the clinic by his parents for evaluation of craniofacial and hand anomalies. Genetic testing confirms an *FGFR2* abnormality consistent with Apert syndrome. Which of the following hand anomalies is most likely in this infant?

- A) Camptodactyly
- B) Clinodactyly
- C) Ectrodactyly
- D) Macrodactyly
- E) Syndactyly

The correct response is Option E.

The hand anomaly most associated with Apert syndrome is syndactyly.

Apert syndrome, or acrocephalosyndactyly, is a syndrome resulting from a defect in chromosome 10q, the site of the fibroblast growth factor-2 receptor. This syndrome consists of coronal craniosynostosis, mid face hypoplasia with retrusion, and syndactylies of the hands and feet. These may be type I (syndactyly of digits 2–4 with a free thumb; “spade hand”), type II (syndactyly of digits 2–4 with a simple syndactyly of the thumb; “mitten hand”), or type III (complex syndactyly of all digits with complex thumb syndactyly; “rosebud hand”).

The other choices are not typically associated with Apert syndrome. Camptodactyly is a fixed-flexion deformity of the proximal interphalangeal (PIP) joint(s), most commonly the little finger. Macrodactyly involves the localized overgrowth of bone and soft tissue. Clinodactyly is congenital deviation of a digit in the radioulnar plane. Ectrodactyly refers to a split-hand/split-foot malformation.

REFERENCES:

1. Fearon JA, Podner C. Apert syndrome: evaluation of a treatment algorithm. *Plast Reconstr Surg*. 2013 Jan;131(1):132-142.
2. Upton J. Apert syndrome. Classification and pathologic anatomy of limb anomalies. *Clin Plast Surg*. 1991 Apr;18(2):321-355.
3. Chang J, Danton TK, Ladd AL, et al. Reconstruction of the hand in Apert syndrome: a simplified approach. *Plast Reconstr Surg*. 2002 Feb;109(2):465-470; discussion 471.



54. A 65-year-old woman undergoes open reduction and internal fixation for the injury displayed in the x-ray study shown. Six weeks postoperatively, she has diffuse swelling, stiffness, and pain of the right upper extremity. Her skin appears shiny, and she has changes in the patterns of both hair and perspiration in the right upper extremity when compared with the left upper extremity. After injury, treatment with which of the following would most likely have decreased her risk for this complication?

- A) Amitriptyline
- B) Ascorbic acid
- C) Gabapentin
- D) Prednisone
- E) Pregabalin

The correct response is Option B.

Complex regional pain syndrome (CRPS) is chronic pain that persists in the absence of ongoing cellular damage and is characterized by autonomic dysfunction, trophic changes, and impaired function. In the perioperative period, the physiologic consequences of CRPS in the upper extremity contribute to or create one or more of the following: clinically significant osteopenia, delayed bony healing or nonunion, joint stiffness, tendon adhesions, arthrofibrosis, pseudo-Dupuytren palmar fibrosis, swelling, and atrophy. The reported incidence of CRPS is 5.5 to 26.2 per 100,000 person-years, and the prevalence is reported as 20.7 per 100,000 person-years. Women are more frequently affected than men, with a ratio of 3:1 to 4:1; the upper extremity is involved more frequently than the lower extremity; and fracture is the most common causative event. Incidence of CRPS after distal radius fracture has been reported to be between 22 and 39%.

In a double-blind, prospective, multicenter trial by Zollinger et al., 416 patients with 427 wrist fractures were studied for the effects of prophylactic vitamin C (ascorbic acid) on the risk of subsequent development of CRPS. Administration of 500 mg vitamin C daily was found to significantly decrease the incidence of CRPS in patients with distal radius fracture. The authors recommend treatment for 50 days.

The other four medications listed have all been reported for the treatment of patients diagnosed with CRPS. None have been reported to decrease the incidence of CRPS when used prophylactically.

REFERENCES:

1. Li Z, Smith BP, Tuohy C, et al. Complex regional pain syndrome after hand surgery. *Hand Clin.* 2010 May;26(2):281-289.
2. Zollinger PE, Tuinebreijer WE, Breederveld RS, et al. Can vitamin C prevent complex regional pain syndrome in patients with wrist fractures? A randomized, controlled, multicenter dose-response study. *J Bone Joint Surg Am.* 2007 Jul;89(7):1424-1431.

55. A 15-year-old girl sustained an isolated open tibial fracture in a motor vehicle collision. At the proximal third of the tibia, 15 cm of anterior soft-tissue loss is noted. Despite fracture reduction, the foot is warm but pulseless without dopplorable signals. The patient is otherwise stable. Which of the following is the most appropriate next step in management?

- A) Below-knee amputation
- B) CT angiography
- C) Four-compartment fasciotomy
- D) Internal fixation and soft-tissue coverage
- E) Surgical exploration of the popliteal artery

The correct response is Option B.

Lower extremity fractures with combined soft-tissue and neurovascular trauma have high rates of complications, and a percentage of these injuries lead to amputation. Risk factors for amputation include Gustilo IIIC injuries, sciatic or tibial nerve injuries, prolonged ischemia (more than 4 to 6 hours), significant soft-tissue injury, significant wound contamination, multiple injured extremities, advanced age, lower versus upper extremity trauma, and futile attempt at revascularization. While tibial nerve injury is a risk factor and relative indication for amputation, it is never an absolute indication for amputation.

Hard signs for vascular injury include: active hemorrhage, expanding hematoma, bruit or thrill, absent distal pulses, and distal ischemic signs and symptoms (five P's). In the face of these hard signs, imaging such as CT angiography should be used to evaluate for vascular injury. With that said, most hard signs can be explained by soft-tissue or bone bleeding, traction of intact arteries due to unreduced fractures, or compartment syndrome.

Early soft-tissue coverage is associated with a lower complication rate. The goal is to close wounds within 7 to 10 days to decrease the risk for infection, osteomyelitis, nonunion, and further tissue loss.

It is best to get wound control prior to bone grafting, avoiding the risk of losing valuable limited bone; therefore, bone grafting is generally postponed until 8 to 10 weeks after soft-tissue wound coverage.

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1. Parrett BM, Pribaz JJ. Lower Extremity Reconstruction. *Rev Med Clin Condes*. 2010;21(1):66-75.
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56. A 45-year-old man comes to the office for follow-up evaluation 3 months after undergoing amputation through the distal third of the middle phalanx of the long finger. He underwent 6 weeks of occupational therapy, but he demonstrates 45 degrees of active proximal interphalangeal (PIP) joint flexion with the initiation of flexion, followed by paradoxical extension with continued attempted flexion. Passive flexion at the PIP joint is 100 degrees. The unaffected digits have full 100 degrees of active flexion at the PIP joint. Which of the following surgical interventions performed on the long finger is most appropriate to achieve full flexion at the PIP joint of the long finger?

- A) Division of the flexor digitorum profundus tendon
- B) Extensor tenolysis
- C) Flexor tenolysis
- D) Release of PIP joint contracture
- E) Release of the lumbrical
- F) Revision amputation

The correct response is Option E.

This is a lumbrical plus finger as a result of amputation of the long finger at the distal third of the middle phalanx. The flexor digitorum profundus (FDP) tendon has retracted, increasing tension on the lumbricals during flexion through the FDP tendon. This leads to paradoxical extension of the proximal interphalangeal (PIP) joints with attempted flexion of the digit. Division of the lumbrical to the long finger will solve this problem.

PIP joint arthrotomy is not necessary, as this is not a PIP joint flexion or extension contracture. The scenario described insinuates this by providing the information about the passive range of motion as compared with the active range of motion at the PIP joint.

Flexor tendon adhesions do not lead to paradoxical extension with attempted flexion. Therefore, flexor tenolysis will not improve the range of motion of the PIP joint.

The PIP joint has full passive flexion and an ability to extend at the PIP joint, making significant extensor adhesion less likely, and therefore, extensor tenolysis a less worthwhile procedure than lumbrical release to address this issue.

Division of the FDP tendon will not improve flexion of the long finger PIP joint or address the paradoxical extension at the PIP joint.

Revision amputation of the long finger will not address the paradoxical extension at the PIP joint.

REFERENCES:

1. Parkes A. The “lumbrical plus” finger. *J Bone Joint Surg Br.* 1971 May;53(2):236-239.
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57. A 16-year-old girl with no history of international travel is brought to the office because of gradually increasing size of the feet, swelling of the legs, and loss of definition of the calves. Her parents say they first noticed that the soft tissue of her ankles was compressed by her shoes 2 years ago. Family history includes foot, leg, and ankle swelling. Physical examination shows relative effacement of the knee-calf and calf-ankle junctions. Pitting edema is noted. Which of the following is the most likely diagnosis?

- A) Filariasis
- B) Lymphedema praecox
- C) Lymphedema tarda
- D) Milroy disease
- E) Secondary lymphedema

The correct response is Option B.

Lymphedema praecox is the most likely form of hereditary lymphedema. It typically manifests at puberty and has a chronic course. The scenario describes a classic case of lymphedema praecox—bilaterality, occurring sometime around puberty.

Filariasis is the most common cause of lymphedema worldwide, but it is not endemic to nontropical countries. *Wuchereria bancrofti*, *Brugia malayi*, *Brugia timori*, *Onchocerca volvulus*, and *Loa loa* are parasites that cause filariasis.

Lymphedema tarda arises in middle age by definition. It is another form of primary lymphedema.

Milroy disease is not the appropriate response. This is a congenital form of lymphedema, usually present at birth or manifesting shortly after birth. It often has asymmetries to the symptoms. The scenario described would not be typical of Milroy disease.

Secondary lymphedema could theoretically occur in a 16-year-old girl, bilaterally and symmetrically with no additional symptoms or examination findings, but it is very unlikely. Malignancies that cause secondary lymphedema would also cause other findings, particularly if cancer had been present for 2 years or more. The child has no history of other trauma, insult, or infection at the groin. Also, the patient

described has a family history of leg swelling, which is strongly suggestive of some form of primary lymphedema.

REFERENCES:

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2. Smeltzer DM, Stickler GB, Schirger A. Primary lymphedema in children and adolescents: a follow-up study and review. *Pediatrics*. 1985 Aug;79(2):206-218.

58. A 48-year-old right-hand–dominant man who is a carpenter is evaluated because of progressive intermittent discomfort in his dominant hand. Symptoms include hand cramping during work activities, sensitivity to cold, tingling of the ulnar fingers, and difficulty holding heavy objects. He does not smoke cigarettes. Physical examination shows decreased sensation, pallor, and decreased capillary refill time in the ring and little fingers. Which of the following is the most likely diagnosis?

- A) Hypothenar hammer syndrome
- B) Raynaud disease
- C) Thoracic outlet syndrome
- D) Thromboangiitis obliterans
- E) Ulnar tunnel syndrome

The correct response is Option A.

The patient's presentation is classic for hypothenar hammer syndrome, or trauma-induced thrombosis of the ulnar artery. This condition is significantly more common in men than in women (9:1), peaks in incidence between 40 and 60 years of age, and is often associated with vocational (e.g., carpenter, machinist, mechanic) or recreational activities (e.g., golf, baseball catchers) that subject the ulnar base of the palm to repeated vibration or blunt trauma. Unlike thromboangiitis obliterans (Buerger disease) or Raynaud disease, the presenting signs and symptoms are almost always unilateral and localized to the ulnar side of the hand and can include pain over the hypothenar eminence, cold sensitivity, paresthesias in the ring and little fingers, blanching and slow capillary refill in the ring and little fingers, and possible positive Allen test. Occasionally, there may be an aneurysm (pulsatile mass) in the ulnar tunnel. Nonoperative treatment, such as activity modification, is effective in many cases, but persistent symptoms or the presence of an aneurysm may warrant resection of the involved area with vein grafting.

Buerger disease is an acquired vasculitis that occurs almost exclusively in smokers. It is typically bilateral, not localized to the ulnar side of the hand, more common in males (3:1) between the ages of 30 and 45 years, and progresses from intermittent claudication to severe ischemia with ulceration and necrosis of the affected fingers. Raynaud disease is an idiopathic vasospastic disorder that is more common in females under the age of 40 years. This typically affects all fingers and is often bilateral. Symptoms include acute episodes of blanching and lack of blood flow

(white fingers), followed by cyanosis (blue finger discoloration), and eventual rapid reperfusion and hyperemia (fingers turn bright red). Ulnar tunnel syndrome refers to compression of the ulnar nerve in the ulnar tunnel, often by a ganglion cyst. While ulnar nerve compression can be a component of hypothenar hammer syndrome, this diagnosis does not include an ischemic presentation as portrayed in the case. Thoracic outlet syndrome is neurovascular compression of the subclavian vessels and brachial plexus. This condition can present with upper extremity cold intolerance and sensory symptoms localized to the ulnar nerve, but the symptoms are usually more diffuse, and vascular compromise is rare and not specific to the ulnar hand.

REFERENCES:

1. Yuen JC, Wright E, Johnson LA, et al. Hypothenar hammer syndrome: an update with algorithms for diagnosis and treatment. *Ann Plast Surg*. 2011 Oct;67(4):429-438.
2. Lifchez SD, Higgins JP. Long-term results of surgical treatment for hypothenar hammer syndrome. *Plast Reconstr Surg*. 2009 Jul;124(1):210-216.

59. The metacarpophalangeal (MCP) joint of the thumb is which of the following types of joint?

- A) Ball-and-socket
- B) Condylloid
- C) Hinge
- D) Pivot
- E) Saddle

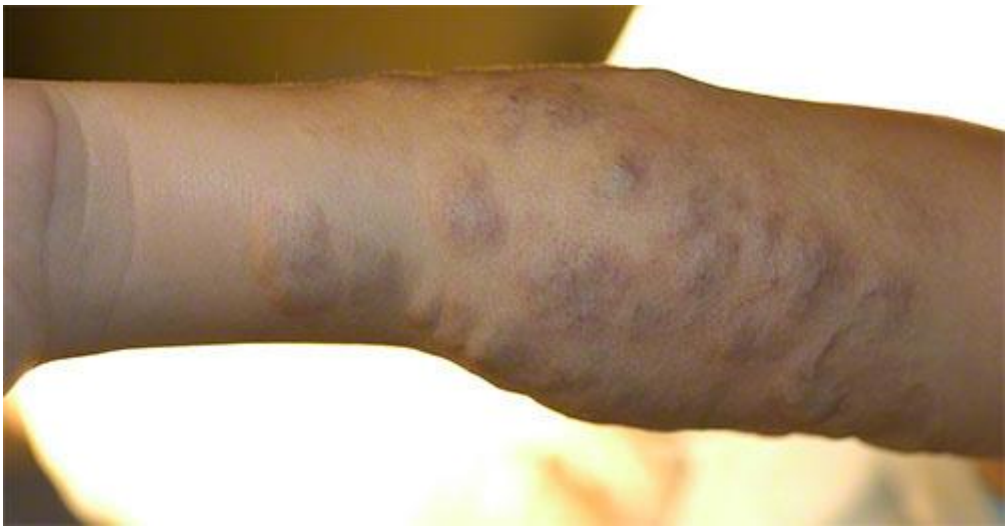
The correct response is Option C.

The metacarpophalangeal (MCP) joint of the thumb and interphalangeal joints of the index through little fingers are hinged joints and allow flexion and extension only. Lateral forces can disrupt the collateral ligaments, resulting in partial or full tears.

Condylloid joints allow flexion and extension, abduction and adduction, and circumduction, and they can be seen in the MCP joints of the index through little fingers and in wrist joints. Saddle joints allow flexion and extension, abduction and adduction, and circumduction, and they can be seen in the carpometacarpal joint on the thumb. Ball-and-socket joints allow flexion and extension, abduction and adduction, and internal and external rotation, and they can be seen in the shoulder and hip joints. Pivot joints allow rotation and are seen in the atlas and axis bones.

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1. Doty JF, Rudd JN, Jemison M. Radial collateral ligament injury of the thumb with a Stener-like lesion. *Orthopedics*. 2010 Dec 1;33(12):925.
2. Lee AT, Carlson MG. Thumb metacarpophalangeal joint collateral ligament injury management. *Hand Clin*. 2012 Aug;28(3):361-370.
3. Tang P. Collateral ligament injuries of the thumb metacarpophalangeal joint. *J Am Acad Orthop Surg*. 2011 May;19(5):287-296.
4. Leversedge FJ. Anatomy and pathomechanics of the thumb. *Hand Clin*. 2008 Aug;24(3):219-229.



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

60. A 3-year-old boy is brought to the office because of recurrent swelling, discoloration, and occasional discomfort of the right forearm. Discoloration and swelling have been present since birth, but these features have become more pronounced with growth and are exacerbated by limb dependency. A photograph is shown. Which of the following is the most appropriate initial treatment in this patient?
- A) Interferon alpha therapy
 - B) Propranolol therapy
 - C) Reassurance that the condition will resolve with time
 - D) Sclerotherapy
 - E) Systemic corticosteroid therapy

The correct response is Option D.

The lesion shown is a venous malformation. Unlike infantile hemangioma, these lesions are present at birth and grow proportionately with the child, and therefore, cannot be expected to resolve over time. Venous malformations can become more symptomatic with growth and swelling or symptoms are exacerbated by dependency. In addition, rapid swelling and pain can result from phlebothrombosis (clotting) in the anomalous venous channels. The most effective treatment for symptomatic lesions is sclerotherapy. Operative excision is generally reserved for

focal lesions or those with significant functional effects; because the lesions involve critical tissues and are poorly circumscribed, operative excision is rarely curative. The other options presented have been used to treat infantile hemangioma, but have not demonstrated effectiveness for venous, arteriovenous, or lymphatic malformations.

REFERENCES:

1. Greene AK, Alomari AI. Management of venous malformations. *Clin Plast Surg*. 2011 Jan;38(1):83-93.
2. Greene AK. Vascular anomalies: current overview of the field. *Clin Plast Surg*. 2011 Jan;38(1):1-5.



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

61. A 20-year-old man has purulent breakdown 5 months after sustaining a Gustilo type IIIB open fracture treated with intramedullary rod placement and skin grafting over a medial gastrocnemius flap. A postoperative x-ray study and current photograph are shown. The intramedullary rod is removed and an external fixator is placed. There is 1.5 cm of bone without periosteum surrounding the fracture exposed in the wound. Which of the following is the most appropriate next step in wound reconstruction?
- A) Full-thickness skin grafting with a bolster dressing
 - B) Reconstruction with an anterior tibial artery perforator flap
 - C) Reconstruction with a lateral gastrocnemius muscle flap and skin grafting
 - D) Reconstruction with a pedicled descending medial genicular artery flap
 - E) Split-thickness skin grafting with negative pressure wound therapy

The correct response is Option B.

Perforator flap reconstruction, whether free or pedicled, has become increasingly popular over the past decade. Perforator flap use allows for the creation of an axial pattern flap without the sacrifice of a major artery and can often be done for areas once considered to require free flaps for coverage. Prior transfer of a medial gastrocnemius flap might disrupt perforators from the posterior tibial artery to the medial leg skin, but would not have disturbed anterior tibial artery perforators through the skin of the anterolateral leg.

Skin grafting, whether split- or full-thickness, would not be successful on fractured bone without periosteum, regardless of the type of dressing used.

The lateral gastrocnemius muscle is smaller and cannot reach as far as the medial gastrocnemius. It would not be able to reach the mid-shaft tibia defect shown in this patient.

The descending medial genicular artery is the pedicle of the medial femoral condyle flap. It is normally used as a bone graft donor, although an overlying skin paddle can be harvested with it. When used in a pedicled fashion, it can be transposed proximally onto the thigh, but not distally onto the leg.

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1. Hallock GG. A paradigm shift in flap selection protocols for zones of the lower extremity using perforator flaps. *J Reconstr Microsurg*. 2013 May;29(4):233-240. Epub 2013 Mar 5.
2. Iorio ML, Masden DL, Higgins JP. Cutaneous angiosome territory of the medial femoral condyle osteocutaneous flap. *J Hand Surg Am*. 2012 May;37(5):1033-1041. Epub 2012 Apr 5.
3. Kasabian AK, Karp NS. Lower extremity reconstruction. In: *Grabb & Smith's Plastic Surgery*. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2014: 941-954.

62. A 9-year-old boy is evaluated because of severe, worsening arm pain, finger swelling, and numbness 2 days after undergoing cast treatment for a fracture. The cast is removed, and a fasciotomy is performed. Which of the following muscles is most likely to have sustained damage?

- A) Extensor carpi radialis brevis
- B) Extensor digitorum communis
- C) Extensor pollicis longus
- D) Flexor digitorum profundus
- E) Flexor digitorum superficialis

The correct response is Option D.

The most likely muscle to sustain damage is the flexor digitorum profundus.

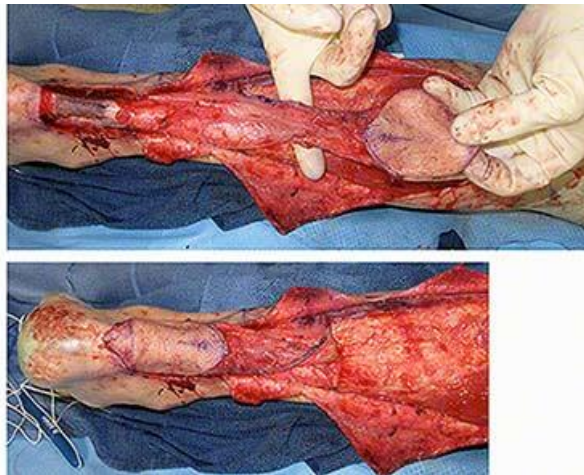
The patient described has signs of compartment syndrome, resulting from a tight cast and swelling due to the fracture. Early recognition and treatment is necessary to prevent permanent damage. The pressure within the muscles increases and prevents blood flow to the area and capillary exchange of nutrients. Fasciotomy is recommended if compartment pressure exceeds 30 mmHg, or if the difference between intracompartmental pressure and diastolic blood pressure is less than 30 mmHg. If left untreated, ischemic necrosis to the muscles can result, causing Volkmann ischemic contracture. This gives rise to scarring and permanent shortening of the muscles. The deep muscles of the forearm, the flexor digitorum profundus, and flexor pollicis longus are the first to sustain damage. If the condition continues, all muscles of the forearm can be involved. The hand is left in a contracted intrinsic minus configuration, with severe disability.

The more superficial muscles (flexor digitorum superficialis) are less likely to be affected than the deep muscles. The extensor muscles (extensor digitorum communis, extensor pollicis longus, and extensor carpi radialis brevis) are the last to be involved in Volkmann ischemic contracture.

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2. Hughes T. Compartment Syndrome and Volkmann's Contracture. In: Trumble T, Rayan GM, Baratz M, eds. *Principles of Hand Surgery and Therapy*. 2nd ed. Philadelphia: Churchill Livingstone; 2010:154-166.
3. Klenerman L. The evolution of the compartment syndrome since 1948 as recorded in the JBJS (B). *J Bone Joint Surg Br*. 2007 Oct;89(10):1280-1282.



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

63. A 35-year-old man is referred to the office after undergoing prolonged failed attempts at local wound care of an exposed Achilles tendon. Physical examination shows that the tendon is beginning to desiccate. Coverage with a flap is performed, as shown. The blood supply to this flap is derived from which of the following arteries?

- A) Anterior tibial
- B) Geniculate
- C) Peroneal
- D) Popliteal
- E) Superficial femoral

The correct response is Option C.

The flap used to cover the Achilles tendon in the patient described is the reverse sural fasciocutaneous flap. It is based on perforators from the peroneal artery through a network of small vessels. The general axis of the flap follows the sural nerve from behind the lateral malleolus to the mid portion of the gastrocnemius muscle bellies. Sural nerve injury results in loss of lateral foot sensation. This is often of no functional consequence because its harvest does not result in loss of a major neurovascular structure.

The other vessels noted do not supply inflow to the flap.

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64. A 30-year-old man is evaluated after sustaining a laceration of the left ulnar nerve at the level of the mid humerus. Exploration and direct repair of the ulnar nerve are performed immediately. Which of the following interventions is most likely to result in optimal recovery of hand function?

- A) Anterior interosseus nerve transfer to the ulnar nerve
- B) Dynamic splinting
- C) Electrical stimulation of the ulnar nerve
- D) Flexor digitorum superficialis tendon transfer to the A2 pulley
- E) Wrist extensor tendon transfer to the lumbricals

The correct response is Option A.

High ulnar nerve injuries are plagued by poor recovery of intrinsic function even when the nerves are repaired under optimal conditions. To maximize recovery and restore intrinsic function in the hand, one of the most effective interventions is transfer of the motor branch of the anterior interosseus nerve to the motor branch of the ulnar nerve at the wrist. Recently, this has been shown to also be useful as a “babysitter” transfer, potentially retaining motor endplates in the small muscles of the hand while a primarily repaired ulnar nerve regenerates.

Dynamic splinting has played a role in radial palsies and is frequently employed to overcome joint contractures that are not fixed (with a hard endpoint). This would not assist in hand recovery in this setting.

Electrical stimulation performed by a hand therapist helps in retraining innervated muscles but will not improve function in the denervated small muscles of the hand.

Tendon transfers have been the mainstay of functional restoration when nerve repair is not possible and/or the timeframe that has elapsed is great enough to make successful reinnervation of the target muscles unlikely. Both the wrist extensor-to-lumbrical transfer and the flexor digitorum superficialis transfer have been used to correct the “clawing” associated with ulnar palsies.

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65. A 10-year-old boy who underwent surgical repair of near-complete avulsion of the fingertip dorsally at the level of the mid nail bed 8 months ago is evaluated because of hook-nail deformity of the long finger. Which of the following structures is most likely to be deficient when considered for surgical reconstruction?

- A) Distal tuft
- B) Germinal matrix
- C) Sterile matrix
- D) Volar epidermis
- E) Volar pulp

The correct response is Option A.

Hook-nail deformity is a volar curvature of the nail that occurs because of lack of bony support to the sterile matrix. Hook-nails most commonly occur after trauma. The best means of prevention is ensuring that the distal limit of sterile matrix is a minimum of 2 mm proximal to the distal phalanx tip. Reconstruction includes grafting, local and regional flaps, and distal flaps. Bone grafting (free, vascularized or phalanx osteotomy) is another option. Bone grafting has the highest failure rate due to reabsorption. Free vascularized nail flaps, arterialized venous nail flaps, and osteo-onychocutaneous nail flaps are another option.

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66. A 66-year-old man comes for evaluation because of a chronic left lower extremity wound. He reports that the wound has been present for the past 15 years. Physical examination shows an 8 × 10-cm wound on the lateral aspect of the left calf. Which of the following is the most appropriate next step in diagnosis?

- A) Angiography
- B) Biopsy
- C) Bone scan
- D) CT scan
- E) MRI

The correct response is Option B.

The most important next step in establishing a diagnosis in this patient is an excisional biopsy. The clinical appearance and duration of the chronic wound is highly suggestive of a Marjolin ulcer in the setting of a chronic venous stasis ulcer. Marjolin ulcers are defined as malignant generation in the presence of a burn wound or other chronic inflammatory conditions. The most common etiology is a burn wound; however, malignancies have been found in chronic wounds secondary to pressure ulceration, trauma, venous stasis, and others. The most common pathologic diagnosis is well-differentiated squamous cell carcinoma (SCC), but basal cell carcinoma and various other sarcomas have been reported in the literature. Marjolin ulcers are thought to be aggressive forms of SCC with metastatic potential related to tumor grade. The incidence of metastasis is 10% for Grade 1 lesions, 59% for Grade 2, and 86% for Grade 3.

Diagnosis is based on clinical appearance, history, and most importantly biopsy. Patients should also receive a thorough regional lymph node exam, CT scan or MRI, and routine laboratory analysis. Sentinel lymph node biopsy may be indicated. Treatment is generally wide excision of the chronic wound and rapid coverage with skin grafts or tissue flaps. Depending on tumor characteristics, adjuvant radiation therapy may be recommended.

Angiography will evaluate the arterial flow of the extremity and may be important in planning coverage of the wound, but it is not required to rule out a malignancy. MRI, CT scan, and x-ray studies can also be helpful as adjunctive diagnostic techniques to evaluate the extent of the tumor and presence of metastasis, but they are not used for diagnosis alone.

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67. A 45-year-old right-hand–dominant man who is a tennis player is evaluated because of a 6-month history of pain in the right lateral elbow. He has pain when lifting objects, and the pain radiates to the forearm. Physical examination shows tenderness just distal and anterior to the lateral epicondyle. Which of the following muscles is most likely affected?

- A) Brachioradialis
- B) Extensor carpi radialis brevis
- C) Extensor carpi radialis longus
- D) Extensor carpi ulnaris
- E) Extensor digiti minimi

The correct response is Option B.

The extensor carpi radialis brevis (ECRB) origin is the primary muscle involved in lateral epicondylitis. The undersurface is avascular, making it a potential site for degeneration and partial tears. The ECRB shares a common origin with the extensor carpi ulnaris, extensor carpi radialis longus, and brachioradialis. The extensor digiti minimi also originates from the lateral epicondyle and has been involved in some cases of lateral epicondylitis, but not as commonly as the ECRB.

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68. Stellate ganglion blocks help alleviate the symptoms of complex regional pain syndrome in which of the following ways?

- A) Helping repair nerve injuries
- B) Increasing parasympathetic tone
- C) Reducing sympathetic tone
- D) Relaxing the muscles of the upper extremity
- E) Releasing the body's natural endorphins

The correct response is Option C.

Complex regional pain syndrome (CRPS) is a long-term pain condition that is believed to result from dysfunction in the central or peripheral nervous systems. CRPS is characterized by pain, swelling, or stiffness in the affected hand or extremity. The pain may be out of proportion to the injury that triggers it.

There are two types of CRPS. In type I, there is no identifiable nerve injury. In type II, there is an identifiable nerve injury. The name of this disorder was changed from reflex sympathetic dystrophy to CRPS because not all patients have increased sympathetic tone.

Stellate ganglion blocks may be used to anesthetize the stellate ganglion, which is a cluster of sympathetic nerves at the base of the neck, in an effort to decrease the overactivity of the sympathetic nerves seen in CRPS. The sympathetic nervous system has been implicated in the pathophysiology of CRPS, and consequently, sympathetic nervous system blockade is widely used to treat CRPS.

Sympathetic nervous system dysfunction is presumed to be an essential component of the syndrome, and sympathetic blockade has been recommended as early as possible to interrupt and reverse the process. The treatment effectively cuts the vicious cycle of pain, immobilization, and decreased joint motion.

Stellate ganglion blocks do not act to increase parasympathetic tone, relax muscles, release endorphins, or repair injured nerves.

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69. A 21-year-old man comes to the office after injuring the right long finger while playing football. On physical examination, the patient is unable to flex the distal phalanx. Hollowness is noted along the volar aspect of the finger, with pain in the palm upon palpation. X-ray studies show no abnormalities. Which of the following is the latest at which primary repair is expected?

- A) 1 day
- B) 1 week
- C) 1 month
- D) 2 months
- E) 3 months

The correct response is Option B.

Rupture of the flexor digitorum profundus (FDP) tendon from its distal attachment is commonly known as jersey finger. The injury is often overlooked by players and trainers and misdiagnosed as a sprained finger, but it requires more urgent management than these minor injuries. Jersey finger occurs when a flexed distal interphalangeal (DIP) joint is suddenly and forcefully hyperextended, leading to rupture of the FDP tendon at its insertion on the distal phalanx.

FDP injuries can be classified based upon the degree of tendon retraction, as described in Leddy and Packer's grading scheme:

- Type I injuries involve retraction of the profundus tendon all the way to the palm, with associated injuries to the vincula longus and vinculum brevis. Injuries to the vincula disrupt the blood supply to the tendon, necessitating surgical repair within 7 days to avoid necrosis of the tendon and a permanent contracture deformity.
- Type II injuries involve retraction of the tendon to the proximal interphalangeal (PIP) joint. The tendon stump is held in place by the vincula longus, which are often intact. An avulsion fracture sometimes occurs with type II injuries, and often becomes trapped in the A2 pulley. Without an observable bony fragment on x-ray study, it is impossible to determine the degree of retraction; thus, all type II injuries should be surgically repaired within 7 days.

