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- Log in to the website.
- Select the “Start Exam” link and read and acknowledge the honor code statement.
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When your answers have been submitted successfully, you will be directed to an online survey about your examination experience. Your participation is critical to future planning so please answer all the questions.

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American Society of Plastic Surgeons In-Service Examination



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

Material released March 2021.

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for the

In-Service Examination



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Section 1: Comprehensive



1. A 69-year-old man presents to the office with a large (5 x 7-cm) melanoma involving his right cheek. A photograph is shown. After resection with clear margins, which of the following methods of reconstruction will provide the best aesthetic result?
- A) Cervicofacial flap
 - B) Immediate tissue expansion
 - C) Primary repair
 - D) Radial forearm free flap
 - E) Split-thickness skin graft

The correct response is Option A.

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Large defects of the cheek are best repaired with local skin when possible. Cervicofacial flaps can be used for moderate to large defects of the cheek with tension free repair (as shown in the photographs), which is vitally important to avoid eyelid-related complications, such as ectropion. Primary repair is useful for smaller cheek defects but would not be possible in this situation. A split-thickness skin graft would not provide optimal soft tissue match, and would undergo significant secondary contracture, resulting in eyelid malposition. They may be used in a temporary situation until definitive reconstruction. Full-thickness skin grafts may be an option; however, they tend to appear shiny and patch-like. Tissue expanders are useful in the head and neck, particularly in the scalp; however, in this particular case it is not advisable to use a tissue expander adjacent to an open wound. There is a significant risk of infection or extrusion. A radial forearm free flap could be an option if local tissue is not available, but would result in an unnecessarily long procedure with secondary donor site.

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2. A 35-year-old African American woman presents with multiple bilateral draining sinus tracts of the axillae and inguinal creases that first began after pregnancy two years prior. Topical and oral antibiotic therapy has failed to resolve the lesions. She has also required incision and drainage of cystic lesions within the areas of involvement during this time. She is reluctant to undergo surgical excision and inquires about approved agents. Which of the following medications is an FDA-approved treatment for this patient's condition?

A) Adalimumab (Humira)

B) Efalizumab (Raptivia)

C) Etanercept (Enbrel)

D) Rituximab (Truxima)

E) Vedolizumab (Entyvio)

The correct response is Option A.

The patient is presenting with hidradenitis suppurativa (HS) characterized as serial flares of inflammatory cutaneous eruptions of cystic lesions and draining sinus tracts. The locations of involvement coincide with the apocrine sweat glands, which are primarily located in the axillae, inguinal creases, and perianal cutaneous areas, as well as the breasts.

Tumor necrosis factor alpha (TNF- α) antagonism has been shown to inhibit HS by decreasing the number of flares and lesions over time. Specifically, adalimumab (Humira) has been studied in randomized controlled trials (PIONEER I and II) showing clinical response in a majority of patients and is FDA-approved for treatment of HS. Open-label extension trials have been performed showing an acceptable safety profile while decreasing disease burden for chronic treatment (3 years).

Etanercept (Enbrel), a TNF- α blocker, and vedolizumab (Entyvio), an integrin A4N7 antibody, have not been demonstrated to successfully treat HS, but have been used to treat Crohn's disease (both agents), psoriasis (etanercept), and rheumatoid arthritis (etanercept).

Rituximab (Rituxan) is a monoclonal antibody to CD20 and is used to treat rheumatoid arthritis. Efalizumab (Raptiva) is a monoclonal antibody to leukocyte function antigen-1 (LFA-1). Neither of these agents has been studied with regard to HS.

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Although monoclonal antibodies do not inhibit the entire immune system, there is an increased risk of infections as well as lymphomas during their use.

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3. A 28-year-old woman presents to the clinic 3 years after she sustained large, full-thickness burns to the anterior neck. She has undergone reconstruction with a fasciocutaneous free flap. She does not like the contracture and webbing along the margin of the reconstruction. Two contiguous 45-degree Z-plasties are planned over a total length of 10 cm. The expected increase in scar length is which of the following?
- A) 2.5 cm
 - B) 5.0 cm
 - C) 7.5 cm
 - D) 10.0 cm
 - E) 12.5 cm

The correct response is Option B.