- Type III injuries involve a large avulsion fragment that is often intraarticular. The bony fragment prevents retraction past the A4 pulley and holds the tendon in near-anatomic position, obviating the need for urgent repair. Type III injuries are amenable to repair within 2 to 3 months.
- Type IV injuries are type III lesions with the addition of an avulsion of the FDP tendon from the fracture fragment. Type IV injuries are rare but require urgent repair because of the disruption to the tendon's blood supply.

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70. An otherwise healthy 30-year-old man is evaluated because of left foot drop after posterior knee dislocation. The common peroneal nerve is explored at the level of the knee shortly after the time of injury and found to be in continuity. The patient does not return for follow-up examination within the next year. Eighteen months after the injury, the patient returns for follow-up examination and shows no improvement of the foot drop. Passive range of motion of the ankle is full. Which of the following transfers is most likely to correct this patient's foot drop deformity?

- A) Peroneus brevis tendon with graft to calcaneus bone
- B) Peroneus longus tendon to calcaneus bone
- C) Peroneus longus tendon to talus bone
- D) Tibialis anterior nerve to tibialis posterior nerve
- E) Tibialis posterior tendon to tibialis anterior tendon

The correct response is Option E.

Common peroneal nerve injury is common after posterior knee dislocation, usually occurring at or near where the nerve crosses the fibula neck. After surgical exploration to confirm the peroneal nerve is intact, initial management consists of supportive care with an ankle brace to correct foot drop. Patients are observed clinically for recovery, often with serial electromyography and nerve conduction studies.

Tibialis posterior to anterior transfer will restore the patient's ability to dorsiflex the ankle. The donor muscle is innervated by the tibial nerve, which is not commonly injured in a posterior knee dislocation. The tendon is dis-inserted from the tarsus and brought out through the medial leg.



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

It is transferred through the interosseous membrane to the tibialis anterior tendon.

By 18 months after injury, the motor end plates to the tibialis anterior have degenerated, making a nerve transfer no longer an option. Earlier after injury, a nerve transfer from the tibialis posterior to the tibialis anterior might be a feasible option.

Peroneus longus and brevis would also be paralyzed in the setting of a common peroneal nerve injury such as this patient's. In certain situations, such as with some patients with leprosy, the deep peroneal nerve is not paralyzed. For these patients, the peroneus longus can be used as a tendon transfer, but it is normally used to provide toe extension in conjunction with a tibialis posterior transfer to provide ankle dorsiflexion.

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71. A 35-year-old woman who underwent surgical release of the first dorsal compartment 8 months ago is evaluated because of severe pain over the anatomical snuffbox of the right hand since the surgery. Physical examination shows focal tenderness over the region of the first dorsal compartment, a Tinel sign at the surgical scar, and numbness distal to the surgical scar. Medication includes gabapentin since the pain began, and the patient has attempted desensitization in hand therapy. Which of the following is the most appropriate next step in management?
- A) Exploration silicone capping of the palmar cutaneous nerve
 - B) Initiation of oral pregabalin therapy
 - C) Iontophoresis with dexamethasone
 - D) Neurolysis and intramuscular placement of the superficial radial nerve
 - E) Phenol injection into the scar and compression glove therapy

The correct response is Option D.

One potential complication from surgical treatment of de Quervain disease (first dorsal compartment release) is injury to branches of the radial sensory nerve. When such injury is suspected, treatment should consist of exploration and, if possible, repair of the injured nerve branch. When this is not possible, multiple surgical options are available; transposition of the injured radial sensory nerve into the brachioradialis has been one of the commonly employed treatment strategies. Alternatives include transposition of the nerve into bone or a vein, nerve stripping, and coverage of the injured nerve with vascularized tissue.

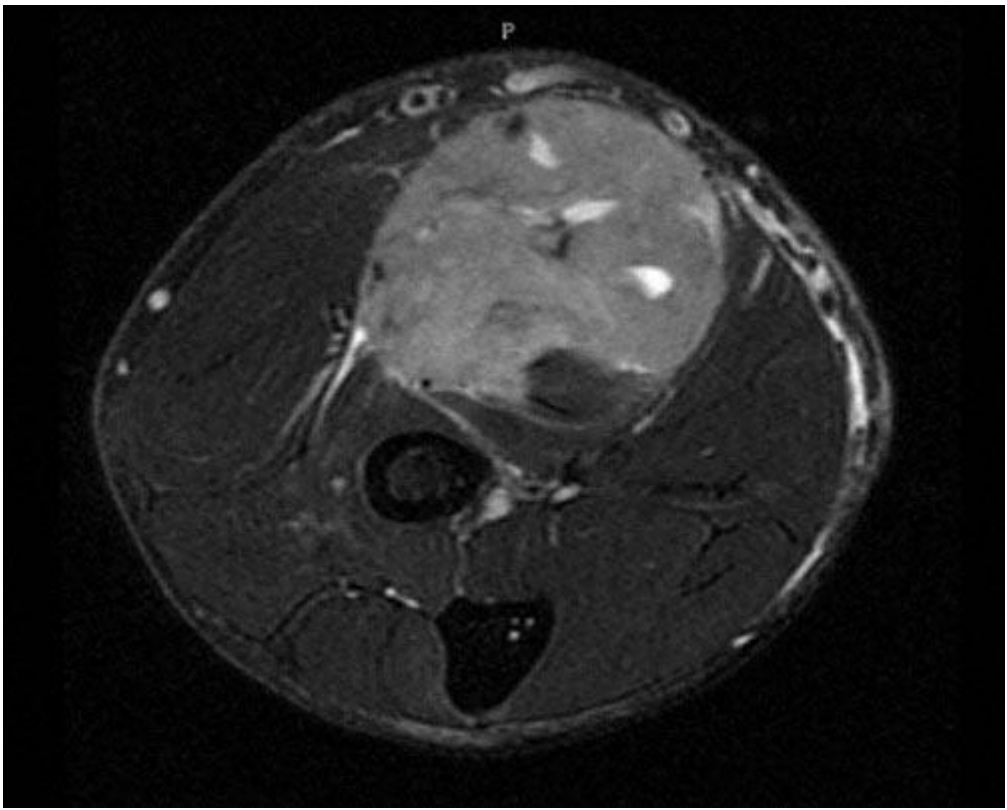
Both gabapentin and pregabalin are useful medical interventions for nerve pain. General guidelines suggest proceeding with surgical treatment for suspected neuromas if no improvement occurs after 6 months of oral therapy.

Iontophoresis with corticosteroids has no proven efficacy for neuroma therapy. Phenol has been employed for stump neuromas and for Morton's neuromas; however, there is no evidence to support its use in non-amputation neuroma treatment.

Silicone capping, once advocated for treatment of end-neuromas, has fallen out of favor because of poor pain relief results and displacement/migration of the caps.

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72. A 45-year-old man has a mass in the left volar forearm. An MRI is shown. Oncologic resection will involve removing all muscles of the anterior forearm compartment. Which of the following techniques is most appropriate to reconstruct finger flexion postoperatively?
- A) Flexor digitorum profundus to superficialis transfer
 - B) Flexor pronator slide
 - C) Free gracilis innervated by a median nerve branch
 - D) Oberlin-Mackinnon nerve transfer
 - E) Pedicled latissimus dorsi muscle flap transfer

The correct response is Option C.

A free gracilis muscle would provide a good strength and excursion match to the native finger flexors it would replace. Vascular and nerve connections could be performed in the distal upper arm, outside of the zone of resection. While individual

finger flexion would not be restored, the patient would be able to make a composite fist after this surgery.

The flexor digitorum profundus to superficialis transfer is used to treat flexor spastic contracture, typically with palmar hygiene issues, in a patient who still has some voluntary motor control. It requires the presence of flexor digitorum profundus and superficialis muscles, both of which would be removed as part of the anterior forearm compartment muscles.

The Oberlin-Mackinnon nerve transfer transfers branches of the median nerve and ulnar nerve to the brachialis and biceps muscles, respectively. It is used to restore elbow flexion and would not provide finger flexion.

A flexor pronator slide detaches the muscles originating from the medial epicondyle of the humerus and advances them distally. It is used to treat contractures of the fingers, often in patients with mild to moderate Volkmann contracture. In this patient, the flexor muscles have been resected, so this procedure is not possible.

A latissimus dorsi muscle provides broad soft-tissue coverage for wounds and can also provide a strong flexion force. It cannot reach beyond the distal elbow. It can restore elbow flexion but cannot be used as a pedicled transfer to restore finger flexion.

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73. A 7-year-old boy is evaluated because of capillary malformations in the right leg and thigh, which have been present since birth. Physical examination shows venous varicosities over the anterior leg and medial thigh. Girth of the affected lower limb is increased compared with the unaffected limb. Duplex imaging discloses no sign of arteriovenous fistulae. This patient is at greatest risk for which of the following conditions?

- A) Chondrosarcoma
- B) Disseminated intravascular coagulation
- C) High-output cardiac failure
- D) Limb-length discrepancy
- E) Pathologic fracture

The correct response is Option D.

The presence of capillary malformations, varicosities, and limb hypertrophy paired with the absence of arteriovenous (AV) fistulae is classic for Klippel-Trénaunay syndrome. Up to 67% of patients with Klippel-Trénaunay syndrome will exhibit limb-length discrepancy, most commonly with the affected limb being hypertrophic.

Pathologic fractures may occur through enchondromas found in Maffucci syndrome. Since the lesions have been present since birth and the child is young, presentation is less consistent with Maffucci syndrome, which presents in adolescence in roughly 80% of patients. These enchondromas also hold a 15 to 30% risk for malignant transformation to chondrosarcoma.

High-output cardiac failure is a feature of vascular malformations that include AV fistulae; the classic example is Parkes-Weber syndrome.

Disseminated intravascular coagulation can result in life-threatening thrombocytopenia. Referred to as Kasabach-Merritt syndrome, this finding is more common in abnormalities such as kaposiform hemangioendothelioma.

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

74. A 48-year-old right-hand–dominant man with a history of cadaveric renal transplantation comes to the emergency department because of a swollen, painful left hand. A photograph is shown. He works as a crab fisherman and reports that he was bitten in the first web space by a crab 18 hours ago. He is taken to the operating room for emergent debridement. Intraoperative Gram stain shows a gram-negative, curve-shaped rod. In addition to aggressive surgical treatment, administration of which of the following antibiotics is most appropriate to treat this patient?
- A) Cephalexin
 - B) Levofloxacin
 - C) Linezolid
 - D) Nafcillin
 - E) Vancomycin

The correct response is Option B.

Vibrio vulnificus is a common *Vibrio* species causing soft-tissue infections of the hand. *Vibrio* species are ubiquitous in aquatic environments including saltwater bodies. Immunocompromised hosts are at greater risk for amputation and death. The best chance for patient survival includes early diagnosis and initiation of appropriate antibiotics, as well as urgent surgical debridement for any evidence of necrotizing infection.

A broad range of antibiotics are effective against *Vibrio* species, including *V. vulnificus*. Agents effective against gram-negative rods, including quinolones, aminoglycosides, and aminopenicillins, are all effective against *V. vulnificus*. While all cephalosporins are effective against *Vibrio* species, third-generation cephalosporins are up to 130 times more potent than first- or second-generation cephalosporins. Vancomycin, nafcillin, and linezolid are all narrow-spectrum antibiotics, primarily effective against gram-positive cocci, and are not effective against *Vibrio* species.

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75. A 43-year-old woman is evaluated for intrinsic wasting and paresthesias of the little and ring fingers. Which of the following is the most likely site of nerve entrapment?

- A) Anconeus epitrochlearis
- B) Arcade of Frohse
- C) Lacertus fibrosis
- D) Ligament of Struthers
- E) Pronator teres

The correct response is Option A.

Nerve entrapment is caused by the anconeus epitrochlearis. The scenario describes both motor and sensory signs and symptoms attributable to ulnar nerve compression. Ulnar nerve entrapment at the elbow is the second most common nerve entrapment neuropathy in the upper limb other than carpal tunnel syndrome in young adults. The most common cause is the ligament of Osborne. The anconeus epitrochlearis muscle, which is a congenital accessory muscle, arises from the medial epicondyle of the humerus and inserts at the olecranon process of the ulna. It can be found in normal elbows with an incidence of between 4 and 34%. It has been associated with ulnar nerve compression at the elbow.

The arcade of Frohse has been associated with posterior interosseous nerve entrapment. The lacertus fibrosis, pronator teres, and ligament of Struthers have been associated with median nerve compression. Note that the arcade of Struthers may be associated with ulnar nerve compression, but this option is not provided.

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2. Knutsen EJ, Calfee RP. Uncommon upper extremity compression neuropathies. *Hand Clin*. 2013 Aug;29(3):443-453.
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76. A 30-year-old woman comes to the office for consultation regarding a 2-year history of a slow-growing mass on the volar aspect of the left ring finger. The growth is adjacent to the distal interphalangeal (DIP) joint. Physical examination shows the mass is firm and cannot be transilluminated. The overlying skin is intact. Which of the following is the most likely diagnosis?

- A) Desmoid tumor
- B) Ganglion cyst
- C) Giant cell tumor
- D) Pyogenic granuloma
- E) Vascular tumor

The correct response is Option C.

The mass described in this scenario is a giant cell tumor of the tendon sheath. These growths are common in adults younger than 50 years of age. These masses are slow-growing, firm, lobulated, and painless. Giant cell tumors are the second most common tumor of the hand, after ganglion cysts. Unlike ganglion cysts, giant cell tumors cannot be transilluminated. Moreover, they usually occur on the volar aspect of the hand, and bone invasion is not commonly seen. These characteristics are not true of vascular tumors, desmoids, or pyogenic granulomas.

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77. A 45-year-old man is evaluated 2 weeks after open reduction and internal fixation of an extra-articular fracture of the distal tibia because of wound dehiscence. Physical examination shows exposed hardware and a 5 × 3-cm open wound above the medial malleolus. After thorough debridement, hardware removal, and placement of an external fixator, the wound is closed with a perforator propeller flap based on a posterior tibial artery perforator. During dissection and inset, the flap becomes progressively swollen and blue, with brisk capillary refill noted for the entire length of the flap. Which of the following is the most appropriate next step in management?

- A) Application of nitropaste
- B) Free flap salvage
- C) Postoperative leech therapy
- D) Proximal perforator dissection to source vessel
- E) Observation

The correct response is Option D.

This patient has an open wound in the distal third of the tibia closed with a propeller flap based on a perforator from the posterior tibial artery. The most common complications associated with this type of reconstruction are venous congestion and partial flap loss. If congestion is encountered during flap elevation, it is essential to dissect the perforator all the way back to the named source vessel to release all fascial attachments and any areas of potential constriction or tethering. This would be the first strategy to improve venous outflow during flap dissection. The venae comitantes accompanying the perforator are very thin-walled and susceptible to kinking, especially when flap inset requires a 180-degree rotation.

Propeller flaps are island fasciocutaneous flaps based on a single dissected perforator. They are termed “freestyle” because the design of the flap is determined intraoperatively based on the dissection of the perforator, which has variable anatomy. Ideal perforators are greater than 0.5 mm in diameter and pulsatile. Perforator flaps of the lower extremity should be designed longitudinally based on directional blood flow. Most published series report greater than 90% flap survival with an 8 to 10% rate of complications. If tension or kinking still exists after proximal perforator dissection, microsurgical venous supercharging would be the next course of action, if possible. De-rotating the flap and placing it back into the donor site as a delay procedure can be used as a last resort; however, vascular delay is traditionally used to augment the arterial inflow of a flap by allowing the choke

vessels to open and organize the flow in an axial fashion. The flap remains susceptible to venous congestion when it is rotated for inset after the delay as well.

A small amount of decreased venous drainage is expected with most perforator flaps; however, it is generally mild, not progressive, and confined to the distal tip of the flap. This venous insufficiency can be observed and will generally resolve in the early postoperative period. In this case, the congestion was noted early during flap dissection along the full length of the flap. For severe early venous congestion, observation is not appropriate.

Leech therapy is often used to relieve venous congestion of flaps and replanted parts postoperatively if additional venous outflow cannot be established surgically. Abandoning further surgical efforts to plan for leeching would not be advised as an initial course of action.

The traditional reconstructive algorithm for reconstruction of distal one-third defects recommends free tissue transfer. The advent of perforator propeller flaps allows for reconstruction with available like tissue that does not involve microsurgery. Free flap reconstruction would generally be the plan following complete flap loss, but it would not be the next step in management of venous congestion.

Acute venous insufficiency should not be managed with nitropaste therapy.

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78. A 56-year-old man is evaluated because of Dupuytren contractures of the hand with palpable cords. Collagenase injection of which of the following joint contractures is most likely to result in serious complications?
- A) Index metacarpophalangeal (MCP) contracture of 50 degrees
 - B) Long proximal interphalangeal (PIP) contracture of 30 degrees
 - C) Ring MCP contracture of 60 degrees
 - D) Little PIP contracture of 20 degrees
 - E) Thumb MCP contracture of 40 degrees

The correct response is Option D.

Collagenase injection has been FDA-approved for the treatment of Dupuytren contractures with palpable cords and works by dissolving collagen contained in the cord. Injection is typically performed with placement of collagenase along several areas along the Dupuytren cord using a hubless 1-mL syringe, followed by a finger extension procedure approximately 24 hours after injection. Care should be taken to avoid injecting into tendons, nerves, blood vessels, or other collagen-containing structures.

Injection of the 20-degree contracture of the little finger proximal interphalangeal (PIP) joint is most likely to result in serious complications.

Dupuytren contracture is a disease resulting in progressive contracture of the palmar fascia. The disease involves activity of myofibroblasts and has a genetic component, being more common in people of northern European descent.

Treatment of PIP contractures of the little finger is most likely to result in serious complications. There have been a few incidents of flexor tendon rupture occurring from collagenase injections, and these are thought to occur due to the proximity of the flexor tendon to the Dupuytren cord. Care must be taken to keep the collagenase injection away from the flexor tendon in this finger. Recommendations for collagenase injections for PIP contractures in the little finger include keeping the injection no more than 2 to 3 mm deep and as close to the palmar digital crease as possible, staying no more than 4 mm distal to the palmar digital crease.

Serious complications are not found to be more frequent in other digits or in the metacarpophalangeal (MCP) vs. PIP joints (other than in the little finger PIP joint).

The degree of contracture does not have a bearing on the incidence of serious complications.

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

79. A 52-year-old man is evaluated because of a congenital deficiency of the upper extremity. A photograph is shown. This patient's developmental abnormality most likely occurred during which of the following periods of gestation?

- A) 0–4 weeks
- B) 5–8 weeks
- C) 9–13 weeks
- D) 14–18 weeks
- E) 19–23 weeks

The correct response is Option B.

The most likely period of time during gestation for this abnormality is 31 to 45 days.

This patient presents with transverse deficiency of the upper limb (phocomelia). This can result from abnormal development of the limb with an interruption in longitudinal growth.

The limb develops with formation of a limb bud at 26 days after gestation, which rapidly enlarges with growth of the embryo until approximately 47 days. At around 52 to 53 days after gestation, the fingers are separate. Embryogenesis is complete by 8 weeks, and all limb structures are present.

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

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

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

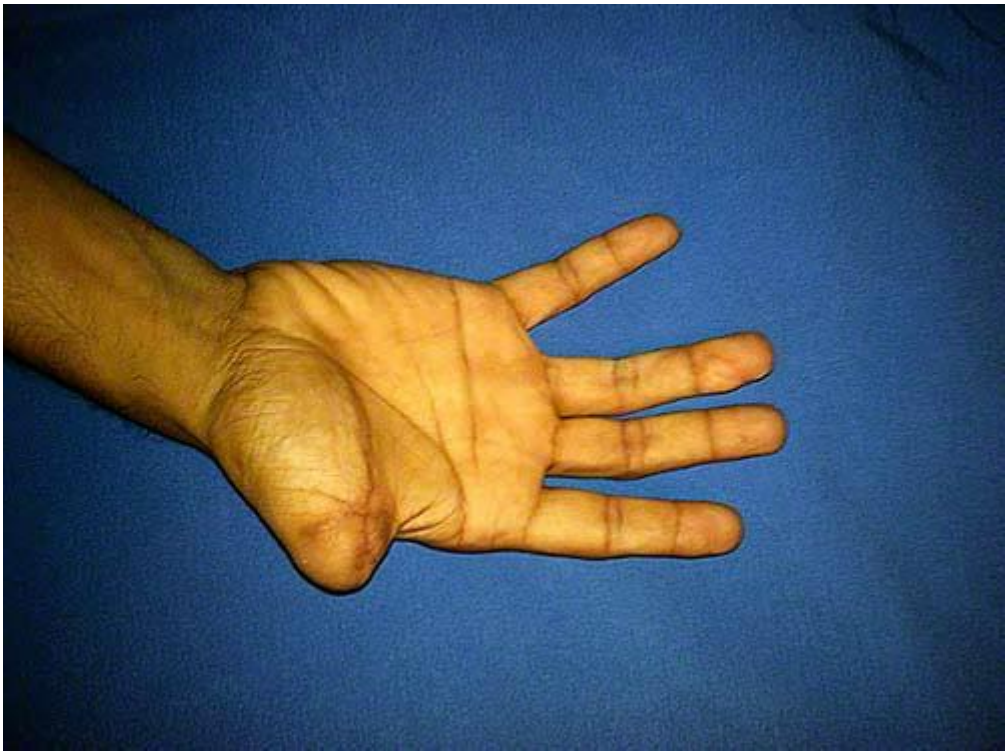
Dorsal-ventral limb development is signaled by the Wnt signaling pathway, which produces a transcription factor, *LMXI* that induces the development of dorsal structures. In the ventral portion of the limb, the *ENI* gene product blocks the Wnt pathway, leading to ventralization.

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

Most limb abnormalities occur during the period of 4 to 8 weeks. In this case, the transverse deficiency likely occurred earlier in the process of limb outgrowth, while abnormalities of the digit would have taken place towards the end of this period.

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

80. A 25-year-old man is evaluated for thumb reconstruction after failed replantation just distal to the metacarpophalangeal (MCP) joint. The amputation was a sharp injury with no avulsion component. A photograph is shown. Which of the following is the dominant arterial pedicle for the most appropriate flap for reconstruction?
- A) First dorsal metatarsal artery
 - B) Lateral plantar artery
 - C) Peroneal artery
 - D) Radial artery
 - E) Superficial circumflex iliac artery

The correct response is Option A.

The microvascular reconstruction of choice is a toe-to-thumb transfer involving the great toe. The most common arterial pedicle for this composite flap is the first dorsal metatarsal artery (~70%), a branch of the dorsalis pedis artery. The great toe can be

harvested en bloc, as a trimmed flap to improve size match, or as a wrap-around soft-tissue flap for more distal or soft-tissue-only reconstructions. Less commonly, there is a dominant plantar arterial system from the plantar digital arteries via the lateral plantar artery. Communications between the dorsal and plantar systems exist between the metatarsals, and a flap with plantar-dominant inflow can be traced back to the dorsalis pedis in most cases, although the dissection is tedious. Many authors recommend vein grafting if more length is needed in a plantar-dominant flap.

This patient requires mostly restoration of length and sensibility. Reconstruction with a toe-to-thumb transfer has the advantages of transferring similar glabrous tissue with good cosmetic match. Flexion, extension, and sensation can be restored with good outcomes, according to the literature. This patient has an intact carpometacarpal joint and adequate range of motion should be maintained.

The lateral plantar artery is the arterial pedicle for the medial plantar artery fasciocutaneous flap. It does not contribute to the plantar arch. This flap is used mostly as a pedicle flap for coverage of defects on the forefoot and heel. It can be used for free tissue transfer. The deep plantar arch is an anastomotic network between the lateral plantar and dorsalis pedis arteries.

The peroneal artery is the pedicle for the free fibula osteocutaneous flap; however, this is not described for use in thumb reconstruction.

Osteoplastic reconstruction for thumb defects not involving the basilar joint have been described as both pedicle and microvascular free flaps. These involve a vascularized soft-tissue flap surrounding a nonvascularized bone graft. The radial artery is the pedicle for the radial forearm flap, which can be harvested as a soft-tissue flap around an iliac crest bone graft, or as an osteocutaneous flap. The superficial circumflex iliac artery is the pedicle for the groin flap. This is mostly described as a staged pedicled flap for osteoplastic reconstruction around an iliac crest bone graft. Both of these techniques are complicated by poor return of sensation and bone resorption. They should be used as second-line options when free toe transfer or pollicization is not available due to severity of injury or other patient-related concerns.

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

81. An 87-year-old woman with a history of squamous cell carcinoma on the left lower extremity comes for evaluation because of the ulcer shown in the photograph. When the tumor did not resolve 9 months ago, she underwent radiation therapy for 4 weeks followed by excision. All margins were negative. Coverage of the wound with a split-thickness skin graft 6 months ago was not successful. Physical examination shows an ulcerated area over the anterior compartment. There is moderate fibrinous debris within the ulcer. Which of the following is the most likely underlying cause of the impeded wound healing?
- A) Decreased vascularity
 - B) Elevated oxygen tension
 - C) Enhanced angiogenesis
 - D) Fibroblast hyperplasia
 - E) Peripheral margin hypokeratosis

The correct response is Option A.

Radiation therapy produces many changes in the skin, whether it is directed at the skin, such as for skin cancer, or directed at deeper structures. Direct damage to blood vessels in the wound bed (obliterative endarteritis) produces decreased oxygen tension. Unlike nonirradiated wounds, radiated wounds do not respond with increased angiogenesis. Decreased breaking strength of radiated wounds is caused by both edema of collagen bundles and direct injury to the fibroblasts that would otherwise repair them. Radiated wounds have hyperkeratotic edges, which impair both contraction and keratinocyte migration.

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82. A 24-year-old man is evaluated because of a 1-cm metacarpal defect after sustaining a gunshot wound to the hand. In addition to operative fixation of the fracture, which of the following materials placed into the defect is most likely to promote osteogenesis?

- A) Calcium hydroxyapatite
- B) Cancellous autograft
- C) Cortical allograft
- D) Demineralized bone matrix
- E) Methylmethacrylate

The correct response is Option B.

The material that will most likely provide osteogenesis is cancellous autograft.

Bony defects can be constructed by a variety of methods, and there has been an increase in the number of biomaterials that can be used. Autograft bone is obtained from the same individual, while allograft bone is obtained from another human source (i.e., cadaveric or donor). Demineralized bone matrix does not contain calcium, but retains growth factors and proteins as the nonmineralized components of bone. Calcium hydroxyapatite is a bone substitute that mimics bone in mineral structure, and gradually becomes replaced with native bone. Methylmethacrylate is used in orthopedic bone cement, and is not biodegraded or replaced, but can provide rapid structural support.

Osteoconduction refers to the replacement of the graft material through a process known as creeping substitution, where native cells from the surrounding bone break down the material and replace it with new bone. This is the primary mechanism of healing of cortical bone grafts. It is also seen in biocompatible materials that are replaced with bone, such as calcium hydroxyapatite.

Osteoinduction refers to the stimulation of bone-forming cells from surrounding host tissues, resulting in activation of progenitor cells and differentiation into osteoblasts, leading to the creation of new bone. This process occurs due to growth factors that are present in the graft material, and can be seen in cancellous bone grafts, as well as demineralized bone matrix, which contains growth factors. Osteoinduction also occurs with cortical grafts, although to a lesser extent.

Osteogenesis refers to new bone formation, which is provided from surviving cells within the graft material. In order for osteogenesis to occur, viable cells must be transferred with the graft. This is seen in autograft materials, but not in allograft materials, which are processed and may be decellularized. Cells contained within autografts can survive and produce new bone. Vascularized bone transfer may give rise to more cell viability than traditional autografts, because it maintains perfusion to the grafted bone, rather than relying on nutrients from the bed.

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83. An 11-year-old boy is brought to the emergency department after sustaining an injury to the tip of the left long finger while playing baseball. The long fingertip is held in a flexed position. The proximal nail plate is slightly visible superficial to the eponychial fold, and a small subungual hematoma is noted. An x-ray study is shown. Which of the following is the most appropriate management?
- A) Closed reduction and distal interphalangeal joint extension splinting for 6 to 8 weeks
 - B) Closed reduction, removal of nail plate, and percutaneous pinning
 - C) Open reduction, repair of nail bed, and Kirschner wire fixation
 - D) Repair of zone I flexor tendon avulsion
 - E) Suture repair of lacerations and observation for 6 weeks

The correct response is Option C.

This patient has a Seymour fracture, or an open physeal/juxta-epiphyseal fracture of the distal phalanx. These injuries present as mallet-like injuries, but they are open fractures by definition. The treatment of choice is open reduction, debridement of the fracture site, repair of associated nail bed laceration, and Kirschner wire fixation of the fracture across the distal interphalangeal (DIP) joint.

The injury is secondary to hyperflexion and is essentially a Salter I or Salter II fracture of the distal phalanx. The flexed posture occurs because the terminal extensor tendon inserts on the proximal dorsal epiphysis, while the flexor digitorum profundus inserts on the metaphysis of the bone distal to the fracture site. These injuries can often be mistaken for mallet injuries or DIP dislocations. Often a flap of nail bed matrix becomes interposed between the fracture fragments, preventing closed reduction. This must be repaired. It is recommended to not discard the nail plate, because it helps maintain bone reduction. Dorsal physeal widening and flexion of the distal fracture fragment is seen on lateral x-ray studies.

Observation alone for a Seymour fracture, mallet finger, or DIP dislocation is inappropriate.

Closed reduction and DIP extension splinting is generally the treatment of choice for mallet-type injuries. These can be purely soft-tissue mallet fingers or osseous mallet fractures. Initial treatment should include closed reduction by extension or hyperextension and splinting that isolates the DIP joint in extension. Generally, the splint is worn for 6 to 8 weeks continuously, and then for a period of time at night as indicated. Compliance may be an issue with the pediatric or adolescent population, and the patient should be seen regularly to assess splint fit and skin integrity.

Closed reduction and pinning may be necessary for osseous mallet fingers with associated volar subluxation of the distal phalanx. Several techniques have been described, but this is not appropriate for a Seymour fracture. The nail bed tissue must be reduced from the fracture site to achieve anatomic reduction in this case. Also, closed treatment has an unacceptable incidence of infection, residual finger deformity from incomplete reduction, and nail deformity.

A zone I flexor tendon avulsion, or jersey finger, would present with the DIP joint held in extension. This is opposite to the presentation of this patient. In that case, the patient would require open exploration and reinsertion of the profundus tendon to the distal phalanx via bone tunnels or suture anchor.

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84. A 48-year-old right-hand–dominant man comes to the office for evaluation of a tender mass of the distal volar forearm. Tinel sign is positive at the site of the mass. MRI shows that the mass involves the median nerve. Biopsy of the mass confirms a malignant peripheral nerve sheath tumor. On the basis of these findings, this diagnosis is most likely associated with which of the following conditions?

- A) Amyotrophic lateral sclerosis
- B) Charcot-Marie-Tooth disease
- C) Multiple sclerosis
- D) Neurofibromatosis 1
- E) Parkinson disease

The correct response is Option D.

The correct response is that neurofibromatosis 1 (NF1) is associated with malignant peripheral nerve sheath tumors (PNSTs).

The majority of “nerve tumors” are PNSTs. Schwannomas and neurofibromas are the most common.

Malignant soft-tissue tumors of the hand are very rare and constitute only 1 to 2% of hand tumors. Malignant PNSTs have a very low annual incidence of 0.001% in the general population, and between 2 and 5% in patients with NF1. The plexiform subtype of neurofibromas poses a substantial risk of malignant degeneration.

Amyotrophic lateral sclerosis, multiple sclerosis, Charcot-Marie-Tooth disease, and Parkinson disease are not commonly associated with malignant PNSTs.

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85. A 35-year-old woman is evaluated because of a 15-year history of bilateral lower extremity lymphedema. She reports no trauma that led to the lymphedema. Physical examination shows extensive bilateral non-pitting edema from the pelvis to the knees. Ultrasonography and MRI show adipose tissue hypertrophy and diffuse soft-tissue edema. Which of the following is the most appropriate treatment for this patient?

- A) Furosemide and compression therapy
- B) Furosemide and subcutaneous drain placement
- C) High-dose furosemide therapy
- D) Subcutaneous drain placement
- E) Suction-assisted lipectomy and compression garments

The correct response is Option E.

The patient described has severe primary lower extremity lymphedema. Primary lymphedema is the result of an absence or abnormality of the lymphatic system, and it is characterized according to the age of onset (e.g., birth, puberty, early adulthood). Mild or moderate lymphedema can be treated with compression garments, massage therapy, or manual lymphatic drainage. However, severe lymphedema can benefit from surgical intervention. Surgical intervention (i.e., suction-assisted lipectomy) is generally reserved for the most severe cases because of the risks of the procedure, which include multiple stages, wound dehiscence, scarring, and thromboembolism. Liposuction is typically followed by the use of compression garments. Therefore, suction-assisted lipectomy followed by the use of compression garments is the correct answer since this option involves surgical intervention.

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86. A 36-year-old man comes to the office because of a 16-month history of diffuse pain of the posterior right shoulder. There is no history of trauma. Results of x-ray study are negative for an osseous injury. Physical examination shows atrophy isolated to the posterior scapular muscles. Motor and sensory examination of the right upper extremity shows weakness in shoulder external rotation with the arm adducted; no other abnormalities are noted. Which of the following nerves is most likely injured?

- A) Axillary
- B) Long thoracic
- C) Spinal accessory
- D) Suprascapular
- E) Thoracodorsal

The correct response is Option D.

The patient has an isolated palsy of the suprascapular nerve, the first branch off of the upper trunk (C5, C6) of the brachial plexus. Causes can include trauma, ganglion cyst (supraspinous fossa), or direct compression of the nerve as it passes under the transverse scapular ligament. Symptoms include diffuse posterior shoulder pain, atrophy of the supraspinatus and infraspinatus muscles, and weakness in shoulder external rotation.

The axillary nerve comes off of the posterior cord and innervates the deltoid muscle and teres minor muscle; palsy would primarily impair shoulder abduction. The long thoracic nerve is composed of contributions from the C5-C7 roots and innervates the serratus anterior muscle; a deficit would lead to scapular winging. The thoracodorsal nerve (C6-C8), a branch of the posterior cord, innervates the latissimus dorsi muscle; a deficit would impair shoulder extension, adduction, and internal rotation. The spinal accessory nerve innervates the trapezius and sternocleidomastoid muscles. Injury to this nerve does not affect the periscapular musculature.

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87. A 25-year-old man is evaluated because of a deep 6-cm, palpable mass to the mid-volar forearm. MRI is performed, but the diagnosis remains inconclusive. An initial diagnostic biopsy is planned. Which of the following is most appropriate during this procedure?

- A) Avoidance of cautery
- B) Leaving the biopsy site open with compressive dressings
- C) Performance of an excisional biopsy
- D) Placement of a skin crease transverse incision
- E) Use of a tourniquet without Esmarch bandage

The correct response is Option E.

An open biopsy is done for forearm tumors that cannot be diagnosed as benign on clinical or radiographic grounds. For a large lesion, an incisional biopsy is performed to minimize the risk of surrounding surgical field tumor contamination. Wide undermining must be avoided.

The biopsy is done with a bloodless field and a tourniquet, but elevate the arm only for exsanguination without an Esmarch bandage. Obtain meticulous hemostasis before wound closure. Sutures are placed close to the wound edges to avoid additional tumor skin contamination.

While a transverse incision may provide a better cosmetic result, it may complicate limb-sparing surgery if pathology determines malignancy.

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88. A 21-year-old man with a crush injury to the right forearm is evaluated because of severe pain at rest and with passive range of motion 24 hours after he was released by the emergency department. The patient reports no paresthesias. Which of the following assessments is the most appropriate next step in management?

- A) Compartment pressures
- B) CT scan
- C) MRI
- D) Ultrasonography
- E) Urinalysis

The correct response is Option A.

The patient described sustained a crush injury, and subsequently experienced increased pain in the affected extremity. He ultimately experienced pain upon passive motion as well. This scenario should elevate suspicion for compartment syndrome. Other signs and symptoms of compartment syndrome include paresthesias, which this patient did not have, as well as poikilothermia, and pulselessness, which is a late finding. Compartment syndrome can be the result of high-impact trauma or low-impact injury, and it should be identified as early as possible to prevent permanent disability. Therefore, the next best step in the care of this patient is measurement of compartment pressures to determine if fasciotomy is necessary to release the build-up of pressure in the forearm. Radiological imaging will waste time and possibly worsen the patient's prognosis. Urinalysis should be performed as part of the patient's overall workup in order to assess the potential for acute tubular necrosis, but it is not the definitive next step.

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89. A 35-year-old woman who is an artist is evaluated because of Boutonnière deformity with a flexed proximal interphalangeal (PIP) joint and an extended distal joint. She reports sustaining a laceration from a paint knife to the nondominant midline dorsal PIP joint 6 months ago. She did not seek medical attention at the time of injury. This patient's deformity is a result of attenuation of which of the following structures?

- A) Oblique retinacular
- B) Sagittal bands
- C) Terminal tendon
- D) Triangular ligament
- E) Volar plate

The correct response is Option D.

A Boutonnière deformity occurs with injury to the central tendon and injury or attenuation of the triangular ligament. The lateral bands migrate volarly to become proximal interphalangeal (PIP) joint flexors, and their action is on the distal interphalangeal (DIP) joint, extending it. The triangular ligaments are bound by the lateral bands, central slip, and terminal tendon.

The sagittal bands of the metacarpophalangeal (MCP) joint originate from the volar plate and anchor the extensor mechanism. The oblique retinacular ligament originates from the volar lateral crest of the proximal phalanx and inserts into the terminal tendon. The volar plates stabilize the MCP and PIP joints. The terminal tendon is the convergence to the lateral bands at the dorsum of the middle phalanx inserting on the distal phalanx.

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90. A 44-year-old woman is evaluated because of a 6-month history of pain in her right upper chest and back, intermittent coolness in her right hand, and numbness and tingling of her right ring and little fingers. Results of the Adson test show a decreased radial pulse on the affected side, and the Roos test reproduces the patient's symptoms on the affected side. Which of the following is the most appropriate next step?

- A) Decompression of ulnar nerve at elbow
- B) Noninvasive vascular study and electrodiagnostics
- C) Resection of anterior and middle scalene muscles
- D) Transaxillary resection of first rib
- E) Observation

The correct response is Option B.

Three kinds of surgical procedures are employed to treat thoracic outlet compression syndrome (TOCS): transaxillary resection of the first rib, transcervical anterior and medial scalenectomies, and combined transaxillary first rib resection with immediate anterior and medial scalenectomies. This is the most complete procedure for total decompression of the thoracic outlet region. Because 70% of cases have soft-tissue involvement as the etiology of TOCS, current treatment includes transcervical anterior and middle scalenectomy in most TOCS cases.

Prior to any surgery, patients are treated conservatively with an exercise program for TOCS involving scalene stretching, first rib intercostal relaxation, nerve gliding, muscle relaxants, and pain patches for painful myofascial trigger points. Unfortunately, these conservative treatment modalities may yield only limited temporary help.

TOCS is usually classified in two groups. A neurogenic group comprises nearly 90% of all cases. This group usually has upper extremity pain, numbness, and tingling. A true vascular group comprises 10% of cases. Approximately 50% of patients still complain of coldness in the extremity. Approximately 40 to 50% of TOCS cases have concomitant peripheral nerve compression symptoms. Simple distal decompression of nerves will not usually lead to near-complete resolution of symptoms in cases of true TOCS.

There are two tissue groups that cause TOCS: soft tissue and osseous structures. The soft-tissue group includes anterior and middle scalene and their sheath, ligaments, and bands. This group comprises at least 70% of all TOCS cases because of congenital and acquired changes in the soft tissues. The osseous group comprises 30% or less of all TOCS cases and includes cervical rib, changes in the first rib, and clavicle due to injury.

Because TOCS can present with several different findings (including vascular and neurological compromise), it is advisable to work up these findings prior to committing to a treatment course. Noninvasive vascular studies and electrodiagnostics is the most reasonable first step in working up and treating these patients.

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91. A 45-year-old man is brought to the emergency department after sustaining a fracture of the neck of the fibula after being struck by a baseball. Physical examination shows major nerve deficit. Which of the following actions will the patient be unable to perform?

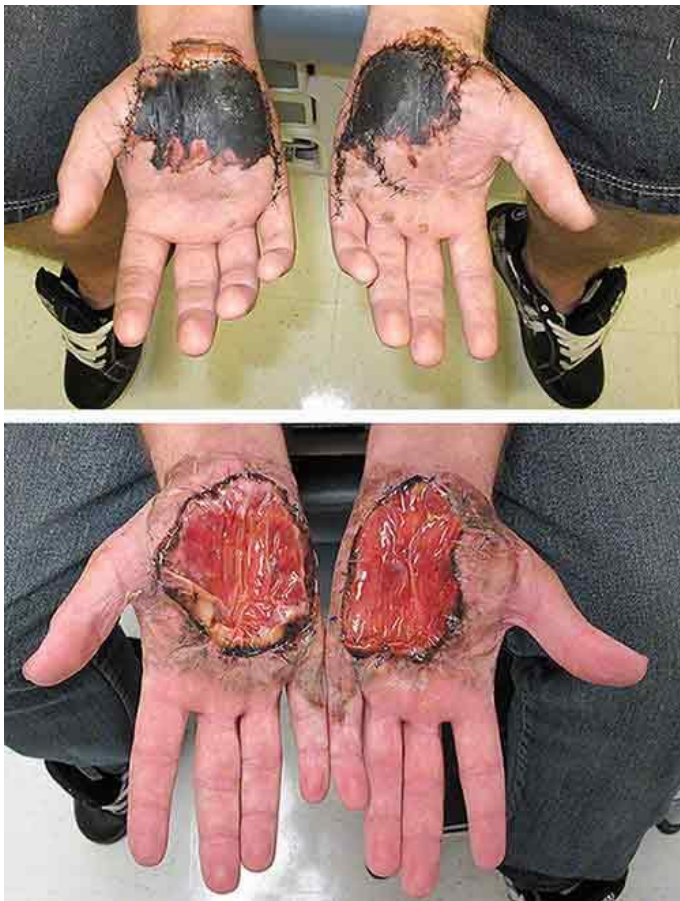
- A) Dorsiflex the foot
- B) Extend the leg
- C) Flex the leg
- D) Invert the foot
- E) Plantar flex the foot

The correct response is Option A.

The most commonly injured nerve in the leg is the common peroneal nerve because of its superficial location as it courses around the neck of the fibula. The common peroneal nerve then divides into the superficial and deep branches. The superficial branch will evert the foot by innervating the lateral compartment of the leg, while the deep branch will dorsiflex the foot by innervating the anterior compartment. The superficial branch also provides sensation for the anterior and lateral sides of the leg and the majority of the dorsum of the foot and toes, including the medial side of the big toe. Paralysis of the common peroneal nerve would lead to foot drop and foot inversion, abnormal “steppage” gait, and loss of sensation.

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

92. An otherwise healthy 22-year-old man is brought to the emergency department after sustaining full-thickness skin loss to the hands. Two-stage reconstruction is planned using a bilaminar neodermis (Integra), followed by skin grafting and simple gauze dressings. Which of the following is the average time for maturation (time from application to removal of silicone layer) of Integra with simple gauze dressings only?
- A) 1 week
 - B) 3 weeks
 - C) 6 weeks
 - D) 9 weeks
 - E) 12 weeks

The correct response is Option B.



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

Integra is a bilaminar skin substitute, composed of a silicone outer layer (mimicking the epidermis) and a biologic scaffold for the inner, dermal layer. Typical maturation (time from application to removal of silicone layer) is 21 days. This process can be accelerated with the use of negative-pressure dressings, but that is not described in this scenario.

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2. Chalmers RL, Smock E, Geh JL. Experience of Integra in cancer reconstructive surgery. *J Plast Reconstr Aesthet Surg.* 2010 Dec;63(12):2081-2090. Epub 2010 Mar 23.
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6. Tenenhaus M, Rennekampff. Burn surgery. *Clin Plast Surg.* 2007 Oct;34(4):697-715.

93. A 7-year-old girl is brought for evaluation because of a 2-month history of an asymptomatic 1-cm mass over the volar radial aspect of the wrist. The parents note no history of trauma. On physical examination, the mass is not adherent to the skin but affixed to the deeper tissues. She has full range of motion of the wrist without signs of carpal instability. X-ray studies of the wrist show no abnormalities. MRI is consistent with a ganglion. There is no evidence of carpal ligamentous injury. Which of the following is the most appropriate next step in management?

- A) Observation
- B) Sclerotherapy
- C) Closed rupture
- D) Wrist arthroscopy
- E) Surgical excision

The correct response is Option A.

The next step in management is a period of observation. Although there is no general consensus regarding the best treatment for pediatric ganglions, most prefer observation and splinting for asymptomatic wrist ganglions. In the literature, the majority of pediatric wrist ganglions will spontaneously rupture and resolve without intervention. The diagnosis of volar wrist ganglion has been made by history, physical examination, and MRI, making needle biopsy unnecessary. This mass is asymptomatic and there is no sign of carpal ligamentous injury on the x-ray study or MRI, therefore there is no surgical indication for excision or wrist arthroscopy.

Closed rupture is a trauma and antiquated therapy for ganglions. Sclerotherapy does not treat wrist ganglia.

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2. Rosson JW, Walker G. The natural history of ganglia in children. *J Bone Joint Surg Br.* 1989;71(4):707-708.
3. Wang AA, Hutchinson DT. Longitudinal observation of pediatric hand and wrist ganglia. *J Hand Surg Am.* 2001;26(4):599-602.

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94. A 5-year-old boy who underwent closed reduction and pinning of a supracondylar humerus fracture is evaluated in the postanesthesia care unit because of absence of palpable radial pulse in the left wrist. Physical examination shows the left hand is warm with color similar to the right hand. No pulses are palpable at the level of the wrist. Without surgical exploration, which of the following is the most likely outcome for the left forearm?

- A) Fibrosis of the deep flexor compartment
- B) Ischemic necrosis of the radial hand
- C) Median nerve palsy
- D) Physeal arrest in the forearm bones
- E) No functional impairment

The correct response is Option E.

Vascular impairment related to pediatric supracondylar fractures occurs in roughly 5 to 10% of patients. Given the nontrivial morbidity of exploration of the brachial artery after reduction of the supracondylar fracture, controversy exists over what criteria should prompt surgical intervention. Recent large, retrospective studies have demonstrated that absence of pulses in the wrist after reduction is not, by itself, associated with poor outcomes. Most patients who lack pulses immediately after reduction, but who have an otherwise perfused hand, go on to recover a palpable radial pulse within 24 to 48 hours after the reduction. In this patient with a perfused hand, observation can be expected to result in a good outcome.

Physeal arrest can occur secondary to ischemia, but this would not be the expected outcome based on the perfusion of the hand. Fibrosis of the deep flexor compartment (Volkmann ischemic contracture) is associated with compartment syndromes but would be rare in this setting. Median nerve impairment associated with the vascular insufficiency at the time of injury is advocated as an indication for surgical exploration. Development of a new median palsy as a late result of the vascular injury is unlikely.

Rare case reports of late development of ischemia in the forearm and hand occur, and families should be counseled to watch for color or temperature changes in the hand following discharge after the recommended observation period of 24 to 48 hours.

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1. Weller A, Garg S, Larson AN, et al. Management of the pediatric pulseless supracondylar humeral fracture: is vascular exploration necessary? *J Bone Joint Surg Am.* 2013 Nov 6;95(21):1906-1912.
2. Scannell BP, Jackson JB 3rd, Bray C, et al. The perfused, pulseless supracondylar humeral fracture: intermediate-term follow-up of vascular status and function. *J Bone Joint Surg Am.* 2013 Nov 6;95(21):1913-1919.

95. A 39-year-old man is referred to the office 4 months after repair of a zone II flexor tendon involving both the flexor digitorum superficialis and flexor digitorum profundus tendons to the right long finger. He still has poor range of motion of his long finger. Physical examination shows 45 degrees of active range of motion at the proximal interphalangeal (PIP) joint and 25 degrees of active range of motion at the distal interphalangeal (DIP) joint. Active and passive ranges of motion are equal. Which of the following is the most appropriate next step in management?
- A) Continued hand therapy to improve passive range of motion
 - B) Flexor tenolysis
 - C) PIP arthrodesis
 - D) Two-stage flexor tendon reconstruction
 - E) Observation to allow for scar remodeling

The correct response is Option A.

This patient has adhesions after flexor tendon injury and repair. In this scenario, the recommended course of action is to continue hand therapy to improve passive range of motion. A successful functional outcome following tendon injury depends on supple joints with full passive range of motion and tendon gliding. The ultimate goal would be to perform flexor tenolysis; however, the indications are clear that the patient must have minimal soft-tissue edema, minimal scarring, and full or near-full passive range of motion.

Active tendon range of motion depends on the flexor digitorum superficialis and flexor digitorum profundus gliding within the flexor tendon sheath. Flexor tendon adhesions are a potential complication any time the flexor tendon sheath is violated, as a result of either surgery or trauma. The literature shows a reoperation rate of 6% after flexor tendon repair and an adhesion rate of 4%.

This patient is 4 months post-surgery and reports compliance with supervised hand therapy. Despite this, he has poor active and passive range of motion. Although most authors recommend waiting at least 3 to 6 months before attempting tenolysis, this patient is unlikely to improve with observation alone.

Tenolysis is a technically demanding procedure, and all patients must be counseled preoperatively that complications such as neurovascular injury, injury to the pulley system, and tendon rupture are possible outcomes. In cases of tendon rupture or

patients requiring pulley reconstruction at the time of tenolysis, two-stage tendon reconstruction with implantation of a silicone rod is indicated. However, this would be a salvage procedure only and not first-line treatment.

Proximal interphalangeal (PIP) joint arthrodesis would be limited to a salvage procedure in patients who are unable to undergo tendon repair or reconstruction.

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96. Following central slip injury, volar subluxation of the lateral bands can lead to which of the following deformities?

- A) Boutonnière
- B) Lumbrical plus
- C) Mallet
- D) Quadriga
- E) Swan-neck

The correct response is Option A.

The triangular ligament stabilizes the lateral bands dorsally, thereby preventing volar subluxation of the lateral bands to the proximal interphalangeal (PIP) joint rotation of axis, and the boutonnière deformity.

The swan-neck deformity occurs when the lateral bands sublux dorsal to the PIP joint rotation of axis. This is prevented by the transverse retinacular ligament, which acts to prevent dorsal migration of the lateral bands at the PIP joint.

Neither the mallet, quadriga, or lumbrical plus deformities are caused by volar subluxation of the lateral bands.

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2. Skirven T. Rehabilitation after tendon injuries. In: Tubiana R, Gilbert A, eds. *Tendon, Nerve and Other Disorders*. Valley Stream, NY: Martin Dunitz; 2005:141-154.

97. A 24-year-old man comes to the office because of a scaphoid wrist nonunion with apex dorsal angulation and proximal pole avascular necrosis. A free tissue transfer from the lower extremity is planned. A branch of which of the following arteries supplies the most appropriate flap for this patient?

- A) Dorsalis pedis
- B) Genicular
- C) Lateral femoral circumflex
- D) Medial sural
- E) Peroneal

The correct response is Option B.

The descending genicular artery is the arterial pedicle for the medial femoral condyle free vascularized osseous corticoperiosteal free flap, or free vascularized bone graft. Scaphoid nonunions with a humpback deformity, carpal collapse, and proximal pole osteonecrosis are difficult to treat. Vascularized bone grafts have been shown to have nearly 2× the union rate of traditional nonvascularized bone grafts. Vascularized corticocancellous bone has the potential to revascularize necrotic bone and can provide structural support for fractures with loss of height of the scaphoid. Studies have shown superior union rates for the medial femoral condyle vascularized bone graft versus pedicled grafts from the distal radius. Anatomical studies show no clinical loss of stability of the femur after flap harvest.

The peroneal artery is the blood supply of the fibular osseous or osteocutaneous free flap. It is generally reserved for head and neck reconstruction and larger defects of the extremities.

The descending branch of the lateral femoral circumflex artery supplies the anterolateral thigh free flap. The dorsalis pedis artery supplies the dorsalis pedis fasciocutaneous flap. The medial sural artery and its perforators supply the medial gastrocnemius muscle, and musculocutaneous and fasciocutaneous flaps. All of these flaps are used for soft-tissue defects alone and are not appropriate for reconstruction of bony defects.

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98. A 39-year-old man comes to the office 3 months after falling 10 feet from a ladder because of persistent radial-sided wrist pain, swelling, decreased grip strength, and a painful clicking in the wrist with moderate activity. Physical examination shows diffuse tenderness of the radial wrist and a painful “clunk” when palpating the scaphoid during radial deviation of the wrist. Initial x-ray studies showed no fracture or dislocation. Recent standard x-ray studies of the wrist show no fracture and normal carpal bone alignment. Which of the following is the most likely diagnosis?

- A) de Quervain tenosynovitis
- B) Dynamic scapholunate instability
- C) Flexor carpi radialis tendinitis
- D) Kienböck disease
- E) Occult scaphoid fracture

The correct response is Option B.

This patient has dynamic scapholunate instability. These injuries can be difficult to diagnose and require a high index of suspicion. A normal x-ray study at 12 weeks in the setting of these clinical findings suggests there is a disruption of the scapholunate interosseous ligament (SLIL) that is symptomatic only with mechanical loading.

The SLIL is the primary stabilizer of the scapholunate joint, but it is surrounded by multiple secondary stabilizers consisting of the extrinsic wrist ligaments. Normal kinematic motion of the proximal carpal row is controlled by the tough interosseous ligaments. The dorsal component of the SLIL is the primary restraint to distraction, torsion, and translational forces. Disruption of the dorsal SLIL alone will result in changes in wrist mechanics, but the presence of the intact secondary stabilizing ligaments will prevent changes seen on a normal static x-ray study, such as scapholunate dissociation or an increased scapholunate angle.

Stress view x-ray studies, such as the clenched-pencil view, should be obtained when dynamic instability is suspected in the setting of a normal static x-ray study series. These results can be compared with the contralateral normal side. Non-contrast MRI is an advanced imaging modality averaging 71% sensitivity, 88% specificity, and 84% accuracy for SLIL tears. There is improved accuracy with 3.0T

MRI machines. Wrist arthroscopy is the gold standard for diagnosis and can be combined with therapeutic procedures such as debridement or thermal shrinkage.

An occult scaphoid fracture should be visible at 12 weeks following the injury. Bone resorption at the fracture site makes the fracture line generally visible within 14 days. If suspicion remains for an occult scaphoid fracture at 2 weeks, additional imaging such as MRI or CT scan is indicated. At 3 months following the injury, any fracture present should be visible and treated as a non-union of the scaphoid.

De Quervain tenosynovitis is defined as tendinitis of the first dorsal extensor compartment. This condition generally presents with pain and tenderness over the radial styloid with a positive Finkelstein test. Tenderness of the carpal bones and carpal bone instability such as a painful “clunk” would not be present. The condition is most associated with repetitive use and not acute trauma.

Kienböck disease involves collapse of the lunate due to vascular insufficiency and avascular necrosis. Etiology is unknown but may involve a combination of anatomic factors and trauma. Early symptoms are similar to a wrist sprain but involve more global wrist pain, loss of dorsiflexion, and tenderness of the dorsal wrist over the lunate. Early stage I disease can have normal x-ray studies but will often show signs of a lunate fracture. Later stage disease shows sclerosis and ultimately fracture or collapse of the lunate.

Flexor carpi radialis (FCR) tendinitis is not a common diagnosis. It presents with wrist pain, crepitus, and point tenderness over the FCR at the wrist flexion crease with flexion and radial deviation. Although it is a cause of radial-sided wrist pain, findings of carpal bone instability on examination are not present.

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99. A 51-year-old woman is evaluated because of numbness and tingling of the dorsal and palmar aspects of the left hand, extending to the ring and little fingers, with worsening symptoms at night. Physical examination shows weakness of finger abduction in the hand. Which of the following is the most likely electrodiagnostic finding?

- A) Decreased median conduction velocity from above elbow to wrist
- B) Decreased ulnar conduction velocity from above elbow to wrist
- C) Decreased ulnar conduction velocity from below elbow to wrist
- D) Prolonged median sensory latency from wrist to digit
- E) Prolonged ulnar sensory latency from wrist to digit

The correct response is Option B.

The most likely electrodiagnostic finding is decreased ulnar conduction velocity from above elbow to wrist.

This patient exhibits symptoms of ulnar nerve compression at the cubital tunnel. Cubital tunnel syndrome is characterized by numbness and tingling in the ulnar nerve distribution (ulnar side of hand, involving little finger and ulnar half of ring finger) and can lead to intrinsic weakness. Compression occurs at the level of the elbow, with slowing of nerve conduction across the area of compression.

Electrodiagnostic findings in ulnar nerve compression consist of decreased ulnar conduction velocity in the segment from above elbow to the wrist. Comparison of conduction velocities between above elbow to wrist and below elbow to wrist may show a difference, with nerve conduction being faster when measured from below the elbow, as the area of compression is not traversed. Conduction velocities from below elbow to wrist should not be affected. Ulnar nerve compression at the cubital tunnel can be distinguished from compression at the Guyon canal, as symptoms in the dorsal hand are not involved during nerve compression at the Guyon canal (at the level of the wrist), because the dorsal sensory branch of the ulnar nerve branches proximal to the wrist.

Prolonged median sensory latency from wrist to digit is seen in carpal tunnel syndrome.

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3. Palmer BA, Hughes TB. Cubital tunnel syndrome. *J Hand Surg Am*. 2010 Jan;35(1):153-163.

100. A 40-year-old woman is evaluated because of a 1-year history of lymphedema of the right lower extremity. BMI is 28 kg/m². Physical examination shows asymmetry of the right lower extremity and increased circumference of the thigh and calf compared with the left lower extremity. Which of the following is the most appropriate initial treatment?

- A) Administration of a diuretic
- B) Excision of the affected skin and subcutaneous tissue
- C) Formation of a diet and exercise regimen
- D) Intermittent pneumatic pump compression
- E) Microvascular lympholymphatic anastomosis

The correct response is Option D.

Intermittent pneumatic pump compression therapy should be instituted. The mainstay of treatment is medical, including meticulous hygiene and regular inspection. Patients should be encouraged to lose weight, avoid even minor trauma, avoid constrictive clothing, and elevate the affected extremity. All patients should also use compression garments continuously during the day.

Lymphedema is the accumulation of protein-rich fluid in the interstitial space caused by lymphatic dysfunction. Lymphatic flow must be decreased by 80% before interstitial fluid begins to accumulate as compensatory mechanisms such as increased macrophage activity and spontaneous lymphovenous anastomoses are exhausted. Increased concentrations of interstitial protein cause inflammation and fibrosis, leading to a cycle of further damage to lymphatics, worsening inflammation, and an enlarged extremity. Chronic lymphedema leads to deposition of fat and fibrous tissue.

The classic finding involves edema, beginning in the distal extremity. Measurements of limb circumference at multiple levels may show enlargement compared with the contralateral side. Other conditions may cause peripheral edema, but in general, bilateral lower extremity edema is caused by systemic disease. Unilateral edema is more likely a result of venous insufficiency or lymphedema.

Lymphedema is a chronic disease that is difficult to manage and treat, and there is no medical or surgical cure. In general, simpler methods are recommended for

patients with newly diagnosed lymphedema, such as in this patient. Surgery is generally recommended for patients who have failed conservative therapy.

Diuretics play no role in the treatment of lymphedema.

Physiologic procedures, such as microvascular lympholymphatic or lymphovenous anastomoses, have not shown favorable long-term results.

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Section 3: Craniomaxillofacial

101. A 60-year-old man undergoes microvascular anastomosis. The proximal facial artery off the external carotid artery is to be dissected and used as a recipient vessel. During the procedure, a large, overlying, nerve-like structure is inadvertently transected. Which of the following is the most likely consequence?
- A) Dysarthria
 - B) Lip elevation
 - C) Shoulder drop
 - D) Tongue numbness
 - E) Vocal cord paralysis

The correct response is Option A.

The facial artery generally starts as part of the lingual-facial trunk, then travels below the hypoglossal nerve before it enters into the submandibular gland and along the lateral border of the mandible. Failure to recognize this structure could cause injury and subsequent loss of motor function of the ipsilateral tongue. Ipsilateral hypoglossal (XII) nerve injury causes the tongue to move toward the side of damage, resulting in dysarthria, and problems moving solid food to the oropharynx.

Vocal cord paralysis is related to a recurrent laryngeal or vagus (X) nerve injury, which could happen after superior laryngeal artery or common carotid dissection, respectively.

Shoulder drop is related to accessory (XI) nerve injury, which has anatomic relation to the occipital artery.

Tongue numbness is from an injury to the lingual nerve (related mostly to the laryngeal artery and submandibular duct).

Lip elevation is related to a marginal mandibular (V3) nerve injury—this nerve runs with the facial artery lateral to the mandible, but not below the margin of the mandible.

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102. In patients without loss of posterior vertical height, which of the following is the most appropriate duration of maxillomandibular fixation (MMF) for treatment of minimally displaced bilateral subcondylar fractures of the mandible?
- A) 1 week
 - B) 4 weeks
 - C) 8 weeks
 - D) None; stabilize mandible with gunning splint for 8 weeks
 - E) None; treat patient with soft diet

The correct response is Option B.

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

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

Given the current hypothesis, ankylosis of the TMJ is most likely a manifestation of direct injury within the joint capsule or condylar head itself. It is imperative to point out that as a result, there should be a lower risk of ankylosis in subcondylar fractures compared with fractures of the condylar head. Therefore, the position of the fracture line relative to the joint capsule should be closely examined, and a longer period of MMF should be employed if there is no involvement of the condylar head, disc, or capsule. A longer period of MMF commonly results in better union of the fractured segments with no increase in the incidence of ankylosis. In a nondisplaced fracture or minimally displaced fracture with a functional occlusion, 4 to 6 weeks of MMF is recommended, followed by 2 to 3 weeks of guiding elastics. The same treatment applies in the case of a nondisplaced bilateral fracture. However, this scenario is less common because the force parameters to cause the bilateral fracture are often greater and tend to displace the fracture fragments significantly, necessitating ORIF. The patient will most likely develop shortening of the masseter muscle and stiffness with prolonged immobilization during 8 to 10 weeks. With bilateral instability, the fracture pattern is unstable and soft diet alone would likely lead to malocclusion. A gunning splint is often used in edentulous mandible only and is not functional MMF.

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1. Ellis E 3rd, Miles BA. Fractures of the mandible: a technical perspective. *Plast Reconstr Surg*. 2007 Dec;120(7 Suppl 2):76S-89S.
2. Hackenberg B, Lee C, Caterson EJ. Management of subcondylar mandible fractures in the adult patient. *J Craniofac Surg*. 2014 Jan;25(1):166-171.



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

103. A 78-year-old woman undergoes resection of a melanoma on the nose. Margins are free of tumor. A photograph is shown. Which of the following methods of reconstruction is most appropriate for this defect?

- A) Bilobed flap
- B) Cheek flap
- C) Dorsal nasal flap
- D) Full-thickness skin graft
- E) Partial-thickness skin graft

The correct response is Option D.

In considering nasal reconstruction, the surgeon must adequately describe the location of the defect since it is important in choosing a reconstructive method. The classically described nasal subunits, based on location, include the ala(s), tip, soft triangle(s), sidewall(s), and dorsum. The current defect is limited to the nasal side wall.

Bilobed flaps are ideal for circular defects located at the nasal tip. Through recruitment and rotation of lax tissue from the nasal dorsum or sidewall, it shifts tissue towards the tip. Similarly, dorsal nasal flaps rotate tissue from the nasal dorsum to reconstruct tip defects. The defect shown is also too large to close with

either a bilobed or dorsal nasal flap. A cheek flap would be inadequate for a side-wall defect, since it would efface the important anatomic junction between the cheek and the nose. While either a full-thickness or split-thickness skin graft could adequately close this side-wall defect, the increased thickness of a full graft would have better cosmesis with less secondary contracture and distortion. A full-thickness graft should be harvested from an area anatomically as close as possible to the defect. While local flaps are preferred on the face, the nasal side wall is considered a privileged area for skin grafting since the native skin is thin and there is strong underlying bony structure to resist contractile forces of skin grafts. In other areas of the nose, skin grafts are generally avoided.

The defect shown could also have been closed with a forehead flap, but this was not listed as an option.

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1. Menick F. Nasal Reconstruction. In: Thorne CH, Chung KC, Gosain AK, et al., eds. *Grabb and Smith's Plastic Surgery*. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2013: 368.
2. Ibrahim AM, Rabie AN, Borud L, et al. Common patterns of reconstruction for Mohs defects in the head and neck. *J Craniofac Surg*. 2014 Jan; 25(1): 87-92.

104. A 60-year-old woman comes to the office for evaluation of a firm, violaceous, 3-cm lesion of the left cheek. An incisional biopsy shows a Merkel cell tumor. The residual margins are positive. Which of the following is the most appropriate management?

- A) Chemotherapy
- B) Laser ablation
- C) Mohs micrographic surgery
- D) Radiation therapy and chemotherapy
- E) Wide local excision and radiation therapy

The correct response is Option E.

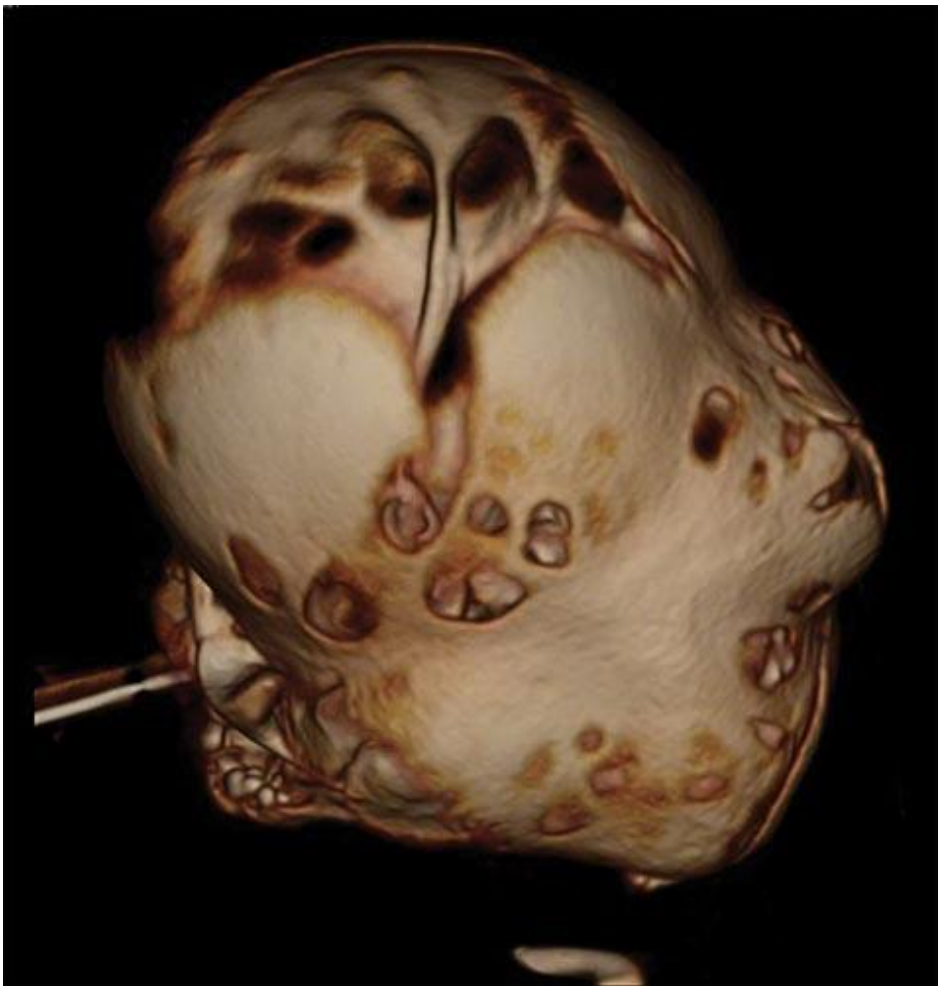
Merkel cell tumor is an unusual and highly aggressive skin cancer. More than 50% of Merkel cell tumors occur in the head and neck region. Risk factors for Merkel cell tumors are exposure to sun and ultraviolet light, and immunosuppression. There is a recent association with Merkel cell polyomavirus.

Merkel cell generally presents as a firm, painless nodule (up to 2 cm in diameter) or as a mass (>2 cm in diameter). Although classically described as red in color, it may be flesh-colored or blue. It often enlarges rapidly.

The standard of management is surgical excision combined with radiation therapy. Radiation therapy decreases local recurrence rates. Node-negative patients with no distant metastasis treated with surgery and radiation have 5-year survival rates of approximately 90%. Mohs micrographic surgery and wide local excision are both accepted modalities of surgical resection. It is well known that surgery alone is insufficient to cure or control Merkel cell tumors. Consideration should be given to evaluation of the lymph nodes. Sentinel node biopsy is a common modality.

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1. Pellitteri PK, Takes RP, Lewis JS, et al. Merkel cell carcinoma of the head and neck. *Head Neck*. 2012 Sep;34(9):1346-1354. Epub 2011 Jun 20.
2. Huber GF. Modern management of Merkel cell carcinoma. *Curr Opin Otolaryngol Head Neck Surg*. 2014 Apr;22(2):109-115.



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

105. A 2-day-old male newborn is evaluated for the skull findings shown in the CT scan. Which of the following best describes the anomaly in this patient?

- A) Brachycephaly
- B) Kleeblattschädel deformity
- C) Posterior plagiocephaly
- D) Scaphocephaly
- E) Trigonocephaly

The correct response is Option B.

This CT scan shows craniosynostosis of multiple sutures including the coronal, lambdoid, and a portion of the sagittal suture, which is characteristic of a Kleeblattschädel deformity. Brachycephaly is characterized by bicoronal craniosynostosis alone and is most commonly seen in syndromic craniosynostosis. Scaphocephaly is isolated involvement of the sagittal suture and is the most common type of craniosynostosis. Metopic synostosis is the cause of trigoncephaly and this suture is open in the CT scan. Lambdoid, which produces posterior plagiocephaly synostosis, is seen in the CT scan but not in isolation and is the least common of the single suture synostoses.

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1. Cohen MM Jr. Cloverleaf skulls: etiologic heterogeneity and pathogenetic variability. *J Craniofac Surg*. 2009 Mar;20 Supp 1:652-656.
2. Bristol RE, Lekovic GP, Rekate HL. The effects of craniosynostosis on the brain with respect to intracranial pressure. *Semin Pediatr Neurol*. 2004 Dec;11(4):262-267.
3. Vander Kolk CA. Syndromic craniosynostosis. In: Achauer BM, Eriksson E, Guyuron B, Coleman JJ III, Russell RC, Vander Kolk CA, eds. *Plastic Surgery: Indications, Operations, and Outcomes*. 1st ed. Maryland Heights, MO: Mosby; 2000:707-719.

106. Which of the following terms best describes the temporomandibular joint?

- A) Ellipsoid (condyloid)
- B) Gliding (arthrodial)
- C) Hinge-sliding (ginglymoarthrodial)
- D) Pivot (trochoid)
- E) Saddle (ephippial)

The correct response is Option C.

The temporomandibular joint is classified as a ginglymoarthrodial joint since it has both hinge and sliding components during jaw opening. These functions take place in the two separate compartments in the joint, upper and lower, that are effectively separated by an articular disc. During the first 20 mm of jaw opening, the condyle rotates in the lower compartment (space between condylar head and articular disc) in a nearly pure hinge motion. For further opening to take place, the condyle translates (or shifts) forward with the articular disc through the upper compartment (space between the articular disc and the joint surface). The other options describe other joint configurations. Examples of each are: saddle, thumb basilar joint; pivot, atlas-axis (C1-2 neck); gliding, tarsal bones in the foot; ellipsoid, radiocarpal articulation.

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1. Choi KY, Yang JD, Chung HY, et al. Current concepts in the mandibular condyle fracture management part I: overview of condylar fracture. *Arch Plast Surg*. 2012 Jul;39(4):291-300. Epub 2012 Jul 13.
2. Tanaka E, Detamore MS, Mercuri LG. Degenerative disorders of the temporomandibular joint: etiology, diagnosis, and treatment. *J Dent Res*. 2008 Apr;87(4):296-307.

107. A 6-year-old boy is brought to the emergency department following facial trauma from falling on his bicycle handlebars. Which of the following mandible fracture locations is most commonly associated with anterior open bite?

- A) Angle
- B) Body
- C) Coronoid
- D) Subcondylar/condylar
- E) Symphysis/parasymphysis

The correct response is Option D.

Anterior open bite, also known as apertognathia, is vertical separation of the maxillary and mandibular anterior teeth. It is caused by premature contact of the posterior molars, most commonly following bilateral subcondylar mandible fracture. When present, a unilateral subcondylar/condylar fracture causes an open bite on the side opposite the fracture.

REFERENCES:

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2. Manson P. Facial Fracture. In: Mathes SJ, Hentz VR, eds. *Plastic Surgery*. Vol 2. Philadelphia: Saunders-Elsevier; 2006:77.

108. Which of the following is a standard for accreditation of an ambulatory surgery facility as it relates to plastic surgeons?

- A) All team members of the ambulatory facility caring for pediatric patients must be certified in Pediatric Advanced Life Support
- B) Ambulatory facilities are inspected every 5 years
- C) Patients undergoing ambulatory surgery during general anesthesia require a responsible adult to monitor them for 1 to 2 hours after discharge from the ambulatory surgery center
- D) Plastic surgeons working in the ambulatory surgery facility must be board certified by the American Board of Plastic Surgery
- E) Surgeons operating in an ambulatory surgery center are required to demonstrate that they hold unrestricted hospital privileges at an acute-care hospital within 30 minutes' driving time of the facility

The correct response is Option E.

The American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) requires surgeons to be Board Certified or Board Eligible with a Board recognized by the American Board of Medical Specialties. A patient who underwent general anesthesia needs a responsible adult to supervise him/her for 12 to 24 hours. Surgeons are required to demonstrate that they hold unrestricted hospital privileges at an acute-care hospital within 30 minutes' driving time of the ambulatory facility. If pediatric patients are cared for, at least one member of the team needs to be certified in Pediatric Advance Life Support (PALS). Ambulatory care facilities are inspected every 3 years by the AAAASF.

REFERENCES:

1. American Association for Accreditation of Ambulatory Surgery Facilities, Inc. Regular Standards and Checklist for Accreditation of Ambulatory Surgery Facilities. Version 13, August 2011. Available at: http://www.aaaasfsurveyors.org/asf_web/PDF%20FILES/ASC%20Standard%20and%20Checklist%20Version%2013.pdf. Accessed 25 March, 2013.
2. American Association for Accreditation of Ambulatory Surgery Facilities, Inc. Procedural Standards and Checklist for Accreditation of Ambulatory Surgery Facilities. Available at: www.aaaasf.org. Published August 2011.

109. A 45-year-old woman is evaluated for a 2.5-cm, biopsy-proven squamous cell carcinoma of the left floor of the mouth. Imaging studies show cortical mandibular invasion, but no enlarged cervical lymph nodes or distant metastatic disease. A tracheostomy is performed. Immediate reconstruction is planned. Which of the following is the most appropriate surgical treatment for this cancer?

- A) Wide local excision alone
- B) Wide local excision and marginal mandibulectomy
- C) Wide local excision and neck dissection
- D) Wide local excision, marginal mandibulectomy, and neck dissection
- E) Wide local excision, segmental mandibulectomy, and neck dissection

The correct response is Option E.

Oral cavity cancers are staged based on the following criteria set forth by the American Joint Committee on Cancer:

Primary tumor staging for oral cavity cancers (T)

- TX Primary tumor cannot be assessed
- T0 No evidence of primary tumor
- Tis Carcinoma in situ
- T1 Tumor = 2 cm in greatest dimension
- T2 Tumor >2 cm but not more than 4 cm in greatest dimension
- T3 Tumor >4 cm in greatest dimension
- T4a Moderately advanced, local disease
 - Lip – Tumor invades through cortical bone, inferior alveolar nerve, floor of mouth, or skin of face
 - Oral cavity – Tumor invades adjacent structures (e.g., through cortical bone, into deep extrinsic muscle of the tongue, maxillary sinus, or skin of face)
- T4b Very advanced, local disease
 - Tumor invades masticator space, pterygoid plates, or skull base and/or encases internal carotid artery

The cancer described is a stage T4aN0M0 cancer of the floor of mouth. The T-stage is 4a based on cortical mandibular invasion demonstrated by radiographic imaging. Concern for mandibular invasion should be raised whenever a tumor abuts or is fixed to the mandible.

Mandibulectomy is indicated. Cortical invasion of the mandible is an indication for segmental mandibulectomy, in which the full thickness of the involved mandible and grossly disease-free margin are removed by osteotomies. Marginal mandibulectomy involves removal of the alveolar ridge and varying amounts of the inner or lingual table of the mandible depending on the location of the tumor. Marginal mandibulectomy is performed when cancers abut the mandible or invade the periosteum, but do not grossly invade the cortex of the bone.

Although clinically and radiographically the neck does not have nodal metastases (stage N0), surgical treatment is usually performed due to the risk for occult nodal metastases (20% or more in some studies). Such dissection also facilitates reconstruction by exposing potential recipient blood vessels for microvascular free tissue transfer.

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2. Wax MK, Bascom DA, Myers LL. Marginal mandibulectomy vs segmental mandibulectomy: indications and controversies. *Arch Otolaryngol Head Neck Surg.* 2002 May;128(5):600-603.

110. A 10-year-old boy with a history of fronto-orbital advancement for craniosynostosis as an infant is brought to the office for evaluation. He would like to play football, but his parents are concerned about a persistent calvarial defect. Physical examination shows a 4 × 4-cm area of the right forehead that has no bony coverage; dural pulsations are observed. Which of the following is the most appropriate management?

- A) Fabrication of a custom implant
- B) Reconstruction with methylmethacrylate
- C) Split calvarial bone grafting
- D) Split rib grafting
- E) Observation and delayed treatment until after completion of growth

The correct response is Option C.

This is a growing child with a large calvarial defect in a problematic location. Therefore, the defect needs to be addressed sooner rather than later, due to the potential risk for trauma and the child's desire to be active. The gold standard for reconstruction of defects of this size and location is split calvarial bone grafting. Rib grafting would work, but would necessitate another donor site and contouring issues. A custom implant or methylmethacrylate would fix the problem in the short term, but would not grow with the child, necessitating additional surgery in the future.

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1. Goldstein JA, Paliga JT, Bartlett SP. Cranioplasty: indications and advances. *Curr Opin Otolaryngol Head Neck Surg*. 2013 Aug;21(4):400-409.
2. Beidas OE, Deschamps-Braly JC, Morgan AM, et al. Safety and efficacy of recombinant human bone morphogenetic protein 2 on cranial defect closure in the pediatric population. *J Craniofac Surg*. 2013 May;24(3):917-922.
3. Rogers GF, Greene AK. Autogenous bone graft: basic science and clinical implications. *J Craniofac Surg*. 2012 Jan;23(1):323-327.

111. A 25-year-old man is evaluated after sustaining a left zygomaticomaxillary complex (ZMC) fracture. On exploration of the fracture through the upper buccal sulcus, left brow, and left trans-conjunctival incisions, the fracture crosses the infraorbital foramen, and the left orbital floor fracture is significantly depressed and displaced. Open reduction and internal fixation (ORIF) of the orbital floor and ZMC fractures is performed. Which of the following is the most appropriate CPT code for this patient?

CPT Code	Description
21360	ORIF malar fracture only
21365	ORIF of “complicated” malar fracture only
21390	orbital blowout fracture repair, periorbital approach with alloplastic or other implant

- A) 21360
- B) 21365
- C) 21390
- D) 21360 and 21390
- E) 21365 and 21390

The correct response is Option E.

21365 is the appropriate code for the zygomaticomaxillary complex (ZMC) fracture repair since the repair requires multiple incisions and the fracture crosses the infraorbital foramen. The orbital floor repair is not considered “bundled” with the repair of the ZMC fracture and should be billed separately as a distinct procedure.

21360 is not the appropriate code for this complicated ZMC fracture. 21390 is correctly added to this code, however.

21360 is the appropriate code for a simple repair of a ZMC fracture and does not include reduction and repair of the concurrent orbital floor fracture.

21390 is not the appropriate code without 21365.

21365 is the appropriate code for the ZMC fracture repair, however, this option omits the code for the reduction and repair of the orbital floor fracture.

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2. American Medical Association. *CPT 2013 Professional Edition*. American Medical Association; 2012: 102.



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

112. A 6-month-old girl is brought to the office for evaluation of an isolated cleft of the soft palate. A photograph is shown. Which of the following genes is most likely defective in this patient?

- A) *FGFR2*
- B) *IRF6*
- C) *MSX1*
- D) *SHH*
- E) *TGF-beta*

The correct response is Option B.

The patient has Van der Woude syndrome, an autosomal dominant condition affecting 1:35,000 to 1:100,000 persons. The pathognomonic features include lower lip pits, as seen in the photograph, and clefting of the palate, lip, or both. This syndrome is the most common single-gene cause of cleft lip and palate. *IRF6* codes for a transcription factor that is involved in the early development. The mutated copy of the gene decreases the amount of active protein and results in the defects associated with this syndrome and popliteal pterygium syndrome. The remaining genes and their products have been implicated in craniofacial morphogenesis and

etiopathogenesis of cleft lip/palate. Nevertheless, none are associated with lip pits or are an autosomal dominant cause of facial clefting.

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2. Huang JJ, Hou JW, Tan YC, et al. Van der Woude syndrome: clinical presentation in 64 patients. *Cleft Palate Craniofac J.* 2007 Nov;44(6):649-652.



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

113. An otherwise healthy 4-year-old boy is brought to the office for evaluation of a large scalp hemangioma. A photograph is shown. The family has requested removal of the hemangioma before he enters school. Which of the following is the most appropriate management in this patient?
- A) Deferral of surgery for 2 years
 - B) Excision and skin grafting
 - C) Single-stage excision and closure
 - D) Staged excision and closure
 - E) Tissue expansion

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

The correct response is Option C.

Although the hemangioma shown is sizable, judicious mobilization of the scalp and galeal scoring allow the resultant defect to be easily closed without resorting to delayed rotational flaps, tissue expanders, or skin grafting. Single-staged excision and linear closure is the simplest, most predictable manner of closing small to intermediate-sized scalp defects such as the one in the patient described. The maximum defect using this technique is not well defined, but at least one series has demonstrated successful primary closure of defects in infants of up to 7 cm without using the other alternatives listed or tissue expansion. Delaying the resection for another 2 years might be productive in a younger child, but further involution is unlikely in a 4-year-old. Staged excision is possible, but unnecessary for this lesion; moreover, repair along the edge of the friable hemangioma can lead to wound problems.

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1. Spector JA, Blei F, Zide BM. Early surgical intervention for proliferating hemangiomas of the scalp indications and outcomes. *Plast Reconstr Surg*. 2008 Aug;122(2):457-462.
2. Couto RA, Maclellan RA, Zurakowski D, et al. Infantile hemangioma: clinical assessment of the involuting phase and implications for management. *Plast Reconstr Surg*. 2012 Sep;130(3):619-624.

114. A 20-year-old man is evaluated for reconstruction of the lip after sustaining a traumatic blast injury to the face with complete loss of the lower lip. The patient wishes to have a symmetric, dynamic, and competent lower lip. Which of the following treatment plans is most likely to achieve the patient's desired outcome?

- A) Innervated anterolateral thigh flap
- B) Innervated gracilis muscle
- C) Innervated regional advancement flaps (Karapandzic)
- D) Prosthetic lower lip appliance
- E) Radial forearm flap with tendon graft

The correct response is Option B.

Total lower lip reconstruction is very challenging. A prosthetic lower lip may have acceptable static appearance but does not afford competency or dynamic function. An anterolateral thigh flap would be bulky and adynamic. Innervated regional advancement flaps are not indicated for total lip loss and would lead to microstomia. A radial forearm flap with a tendon graft can achieve an acceptable appearance and competence. The radial forearm flap is unable to achieve spontaneous lower lip movement that is as symmetrical as that of the functional gracilis muscle flap. If a split-thickness skin graft from the scalp is used, the color match can be superior to radial forearm flap as well. The functional gracilis flap is most likely to achieve this patient's goals.

REFERENCES:

1. Anvar, BA, Evans BC, Evans GR. Lip reconstruction. *Plast Reconstr Surg.* 2007 Sep 15;120(4):57e-64e.
2. Ninkovic M, Spanio di Spilimbergo S, Ninkovic M. Lower lip reconstruction: introduction of a new procedure using a functioning gracilis muscle free flap. *Plast Reconstr Surg.* 2007 Apr 15;119(5):1472-1480.

115. In patients with ameloblastoma, which of the following cell populations gives rise to this tumor?

- A) Cementoblast tissue
- B) Enamel
- C) Gingiva
- D) Nerve root
- E) Odontogenic epithelium

The correct response is Option E.

Ameloblastomas are benign odontogenic tumors derived from odontogenic epithelium. They are typically slow growing, and present in the fourth or fifth decade of life as a mandibular mass in most individuals (80%).

Odontogenic cementoblast tissue is not appropriate because this tissue gives rise to an extremely rare benign odontogenic tumor, the cementoma.

Gingiva is the mucosal covering of the alveolar bone.

Enamel is the dense compound of teeth.

REFERENCES:

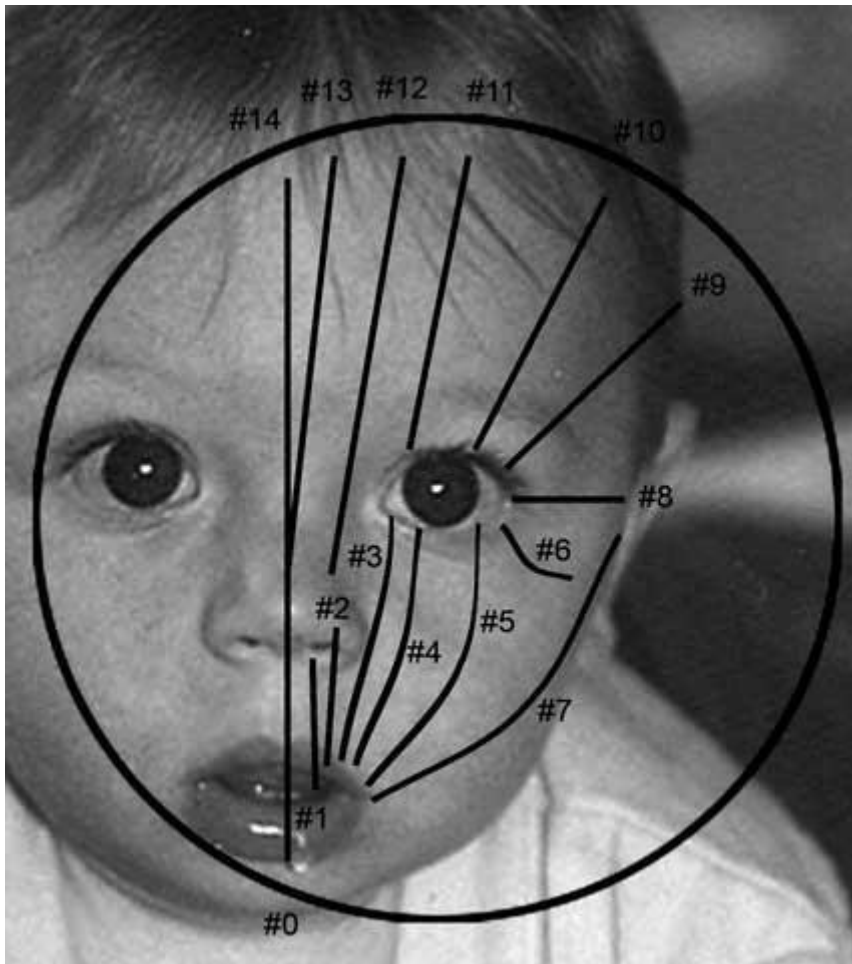
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116. According to the Tessier cleft classification types, at which of the following areas is the most common facial cleft centered?

- A) Frontonasal suture
- B) Frontozygomatic suture
- C) Nasomaxillary buttress
- D) Superior orbit
- E) Zygomaticotemporal suture

The correct response is Option E.

Patients with rarer facial clefts are classified according to the system proposed by Tessier in 1973. Each cleft is classified by the soft-tissue findings and the bony defects as they relate to the orbit. Nos. 0 through 7 occur in the lower half of the face as delineated by the orbital commissure, and Nos. 9 through 14 occur in the upper half of the face. The most common facial cleft is the No. 7 cleft centered in the region of the zygomaticotemporal suture. It includes variable expression of macrostomia and hypoplasia of the zygoma.



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1. Kawamoto HK Jr. Craniofacial clefts. In: Aston SJ, Beasley RW, Thorne CH, et al, eds. *Grabb and Smith's Plastic Surgery*. 5th ed. Philadelphia: Lippincott-Raven; 1997:349-363.
2. Kawamoto HK Jr. Rare craniofacial clefts. In: McCarthy JG, ed. *Plastic Surgery*. Philadelphia: WB Saunders; 1990:2945-2951.
3. Tessier P. Anatomical classification of facial, cranio-facial and latero-facial clefts. *J Maxillofac Surg*. 1976 Jun;4(2):69-92.

117. Which of the following factors is most likely to increase the risk for osteoradionecrosis secondary to radiation therapy?

- A) Dental caries
- B) Edentulous mandible
- C) Oral thrush
- D) Osseointegrated implants
- E) Radiation dose of 3500 cGy

The correct response is Option A.

Osteoradionecrosis (ORN) of the mandible is uncommon but can occur in up to 10% of patients after undergoing radiation therapy for oral cancers. The risk increases once radiation doses exceed 6500 cGy. Most reports of ORN have dental caries and extraction sites as precipitating factors. Periodontal disease can also lead to ORN. After undergoing radiation therapy, patients can develop oral candidiasis and xerostomia, and they may also have edentulous mandibles with dental implants after reconstruction. However, these do not increase the risk for ORN. Surgical resection and hyperbaric oxygen therapy are the mainstays of treatment.

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2. Celik N, Wei FC, Chen HC, et al. Osteoradionecrosis of the mandible after oromandibular cancer surgery. *Plast Reconstr Surg*. 2002 May;109(6):1875-1881.
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118. A 25-year-old woman is evaluated for unilateral facial paralysis after she sustained an episode of Bell palsy that did not respond to oral administration of corticosteroids. Methods for functional reconstruction using a gracilis muscle transfer are discussed. Which of the following is an advantage of this muscle transfer for this patient?

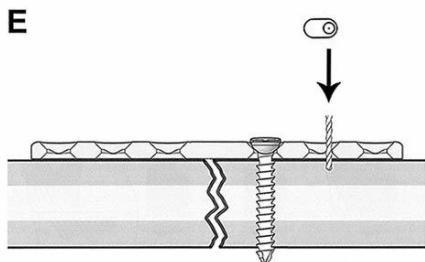
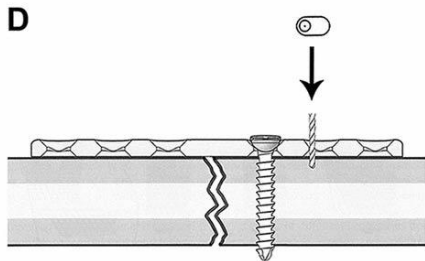
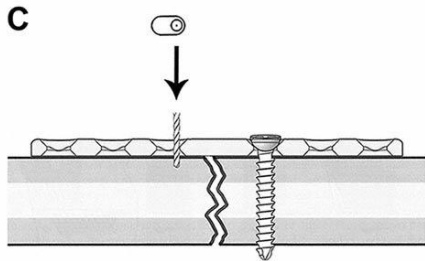
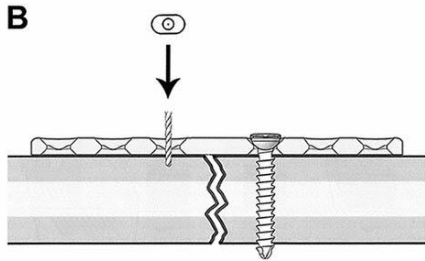
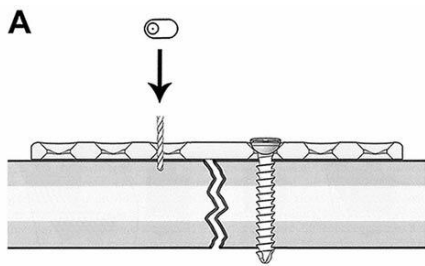
- A) Ability of the nerve to reach the contralateral side
- B) Ability to incorporate overlying tendon
- C) Multiple directions of pull
- D) Reliable vascular pedicle
- E) Two dominant nerves

The correct response is Option D.

The gracilis muscle has been widely used for facial reanimation because of its many advantages. The muscle is located in the inner thigh, which makes harvest easy in a supine position and keeps the donor site well hidden. It has a single constant vascular pedicle of adequate length for transfer. Although it is able to generate sufficient force for animation, it has only one direction of pull and is thus best suited for restoring only one component of smiling. There is no overlying tendon, and there is a single dominant nerve that is not able to reach the contralateral side of the face.

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2. Chuang DC. Technique evolution for facial paralysis reconstruction using functioning free muscle transplantation--experience of Chang Gung Memorial Hospital. *Clin Plast Surg*. 2002 Oct;29(4):449-459.
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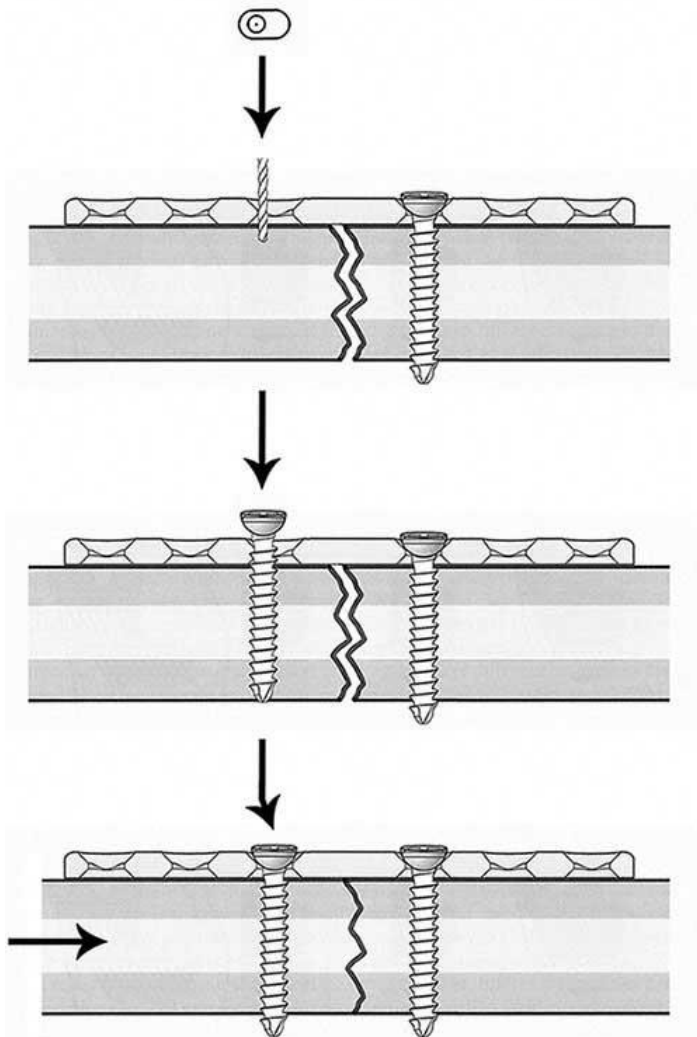
119. A 32-year-old man undergoes open reduction and internal fixation of a fracture in the left body of the mandible. A six-hole dynamic compression plate is chosen for the inferior mandibular border. The first screw is placed bicortically through a plate hole immediately adjacent to the line of fracture. To obtain maximum compression at the fracture line using the spherical gliding principle, the most appropriate next step is to drill for a second screw at which of the following locations (A–E)?

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

The correct response is Option A.

To obtain maximum compression at the fracture line using the spherical gliding principle, the most appropriate next step is to drill for a second screw eccentrically, away from the line of fracture, through a plate hole located across the fracture line.

Concentric or neutral drilling occurs in the center of a plate hole, while eccentric drilling occurs in the periphery (corner) of the plate hole (either away or closer to the line of fracture).



The figure above illustrates the spherical gliding principle in a dynamic compression plate. The special geometry of the plate hole—together with eccentric, away from the fracture line, placement of the screw that has a spherically shaped head—allows interfragmentary compression in an axial direction when the screw is driven fully into the plate hole. For appropriate fracture compression to occur, the head of the screw that was placed first must be well seated into the plate hole, stabilizing the plate against the underlying bony segment.

Drilling concentrically (neutrally) through a plate hole located across the fracture line would cause no axial movement of the underlying bone fragments upon tightening of the screw against the plate, generating no further compression at the fracture line.

Drilling eccentrically, closer to the line of fracture, through a plate hole located across the fracture line would increase the fracture gap upon tightening of the screw against the plate.

Placement of a second screw in a plate hole located on the same side of the first screw (in relation to the line of fracture) would have no effect over the fracture line. Also, after eccentric (away from the line of fracture) placement of one screw on each side of the fracture, the remaining screws should be placed concentrically.

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2. Prein J, Rahn BA. Scientific and technical background. In: Prein J, ed. *Manual of Internal Fixation in the Cranio-Facial Skeleton*. 1st ed. New York: Springer; 1998:1-49.

120. An 11-month-old male infant is noted by his parents to have a painless, progressive, right maxillary growth. At an outside facility, an incisional biopsy is performed. The pathology shows sinonasal myxoma. Postoperative MRI shows residual tumor with surrounding inflammation. Which of the following is the most appropriate treatment plan?

- A) Chemotherapy and radiation therapy
- B) Chemotherapy only
- C) Curettage debulking of the tumor
- D) Surgical resection with clear margin
- E) Observation

The correct response is Option D.

Myxomas are slow-growing benign tumors. When they present in the infant face, they are most common in the maxilla or mandible. They present as a painless, progressive facial swelling and should be surgically removed with a clear margin. These tumors should have a clear margin to prevent incomplete resection and continued growth. They are not always well circumscribed, so a normal margin or tissue plane should be resected with the tumor.

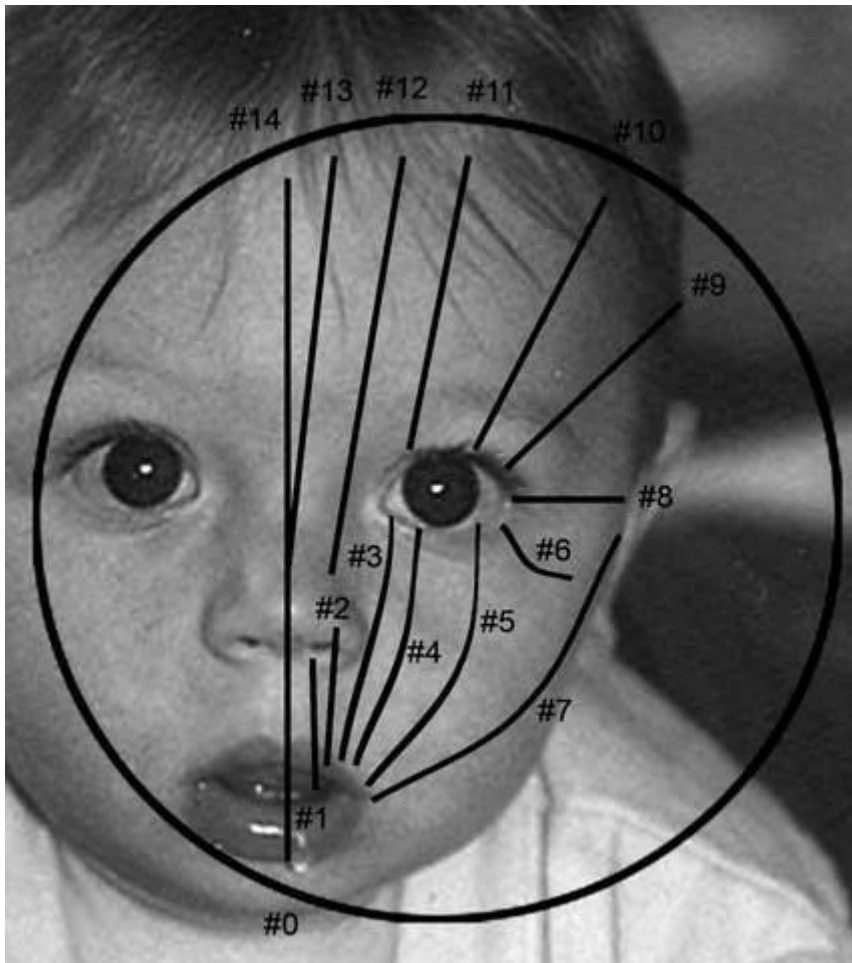
REFERENCES:

1. Rotenberg BW, Daniel SJ, Nish IA, et al. Myxomatous lesions of the maxilla in children: a case series and review of management. *Int J Pediatr Otorhinolaryngol*. 2004 Oct;68(10):1251-1256.
2. Wachter BG, Steinberg MJ, Darrow DH, et al. Odontogenic myxoma of the maxilla: a report of two pediatric cases. *Int J Pediatr Otorhinolaryngol*. 2003 Apr;67(4):389-393.

121. Which of the following congenital clefts involves the lower eyelid?

- A) 0
- B) 1
- C) 5
- D) 8
- E) 9

The correct response is Option C.



Craniofacial clefts are highly variable and can range from mild forme fruste to severe with involvement of all the layers of the soft tissue and skeletal structures. Tessier described a classification system still in use today based on the bony and soft-tissue landmarks involved in the clefts. Corrective surgery is required in stages, with the timing based on the level of functional problems, including ocular exposure, and airway problems early on. The clefts can be broadly grouped into midline and paramedian clefts (numbers 0 to 14, 1 to 13, 2 to 12), oro-nasal-ocular clefts (numbers 3 to 11, 4 to 10, 5 to 9), and lateral clefts (numbers 6, 7, and 8). In this system, the numbers 0 to 6 refer to clefts below the orbital and numbers 8 to 14 are above the orbit, with 7 being truly lateral.

REFERENCES:

1. Bradley JP Kawamoto HK. Craniofacial clefts. In: Rodriguez ED, Losee JE, Neligan PC, eds. *Plastic Surgery*. Vol 3. Philadelphia: Elsevier-Saunders; 2012:701-725.
2. Allam KA, Wan DC, Kawamoto HK, et al. The spectrum of median craniofacial dysplasia. *Plast Reconstr Surg*. 2011 Feb;127(2):812-821.
3. Hunt JA, Hobar PC. Common craniofacial anomalies: facial clefts and encephaloceles. *Plast Reconstr Surg*. 2003 Aug;112(2):606-615.



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

122. A 4-month-old male infant is brought to the office for evaluation of an abnormal head shape that has been present since birth. The patient is developmentally appropriate and has no other abnormalities. A photograph is shown. At which of the following ages does the involved suture normally fuse?
- A) 2 weeks
 - B) 8 months
 - C) 3 years
 - D) 10 years
 - E) 22 years

The correct response is Option B.

The patient in the photograph has metopic craniosynostosis. The primary clinical features of trigonocephaly are a palpable metopic ridge, bossing with thickened bone at the glabella, bifrontal narrowing, recession of the superior orbital rims, temporal

narrowing, and hypotelorism. Trigonoccephaly is also known as a keel-shaped deformity.

The metopic suture is the first cranial suture to fuse and this usually occurs at approximately 8 months of age. The other cranial sutures generally fuse in adulthood.

Treatment depends on the age of presentation and extent of deformity. Options for management are varied and range from no intervention for minimal deformity, burring of the metopic ridge only, endoscopic synostectomy with helmet therapy, and bilateral fronto-orbital advancement.

REFERENCES:

1. Shin JH, Persing JA. Nonsyndromic Craniosynostosis and Deformational Plagiocephaly. In: Thorne CH, Bartlett SP, Beasley RW, et al, eds. *Grabb & Smith's Plastic Surgery*. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006:229-230.
2. Vu HL, Panchal J, Parker EE, et al. The timing of physiologic closure of the metopic suture: a review of 159 patients using reconstructed 3D CT scans of the craniofacial region. *J Craniofac Surg*. 2001 Nov;12(6):527-532.

123. A 22-year-old woman comes to the office because she is unhappy with the appearance of the lower third of her face. On examination, she has a class II occlusion. Lateral cephalometric evaluation shows an SNA angle of 82 degrees (N 80-84), an SNB angle of 75 degrees (N 78-80), and an ANB angle of 7 degrees. Cranial base anatomy shows no abnormalities. Which of the following orthognathic procedures is most appropriate in this patient?

- A) LeFort I maxillary advancement
- B) LeFort I maxillary advancement with mandibular setback
- C) Maxillary impaction
- D) Sagittal split mandibular osteotomy with advancement
- E) Sliding genioplasty

The correct response is Option D.

This patient has a skeletal class II deformity with a retrognathic mandible and normal maxillary projection. The SNA angle of 82 degrees (N 80-84) indicates a normally positioned maxilla relative to the cranial base, while the SNB angle of 75 degrees (N 78-80) indicates a retrognathic mandible relative to the cranial base. The ANB angle confirms the class II deformity (>4 degrees). A mandibular sagittal split osteotomy with advancement will correct this deformity.

Maxillary impaction is used to treat vertical maxillary excess.

LeFort I maxillary advancement will worsen this patient's deformity.

REFERENCES:

1. Cottrell DA, Edwards SP, Gotcher JE. Surgical correction of maxillofacial skeletal deformities. *J Oral Maxillofac Surg*. 2012 Nov;70(11 Suppl 3):e107-136.
2. Thorne CH, Beasley RW, Aston SJ, et al, eds. *Grabb and Smith's Plastic Surgery*. 6th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2007:256-268.

124. A 5-year-old girl with Möbius syndrome is brought to the office for evaluation of facial paralysis. Physical examination shows masklike facies, inability to animate the face bilaterally, and generalized hypoplasia of the tongue. Which of the following is the most appropriate donor nerve to restore facial function in this patient?

- A) Hypoglossal
- B) Ipsilateral facial
- C) Masseteric
- D) Spinal accessory
- E) Phrenic

The correct response is Option C.

In the case of Möbius syndrome and most pediatric patients with facial paralysis in which the facial muscles are no longer available, a microneurovascular transfer with a muscle flap is the preferred treatment. The gracilis is the most advocated muscle used for this purpose. Pediatric patients are generally very motivated and do well with microneurovascular transfer with a muscle flap.

In Möbius syndrome, the sixth and seventh cranial nerves are commonly involved. Other cranial nerves may be involved as well. In addition to the facial muscles not being available for reconstruction, the cranial nerves are also not available in patients with Möbius syndrome. Hence, transfer to the ipsilateral or contralateral facial nerve is not a viable option for reconstruction in patients with Möbius syndrome, as the facial nerve does not function.

Use of the hypoglossal nerve in patients with Möbius syndrome is relatively contraindicated due to worsening of tongue function. The “babysitter” technique utilizes the hypoglossal nerve as a donor nerve.

The masseteric nerve is preferred over the spinal accessory and phrenic nerves as it provides better motor strength and lower morbidity in the muscle transfer.

REFERENCES:

1. Havlik RJ. Miscellaneous craniofacial conditions. In: Thorne CH, Bartlett SP, Beasley RW, Aston SJ, Gurtner GC, Spear SL, eds. *Grabb & Smith's*

Plastic Surgery. 6th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2006:282-285.

2. Borschel GH, Zucker RM. Facial paralysis. In: Persing JA, Evans GRD, eds. *Soft-Tissue Surgery of the Craniofacial Region*. New York, NY: Informa Healthcare USA, Inc.; 2007:359-373.
3. Zucker RM, Goldberg CS, Manktelow RT. Facial animation in children with Möbius syndrome after segmental gracilis muscle transplant. *Plast Reconstr Surg*. 2000 Jul;106(1):1-8.

125. A 5-year-old girl, who is a Jehovah's Witness, is scheduled to undergo extensive cranioplasty. Bloodless surgery has been scheduled at an institution offering a blood conservation program. During the procedure, the patient becomes hemodynamically unstable from excessive, ongoing intraoperative bleeding and is found to have a hemoglobin level of 6.0 g/dL. The patient's parents refuse to consent to a blood transfusion. Which of the following is the most appropriate next step in management?

- A) Administration of blood products
- B) Administration of erythropoietin
- C) Initiation of vasopressors
- D) Resuscitation with albumin
- E) Resuscitation with hypertonic saline

The correct response is Option A.

The issue of religious beliefs and medical management is a difficult ethical scenario that can arise in the care of pediatric patients. It is generally accepted in many countries with the support of international law that a minor should not be put at risk because of the religious beliefs of his/her parents. In this case, a blood transfusion is clearly needed but is not a medical treatment accepted by Jehovah's Witnesses. In the United States, the American Academy of Pediatrics recommends that in cases of "an imminent threat to a child's life," physicians in some cases may "intervene over parental objections." In general, a contingency of bloodless surgery programs for pediatric patients is the reservation of the legal right to give blood if an emergent need arises, despite the lack of parental consent. It is generally accepted that blood products may be given to minors if it is in the best interest of the patient despite parental religious beliefs or other objection. This course of action has been supported a number of times in the court of law.

REFERENCES:

1. Brezina PR, Moskop JC. Urgent medical decision making regarding a Jehovah's Witness minor: a case report and discussion. *N C Med J*. 2007 Sep-Oct;68(5):312-316.
2. Frader JE, Crain LS, Moseley KL, et al. American Academy of Pediatrics Committee on Bioethics. Religious objections to medical care. *Pediatrics*. 1997 Feb;99(2):279-281.

126. A 6-year-old boy with a repaired unilateral complete cleft lip and palate presents for an annual cleft team clinic visit. Initiation of palatal expansion is discussed with the child's parents. Timing for initiation of palatal expansion should be based upon which of the following?

- A) Alveolar cleft width
- B) Canine eruption
- C) Occlusal status
- D) Patient age
- E) Severity of alveolar collapse

The correct response is Option B.

Alveolar bone grafting should be performed during the time of transitional dentition. Specifically, it has the greatest chance for success after the incisors erupt, but before the eruption of the canine. Tooth development/eruption varies from child to child, so there is no set age for bone grafting. Alveolar cleft width will determine the amount of bone grafting, but not the timing. Severity of alveolar collapse will affect the duration of palatal expansion, but not timing. Occlusal status should not play a role in surgical decision-making for alveolar cleft grafting, as it will be addressed later with either orthodontics or jaw surgery after skeletal maturity.

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1. Nishihara K, Nozoe E, Maeda A, et al. Outcome following secondary autogenous bone grafting before and after canine eruption in patients with unilateral cleft lip and palate. *Cleft Palate Craniofac J*. 2012 Nov 5. [Epub ahead of print.]
2. Schultze-Mosgau S, Nkenke E, Schlegel AK, et al. Analysis of bone resorption after secondary alveolar cleft bone grafts before and after canine eruption in connection with orthodontic gap closure or prosthodontic treatment. *J Oral Maxillofac Surg*. 2003 Nov;61(11):1245-1248.
3. Sharma S, Rao DJ, Majumder K, et al. Secondary alveolar bone grafting: Radiographic and clinical evaluation. *Ann Maxillofac Surg*. 2012 Jan;2(1):41-45.

127. Which of the following concomitant fractures is most likely to affect the perceived reduction when performing open reduction and internal fixation of a zygomaticomaxillary complex fracture?

- A) Anterior maxillary wall comminution with loss of bone
- B) Articular tubercle of the zygomatic arch
- C) Le Fort I fracture
- D) Naso-orbito-ethmoid fracture
- E) Orbital floor blowout fracture

The correct response is Option D.

When surgically reducing a zygomaticomaxillary complex (ZMC) fracture (tripod fracture), the surgeon uses multiple landmarks to confirm adequate reduction. The lateral orbital sidewall is the most reliable landmark as it is a three-dimensional landmark (junction of frontal bone, sphenoid, and zygoma). Other landmarks include the zygomaticofrontal suture, the zygomaticomaxillary lateral buttress, the orbital rim, and the zygomatic arch. Because the orbital rim is easily visualized, surgeons may rely heavily on this landmark for alignment. Sometimes due to orbital swelling or poor visualization, the lateral orbital wall is not easy to assess for adequate reduction of the fracture. If the orbital rim appears to be reduced (well aligned) but the ZMC fracture is not well reduced, then an ipsilateral unreduced naso-orbito-ethmoid (NOE) fracture is the most likely reason. It is important to reduce the NOE fracture before aligning the orbital rim for the ZMC fracture reduction. Postoperative deformity will ensue if the NOE fracture is not reduced and the ZMC is plated in position based on the orbital rim alignment. The deformity will lead to enlarged orbital volume and facial widening, loss of malar projection, and enophthalmos. Proper reduction and initial management are important, as secondary corrections are more difficult and have more morbidity.

REFERENCES:

1. Buchanan EP, Hopper RA, Suver DW, Hayes AG, Gruss JS, Birgfeld CB. Zygomaticomaxillary complex fractures and their association with naso-orbito-ethmoid fractures: a 5-year review. *Plast Reconstr Surg*. 2012 Dec;130(6):1296-1304.

2. Bogusiak K, Arkuszewski P. Characteristics and epidemiology of zygomaticomaxillary complex fractures. *J Craniofac Surg*. 2010 Jul;21(4):1018-1023.
3. Kelley P, Hopper R, Gruss J. Evaluation and treatment of zygomatic fractures. *Plast Reconstr Surg*. 2007 Dec;120(7 Suppl 2):5S-15S.

128. A 55-year-old man with a history of smoking and poorly controlled diabetes mellitus comes to the emergency department because of a 12-hour history of unilateral proptosis, impaired vision, and severe headaches. Intranasal examination shows dried crusting and black discoloration of the lateral nasal wall and turbinates. Radiology shows a 4-cm mass within the maxillary sinus that extends into the orbit. Biopsy of the mass shows nonseptate hyphae. Which of the following is the most appropriate next step in management?

- A) Craniofacial resection and free flap
- B) Emergent debridement of the sinuses and orbital exenteration
- C) Intravenous administration of an antibiotic
- D) Outpatient oral antifungal medications
- E) Referral to medical oncology

The correct response is Option B.

Rhinocerebral mucormycosis is a rare opportunistic infection of the sinuses, nasal passages, oral cavity, and brain caused by saprophytic fungi. The infection can rapidly result in death. Rhinocerebral mucormycosis commonly affects individuals with diabetes and those in immunocompromised states. The diagnosis of mucormycosis is established by obtaining a biopsy specimen of the involved tissue, and frozen tissue samples should be immediately evaluated for signs of infection. Microscopic characterization of non-septate hyphae, rhizoids, columellae, sporangia, and sporangiospores helps to define genus and species within the order Mucorales. Optimal therapy requires a multidisciplinary approach that relies on prompt institution of appropriate antifungal therapy with amphotericin B (AmB), reversal of underlying predisposing conditions, and, where possible, surgical debridement of devitalized tissue. Surgery should be considered early, and if possible, emergently with the goal of removing all necrotic tissue. Repeated debridements are frequently necessary and the extent of surgery should ideally be guided by evaluation of frozen tissue sections examined histologically. In the scenario provided, orbital involvement will most likely require sacrifice of the eye.

REFERENCES:

1. Gamaletsou MN, Sipsas NV, Roilides E, Walsh TJ. Rhino-orbital-cerebral mucormycosis. *Curr Infect Dis Rep*. 2012 Aug;14(4):423-434.

2. Peterson KL, Wang M, Canalis RF, Abemayor E. Rhinocerebral mucormycosis: evolution of the disease and treatment options. *Laryngoscope*. 1997 Jul;107(7):855-862.

129. A 23-year-old man comes to the office because of a progressive 15-year history of severe unilateral volume loss in the face. The patient says he is unhappy with the changes in his facial appearance but has not noted any changes recently. On examination, volume loss is significant and appears to be limited to the soft tissue. No bony deficit is noted. Which of the following is the most appropriate management?

- A) Alloplastic bony augmentation of the maxilla
- B) Autologous soft-tissue augmentation with a cross-facial nerve graft followed by microvascular gracilis muscle transfer
- C) Autologous soft-tissue augmentation with a microvascular parascapular flap
- D) Autologous soft-tissue augmentation with a pedicled temporalis muscle flap
- E) Hyaluronic acid augmentation of the soft tissues

The correct response is Option C.

It is most likely that this patient has progressive, but now stable, hemifacial atrophy, or Parry-Romberg syndrome. The course is characterized by progressive unilateral atrophy of the soft tissues of the face. The underlying skeleton may be affected in severe forms of the disease. Surgery is indicated when the changes stabilize. The recommended treatment is free tissue transfer, preferably a microvascular parascapular flap, followed by a secondary autologous fat grafting for refinement. Augmentation of the maxilla is not indicated in the absence of bony atrophy. Staged cross-facial nerve grafting followed by microvascular gracilis transfer is indicated for absence of facial nerve function. A pedicled temporalis muscle flap would likely not provide sufficient bulk where needed and potentially leave a hollow at the donor site. Alloplastic augmentation of the soft tissues with hyaluronic acid is only approved for volume loss due to human immunodeficiency virus infection.

REFERENCES:

1. Longaker MT, Siebert JW. Microvascular free-flap correction of severe hemifacial atrophy. *Plast Reconstr Surg*. 1995 Sep;96(4):800-809.
2. Ruff GL. Progressive hemifacial atrophy: Romberg's disease. In: McCarthy JG, ed. *Plastic Surgery*. Philadelphia: WB Saunders; 1990:3135-3143.



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

130. A 60-year-old man undergoes Mohs micrographic resection of an upper eyelid squamous cell carcinoma. A photograph is shown. Which of the following reconstruction procedures will provide the most functional and aesthetically pleasing result in this patient?

- A) Free nasoseptal grafting
- B) Reconstruction with a forehead flap
- C) Reconstruction with a free flap
- D) Reconstruction with a glabellar flap
- E) Reconstruction with a lid switch flap

The correct response is Option E.

A Cutler-Beard flap is a two-stage lid switch flap, taken from the lower lid.



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

Some of its disadvantages include two-stage reconstruction requiring eye occlusion for a number of weeks, sacrifice of lower lid tissue (and, commonly, a subsequent ectopion), and lack of intrinsic support. Many modifications have improved on its design including those that provide support. There are many reports of other types of flaps, but for a defect of this size and the anatomic requirements, the best choice is a lid switch flap.

REFERENCES:

1. Alghoul M, Pacella SJ, McClellan WT, et al. Eyelid reconstruction. *Plast Reconstr Surg*. 2013 Aug;132(2):288e-302e.
2. Fischer T, Noever G, Langer M, et al. Experience in upper eyelid reconstruction with the Cutler-Beard technique. *Ann Plast Surg*. 2001 Sep;47(3):338-342.

131. A 22-year-old woman comes to the office because of oral bleeding and a 20-year history of a radiologically defined arteriovenous malformation. Embolization and resection of the tumor are planned. Which of the following factors is most likely to be associated with an increased risk for recurrence?

- A) Enlargement of the malformation
- B) Patient age
- C) Patient gender
- D) Quiescence of the malformation
- E) Ulceration

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

The correct response is Option E.

According to the Children's Hospital of Boston's experience with arteriovenous malformations, the Schobinger stage of the lesion is most important when considering the individual's recurrence risk for these lesions. In their experience, lesion recurrence was more associated with advanced Schobinger staging than with quiescent lesions, whether these were treated with embolization alone or embolization followed by resection.

Enlargement of the malformation describes a Schobinger Stage I lesion, which has the lowest risk for recurrence in the Boston Children's series. The presence of these lesions, while concerning to parents, typically has a recurrence risk of 80% with embolization alone and 21% with embolization followed by resection.

Patient sex, age, and lesion location did not correlate with lesion recurrence in the Boston Children's series.

Quiescence of the malformation represents a Schobinger Stage III lesion, which is the highest Schobinger stage description among the options listed. This stage lesion has a recurrence risk of 99% with embolization alone and 81% with embolization followed by resection.

REFERENCES:

1. Kohout MP, Hansen M, Pribaz JJ, Mulliken JB. Arteriovenous malformations of the head and neck: natural history and management. *Plast Reconstr Surg*. 1998 Sep;102(3):643-654.
2. Liu AS, Mulliken JB, Zurakowski D, Fishman SJ, Greene AK. Extracranial arteriovenous malformations: natural progression and recurrence after treatment. *Plast Reconstr Surg*. 2010 Apr;125(4):1185-94.

132. A 20-year-old woman with a history of bruxism is evaluated because of a 3-year history of gradual widening of the lower third of the face. Physical examination shows rectangular appearance of the face; occlusion shows no abnormalities. Anteroposterior x-ray study discloses bone spurs at both angles of the mandible. Which of the following is the most appropriate next step in management?

- A) Excision of the submandibular gland
- B) Injection of botulinum toxin type A to the masseter muscle
- C) Marginal mandibulectomy
- D) Suction-assisted lipectomy of the cheek
- E) Superficial parotidectomy

The correct response is Option B.

The patient described has bilateral masseter hypertrophy. Treatment options for this condition include muscle relaxants, injection of botulinum toxin type A, or resection of the internal layer of the masseter muscle.

Superficial parotidectomy is indicated for benign and malignant tumors of the parotid gland.

Resection of the submandibular gland is indicated for recurrent sialadenitis (infection) or obstructive sialodocholithiasis (salivary stones), as well as for benign tumors such as pleomorphic adenomas.

Marginal mandibulectomy may be indicated for certain benign and malignant tumors of the intraoral cavity.

Suction-assisted lipectomy will not treat masseter hypertrophy.

REFERENCES:

1. Ahn BK, Kim YS, Kim HJ, et al. Consensus recommendations on the aesthetic usage of botulinum toxin type A in Asians. *Dermatol Surg*. 2013 Dec;39(12):1843-1860. Epub 2013 Oct 11.
2. Lee DH, Jin SP, Cho S, et al. RimabotulinumtoxinB versus OnabotulinumtoxinA in the treatment of masseter hypertrophy: a 24-week

double-blind randomized split-face study. *Dermatology*. 2013;226(3):227-232. Epub 2013 Jun 14.

3. Kim NH, Chung JH, Park RH, et al. The use of botulinum toxin type A in aesthetic mandibular contouring. *Plast Reconstr Surg*. 2005 Mar;115(3):919-930.

133. A 68-year-old man with a history of laryngeal cancer treated with chemoradiation 2 years ago has a recurrence. He is scheduled for total laryngopharyngectomy with circumferential resection of the pharynx extending from the floor of the mouth to 2 cm above the manubrium. Which of the following is the most appropriate single-stage reconstruction?

- A) Construction of a spit fistula
- B) Coverage with an anterolateral thigh flap
- C) Coverage with a deltopectoral flap
- D) Coverage with a pectoralis flap
- E) Use of gastric pull-up

The correct response is Option B.

The circumferential defect described in this patient requires coverage with a tubularized flap that can span the length of the defect and reestablish continuity of the alimentary track. Gastric pull-up is not a good option in this case because of its high morbidity and poor perfusion in the most proximal region of the gastric flap. Coverage with the pectoralis flap or deltopectoral flap is not an appropriate option because these flaps cannot be tubularized in a single-stage reconstruction. The spit fistula would not restore alimentary tract continuity, and it should only be used if no other reconstructive options are available or if the patient is medically unstable. The anterolateral thigh flap is the best option in this case because it can be tubularized to span the defect. In most cases, the resulting reconstruction is highly effective with restoration of swallowing function in the majority of patients.

REFERENCES:

1. Spyropoulou GA, Lin PY, Chien CY, et al. Reconstruction of the hypopharynx with the anterolateral thigh flap: defect classification, method, tips, and outcomes. *Plast Reconstr Surg*. 2011 Jan;127(1):161-172.
2. Murray DJ, Gilbert RW, Vesely MJ, et al. Functional outcomes and donor site morbidity following circumferential pharyngoesophageal reconstruction using an anterolateral thigh flap and salivary bypass tube. *Head Neck*. 2007 Feb;29(2):147-154.

134. A 7-year-old girl with a history of repair of cleft palate is evaluated because of possible velopharyngeal insufficiency. In addition to evaluation of the patient's speech by trained speech pathologists, which of the following is the most appropriate diagnostic tool?

- A) Cine MRI
- B) CT scan
- C) Examination during anesthesia
- D) Lateral cephalogram
- E) Nasopharyngoscopy

The correct response is Option E.

The primary goal of cleft palate repair is normal speech and swallowing. Velopharyngeal competence, the ability to completely close the velopharyngeal sphincter, is required for the normal production of all but the nasal consonants (in English: /m/, /n/, and /ng/). Velopharyngeal insufficiency (VPI) is defined as the inability to completely close the velopharyngeal sphincter. The primary effects of VPI are nasal air escape and hypernasality. Video fluoroscopy and nasopharyngoscopy can detect the sagittal deficiency closure pattern occurring in patients with VPI after cleft palate surgery. Speech articulation errors (i.e., distortions, substitutions, and omissions) are secondary effects of VPI. The result is decreased intelligibility of speech. The velopharyngeal port is bordered anteriorly by the velum, bilaterally by the lateral pharyngeal walls, and posteriorly by the posterior pharyngeal wall. VPI can be diagnosed by both subjective and objective means. Perceptual evaluation of speech by an experienced speech language pathologist is the standard. Multiview video fluoroscopy and nasopharyngoscopy both provide visual information (i.e., closure pattern and closure rating) that is valuable for surgical planning. However, the need to avoid radiation if centers are migrating away from fluoroscopy has caused most cleft centers to migrate to direct nasopharyngoscopy.

MRI is emerging as a technology for evaluating VPI, but it would not be the first choice for diagnostic workup.

Overall, examination during anesthesia in the operating room would likely not be required, but instead a complete examination and nasopharyngoscopy would likely be performed comfortably in the office. Experience with nasopharyngoscopy has

grown in most comprehensive cleft centers and has become an invaluable tool for surgical planning.

Lateral cephalogram does not provide a dynamic evaluation of the pharynx.

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135. A 65-year-old man is evaluated for right facial nerve paralysis. Upper eyelid reanimation is planned. The gold weight prosthesis is selected. Which of the following considerations is most appropriate for this patient?

- A) Allowing coverage of the upper limbus at rest
- B) Bringing the upper eyelid to within 2 to 4 mm of the lower eyelid
- C) Enabling complete closure of the upper eyelid
- D) Enabling the most rapid closure of the upper eyelid
- E) Providing the best symmetry with the contralateral eye

The correct response is Option B.

Gold weight prostheses are commonly used for upper eyelid reanimation in patients with facial nerve dysfunction. The weight required can be estimated preoperatively by using two-sided tape to secure various test weights to identify the prosthesis that brings the upper eyelid to within 2 to 4 mm of the lower lid and completely covers the cornea. A common mistake is to use a weight that is too heavy in an effort to completely close the upper eyelid, resulting in upper eyelid ptosis and obstruction of field of view. Revision surgery is often needed in these cases. Contralateral symmetry is rarely achieved with gold weights and is not a criterion for assessment. Similarly, the speed with which the upper eyelid is closed is usually slower than the contralateral eyelid and is not a factor in weight selection.

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136. An otherwise healthy 35-year-old woman is evaluated for a 3-cm left parotid mass. Physical examination shows weakness of facial muscles on the side of the tumor. CT scan shows several enlarged cervical lymph nodes. Parotidectomy is performed, and pathologic examination shows a mixed population of poorly differentiated epithelial cells and intermediate cells with occasional secretory cells and neural invasion. Which of the following is the most likely diagnosis?

- A) Hemangioma
- B) Mucoepidermoid carcinoma
- C) Pleomorphic adenoma
- D) Squamous cell carcinoma
- E) Warthin tumor

The correct response is Option B.

Salivary gland tumors are relatively rare and make up about 3 to 4% of all head and neck neoplasms. Approximately 80% of salivary gland tumors originate in the parotid gland. Approximately 80% of parotid gland tumors are benign. Facial paralysis may be associated with malignant tumors and is a sign of neural invasion. Malignant tumors may also metastasize to the regional lymph nodes and to distant sites.

Mucoepidermoid carcinoma is the most common malignancy of the parotid gland and the second most common malignancy of the submandibular and minor salivary glands. Mucoepidermoid carcinomas contain two major elements: mucus-secreting cells, and epithelial cells of the epidermoid variety. Low-grade tumors are associated with a predominance of mucus-secreting cells lining cysts and intervening nests of well-differentiated epidermoid cells. High-grade tumors show few or no mucus-secreting cells and the epidermoid cells are poorly differentiated. Intermediate-grade tumors are defined by less cyst formation than low-grade tumors with nests of epidermoid and less differentiated intermediate cells. The biologic behavior of mucoepidermoid carcinomas correlates with their histologic grade. On the basis of the nerve invasion, the appropriate treatment for this patient includes radical parotidectomy with facial nerve sacrifice. A neck dissection should also be performed for high-grade lesions or those with suspicious adenopathy. Postoperative radiation therapy is usually recommended for higher-grade mucoepidermoid cancers.

Pleomorphic adenoma, also known as benign mixed tumor, is the most common benign tumor of the parotid gland. This tumor is histologically characterized by epithelial and connective tissue elements, with stellate and spindle cells interspersed with a myxoid background. Warthin tumor (papillary cystadenoma lymphomatosum) is the next most common tumor of the parotid gland and is also benign. Warthin tumors predominantly occur in males and are bilateral in 10% of patients. Histologically, they are characterized by papillary cysts and mucoid fluid as well as nodules of lymphoid tissue. Hemangiomas are the most common salivary gland tumors found in children, and usually involve the parotid gland. Like other hemangiomas, they are benign and characterized by a rapid growth phase around the age of 1 to 6 months, followed by gradual involution over 1 to 12 years. Histologically, the tumors are composed of capillaries lined by proliferative endothelial cells. Squamous cell carcinoma is a malignant tumor that rarely involves the parotid gland, in comparison with the skin and aerodigestive tract. When squamous cell cancers occur in the parotid gland, they are usually of metastatic origin, although primary squamous cancers of the salivary glands do occur. They are histologically identical to squamous cell cancers arising from other sites with epithelial cells that form sheets or compact masses that invade adjacent connective tissue. Round nodules of keratinized squamous cells, known as “keratinous pearls,” are the hallmark of well-differentiated squamous cell carcinoma.

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137. A 22-year-old man is brought to the emergency department after sustaining a stab wound to the face. The patient is hemodynamically stable, and physical examination shows a laceration that extends from the tragus of the right ear to the right oral commissure. Which of the following is the most likely primary complication of saliva extravasating into the wound because of parotid duct injury?

- A) Parotid gland atrophy
- B) Salivary fistula
- C) Sialocele
- D) Wound infection
- E) Xerostomia

The correct response is Option C.

If parotid duct injury is not repaired immediately, saliva can leak into the surrounding soft tissues. This leakage most commonly increases the risk for sialocele (pseudocapsule), followed by salivary fistula formation. Wound infection, parotid gland atrophy, and xerostomia (dry mouth) are uncommon. Studies have shown that correction of the more common complications may require surgical or medical treatments such as use of anti-sialogogues, radiation therapy, parasympathetic denervation (tympanic denervation), cauterization of the fistulous tract, reconstruction of the duct, or superficial or total parotidectomy.

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2. Reddy MRH, Reddy NVSS, Krishna IV, et al. Parotid duct repair: a case report. *J Oral Res Rev.* 2012; 4(1): 50-54.

138. A 9-year-old boy is brought to the office because of a long-standing history of pulsatile exophthalmos and proptosis of the right side. CT scan shows absence of the greater sphenoid wing. Which of the following is the most likely diagnosis?

- A) Hemifacial microstomia
- B) Neurofibromatosis
- C) Tessier No. 5 cleft
- D) Treacher Collins syndrome
- E) Unilateral coronal synostosis

The correct response is Option B.

Although each of the disorders or syndromes listed is associated with a periocular soft-tissue or orbital abnormality, only neurofibromatosis is associated with agenesis of the sphenoid wing.

While plastic surgeons primarily manage the soft-tissue manifestations of neurofibromatosis, the disorder is associated with skeletal abnormalities including sphenoid wing aplasia, macrocephaly, scoliosis, and tibial bowing. Sphenoid wing aplasia causes brain herniation through the middle cranial fossa into the orbit with pulsatile exophthalmos, vertical dystopia, and an enlarged orbital volume. Surgical correction involves bone grafts or titanium mesh to reconstruct the sphenoid wing with reduction of the temporal lobe into the middle cranial fossa.

Unilateral coronal synostosis is characterized by foreshortening of the orbital roof on the affected side. Synostosis of the coronal suture causes superior displacement of the lesser wing of the sphenoid with the radiographic appearance of the harlequin deformity. Patients may have strabismus occurring secondary to relative paresis of the superior oblique muscle. The child may tilt the head to compensate. Treacher Collins syndrome is associated with lower eyelid colobomas, zygomatic hypoplasia with hypoplastic or absent zygomas and inferolateral orbital rim clefting, absence of eyelashes, and bilateral mandibular hypoplasia. Hemifacial microstomia is a variant of craniofacial microsomia, distinguished by the presence of concomitant ocular abnormalities, including epibulbar dermoids. The Tessier No. 5 cleft begins behind the canine and extends through the maxillary sinus to the orbital floor. Colobomas of the lateral lower eyelids and clefting of the upper lip medial to the oral commissure are associated.

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2. Jackson IT, Laws ER Jr, Martin RD. The surgical management of orbital neurofibromatosis. *Plast Reconstr Surg*. 1983 Jun;71(6):751-758.

139. A 50-year-old woman comes to the office 2 weeks after receiving botulinum toxin type A injections for forehead rhytids. She is pleased with the results but has developed unilateral eyelid ptosis. Apraclonidine 0.5% eyedrops are prescribed to improve upper eyelid function. Which of the following best describes the mechanism for improvement of upper eyelid ptosis in this patient?

- A) Alpha-2 adrenergic stimulation of the Müller muscle of the upper eyelid
- B) Beta-2 adrenergic stimulation of the levator palpebrae superioris
- C) Muscarinic parasympathetic inhibition of the levator palpebrae superioris
- D) Nicotinic parasympathetic inhibition of the Müller muscle of the upper eyelid

The correct response is Option A.

Apraclonidine is an alpha-2 receptor agonist and is believed to increase muscle tone of the sympathetically innervated Müller muscle located in the upper eyelid.

Beta-2 adrenergic stimulation of the levator palpebrae superioris is not appropriate because apraclonidine does not act as the beta-2 receptor, and it is not believed to stimulate contraction of the levator palpebrae superioris.

Muscarinic parasympathetic inhibition of the levator palpebrae superioris is not appropriate because apraclonidine does not act as the muscarinic parasympathetic receptor.

Nicotinic parasympathetic inhibition of the Müller muscle of the upper eyelid is not appropriate because apraclonidine does not act as the nicotinic parasympathetic receptor.

REFERENCES:

1. Carruthers JD, Lowe NJ, Menter MA, et al. Double-blind, placebo-controlled study of the safety and efficacy of botulinum toxin type A for patients with glabellar lines. *Plast Reconstr Surg*. 2003 Sep 15;112(4):1089-1098.
2. Omoigui S, Irene S. Treatment of ptosis as a complication of botulinum toxin injection. *Pain Med*. 2005 Mar-Apr;6(2):149-151.

3. Scheinfeld N. The use of apraclonidine eyedrops to treat ptosis after the administration of botulinum toxin to the upper face. *Dermatol Online J*. 2005 Mar 1;11(1):9.

140. An otherwise healthy term 6-month-old male infant is evaluated for a mobile, firm, well-circumscribed mass at the right lateral brow in the area of the zygomaticofrontal suture. Which of the following procedures is the most appropriate next step in management?

- A) CT scan
- B) Fine-needle aspiration of the mass
- C) MRI
- D) Surgical excision of the mass
- E) Ultrasonography

The correct response is Option D.

Dermoid cysts are common in the lateral brow. They present as firm, well-circumscribed, slow-growing masses that have the potential for infection or continued growth. Surgical excision is recommended and no imaging is required. CT scan or MRI require sedation and are unnecessary risks for this patient with a lateral dermoid. Midline masses do require imaging because of the risk for intracranial excision.

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2. van Aalst JA, Luerssen TG, Whitehead WE, et al. “Keystone” approach for intracranial nasofrontal dermoid sinuses. *Plast Reconstr Surg*. 2005 Jul;116(1):13-19.

141. A 72-year-old man with advanced congestive heart failure who recently received a left ventricular assist device (LVAD) comes to the office with an ulcerated mass in the mid-parietal region. Punch biopsies reveal squamous cell carcinoma of the skin. The patient has a history of bilateral temporal and midline craniotomies for resection of symptomatic meningiomas. Wide local excision of the tumor creates a scalp defect measuring 8 cm in diameter, with calvarial bone denuded of periosteum at its base. Which of the following is most appropriate for coverage of this patient's defect?

- A) Dermal regeneration template, followed by skin autograft
- B) Fasciocutaneous free tissue transfer
- C) Full-thickness skin autograft
- D) Interpolated scalp flaps, with skin autograft to cover the secondary defect
- E) Pericranial flap, covered with skin autograft

The correct response is Option A.

The most appropriate coverage of the oncologic defect in this patient is with a dermal regeneration template, such as Integra, followed by skin autograft.

Integra is a synthetic bilaminate neodermis composed of a collagen lattice covered with a thin silastic sheet. A single-layer version (collagen only) is also available, allowing stacking of the product for increased soft-tissue thickness. Vascularization of the collagen layer usually occurs in 3 to 4 weeks, at which point the silastic sheet is removed and a thin split-thickness skin autograft is applied. In the absence of pericranium, burring of the exposed calvarium down to healthy bleeding bone is recommended.

A skin autograft applied directly to calvarial bone denuded of periosteal coverage is unlikely to “take.” Interpolated scalp flaps, most likely requiring grafting of a secondary defect (donor site), would be appropriately indicated for coverage of a midparietal 8-cm defect. These are large flaps, based on the major blood vessels supplying the scalp, with an area of undermining that frequently involves the entire scalp. Unfortunately for this patient with multiple previous craniotomies, the resulting scars impose an unacceptably high risk for flap ischemia.

Similarly, a scar-free, well-vascularized pericranial flap large enough to cover the described defect is unlikely to be found in this patient. The safety and success of free

tissue transfer in patients depending on LVADs for hemodynamic stability is still to be determined.

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2. Abbas Khan MA, Chipp E, Hardwicke J, Srinivasan K, Shaw S, Rayatt S. The use of Dermal Regeneration Template (Integra®) for reconstruction of a large full-thickness scalp and calvarial defect with exposed dura. *J Plast Reconstr Aesthet Surg*. 2010 Dec;63(12):2168-2171.
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142. A 62-year-old woman who underwent chemotherapy/radiation protocol for oropharyngeal cancer 10 years ago has onset of severe pain after a dental extraction. Subsequent CT scan shows a pathologic fracture of the mandibular angle. Which of the following is the most appropriate management?

- A) Hyperbaric oxygen therapy
- B) Long-term intravenous antibiotic therapy
- C) Oncology consultation
- D) Open reduction and internal fixation of the mandible
- E) Resection and coverage with a fibular free flap

The correct response is Option E.

Over the past few decades, the use of chemotherapy/radiation as the primary curative treatment for oropharyngeal cancer has increased. In part, this has to do with cure rates and tissue preservation, but it is also due to the rise in human papillomavirus–positive oropharyngeal cancer. Not surprisingly, there has been a marked increase in osteoradionecrosis of the mandible, in particular. The most common cause of pathologic fracture after radiation therapy in the mandible is tooth extraction, usually the third molar, and a subsequent angle injury, as in this case. With a large, multi-decade experience in the use of osseous free flaps, especially the fibular flap, these cases are now routinely managed by resection of the affected bone and immediate reconstruction.

Hyperbaric oxygen, as a single modality for osteoradionecrosis, is at best controversial and would not cure a pathologic fracture.

Intravenous antibiotics can treat osteomyelitis, but in a case of osteoradionecrosis and a fracture, a short course of adjuvant antibiotics (along with appropriate surgery) would be sufficient, at best.

Open reduction and internal fixation of this fracture would not suffice either, because necrotic bone will not heal, even if put into juxtaposition.

Although it is important to assume that any pathology in cases like these are cancerous until proven otherwise, nevertheless, this scenario as described is very common and the constellation of events plus the imaging indicates that oncology's role in this case would be limited at best.

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2. Kelishadi SS, St-Hilaire H, Rodriguez ED. Is simultaneous surgical management of advanced craniofacial osteoradionecrosis cost-effective? *Plast Reconstr Surg*. 2009 Mar;123(3):1010-1017.
3. Jacobson AS, Buchbinder D, Hu K, et al. Paradigm shifts in the management of osteoradionecrosis of the mandible. *Oral Oncol*. 2010 Nov;46(11):795-801. Epub 2010 Sep 16.

143. A 24-year-old man with a history of left facial trauma and condylar fracture of the mandible is evaluated because of redness and perspiration of the left cheek and ear after ingesting certain foods. Aberrant regeneration of which of the following nerves is the most likely cause of this patient's symptoms?

- A) Auriculotemporal
- B) Facial
- C) Great auricular
- D) Inferior alveolar
- E) Lingual

The correct response is Option A.

Although it is most commonly seen after parotidectomy, Frey syndrome has also been encountered after condylar fracture of the mandible and treatment. The syndrome is thought to result from damage to auriculotemporal parasympathetic nerve fibers with subsequent aberrant regeneration and innervation of sympathetic fibers to the sweat glands.

The facial, inferior alveolar, greater auricular, and lingual nerves are not thought to be the underlying cause of Frey syndrome.

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144. A 12-hour-old male newborn has cyanosis that improves with crying. Which of the following is the most likely diagnosis?

- A) Choanal atresia
- B) Laryngomalacia
- C) Macroglossia
- D) Micrognathia
- E) Subglottic stenosis

The correct response is Option A.

Choanal atresia is a unilateral or bilateral anatomic abnormality of the posterior nasal passages and choanae, which prevents nasal gas exchange in newborns. The classic presentation of bilateral choanal atresia is cyanosis that improves with crying. Nasal airway obstruction can also become apparent when attempting to breast-feed the baby. On clinical examination, there would be no fogging of a mirror when held under the nares. The remaining abnormalities are other causes of respiratory obstruction in the pediatric patient.

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145. A 12-year-old girl is evaluated for left-sided progressive hemifacial atrophy. Onset of symptoms started at 10 years of age. She has a history of migraines and experienced a seizure 1 year ago. Physical examination shows left-sided facial atrophy including cheek depression, enophthalmos, and dry skin with hyperpigmentation and alopecia. Maxillofacial CT scan shows associated skeletal changes. Which of the following clinical features is most likely associated with the early onset of the disease process?

- A) Enophthalmos
- B) Facial paralysis
- C) Hyperpigmentation
- D) Seizure disorder
- E) Skeletal atrophy

The correct response is Option E.

Progressive hemifacial atrophy, also known as Parry-Romberg syndrome, is a rare disorder characterized by a self-limiting, slow, progressive, unilateral facial atrophy affecting the skin, subcutaneous tissue, muscle, and osteocartilaginous adjacent structures. It involves one or more trigeminal dermatomes with symptoms usually appearing in the first or second decade of life. The progression of atrophy usually lasts a variable 2 to 10 years. The etiology and pathogenesis of this disease are uncertain.

The severity of soft-tissue involvement appears to be independent of age of onset, facial distribution, or extent of the disease process; however, age of onset has been shown to correlate with the degree of bony hypoplasia. Onset of the disease at an earlier age during skeletal immaturity has a higher likelihood of skeletal involvement.

Clinical features of hemifacial atrophy include enophthalmos, cheek depression, deviation of the mouth and nose towards the affected side, ipsilateral show of teeth, and tongue atrophy. In addition, extracutaneous involvement has been described, including hemiatrophy of the contralateral or ipsilateral arm, trunk or leg, as well as dental, ocular, and neurologic abnormalities such as enophthalmos, headaches, facial pain, and seizures. An age correlation with these features has not been demonstrated. Facial paresthesia has been described but motor function remains intact.

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146. A 4-year-old girl with velocardiofacial syndrome is evaluated for hypernasal speech. She underwent protracted speech therapy after repair of an isolated cleft of the soft palate at age 9 months. Physical examination shows a well-healed palate and trace elevation of the soft palate with phonation. Videofluoroscopy shows poor motion of the velum; adequate lateral pharyngeal wall motion is noted. To improve this patient's speech, which of the following is the most appropriate management of her velopharyngeal insufficiency?

- A) Fat augmentation of the posterior pharyngeal wall
- B) Furlow palatoplasty
- C) Intravelar veloplasty
- D) Reconstruction with a superiorly based pharyngeal flap
- E) Sphincter pharyngoplasty

The correct response is Option D.

While any of the methods listed can potentially improve speech in the patient described, the lack of significant velar motion coupled with poor lateral pharyngeal wall motion makes pharyngeal flap the most predictable alternative of those listed. Intravelar veloplasty effectively restores and repositions the levator sling, but will not overcome the poor lateral wall motion. Furthermore, it is probable (although not certain) that the muscles were properly positioned during the initial operation. Fat augmentation and Furlow palatoplasty can decrease the coronal gap, but will do little to address the deficient lateral pharyngeal wall mobility. Sphincter palatoplasty has yielded good results in patients with this condition, but poor muscle tone and coronal closure make this method less likely to produce a competent pharyngeal sphincter than a properly designed pharyngeal flap.

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147. Isolated orbital fractures most commonly occur in which of the following bones?

- A) Ethmoid
- B) Frontal
- C) Lacrimal
- D) Maxillary
- E) Zygomatic

The correct response is Option D.

Most isolated orbital fractures involve the orbital floor, a majority of which is made up of the maxillary bone. The maxillary bone is quite thin behind the infraorbital rim, and is perforated by the infraorbital nerve passing in a canal below it. Most pure blowout fractures involve the orbital floor.

Long-term epidemiologic data regarding the natural history of orbital bone fractures are important for the evaluation of existing preventive measures and for the development of new methods of injury prevention and treatment.

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148. Which of the following bone substitutes has the capacity for osteoconduction and osseointegration?

- A) Hydroxyapatite
- B) Polymethylmethacrylate
- C) Porous polyethylene
- D) Silicone
- E) Titanium

The correct response is Option A.

Osteoconduction is the ability of a material to encourage bone to grow toward and along its surface. Osseointegration is defined as the direct chemical bonding of an alloplast to the surface of bone without an intervening layer of fibrous tissue. These qualities are important in identifying an appropriate bone substitute in craniofacial reconstruction.

Hydroxyapatite is a bone substitute that has capacity for both osteoconduction and osseointegration and is the base for many of most widely used bone substitutes. Hydroxyapatite is the principal mineral component of bone and comprises 60% of the calcified human skeleton. It has been used clinically for more than 25 years. It is biocompatible, and all forms are resistant to absorption after implantation.

Silicone products do not osseointegrate or osteoconduct.

Polymethylmethacrylate causes an extreme exothermic reaction associated with the setting process and is deleterious to adjacent bone and soft tissue, even with vigorous saline irrigation. It can be designed or shaped ex vivo to avoid thermal injury.

Titanium osseointegrates, but it does not osteoconduct. It provides ideal protection and reconstruction in certain clinical situations where infection is of higher concern.

High-density porous polyethylene implants have pore sizes ranging from 100 to 300 μm . These aid in tissue ingrowth and implant fixation. These implants may be coated with polyhydroxyethylmethacrylate and calcium hydroxide. The hydrophilic nature and calcium coating result in osteoconductivity and a fibro-osseous matrix.

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149. A 54-year-old man comes to the office because of swelling of the left side of the face 3 days after cholecystectomy. Physical examination shows erythema and purulent drainage from the parotid duct. Which of the following is the most appropriate initial management?

- A) Antibiotic therapy and sialogogues
- B) Aspiration of the mass
- C) Incision and drainage of the mass
- D) Oral cultures and oral cavity antibiotic irrigation
- E) Superficial parotidectomy

The correct response is Option A.

Initial treatment of acute suppurative sialadenitis begins with aggressive medical management. This includes prompt fluid and electrolyte replacement, oral hygiene, reversal of salivary stasis, and antimicrobial therapy. Stimulation of salivary flow is done by use of sialogogues such as lemon drops. Warm soaks and massage promote secretion and drainage of the gland.

Oral cultures are typically contaminated by oral flora and therefore do not direct antibiotic treatment. Needle aspiration is more accurate in isolating the cause of suppurative parotitis.

Incision and drainage is reserved for cases resistant to medical management. Surgical removal of the gland is not recommended in the case of an actively infected gland.

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150. A 6-month-old girl is evaluated because of a “flat head.” Physical examination shows right posterior flatness of the cranium with a transcranial difference of 7 mm (minimal to moderate), and mastoid bossing on the ipsilateral side. The right ear and left forehead are anteriorly displaced. The parents report that the child prefers to turn her head to the right. The patient is otherwise healthy and reaching developmental milestones. Which of the following is the most appropriate next step in management?

- A) Cranial orthotic molding helmet
- B) Crib positioning and physical therapy only
- C) CT scan of the head
- D) X-ray studies of the skull
- E) Reassurance

The correct response is Option C.

The clinical findings are suggestive of right unilateral lambdoidal synostosis (synostotic plagiocephaly). If craniosynostosis is suspected, the child may need surgical correction of the defect. Therefore, it is incorrect to pursue reassurance and conservative therapy without confirming the presence of a prematurely fused suture.

Lambdoidal synostosis is the least common premature fusion of a suture (2 to 3% of all synostosis cases). The physical findings have some similarities and distinct differences from the frequently seen positional deformational plagiocephaly. Positional plagiocephaly can have ipsilateral forehead protuberance and anterior displacement of the ipsilateral ear. Lambdoid synostosis, on the other hand, is associated with ipsilateral mastoid bossing and protuberance of the contralateral forehead. The position of the ear, once another landmark to help distinguish between positional and synostotic plagiocephaly, with lambdoid synostosis associated with posterior displacement of the ipsilateral ear, has been questioned in recent years. A literature review showed that the ipsilateral ear has been reported to be nondisplaced, anteriorly displaced, or posteriorly displaced. Therefore, the significance of the position of the ear is unclear at this time.

There is no need for plain film series before head CT scan. Imaging studies are performed to confirm synostosis before surgical intervention.

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Section 4: Breast and Cosmetic

151. A 24-year-old nulliparous woman comes to the office for augmentation mammoplasty. She currently wears a size 34B brassiere and wants her brassiere size to be increased to a D cup. She is a good candidate for subglandular placement of implants. Which of the following risks is decreased by the use of the textured silicone shell compared with the smooth silicone shell?

- A) Capsular contracture
- B) Hematoma
- C) Prosthesis malposition
- D) Rippling
- E) Symmastia

The correct response is Option A.

Texturing of the implant surface has been shown to decrease the rate of capsular contracture when compared with smooth implants when the implants are placed in the subglandular position. The benefit of textured implants may not be present when the implants are placed in a submuscular pocket.

There is no difference in hematoma rates for textured versus smooth implants. Both symmastia and implant malposition are related to pocket dissection and not related to the type of implant placed. In the case of symmastia, the pockets have encroached upon the sternum and are close to each other or are touching. Implant malposition can be related to factors such as inadequate dissection of the pocket, or over-dissection of the pocket. Finally, some studies have demonstrated an increase in rippling with textured implant when compared with smooth implants. However, rippling may be more related to cohesiveness of the gel and fill volumes of the shell, because early reports of experience with the form-stable implant (Natrella 410) seem to show decreased rates of rippling.

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4. Maxwell GP, Van Natta BW, Murphy DK, et al. Natrelle style 410 form-stable silicone breast implants: core study results at 6 years. *Aesthet Surg J*. 2012 Aug;32(6):709-717. Epub 2012 Jun 29.

152. A 46-year-old woman receives several thousand dollars' worth of injectable filler and neurotoxin treatments following an initial consultation with the plastic surgeon. Before receiving the injections, she indicated that she understood the planned treatments and was made aware of the costs. She provided informed consent and paid for the services with a credit card. The plastic surgeon calls the patient for follow-up several weeks after the treatment, and the patient reports being happy with the results. Several months later, the plastic surgeon receives a notice from the credit card company that the patient is now disputing the charges, and the credit card company promptly removes the fees from the plastic surgeon's account. Which of the following is the most appropriate action by the plastic surgeon in response to this situation?

- A) Call the patient and advise her that her charges will be turned over to the police for fraud
- B) Call the patient who referred her and ask if she could encourage this patient to reverse the charges
- C) Contact a lawyer to consider legal action against this patient
- D) Ensure that all future patients sign a policy in advance of any treatment that waives their privacy protection under HIPAA in matters of dispute of payment
- E) Send documentation to the credit card company of the treatments the patient received and proof that she had signed informed consent

The correct response is Option D.

Although it may seem aggressive to have patients sign a financial policy before receiving treatment stating that if there are any matters in dispute after the fact, they waive their right to privacy under the Health Insurance Portability and Accountability Act of 1996 (HIPAA) guidelines, this is the only way in which a case like this may be successfully handled. Without such protection, no information (including the fact that the person was even a patient) may be shared with a credit card company, another patient, the police, or a collection agency because it would be a violation of HIPAA, even if appropriate informed consent were obtained. Calling a patient with any kind of threat about a financial matter should never be done because this would violate ethical standards. Without a patient specifically waiving his/her right to privacy under HIPAA in a signed document, no information about that patient may be shared with the credit card company, and the physician is unable to confirm that the patient is indeed under his care. HIPAA affords complete protection

of a patient's privacy, and, in situations such as these, to the great disadvantage of physicians who accept credit cards for payment. Any dispute cannot be properly addressed by the physician without a patient signing away these rights specifically.

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153. Which of the following represents the lateral border of the breast footprint?

- A) Anterior axillary line
- B) Anterior edge of the latissimus dorsi muscle
- C) Lateral clavicle
- D) Midaxillary line
- E) Posterior axillary line

The correct response is Option A.

The lateral breast is mobile, unlike the inframammary fold. Therefore, the footprint can vary slightly and be just behind the anterior axillary fold, but it does not extend to the midaxillary line. The breast footprint is not described as relating to either the latissimus dorsi or the clavicle.

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2. Hall-Findlay EJ. The three breast dimensions: analysis and effecting change. *Plast Reconstr Surg*. 2010 Jun;125(6):1632-1642.

154. An otherwise healthy 52-year-old woman with a family history of cardiac disease undergoes suction-assisted lipectomy of the flanks, thighs, and abdomen using a tumescent technique. She returns to the emergency department 6 hours after discharge because of slurred speech and restlessness. Which of the following is the most likely diagnosis?

- A) Fat embolism
- B) Lidocaine toxicity
- C) Parietal stroke
- D) Pulmonary embolism
- E) Third spacing

The correct response is Option B.

Because lidocaine absorbs slowly from fat, infiltrate solutions that contain up to 35 mg/kg of lidocaine are generally considered safe. Nonetheless, lidocaine toxicity is still a risk of the procedure. In tumescent solution with epinephrine, peak plasma lidocaine levels occur approximately 10 to 14 hours after infiltration, and thus, the presentation 6 hours after discharge is consistent with peak plasma concentration.

Lidocaine toxicity has symptoms of neurologic or cardiac toxicity. In the early stages, the complications are primarily neurologic and can include slurred speech, restlessness, tinnitus, and a metallic taste, as well as numbness of the mouth. As the concentrations increase, the neurologic concentrations become more severe, and can progress to muscle twitching, seizures, and cardiac arrest. Treatment of lidocaine toxicity is supportive.

Fat embolism presents as a petechial rash, respiratory dysfunction, and cerebral dysfunction, and the symptoms usually appear 24 to 48 hours after surgery. Pulmonary embolism presents as leg pain and edema, tachycardia, and low-grade fevers.

Parietal strokes usually cause sensory symptoms, self-perception anomalies, and left-right agnosia. Third spacing refers to fluid shifts into interstitial spaces and can cause edema, hypotension, and decreased cardiac output.

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2. Klein JA. Tumescent technique for regional anesthesia permits lidocaine doses of 35 mg/kg for liposuction. *J Dermatol Surg Oncol*. 1990 Mar;16(3):248-263.

155. A 45-year-old woman who underwent augmentation mammoplasty 20 years ago comes to the office for a mastopexy to correct her “sagging breasts.” The 450-mL smooth, round saline implants were placed in a subglandular plane through a transaxillary approach. Mastopexy with implant exchange to 350-mL silicone implant is planned. Which of the following pedicles is most likely to present the greatest risk of vascular compromise of the nipple-areola complex in this patient?

- A) Inferior
- B) Lateral
- C) Medial superior
- D) Superior
- E) Superior lateral

The correct response is Option A.

In the augmented breast, the tissues of the lower pole become attenuated, compromising its blood supply. Both the weight of a large implant and the skin stretch caused by implant volume causes thinning and stretching of the lower pole tissues. The long distance from her nipple to inframammary crease provides further evidence that this has occurred. The other pedicles obtain their blood supply from perforator vessels preserved with a subpectoral pocket. Furthermore, the medial and lateral skin flap circulations are less affected by the weight of the implant as is the lower pole. The inferior pedicle can be used in these situations; however, added caution needs to be taken.

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1. Handel N. Secondary mastopexy in the augmented patient: a recipe for disaster. *Plast Reconstr Surg*. 2006 Dec;118(7):152S-163S.
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3. Spear SL. Augmentation/mastopexy: “surgeon, beware.” *Plast Reconstr Surg*. 2006 Dec;118(7):133S-134S.

156. A 49-year-old woman is evaluated because of a traumatic laceration of the right lower eyelid and cheek. Physical examination shows difficulty with eyelid closure, voluntary squinting, and animation. Which of the following branches of the facial nerve is most likely injured?

- A) Buccal
- B) Cervical
- C) Marginal mandibular
- D) Temporal
- E) Zygomatic

The correct response is Option E.

Anatomically, the orbicularis oculi muscle is divided into three segments: pretarsal, preseptal, and orbital. However, functionally, the orbicularis oculi muscle is divided into the medial inner canthal orbicularis and the extracanthal orbicularis. The medial inner canthal orbicularis is responsible for blinking, lower lid tone, and the pumping mechanism of the lacrimal system. Innervation to the inner canthal orbicularis is from the buccal branches of the facial nerve. The zygomatic branch of the facial nerve innervates the extracanthal orbicularis, which controls eyelid closure, voluntary squinting, and animation. The temporal, marginal mandibular, and cervical branches do not provide innervation to the orbicularis oculi muscle.

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1. Alghoul M, Pacella SJ, McClellan WT, et al. Eyelid reconstruction. *Plast Reconstr Surg*. 2013 Aug;132(2):288e-302e.
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157. A 42-year-old woman comes to the office for treatment after receiving a diagnosis of cancer of the right breast. She has decided to undergo mastectomy of the right breast. Which of the following is a relative CONTRAINDICATION to nipple-sparing mastectomy?

- A) Comedo-type breast tumor
- B) Invasive lobular carcinoma
- C) Subareolar tumor
- D) Tumor location 3 cm from the nipple
- E) Tumor size of 2.5 cm

The correct response is Option C.

A relative contraindication to nipple-sparing mastectomy is a centrally located tumor. Although various authors have employed different distance criteria, it is generally accepted that patients whose tumors are within 2 cm of the nipple are not candidates for nipple-sparing mastectomy.

Nipple-sparing mastectomy is an appropriate option for high-risk patients undergoing prophylactic mastectomy and for patients diagnosed with breast cancer who meet certain criteria. Those criteria are: tumor size of 3 cm or less, at least 2 cm from the nipple, not multicentric, and with clinically negative nodes.

Comedo carcinoma of the breast is a type of ductal carcinoma in situ. It is considered to be an early stage of breast cancer, is confined to the ducts, and usually does not spread beyond. It is not a contraindication to nipple-sparing mastectomy.

Invasive lobular carcinoma originates from the breast lobules, may form a thickening of the breast tissue rather than a discrete mass, and is often bilateral. As long as it meets the above criteria, it is not a contraindication to nipple-sparing mastectomy.

Inflammatory breast cancer, Paget disease, and tumors infiltrating the skin are also not candidates for skin-sparing or nipple-sparing mastectomy, according to several authors.

In more recent studies, a tumor size of 3 cm or less appears to result in no increase in local or regional recurrence in nipple-sparing mastectomy compared with

alternative surgical approaches. A tumor of 2.5 cm is not a contraindication to nipple-sparing mastectomy.

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2. Rusby JE, Smith BL, Gui GP. Nipple-sparing mastectomy. *Br J Surg*. 2010 Mar;97(3):305-316.

158. An otherwise healthy 41-year-old woman who underwent Roux-en-Y gastric bypass surgery 24 months ago, followed by a 120-lb (54-kg) weight loss that she maintained for 6 months, undergoes plastic surgery evaluation for a panniculectomy. Medical history includes hypothyroidism that is controlled with levothyroxine. Preoperative cardiovascular examination shows no abnormalities, and results of a pregnancy test on the day of surgery are negative. She undergoes panniculectomy and thigh lift, and on extubation, the patient is lethargic and confused. ECG shows sinus tachycardia, and she remains somnolent and confused. Analysis of thyroid-stimulating hormone and cardiac enzymes, chest x-ray study, and ventilation-perfusion scan show no abnormalities. Which of the following is the most likely diagnosis?

- A) Acute thyroiditis
- B) Diabetic ketosis
- C) Pulmonary embolism
- D) Undiagnosed pregnancy
- E) Vitamin B₁ (thiamine) deficiency

The correct response is Option E.

Thiamine deficiency is most often identified shortly after bariatric surgery but can be diagnosed later. Some patients can develop Wernicke-Korsakoff encephalopathy (WKE). Body stores of thiamine can last from 3 to 6 weeks, and thiamine deficiency is more associated with decreased dietary intake. Although clinical manifestations are very uncommon, and WKE is considered a rare complication, approximately 11% of patients who have undergone Roux-en-Y gastric bypass surgery and take vitamin supplementation show evidence of thiamine deficiency 2 years postoperatively.

The hallmark of thiamine deficiency is neurologic symptoms, but in contrast to WKE, patients rarely exhibit confusion, ataxia, and oculomotor abnormalities. If thiamine deficiency is not recognized and treated, it can have devastating results, including irreversible brain damage and death.

Full nutritional workup of patients is critical.

Confusion is a symptom of diabetic ketosis, but diabetic ketosis is notable for signs of dehydration and excessive thirst or urination, and is associated with Kussmaul respirations.

Acute thyroiditis has symptoms of pain and swelling of the anterior neck. Pulmonary embolism can have symptoms of respiratory distress and right-sided heart strain. Early pregnancy often results in nausea, but not lethargy and confusion.

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159. A 43-year-old woman brings her 10-day-old daughter for evaluation because she is concerned about the appearance of her daughter's nipples. The newborn was born at full-term after an uncomplicated pregnancy. Physical examination shows that the newborn has inverted nipples bilaterally. Which of the following is the most appropriate next step in management?

- A) Continuous elastic outside distraction starting at day of life 14
- B) Suction lengthening of the nipple starting at day of life 14
- C) Suction lengthening of the nipple starting immediately
- D) Transection of the fibrotic bands at 6 months of age
- E) Observation

The correct response is Option E.

It is very common for nipples to be inverted at birth and concerned parents often discuss the condition with pediatricians and practitioners. The mammary ridge begins to develop in the fourth week of development, and produces the primary and secondary buds. The mammary pit is a small depression present at birth into which the lactiferous ducts open. After birth, proliferating mesoderm during the first several weeks of life will cause the inverted nipple to protrude.

In some cases, the inverted nipple persists. Although there may not be a functional consequence, it can lead to difficulty with lactation. Han and Hong described a grading system for inverted nipple: grade I, in which the nipple can be made to protrude manually and can maintain position without traction; grade II, in which the nipple fails to maintain projection after manipulation; and grade III, in which the nipple cannot be pulled out manually. Treatment is based on the grade. In some cases, breast-feeding or use of a breast pump is sufficient to correct the variation. Surgical intervention can be approached in several ways. Constricting the base of the inverted nipple can create projection, severing the ducts can cause projection, and myotomy can cause projection. Any division of the ducts will compromise a patient's ability to breast-feed.

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160. The intercartilaginous incision in rhinoplasty follows the caudal border of which of the following?

- A) Alar lateral crus
- B) Caudal septum
- C) Lower lateral cartilage
- D) Middle crus
- E) Upper lateral cartilage

The correct response is Option E.

The intercartilaginous incision follows the caudal border of the upper lateral cartilage and is located between it and the cephalad border of the alar lateral crus. This incision may connect, and frequently does, with a transfixion incision at the caudal border of the septum at the septal angle.

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161. Gynecomastia that occurs in men who take anabolic steroids is caused by increased levels of which of the following?

- A) Aromatase
- B) Estradiol
- C) High-density lipoprotein
- D) Testosterone

The correct response is Option B.

Anabolic steroids have sex-specific adverse effects. Development of breast tissue in men, a condition called gynecomastia (which is usually caused by high levels of circulating estradiol), may arise because of increased conversion of testosterone to estradiol by the enzyme aromatase. Decreased sexual function and temporary infertility can also occur in men.

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162. A 60-year-old man comes to the office because he desires improvement in the appearance of his lower eyelid and upper cheek area. Physical examination shows a prominent tear trough. Which of the following is the anatomic basis of the tear trough?

- A) Attachment of the orbital septum to the arcus marginalis
- B) Cleft between the palpebral and orbital parts of the orbicularis oculi
- C) Osteocutaneous ligament arising from the medial portion of the maxilla
- D) Prominence of the orbital rim following descent of the malar fat pad
- E) Triangular confluence of the origins of the orbicularis oculi, levator labii superioris alaeque nasi, and levator labii superioris

The correct response is Option C.

Recent articles have greatly improved our understanding of the anatomy of the lower eyelid, tear trough, pre-zygomatic space, and the ligaments in the orbital area.

The tear trough ligament is a true osteocutaneous ligament between the palpebral and orbital portions of the muscle. It extends inferolaterally from the medial canthus to approximately the mid-pupillary line, where it connects with the bilayered orbicularis retaining ligament. Recent anatomic dissection work has shown that this ligament is the anatomic basis of the tear trough deformity.

Fillers should be placed inferior to the tear trough ligament; placing them superiorly will only serve to emphasize lower eyelid fat, and will emphasize the tear trough deformity.

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2. Wong CH, Mendelson B. Facial soft-tissue spaces and retaining ligaments of the midcheek: defining the premaxillary space. *Plast Reconstr Surg*. 2013 Jul;132(1):49-56.

163. Which of the following characteristics is correlated with increased risk of nipple-areola complex necrosis in nipple-sparing mastectomies with immediate reconstruction?

- A) Autologous tissue reconstruction
- B) Direct to implant reconstruction
- C) Patient age
- D) Periareolar incision
- E) Small breast size

The correct response is Option D.

Nipple-sparing mastectomies (NSMs) are becoming more common for both therapeutic and prophylactic mastectomies. Nipple-areola complex (NAC) necrosis can imperil reconstructive efforts, as well as negatively affect patients emotionally. It is important to maximize perfusion to the mastectomy skin flaps and NAC while still performing an oncologically sound procedure. There are multiple different incisions for performing NSM. Periareolar, inframammary-fold, radial, and vertical incisions are the most common. Periareolar incisions are associated with an increased risk of NAC necrosis in NSMs. Type of reconstruction, small breast size, and patient age have not been shown to be linked to increased rates of NAC necrosis.

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164. A 39-year-old woman is evaluated because she is dissatisfied with the appearance of her abdomen. She has had five pregnancies with two full-term deliveries and three second-trimester miscarriages. She takes no birth control pills. Physical examination shows wide diastasis with excess abdominal skin. BMI is 28 kg/m². Abdominoplasty with translocation of the umbilicus is planned. This patient is at increased risk for which of the following complications?

- A) Deep vein thrombosis
- B) Hematoma
- C) Infection
- D) Recurrent diastasis
- E) Wound dehiscence

The correct response is Option A.

A history of two late-term miscarriages stands out as a significant risk factor for thrombophilia (inherited and acquired) and subsequent deep vein thrombosis. It is imperative that these patients be identified and further evaluated. If abdominoplasty is performed, chemoprophylaxis is required.

The most common inherited thrombophilia is factor V Leiden, which is present in 3 to 7% of the Caucasian population. Multiple inherited thrombophilic conditions can be present in the same individual.

Studies have shown that complication rates in abdominoplasty increase in patients with a BMI greater than or equal to 30 kg/m². Based upon history and physical examination alone, the other complications of hematoma, infection, recurrent diastasis, or wound dehiscence should not be significantly increased.

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165. Which of the following is the most common complication associated with “donut” mastopexy?

- A) Boxy breast shape
- B) Increased distance from nipple to inframammary fold
- C) Loss of nipple sensation
- D) Nipple necrosis
- E) Widening of the areola

The correct response is Option E.

A common complication of the “donut” (circumareolar) mastopexy is widening of the areola. This can be minimized by using a Gore-Tex suture placed using the “wagon-wheel” technique and limiting the amount of skin resected to a 2:1 ratio of outside diameter to areolar diameter.

Boxy breast shape is associated with Wise pattern mastopexy. Nipple necrosis is associated with combined augmentation and mastopexy. Increased distance from the nipple to the inframammary fold is associated with vertical mastopexies in which the height of the medial and lateral pillars is too tall. Loss of nipple sensitivity is unusual because there is no parenchymal resection.

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166. A 32-year-old woman is evaluated for lipodystrophy of the central abdomen with skin laxity. She desires volume reduction as well as improvement of the skin laxity. The patient is scheduled for superficial liposuction of the abdomen. Which of the following postoperative complications is most likely in this patient?

- A) Contour irregularities
- B) Hyperpigmentation
- C) Infection
- D) Seroma
- E) Skin necrosis

The correct response is Option A.

The subcutaneous fat of the abdomen is anatomically arranged in two layers: superficial and deep. The superficial adipose layer is located 1 to 2 mm below the dermis and is dense and compact with numerous septations. The deep adipose layer is loose and areolar with few septa. Conventional or traditional liposuction is performed within the deep adipose layer with larger cannulas. Superficial liposuction or subdermal liposuction involves the removal of fat from the superficial compartment found 1 to 2 mm below the dermis, disrupting the extensive septations. Most complications following liposuction are minor and resolve without further surgical intervention. However, the most common complications following superficial liposuction are contour irregularities. Less common complications associated with superficial liposuction include seroma, hyperpigmentation, infection, hypertrophic scar, chronic induration, skin necrosis, and infection.

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167. A 38-year-old woman receives an injection of hyaluronic acid gel fillers to improve the appearance of her nasolabial folds. The evening after she received the injection, the patient calls the answering service and reports to the surgeon that, several hours after the injection, she developed skin "irritation" on the left side of the nose with skin discoloration, swelling, and numbness. Which of the following is the most appropriate next step in management?

- A) Evaluate the patient in person
- B) Initiate treatment with an oral antihistamine
- C) Initiate treatment with an oral benzodiazepine
- D) Tell the patient to immediately apply ice
- E) Reassurance

The correct response is Option A.

The most severe and feared early occurring complication of soft-tissue filler agents is tissue necrosis, caused by interruption of the vascular supply to the area by either direct injury of the vessel, compression of the area around the vessel, or obstruction of the vessel by the filler material. It is a rare event, and although more commonly reported in the glabellar region, it has been reported following injection of the nasolabial fold area with hyaluronic acid gel and calcium hydroxylapatite (Radiesse) filler products, causing alar necrosis.

Treatment options for impending necrosis are based on those recommended for the treatment of the glabella and remain anecdotal. Typically, if noted immediately, injections are halted, warm compresses are applied, and nitroglycerin paste is used for local vasodilatation. Immediate use of hyaluronidase to the injection site is also recommended. The use of hyperbaric oxygen is controversial.

Recognition of the possible problem is essential, so that early intervention can minimize tissue necrosis and subsequent deformity. Ice would potentially worsen the already compromised blood flow to the area and is not recommended. Benzodiazepines and antihistamines do not treat the underlying problem, which is tissue ischemia.

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1. Grunebaum LD, Bogdan Allemann I, Dayan S, et al. The risk of alar necrosis associated with dermal filler injection. *Dermatol Surg.* 2009 Oct;35 Suppl 2:1635-1640.
2. Glaich AS, Cohen JL, Goldberg LH. Injection necrosis of the glabella: protocol for prevention and treatment after use of dermal fillers. *Dermatol Surg.* 2006 Feb;32(2):276-281.
3. Humphrey CD, Arkins JP, Dayan SH. Soft tissue fillers in the nose. *Aesthet Surg J.* 2009 Nov-Dec;29(6):477-484.

168. A 27-year-old woman is evaluated because of pain 2 weeks after undergoing subglandular augmentation mammoplasty. She has no history of fever, chills, or drainage. Physical examination discloses a painful, tender cord in the inframammary region of the left breast. Which of the following is the most appropriate next step in management?

- A) Administration of an antibiotic
- B) Administration of an anticoagulant
- C) Administration of an anti-inflammatory agent
- D) Duplex ultrasonography
- E) Removal of the implant

The correct response is Option C.

Mondor disease of the breast is a benign, self-limiting thrombophlebitis of the inframammary veins. Clinically, Mondor disease usually occurs 2 to 3 weeks postoperatively as a painful, tender cord within the superficial veins of the thoracoepigastric system. Management is observation and includes the use of warm, moist dressings and anti-inflammatory agents for symptomatic relief. The use of anticoagulation, antibiotics, or steroids is not indicated. Implant removal is not indicated in the absence of infection. Duplex ultrasonography is not required for management.

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1. Khan UD. Mondor disease: a case report and review of the literature. *Aesthet Surg J*. 2009 May-Jun;29(3):209-212.
2. Khan UD. Incidence of Mondor disease in breast augmentation: a retrospective study of 2052 breasts using inframammary incision. *Plast Reconstr Surg*. 2008 Aug;122(2):88e-89e.

169. A 55-year-old woman has pain and weakness of the shoulder, and inability to lift her shoulder girdle 2 weeks after undergoing rhytidectomy, advancement of an extended superficial musculoaponeurotic system flap, and plication of the platysma with complete transection. A nerve injury is suspected. During which of the following parts of the rhytidectomy was the nerve most likely injured?

- A) Anchoring the superficial musculoaponeurotic system flap to Lore fascia
- B) Dissection of the lateral neck
- C) Flap elevation at McKinney point
- D) Subplatysmal fat resection
- E) Transection of the platysma

The correct response is Option B.

This patient's symptoms relate to an injury to the spinal accessory nerve (cranial nerve XI). This nerve innervates the sternocleidomastoid and the trapezius muscles. The spinal accessory nerve exits the cranium through the jugular foramen. It then passes deep to the styloid process and under the sternocleidomastoid muscle. The nerve exits the posterior border of the sternocleidomastoid fascia within 2 cm superior to the great auricular nerve. After it exits the muscle, the nerve is vulnerable to injury because it is tightly sandwiched between the skin and the muscle fascia. It then runs obliquely and inferiorly to the anterior edge of the trapezius muscle. The course of the spinal accessory nerve usually follows a path drawn by a line perpendicular to and bisecting a line connecting the angle of the mandible and the tip of the mastoid process.

Lore fascia is a dense tissue inferior to the auricle that can be used to anchor the superficial musculoaponeurotic system fascia. The facial nerve is 2.5 cm deep to this fascia. McKinney point is where the great auricular nerve consistently crosses the mid transverse belly of the sternocleidomastoid muscle approximately 6.5 cm below the caudal edge of the bony external auditory canal. The spinal accessory nerve is posterior to the platysma.

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1. Feldman JJ. Surgical anatomy of the neck. In: Feldman JJ, ed. *Neck Lift*. Boca Raton, FL: CRC Press; 2006:104-105.

2. Chandawarkar RY, Cervino AL, Pennington GA. Management of iatrogenic injury to the spinal accessory nerve. *Plast Reconstr Surg*. 2003 Feb;111(2):611-617;discussion 618-619.
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4. Stuzin JM. MOC-PSSM CME article: Face lifting. *Plast Reconstr Surg*. 2008 Jan;121(1 Suppl):1-19.

170. A 52-year-old woman receives a diagnosis of invasive ductal carcinoma of the right breast. Which of the following details from this patient's history is the strongest risk factor for this diagnosis?

- A) Early first pregnancy (less than 30 years)
- B) Early menarche (less than 12 years)
- C) Early menopause (less than 55 years)
- D) Multiple episodes of breast-feeding
- E) Remote oral contraceptive use

The correct response is Option B.

Early menarche is the highest risk factor for breast cancer of the options listed. Late first pregnancy, late menopause, no breast-feeding, and recent oral contraceptive use are also risk factors for breast cancer but are not as high risk.

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1. Mathes SJ, Lang J. Breast cancer: Diagnosis, Therapy, and Postmastectomy reconstruction. In: Mathes SJ, Hentz VR, eds. *Plastic Surgery*. 2nd ed. Philadelphia: WB Saunders; 2006:631-789.
2. What are the risk factors for breast cancer? Available at: <http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-risk-factors>. Updated February 18, 2013. Accessed February 21, 2013.
3. Hulka BS, Stark AT. Breast cancer: cause and prevention. *Lancet*. 1995 Sep 30;346(8979):883-7.

171. A 35-year-old man is evaluated for a history of sleep apnea and nasal airway obstruction. Physical examination shows a narrowed middle vault with an internal valve of less than 10 degrees and a septum that deviates along the maxillary crest to the left, narrowing the airway. The operative plan is for spreader grafts from the septum, and submucous resection of the deviated portion of the septum. Which of the following is the most appropriate Current Procedural Terminology (CPT) coding for this procedure?

CPT code	Description
20912	Septal cartilage graft
30410	Rhinoplasty, primary; bony pyramid, lateral and alar cartilages and/or tip
30420	Rhinoplasty, primary; bony pyramid, lateral and alar cartilages and/or tip, including major septal repair
30465	Repair of nasal vestibular stenosis
30520	Septoplasty or submucous resection with or without cartilage scoring, contouring, or replacement with graft

- A) 20912 and 30420
- B) 20912 and 30465
- C) 30410 and 30465
- D) 30420 and 30465
- E) 30465 and 30520

The correct response is Option E.

In this patient, the most appropriate code is one that addresses the vestibular stenosis only: 30465. The more inclusive codes of 30410 and 30420 include surgery involving the lower lateral (alar) cartilages to address tip issues, and, in the case of 30410 and 30420, work on the bony pyramid as well; none of which are a component of the procedure undertaken, which is limited to addressing the internal nasal valve narrowing.

CPT code 30520 is most appropriate to use for the septoplasty because the harvesting of cartilage is included in the submucous resection surgical field, and, as a result, cannot be coded separately as a septal cartilage graft harvest. If one were

not performing a septoplasty, then the most appropriate code would be 20912 for the septal graft harvest to be used for the spreader grafts.

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1. Janevicius R. Rhinoplasty coding; part I basic procedures. Arlington Heights, IL: American Society of Plastic Surgeons; 2013.
2. Janevicius R. Rhinoplasty coding; part II complex procedures. Arlington Heights, IL: American Society of Plastic Surgeons; 2013.

172. A 65-year-old woman comes to the office 1 month before a scheduled mastopexy. Annual mammography shows a 1.5-cm mass in the upper outer quadrant. Core needle biopsy is performed. Pathologic examination of excised tissue identifies papilloma without atypia. Which of the following is the most appropriate next step in management?

- A) Bilateral breast sonography
- B) Excisional biopsy of needle-localized area
- C) Repeat annual mammography in 12 months
- D) Repeat mammography at 6-month intervals for 1 year
- E) Stereotactic vacuum-assisted biopsy

The correct response is Option B.

Percutaneous biopsy methods are commonly accepted for the initial evaluation of clinically occult breast lesions, although certain nonmalignant lesions pose dilemmas with respect to the most appropriate clinical management. Papillary lesions of the breast can either be benign or malignant, although differentiation is radiologically difficult. Moreover, it is difficult for pathologists to reliably distinguish among benign, atypical, and malignant papillary lesions on the limited fragmented tissue specimens they receive after needle sampling.

Previous studies have demonstrated high rates of ductal carcinoma in situ (11%) in patients diagnosed with benign papillomas by needle biopsy and who subsequently underwent a surgical excision, although conflicting data suggest an extremely decreased rate of malignancy when histology is benign on needle biopsy.

The management of benign papillary lesions is somewhat controversial. Although conservative follow-up with either yearly mammogram or short-interval follow-up may be appropriate for certain patients diagnosed with benign papilloma, certain features of this patient's lesion make conservative follow-up inappropriate. Sonographic follow-up in a 65-year-old woman with mature breast parenchyma and a solid mammographically detected mass would not provide much additional information, and a repeat percutaneous biopsy, whether core needle or vacuum-assisted, would also not be effective. Given the size of the lesion and the age of the patient, surgical excision is warranted despite the lack of atypia on needle biopsy. Benign papillomas tend to be smaller than 1 cm and centrally located, whereas malignant lesions are more often greater than 1.5 cm and are peripherally located.

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1. Georgian-Smith D, Lawton TJ. Variations in physician recommendations for surgery after diagnosis of a high-risk lesion on breast core needle biopsy. *AJR Am J Roentgenol*. 2012 Feb;198(2):256-263.
2. Irfan K, Brem RF. Surgical and mammographic follow-up of papillary lesions and atypical lobular hyperplasia diagnosed with stereotactic vacuum-assisted biopsy. *Breast J*. 2002 Jul-Aug;8(4):230-233.
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4. Johnson NB, Collins LC. Update on percutaneous needle biopsy of nonmalignant breast lesions. *Adv Anat Pathol*. 2009 Jul;16(4):183-195.

173. A 40-year-old woman, gravida 2, para 2, with abdominal laxity and rectus diastasis is scheduled to undergo abdominoplasty with rectus plication. Which of the following intraoperative nerve blocks is likely to provide postoperative analgesia to the greatest area of lower abdominal skin for this patient?

- A) Direct midline injection of plication area
- B) Iliohypogastric nerve block
- C) Ilioinguinal nerve block
- D) Subcostal nerve block
- E) Transversus abdominis plane block

The correct response is Option E.

Innervation of the anterolateral abdominal wall arises from the anterior rami of spinal nerves T7 to L1. These branches include the intercostal nerves (T7-T11), the subcostal nerve (T12), and the iliohypogastric and ilioinguinal nerves (L1). Because these nerves travel in the plane between the transversus abdominis and internal oblique muscles, they can be conveniently blocked in this area with a single transversus abdominis plane (TAP) block on each side. Although the other nerve block techniques are frequently used in combination, each covers a smaller territory or single dermatome.

The TAP block may be performed via several different approaches. Most experts agree that there is a reliable block of the T10 to L1 dermatomes when the lateral approach from the triangle of Petit is used. The subcostal approach of the TAP block can give a more cephalad block. The combination of bilateral TAP blocks and rectus sheath injections has been found to decrease the need for postoperative narcotic use after abdominoplasty. It has also been useful for patients receiving transverse rectus abdominis musculocutaneous (TRAM) and deep inferior epigastric artery perforator (DIEP) flaps. The TAP block was also found to be superior to conventional ilioinguinal and iliohypogastric nerve blocks in a comparison study of open inguinal hernia repairs.

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174. A 16-year-old girl comes to the clinic because she is dissatisfied with the asymmetric appearance of her breasts. Physical examination shows the right nipple-areola complex is more superiorly located and the breast volume is small. There is absence of the right anterior axillary fold. Which of the following other physical examination findings is most likely?

- A) Accessory nipple
- B) Microtia
- C) Right clubfoot
- D) Scars consistent with repaired cleft lip
- E) Shortened right-hand digits

The correct response is Option E.

The chest findings described are consistent with Poland syndrome with absence of the sternocostal head of the pectoralis major muscle. Poland syndrome can be associated with hand abnormalities, including shortened digits. Cleft lip, accessory nipple, clubfoot, and microtia are not known to be associated with Poland syndrome.

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1. Huemer GM, Puelzl P, Schoeller T. Breast and chest wall reconstruction with the transverse musculocutaneous gracilis flap in Poland syndrome. *Plast Reconstr Surg*. 2012 Oct; 130(4): 779-783.
2. Al-Qattan MM. Classification of hand anomalies in Poland's syndrome. *Br J Plast Surg*. 2001 Mar; 54(2): 132-136.

175. A 55-year-old woman comes to the office for evaluation for blepharoplasty. She says that her eyelids look heavy and give her a tired appearance. She has no history of ophthalmologic issues. Which of the following elements on physical examination is most appropriate for grading ptosis in this patient?

- A) Measurement of marginal reflex distance 1
- B) Measurement of palpebral fissure height
- C) Measurement of superior sulcus depth
- D) Phenylephrine test
- E) Tensilon test

The correct response is Option A.

Patients coming to the office for cosmetic blepharoplasty must always be evaluated for eyelid ptosis before the procedure. Although older patients often have dermatochalasis, fat herniation, and laxity of the orbicularis muscles, upper eyelid ptosis is frequently present as well. Failure to diagnose and address the ptosis at the time of blepharoplasty surgery will often result in patient dissatisfaction, because the ptosis is often more apparent after debulking the upper lid.

A detailed history and physical examination will show both the presence and often the cause of the blepharoptosis. Although involutional ptosis is the most common age-related form of ptosis, myogenic, neurogenic, and mechanical causes must also be ruled out.

The Tensilon test is done when an acquired ptosis caused by myasthenia gravis is suspected. In adults, 1 mg of neostigmine is injected intramuscularly. The ptosis improves in 5 to 15 minutes if myasthenia gravis is the cause.

The phenylephrine test is performed to determine if a posterior approach will be adequate for correction of the ptosis, as in patients who have mild ptosis secondary to Horner syndrome. With this test, application of phenylephrine 2.5% drops initially, or after 3 to 5 minutes, stimulates the Müller muscle and results in 2 to 3 mm of lid elevation.

Physical examination of the eyelids should include measurements of the palpebral fissure height, the marginal reflex distance, levator function or excursion, scleral

show, lid crease height and contour, superior sulcus depth and contour, lagophthalmos, Bell phenomenon, ocular dominance, and eyelid laxity.

The marginal reflex distance 1 (MRD1) is best at determining the degree of ptosis present. With the patient in primary gaze, a light is shined on the eyes and a corneal light reflex is seen mid pupil. The distance of the light reflex to the upper lid margin is the MRD1. This measurement is more accurate than vertical palpebral fissure height, because lower lid position can affect the latter measurement. A normal MRD1 is between 3.5 and 4.5 mm. A MRD1 less than 2.5 mm is considered clinically significant ptosis.

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176. A 45-year-old woman comes to the office because she is interested in having reduction mammoplasty. She asks if undergoing reduction mammoplasty would decrease her risk of breast cancer. Which of the following is the most appropriate response to this patient?

- A) The rate of breast cancer has been shown to be slightly increased in patients who undergo reduction mammoplasty
- B) Reduction mammoplasty appears to decrease the rate by 90%
- C) Reduction mammoplasty decreases the rate of breast cancer but less than prophylactic mastectomies
- D) There is no evidence that reduction mammoplasty decreases cancer risk

The correct response is Option C.

Over the past decade, several large retrospective studies have looked at the rate of developing breast cancer after reduction mammoplasty. The breast cancer rates in patients undergoing reduction mammoplasty have consistently been decreased by about 30%. This differs from prophylactic mastectomy, which lowers the rate by as much as 90%.

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177. Which of the following is the most common reason for reoperation after brachioplasty in patients who have undergone significant weight loss?

- A) Hematoma
- B) Hypertrophic scar
- C) Infection
- D) Seroma
- E) Wound dehiscence

The correct response is Option B.

In general, patients are satisfied with the results of brachioplasty. Complications are not uncommon and some studies report complication rates as high as 50%. Most of these complications are minor in nature. Wound dehiscence is managed with dressing changes. Hematoma and seromas are typically managed with observation or aspiration. In the case of infections, the majority are managed with oral antibiotics.

The most common reason for additional surgery after brachioplasty is to revise the scar. Many patients will have an unfavorable scar that either hypertrophies or widens. This can be addressed by a scar revision, laser treatment, or triamcinolone acetonide (Kenalog) injection.

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1. Knotts CD, Kortesis BG, Hunstad JP. Avulsion brachioplasty: technique overview and 5-year experience. *Plast Reconstr Surg*. 2014 Feb; 133(2): 283-288.
2. Symbas JD, Losken A. An outcome analysis of brachioplasty techniques following massive weight loss. *Ann Plast Surg*. 2010 May; 64(5): 588-591.
3. Zomerlei TA, Neaman KC, Armstrong SD, et al. Brachioplasty outcomes: a review of a multipractice cohort. *Plast Reconstr Surg*. 2013 Apr; 131(4): 883-889.

178. An otherwise healthy 17-year-old nulliparous girl is evaluated because of significant breast asymmetry. She has noted an increase in the size of her left breast over the past 2 months. Current medication includes a combined oral contraceptive. The patient undergoes mammography and biopsy. Pathologic examination of excised tissue shows a benign phyllodes tumor. Which of the following is the most appropriate next step in management?

- A) Enucleation
- B) Mastectomy with sentinel lymph node biopsy
- C) Progestin-only oral contraceptive
- D) Tamoxifen followed by lumpectomy
- E) Wide local excision

The correct response is Option E.

The three most common causes for adolescent unilateral breast enlargement are giant fibroadenoma, phyllodes tumor (previously called cystosarcoma phyllodes), and juvenile breast hypertrophy. Differentiation between phyllodes tumor and giant fibroadenoma on core needle biopsy is difficult. Phyllodes tumors are fibroepithelial tumors and stromal derived. The stromal component can appear similar to a fibroadenoma, and this similarity can make the two difficult to distinguish; in some cases, the stromal component resembles a soft-tissue sarcoma. Core needle biopsy is performed for diagnosis, and phyllodes tumors typically have increased cellularity, mitosis, and stromal overgrowth when compared with fibroadenomas.

Phyllodes tumors of the breast represent approximately 3% of breast neoplasms. They are classified as benign, borderline, or malignant. Wide excision with 1-cm margins is recommended for all classifications. The extent of resection is determined by the grade, and the grade is associated with the risk of local recurrence.

Margin-negative, breast-conserving therapy is appropriate for benign phyllodes tumors. Malignant phyllodes tumors behave more similarly to sarcomas than to other types of breast cancer. Although there is controversy about the role of radiation therapy, this modality is less effective than surgery, and is reserved for margin-positive, malignant tumors. Chemotherapy is not indicated in this patient. The greatest risk with benign phyllodes tumors is local recurrence, and overall, the prognosis of these tumors is considered excellent.

The only known condition associated with the development of phyllodes tumors is Li-Fraumeni syndrome.

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2. Banikarim C, De Silva NK. Overview of breast disorders in children and adolescents. UpToDate Website. Available at: <http://www.uptodate.com/contents/overview-of-breast-disorders-in-children-and-adolescents>. Accessed March 5, 2014.
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179. A 19-year-old man with no available medical history presents for initial evaluation of gynecomastia. Which of the following is most appropriate to include in this patient's workup?

- A) Chest x-ray study
- B) Hand x-ray study
- C) Mammography
- D) Testicular examination

The correct response is Option D.

Gynecomastia can occur because of imbalances of estrogen and testosterone, and it can be associated with obesity, certain drugs, and Klinefelter syndrome. It can also be associated with testicular tumors. Therefore, a testicular examination should be performed. Mammography is not necessary for a routine workup if physical examination shows no abnormal masses. A chest x-ray study is not needed for an otherwise healthy 19-year-old. An x-ray study of the hand can evaluate closure of growth plates when determining if puberty has completed. This is unlikely to be necessary for someone who is 19 years old.

REFERENCES:

1. Rosen H, Webb ML, DiVasta AD, et al. Adolescent gynecomastia: not only an obesity issue. *Ann Plast Surg.* 2010 May;64(5):688-690.
2. Braunstein GD. Clinical practice. Gynecomastia. *N Engl J Med.* 2007 Sep 20;357(12):1229-1237.
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180. A 30-year-old man comes to the office because of symptoms of nasal airway obstruction. Physical examination shows a septal C-shaped deformity without dorsal deviation; Cottle maneuver is negative, and external nasal valves are competent. Which of the following is the most appropriate surgical management?

- A) Alar batten grafting
- B) Columellar strut grafting
- C) Septoplasty
- D) Spreader grafting
- E) Submucous septal resection

The correct response is Option E.

In the patient described, the most appropriate surgical management is submucous septal resection. The important structures that affect nasal airflow and lead to obstruction are the internal and external nasal valves, the inferior turbinates, and the nasal septum. According to the classifications of the deviated nose, the patient described exhibits caudal septal deviation, with a concave (C-shaped) deformity of the septum. This is the most likely cause of this patient's obstruction symptoms. In the absence of internal (negative Cottle maneuver) and external nasal valve collapse, resection of the deviated septum is the maneuver most likely to improve the patient's nasal airflow and alleviate obstruction symptoms. It is of the utmost importance to preserve 9 to 10 mm L-strut of septal cartilage to maintain structural integrity.

Alar batten grafts are placed in a pocket extending from the piriform aperture to a paramedian position in the alar sidewall. They prevent lateral nasal wall collapse and alar retraction during inspiration. They are also effective in providing strength and competency to the external nasal valves. The patient has competent external nasal valves, and thus, alar batten grafts alone will not address his nasal airway obstruction, which is caused by his deviated septum. Alar batten grafts are also used as an adjunct graft to correct a caudal septum deviation *after* septal resection.

Columellar strut graft is placed between the medial crura for nasal tip shaping and support. Open rhinoplasty approach may cause mild loss of tip projection caused by disruption of ligamentous support and increased skin undermining, and a columellar strut will help maintain tip support. It can be used to increase nasal tip projection

effectively. It does not play a role in alleviating airway obstruction caused by septal deviation.

Septoplasty is the scoring of the quadrangle cartilage to influence its shape, in an attempt to straighten it. The cartilage will bend away from the scored surface. It is an important adjunct to septal resection to shapen and straighten a deviated septum. It is likely not powerful or predictable enough to correct a septal C-shaped deformity on its own and alleviate nasal obstruction.

Spreader grafts are usually paired, longitudinal grafts placed between the dorsal septum and the upper lateral cartilages in a submucoperichondrial pocket. They are used to restore or maintain the internal nasal valve, straighten a deviated dorsal septum, improve the dorsal aesthetic lines, and reconstruct an open roof deformity. They are often placed in addition to septal resection. In the patient described, without internal nasal valve collapse and a deviated septum, spreader grafts alone will not likely improve nasal airway obstruction.

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181. A 16-year-old girl comes to the office with her parents because she would like reduction mammoplasty surgery. Height is 5 ft 1 in (155 cm) and weight is 160 lb (72.6 kg). She wears a size 36G brassiere and her breast size has remained the same for the past year. She has significant physical manifestations of macromastia. Her parents report that she does not want to go to work or school because she is embarrassed by the size of her breasts. Which of the following is the most appropriate management of this patient's condition?
- A) Defer reduction mammoplasty until the patient has lost at least 20 lb (9.1 kg)
 - B) Defer reduction mammoplasty until the patient is at least 22 years of age
 - C) Perform reduction mammoplasty
 - D) Refuse to perform surgery until the patient is evaluated by a psychiatrist

The correct response is Option C.

Breast hypertrophy can affect girls as young as 10 to 15 years old and can result in massive breast development that can have profound physical and psychological impact on the patient. Reduction mammoplasty is indicated for these patients, despite the risk of breast growth postoperatively, which may necessitate a secondary operation. As long as the patient has a mature attitude, understands the permanence of the scars involved, and has parents who are supportive of her decision, then surgery should not be delayed simply to wait until the patient reaches a certain age. The large breasts are already a major problem and further growth will compound the problem and make it difficult to manage later.

With the rise in childhood obesity, there has been an increase in the number of patients seeking adolescent reduction mammoplasty. The cause of macromastia in pubertal and parapubertal girls is variable and includes endocrine changes, childhood obesity, and juvenile (virginal) hypertrophy of the breast. Benefits of reduction mammoplasty include resolution of pain, improved quality of life, extroversion, and emotional stability.

Reduction mammoplasty has been clearly proven to decrease the physical manifestations associated with macromastia, regardless of height and weight, as well as provide psychosocial benefits and improve self-esteem, regardless of age of patient.

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182. The dominant vascular supply of the rectus abdominis muscle originates from which of the following vessels?

- A) Common femoral
- B) External iliac
- C) Internal iliac
- D) Internal mammary
- E) Superficial femoral

The correct response is Option B.

Component separation for closure of large abdominal wall defects was first described by Ramirez in 1990. The purpose of the surgery is to achieve abdominal wall closure with well-vascularized, innervated muscle flaps. The primary vascular supply to the rectus muscles are the deep inferior epigastric artery and vein, which arise from the external iliac vessels.

The internal mammary vessels give rise to the superior epigastric arteries and veins, which is a secondary, nondominant vascular supply of the rectus muscles. The femoral vessels give rise to the superficial inferior epigastric artery and vein, which perfuse the skin and subcutaneous fat of the inferior lateral abdomen.

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183. A 42-year-old woman with a 3-cm invasive ductal carcinoma of the right breast is evaluated for breast reconstruction. She has not decided how she wants to manage her contralateral breast. Regarding eliciting a family history, which of the following cancers is associated with a mutation in a breast cancer-susceptibility gene?

- A) Colon
- B) Esophageal
- C) Lung
- D) Pancreatic
- E) Thyroid

The correct response is Option D.

The breast cancer-susceptibility gene types 1 and 2 (*BRCA1* and *BRCA2*) are tumor suppressor genes. Mutations in *BRCA1* and *BRCA2* are associated with hereditary breast and ovarian cancers. Additionally, they can be associated with increased risks of pancreatic and prostate cancer. Thyroid, lung, esophageal, and colon cancer are not associated with increased risks of *BRCA1* and *BRCA2* mutations.

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184. A 65-year-old woman has inadequate tear secretion because of a poorly functioning lacrimal gland. Which of the following aspects of this patient's tear film is most likely to be affected?

- A) The amount of lipid in the tear film
- B) The amount of mucin in the tear film
- C) The antimicrobial property of the tear film
- D) The degree of evaporation of the tear film
- E) The dispersion of the tear film

The correct response is Option C.

Tears are a trilaminar fluid. The precorneal layer is formed by mucin-secreting goblet cells in the conjunctiva. This inner layer of the tear film covers the cornea and promotes the dispersion of the overlying aqueous layer. The meibomian glands produce the outer lipid layer. This oil layer helps to prevent the evaporation of the tear film.

The lacrimal gland secretes the middle layer. This aqueous layer is made of water and proteins. This layer promotes osmotic regulation and the control of infectious agents. As a result, dysfunction can result in dryness and an increase in infections.

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185. Reduction mammoplasty using which of the following pedicles has the greatest risk of altered nipple sensation?

- A) Inferior
- B) Inferocentral
- C) Lateral
- D) Superior
- E) Superomedial

The correct response is Option D.

Reduction mammoplasty with a superior pedicle that involves resection of the tissue at the base of the breast is associated with a higher risk of injury to the nerve branches that innervate the nipple-areolar complex. Innervation from the lateral cutaneous branches runs deep within the pectoral fascia before sharply turning in an anterior direction to innervate the nipple from its deep aspect.

The lateral pedicle, inferior pedicle, and inferocentral pedicle save the tissue containing the lateral cutaneous branches, decreasing the chance for injury to this nerve and reduced nipple sensation. The superomedial pedicle preserves the anterior cutaneous branches which run superficially from the medial aspect of the breast, and also provide sensation to the nipple. The superior pedicle resects both the medial and lateral innervations to the nipple.

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2. Schlenz I, Kuzbari R, Gruber H, et al. The sensitivity of the nipple-areola complex: an anatomic study. *Plast Reconstr Surg*. 2000 Mar;105(3):905-909.

186. A 36-year-old woman with Fitzpatrick Type II skin is evaluated because of melasma that is refractory to hydroquinone therapy. A biopsy is performed, and examination of the specimen confirms the diagnosis of mixed melasma extending to the upper reticular dermis. Administration of which of the following is most appropriate to treat this area?

- A) Glycolic acid 50 to 70%
- B) Jessner solution
- C) Salicylic acid 20 to 30%
- D) Tretinoin
- E) Trichloroacetic acid 35 to 50%

The correct response is Option E.

Chemical peeling causes controlled destruction of parts of the epidermis and/or dermis, followed by regeneration of new dermal and epidermal tissues. In a controlled manner, a chemical peel induces injury at a specific depth of the skin. Peels are categorized as superficial, medium depth, or deep, depending on the level of injury. Superficial peels cause necrosis of the epidermis only. Medium-depth peels create a wound through the epidermis into the level of the upper reticular dermis. Deep peels penetrate to the mid reticular dermis.

Salicylic acid 20 to 30% would cause injury to the stratum corneum and possibly the stratum granulosum with exfoliation. The depth is less than 100 μm , which is classified as superficial-very light. Both glycolic acid 50 to 70% and the Jessner solution penetrate to a depth of 100 μm , which is considered superficial-light. These agents cause necrosis of the entire epidermis down to the basal layer and stimulate regeneration of new epithelium. A medium-depth peel extends 200 μm , penetrates through the epidermis and papillary dermis to the upper reticular dermis, and results in increased collagen production. Trichloroacetic acid solution 35 to 50% would penetrate to medium-depth. A deep peel penetrates to deeper than 400 μm and causes necrosis to part or all of the mid reticular dermis.

Careful preprocedure evaluation is imperative in choosing the appropriate peel for each patient. Fitzpatrick skin type must be assessed to determine the risk of post-peel complications. If a patient has had a recent medium or deep peel within the past 3 months, facial surgery with extensive undermining or isotretinoin therapy within the past 6 months, or a history of keloid scarring, then care must be taken when

selecting medium-depth or deep peels because the risk of hyperpigmentation and/or permanent scarring is increased.

Patients with mixed and dermal melasma are often difficult to treat because of the deeper pigment. A test spot is helpful in determining the patient's tolerance for the peel when there is concern about the potential adverse effects.

Tretinoin 0.01% causes increased turnover of follicular epithelial cells and helps prevent collagen loss. It is not indicated for melasma.

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187. A 28-year-old woman desires augmentation mammoplasty with silicone implants. Physical examination shows tuberous breast deformity with an elevated inframammary crease. Sternal notch to nipple distance is 21 cm bilaterally. Nipple to inframammary crease distance is 3.5 cm bilaterally. Periareolar mastopexy with 350-mL silicone implants is planned. Which of the following operative plans will most effectively minimize the likelihood of a double-bubble deformity?

- A) Lower the inframammary crease by 3 cm
- B) Perform radial release of the lower pole breast fascia
- C) Place implants in subparenchymal pocket
- D) Reinforce the inframammary crease with acellular dermal matrix
- E) Use highly cohesive gel implants

The correct response is Option B.

The tuberous breast is a developmental deformity characterized by a constricted inframammary fold, short nipple to inframammary crease distance, and both horizontal and vertical deficiencies. The pathophysiology of the tuberous breast predisposes the patient to develop a double-bubble deformity. In this patient, the inframammary crease must be lowered to accommodate the implant and improve the vertical skin deficiency. Radial release of the lower pole breast fascia is done with either a cautery or a knife. Multiple radial incisions are made, thereby allowing the tight crease to expand and decrease the chance for a double-bubble deformity.

Lowering the crease is necessary but will increase the chances of a double-bubble deformity. Subparenchymal implant placement and use of highly cohesive gel implants may help but are not the essential procedures required. The use of acellular dermal matrix can help secure the position of the inframammary crease in a patient who develops a double-bubble deformity secondary to an inferior migration of the implant below the inframammary crease. This does not apply in the patient described.

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188. A 55-year-old woman with moderate sun damage to facial skin and facial wrinkles comes to the office for laser skin resurfacing. Which of the following is the most appropriate management regarding respiratory protection from the laser smoke plume?

- A) High-efficiency smoke evacuator placed 20 to 25 cm away from the site of the laser plume
- B) High-efficiency smoke evacuator placed within 1 to 2 cm of the smoke plume
- C) Standard surgical mask alone
- D) Standard wall suction
- E) No specialized equipment or protection is necessary

The correct response is Option B.

Along with ocular hazards and fire hazards, laser smoke plume is a significant occupational hazard, which is often ignored when lasers are used. There are numerous substances, some carcinogenic and mutagenic, released during laser pyrolysis of tissue. Viable skin bacteria, including coagulase-negative *Staphylococcus*, *Corynebacterium*, and *Neisseria*, have been recovered from the laser plume following laser skin resurfacing. In addition, intact viral DNA, particularly of human papillomavirus, has been isolated from carbon dioxide laser plume. Most surgical masks only filter particles that are 5 microns in diameter or larger; however, 77% of particles in the laser plume are 1 micron or smaller. Therefore, well-fitted high-filtration or laser masks should be used instead of standard surgical masks. A high-efficiency smoke evacuator should also be used, but it needs to be within 1 to 2 cm of the laser smoke plume source. The effectiveness of the smoke evacuator is decreased from 99 to 50% as the distance from the laser-treated site is increased from 1 to 2 cm, so 20 to 25 cm away is ineffective.

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189. A 37-year-old woman comes to the clinic to be evaluated for augmentation mammoplasty to improve her breast shape. She is gravida 3, para 3, and breast-fed all of her children. On examination, she has decreased superior pole volume, and the distance from nipple to sternal notch is 28 cm. The nipple-areola complex is below the inframammary fold by 4 cm and is at the lower contour of the breast. Which of the following Regnault classifications of ptosis best describes these findings?

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

The correct response is Option C.

The Regnault classification of breast ptosis is based on the relationship of the nipple to the inframammary fold (IMF) and to the lower contour of the gland.

Pseudoptosis is the not true ptosis. In this situation, the nipple is above the level of the IMF but the breast parenchyma has descended below the IMF.

Grade I is minor ptosis with the nipple at the level of the IMF and above the lower contour of the gland.

Grade II is moderate ptosis with the nipple below the level of the IMF and above the lower contour of the gland.

Grade III is major ptosis with the nipple below the level of the IMF and at the lower contour of the gland.

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190. A 35-year-old woman comes to the office for consultation regarding prophylactic mastectomy and breast reconstruction. The patient's mother and sister were diagnosed with bilateral breast cancer in their premenopausal years. Genetic testing for *BRCA* mutations is negative. Which of the following best estimates this patient's lifetime risk of breast cancer?

- A) 5%
- B) 13%
- C) 20%
- D) 45%
- E) 80%

The correct response is Option D.

The cumulative lifetime risk for a 35-year-old woman whose mother and sister had breast cancer is estimated to be approximately 15%. The risk may increase to as high as 45% if those cancers were premenopausal and bilateral. *BRCA* hereditary cancer is characterized by autosomal dominant genetics with multiple family members in each generation being affected. For patients with *BRCA1* mutation, the risk of breast cancer has been estimated to be between 50 and 80% by age 65 years. The risk of developing ovarian cancer has been estimated to be 10% by age 60 years.

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191. A 25-year-old woman undergoes rhinoplasty to correct a bulbous tip. After a cephalic trim leaving 6 mm of the lower lateral cartilage, transdomal sutures, and infracture, the tip continues to look bulbous. Which of the following techniques is most likely to improve this persistent deformity?

- A) Additional cephalic trimming
- B) Columellar strut grafting
- C) Lateral crural mattress suture
- D) Shield grafting
- E) Spreader grafting

The correct response is Option C.

The most likely cause for a persistent bulbous tip after traditional maneuvers is convexity of the lower lateral cartilages. Lateral crural mattress sutures are effective in improving this convexity. These sutures are placed spanning the convexity and then tightened to straighten the curvature. Another option would be an alar batten graft, which is a graft placed on the medial surface of the lower lateral cartilage. Additional cephalic trim could lead to weakening of the nasal tip support and would not correct the problem. Columellar strut grafting, shield grafting, and spreader grafting will not effectively improve a naturally convex lower lateral cartilage.

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192. A 66-year-old woman undergoes minimal-incision brachioplasty to treat bilateral upper extremity skin laxity. Height is 5 ft 6 in (167.6 cm) and weight is 140 lb (63.5 kg). BMI is 22.6 kg/m². Which of the following suturing techniques is most appropriate to minimize widening of the scar?

- A) Arm dermis to axillary dermis
- B) Arm dermis to axillary dermis to axillary fascia
- C) Arm dermis to axillary dermis to pectoralis major fascia
- D) Axillary dermis to lateral pectoralis major tendon
- E) Axillary dermis to superficial pectoralis minor fascia

The correct response is Option B.

The popularity of brachioplasty has significantly increased in America over the past decade, in large part because of the number of patients undergoing bariatric surgery for morbid obesity. In this population of patients who have undergone massive weight loss, the severity of excess upper extremity skin mandates a long, often hypertrophic scar in the bicipital groove, which is generally accepted by patients. By contrast, older patients with skin laxity but little lipodystrophy and no history of significant weight change are hard-pressed to accept this visible and often unpredictable scar. For this population, minimal-incision brachioplasty has emerged as an excellent solution and has itself been increasing in popularity over the past few years.

In minimal-incision brachioplasty, incisions are limited to the axilla. The procedure is usually combined with suction lipoplasty to remove some excess upper extremity fat, to treat dog ears at the proximal and distal extent of the scar, or to facilitate undermining. Several key maneuvers improve the appearance of the scar and are tantamount to achieving high patient satisfaction after this procedure.

The benefit of anchoring the superficial fascial system was first recognized by surgeons performing traditional brachioplasty procedures. A similar concept applies to minimal-incision brachioplasty, where anchoring of the arm and axillary dermis to the superficial fascia is seen to have several advantages. As part of a layered closure, this technique distributes tension in a more even and controlled manner, releasing the high tension on the final skin closure and decreasing the risk of a widened scar. Moreover, these sutures close the dead space within the axilla and recreate the axillary hollow.

Suturing the arm dermis to the axillary dermis without fascial reinforcement results in a high-tension closure and often a widened, hypertrophic scar. Suturing the skin to the deeper fascial layers would be difficult and deforming.

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193. A 62-year-old man is evaluated for an 8-month history of fullness of the right breast associated with a subareolar mass. He reports no history of pain, nipple discharge, skin changes, or systemic symptoms. There is no family history of breast cancer. Examination of a specimen obtained on biopsy shows ductal epithelial hyperplasia with proliferation of stroma and fibroblasts. Which of the following is the most likely diagnosis?

- A) Ductal carcinoma
- B) Epidermal cyst
- C) Fibroadenoma
- D) Gynecomastia
- E) Lymphangioma

The correct response is Option D.

Gynecomastia is defined as the benign proliferation of male glandular breast tissue. The most common symptom of gynecomastia is painless breast enlargement in adolescent and elderly men. Examination of a breast biopsy specimen may be necessary to exclude breast cancer if mammography and/or breast ultrasonography are suggestive of malignancy. Microscopic findings include ductal epithelial hyperplasia with proliferation of stroma and fibroblasts. Pseudogynecomastia is defined as breast enlargement secondary to fat deposition without glandular proliferation. Fibroadenoma are the most common benign tumor of the female breast. They are most often diagnosed in women between the ages of 20 and 35 years. Fibroadenomas are often ovoid or spherical, freely movable, and often well circumscribed. Microscopic findings include ductal tissue with proliferation of stroma surrounded by fibroblasts. Ductal carcinoma accounts for the majority of breast cancers. Ductal carcinoma is characterized microscopically by cords and nests of tumor cells with varying amounts of gland formation, and cytologic features that range from bland to highly malignant. Epidermal cysts are inclusion cysts lined by well-differentiated epidermis filled with keratin. Lymphangiomas of the breast are distended lymphatic channels interspersed with breast lobules.

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194. A 65-year-old woman desires correction of her “sleepy eyes.” Physical examination shows bilateral moderate involutional ptosis of the upper eyelids. Mild lateral displacement of the tarsal plate is noted. Repair of the levator aponeurosis using an anterior approach is planned. Which of the following best describes the proper vertical plane to position the lifting suture in a single-suture technique?

- A) Apex of the tarsal plate
- B) Lateral limbus
- C) Medial limbus
- D) Mid pupil
- E) Midline of central fat compartment

The correct response is Option D.

To achieve proper contour, the primary lifting suture should be placed on the vertical plane of the mid pupil. It is not uncommon for a patient with involutional ptosis to also have lateral displacement of the tarsal plate. If the central lifting suture is placed at the apex of the tarsal plate, the contour will be abnormally shifted laterally. The medial and lateral limbus position will also cause abnormal contour shifts. The midline of the central fat compartment has an inconsistent location in relation to the pupil.

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195. A French woman, who underwent placement of Poly Implant Prothèse (PIP) gel implants in 2009, comes to the office for consultation because she had heard that the implants were filled with a nonmedical grade silicone. She reports that she has not had any problems with the implants, but would like to know the implications of retaining the implants and whether she should have them removed. This patient should be told that she is at increased risk for which of the following complications if she retains the implants?

- A) Breast cancer
- B) Cytotoxicity
- C) Heavy metal poisoning
- D) Implant rupture
- E) Siloxane poisoning

The correct response is Option D.

The final report, in conjunction with the Department of Health in Australia, has shown a 2 to 6 times increased rupture rate in Poly Implant Prothèse (PIP) implants, which is detectable within 5 years of implantation. Increased levels of siloxane have been detected, but are not considered a health risk. No organic impurities have been detected and platinum levels are decreased in PIP gel compared with medical grade silicone. There is no increased breast cancer risk and no evidence of cytotoxicity. In the light of the increased rupture rate and the nonmedical grade nature of PIP silicone gel, the following recommendations were made:

- all providers of breast implant surgery should contact any women who have or may have PIP implants, if they have not already done so, and offer them a specialist consultation and any appropriate investigation to determine if the implants are still intact;
- if the original provider is unable or unwilling to do this, a woman should seek referral through her general practitioner to an appropriate specialist;
- if there is any sign of rupture, she should be offered an explantation;
- if the implants still appear to be intact, she should be offered the opportunity to discuss with her specialist the best way forward;
- if, in the light of this advice a woman decides with her specialist that, in her individual circumstances, she wishes to have her implants removed, her health care provider should support her in carrying out this surgery. Where

her original provider is unable or unwilling to help, the NHS will remove, but not normally replace, the implants;

- if a woman decides not to seek early explantation, she should be offered annual follow up in line with the advice issued by the specialty surgical associations in January 2012. Women who make this choice should be encouraged to consult their doctor if they notice any signs of tenderness or pain, or swollen lymph glands in or around their breasts or armpits, which may indicate a rupture. At the first signs of rupture, they should be offered removal of the implants.

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196. A 39-year-old woman with a history of fibrocystic breast lesions comes to the office for consultation. She has no family history of breast cancer. Results of routine mammograms have been negative; she has never undergone biopsy. Which of the following is the most appropriate recommendation for this patient regarding managing her risk of breast cancer?

- A) Continue to schedule routine mammograms
- B) Refer for mastectomy
- C) Schedule core needle biopsy
- D) Schedule fine-needle aspiration
- E) Schedule genetic testing

The correct response is Option A.

Studies have shown the fibrocystic changes alone in the breast are not directly linked to an increased risk of breast cancer, so there is no indication for fine-needle aspiration or core biopsy. Cancer risk increases in benign breast disease with increased proliferation and atypical hyperplasia. Even with no family history of breast cancer, it is recommended that the patient continue routine mammograms. Fibrocystic breast disease has not been linked in the literature to an increased risk of mutations of the *BRCA* genes; therefore, genetic testing is unnecessary.

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197. A 32-year-old Korean woman undergoes bilateral upper lid blepharoplasty for creation of a supratarsal crease. A partial incision technique is used. Which of the following is the most likely complication of this procedure?

- A) Asymmetry
- B) Epicanthal webbing
- C) Fold loss
- D) Lagophthalmos
- E) Suture extrusion

The correct response is Option A.

Blepharoplasty is the most common facial cosmetic procedure performed on people of Asian descent. Unlike blepharoplasty in Caucasian faces, the goal of Asian blepharoplasty is to create a supratarsal fold. Asian eyelids are characterized by several key elements including absent or low lid crease, shorter tarsus, descending pre-aponeurotic fat, and minimal or absent connection between the levator aponeurosis and the upper lid dermis. The mainstay of surgical correction is creation of a permanent fixation point between the levator muscle and the supratarsal dermis and subdermal structures.

The most common complication after Asian blepharoplasty is asymmetry. It is important to remember that unlike Caucasian blepharoplasty, the motivation for Asian blepharoplasty is less frequently rejuvenation. Rather, Asian patients are typically younger and desire creation of a supratarsal fold or correction of a preexisting fold asymmetry. Asymmetry is a common preoperative finding and should be well documented and discussed with the patient before surgery. Small differences in positioning of the newly created crease can be very obvious to both patient and surgeon. When recognized immediately after surgery, early revision should be considered.

Other complications unique to Asian blepharoplasty include fold loss, suture extrusion, and epicanthal scarring. Lagophthalmos, which most often results from overresection of upper eyelid skin, is less frequent in Asian blepharoplasty because skin excision is typically more limited, particularly in a younger patient undergoing a partial incision technique. Fold loss may result from a technical error in securing the layers of dermis, epidermis, or levator aponeurosis, or from placing too few sutures. Revisional surgery would be required to correct this problem. Suture

extrusion is not uncommon, given that permanent sutures are used for fixation. Meticulous placement of clear 7-0 nylon and trimming of suture ends will minimize the risk of this complication. If a suture becomes exposed in the first few months postoperatively, removal should be deferred until scarring is mature and fixation is more tenacious. Epicanthoplasty is commonly used in Asian patients with epicanthal folds undergoing blepharoplasty. Various techniques, including Y, W, and modified Z-plasties, have been reported. The epicanthal region is prone to hypertrophic scarring, particularly in Asians who have thick dermis.

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198. A 35-year-old woman comes to the office for consultation because she is dissatisfied with the appearance of her “deflated” and “saggy” breasts. Augmentation/mastopexy is planned. Compared with placement of the implant in the subglandular position, placement of the implant in the subpectoral space will preserve blood supply to the breast tissue and skin through which of the following arteries?

- A) Internal thoracic
- B) Lateral thoracic
- C) Superficial superior epigastric
- D) Thoracoacromial
- E) Thoracodorsal

The correct response is Option D.

The perfusion of the nipple-areola complex is a major concern during breast procedures involving periareolar and intraparenchymal incisions. The nipple-areola complex has a very rich and overlapping perfusion through multiple sources. This fact allows the design of various pedicles to carry the nipple and areola with different techniques. The blood supply through the internal thoracic vessels reaches the breast, nipple, and areola through the intercostal perforators, which may be divided during both subpectoral and subglandular implant placement.

The location of the implant deep or superficial to the pectoralis muscle will not change the perfusion through the superficial epigastric vessels. The same is true for the blood supply through the lateral thoracic vessels. However, the flow through the thoracoacromial vessels to the breast parenchyma will be preserved by placement of the implant deep to the pectoralis muscle. Creation of a subglandular pocket above the muscle will interrupt the collaterals from the thoracoacromial vessels through the muscle to the parenchyma.

The thoracodorsal artery is not a major source of blood supply to the breast and the position of the implant will not affect it.

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199. Which of the following is most effective in decreasing the risk of fire when using a carbon dioxide laser for facial resurfacing?

- A) Clamp the laser cord to surgical drapes
- B) Intubate laser patients to prevent oxygen accumulation on the field
- C) Provide supplemental oxygen with a nasopharyngeal cannula
- D) Use conscious sedation, nerve blocks, and no supplemental oxygen
- E) Use foot pedals only for activating the laser

The correct response is Option D.

Carbon dioxide laser treatments can cause operating room fires. Several papers have shown that a nasopharyngeal oxygen delivery can decrease oxygen levels in the operative field when it is required, but the best way to decrease the level of oxygen on the field is not to use it. Foot pedals can be accidentally activated and should be avoided. Clamping the laser cord can damage the fibers and ignite the laser fiber sheath. Laser skin surfacing can be accomplished without intubation.

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200. A 32-year-old woman is scheduled to undergo augmentation mammoplasty with highly cohesive, anatomically shaped, silicone-filled breast implants. She asks the surgeon about postoperative monitoring for implant rupture. This patient should be counseled that, according to FDA recommendations, postoperative monitoring for rupture most appropriately includes which of the following?

- A) Manual examination 3 years postoperatively, then annually thereafter
- B) MRI screening 2 years postoperatively, then every 3 years thereafter
- C) MRI screening 3 years postoperatively, then every 2 years thereafter
- D) Ultrasonography screening 2 years postoperatively, then every 3 years thereafter
- E) Ultrasonography screening 3 years postoperatively, then every 2 years thereafter

The correct response is Option C.

Diagnosis of rupture is difficult by physical examination alone, which is why the majority of ruptures are silent. Subsequent MRI screening for silent rupture is recommended initially 3 years postoperatively, then every 2 years thereafter.

Highly cohesive, anatomically shaped, silicone-filled breast implants combine the “gummy bear” silicone with an anatomical shape, in which inferior pole projection is higher than the superior pole projection. In studies of Allergan’s Natrelle 410 breast implants (the “Pivotal Study,” the 410 Swedish MRI study, and the 410 European MRI study) approximately 3 in 100 women had silent ruptures.

Cohesive gel is still subject to rupture, because rupture occurs when the shell fails. In cohesive implants, however, as opposed to noncohesive implants, the rupture rarely becomes extracapsular.

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Thank you for your participation.

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