A 45-degree Z-plasty is expected to lengthen the total scar by 50%. If each Z-plasty covers 5 cm of scar, then each Z-plasty will increase scar length by 2.5 cm, for a total increase of 5 cm. Theoretical gains in length for Z-plasty angles are as follows:

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

The Z-plasty was the first flap introduced using a mathematical approach to correct a skin defect or scar. A standard Z-plasty design uses three incisions of equal length and two angles of equal degree. The primary principle is to transfer lateral skin excess to lengthen and reorient tight scars or contractures. The central incision is oriented parallel to the long axis of the scar, or the scar may be incorporated as an excision acting as the central incision. The resultant triangular skin flaps are transposed with each other, resulting in a new central incision that is perpendicular to the original orientation.

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4. A 24-year-old female scuba diver presents with a 9-month history of swelling and painful flexion of the left hand. She finished a 2-week course of cephalexin, as well as a methylprednisolone dose pack, without improvement in her symptoms. Previous blood cultures tested negative. Complete blood count, rheumatoid factor, double-stranded antinuclear antibodies, uric acid level, and erythrocyte sedimentation rate are all within normal limits. MRI shows diffuse flexor synovitis. The patient is brought to the operating room for incision and drainage and biopsy. A synovial biopsy specimen is obtained and sent for culture. Aside from routine culture and sensitivity, a portion of the specimen should be sent for culture in which of the following types of media?
- A) Cary-Blair
 - B) Charcoal-yeast agar
 - C) Chocolate agar
 - D) Löwenstein-Jensen
 - E) MacConkey agar

The correct response is Option D.

This patient's clinical picture is concerning for *Mycobacterium marinum* infection. Therefore, a portion of the specimen should be sent for culture in Löwenstein-Jensen medium at 30°C (86°F). *Mycobacterium marinum* is an atypical mycobacterial species found in both fresh and saltwater. In part due to its low prevalence, the infection is often misdiagnosed and patients present after months of inappropriate treatment. Adding to the difficulty in diagnosis is the mishandling of culture specimens. Löwenstein-Jensen medium is specifically suited for the growth of tubercle bacilli species. Furthermore, *Mycobacterium marinum* specimens should be cultured at 30°C (86°F), which is a lower temperature than routine bacterial cultures. PCR assay is another effective test for diagnosis. Chocolate agar medium is often used for growth of pneumococcal, gonococcal, and meningococcal specimens. MacConkey agar is most commonly used for growth of *Enterobacter*. Cary-Blair medium is for transport of fecal specimens. Charcoal-yeast agar contains increased iron and cysteine to promote the growth of *Legionella pneumophila*. Partly because of the indolent disease course and delay in diagnosis, *Mycobacterium marinum* infections have been reported to result in carpal tunnel syndrome, diffuse synovitis, and septic arthritis.

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5. A 57-year-old woman presents to the emergency department with fever and erythema of the left chest wall 10 days after undergoing exchange of the tissue expander for a permanent silicone implant. She states that she recalls developing a rash after being treated with penicillin for strep throat as a child. Current temperature is 38.8°C (101.8°F). Based on the local microbiome, the first-line treatment in this case should be cefazolin. Which of the following is the likelihood of this patient developing a reaction to cefazolin?

A) 3%

B) 9%

C) 15%

D) 20%

E) 30%

The correct response is Option A.

Penicillin allergy is reported in up to 10% of patients. While older studies suggested reported a risk of reaction to cephalosporins in up to 8.1% of these patients, newer studies suggest this is an overestimation of the risk. On skin testing, fewer than 10% of patients with a reported history are confirmed to have a penicillin allergy. Among patients with a confirmed penicillin allergy, studies suggest that 97% will still tolerate cephalosporins. As such, the likelihood of a reaction in this case is likely to be approximately 3% because the patient did not have a confirmed penicillin allergy. Ideally, all patients who report a penicillin allergy should undergo allergy testing.

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6. A 45-year-old woman is referred to the lymphedema center for evaluation of bilateral lymphedema of the lower extremities. The edema has been present for at least 5 years. She is morbidly obese with a BMI of 58 kg/m^2 , has well-controlled diabetes, and no history of operations or trauma to the lower extremities. She has seen a lymphedema specialist for ongoing conservative management and continues to wrap and elevate her legs with reasonable compliance. Despite this, she feels that the increase in size, heaviness, and fatiguability of her legs inhibits her activity level. The patient has enlarged legs and a positive Stemmer sign. Bilateral lower extremity lymphoscintigraphy demonstrates delayed radiotracer transit to the groins with dermal backflow. Which of the following is the most appropriate initial surgical option for this patient?
- A) Bariatric surgery
 - B) Combined lymph node transfer and lymphovenous bypasses
 - C) Liposuction
 - D) Lymphovenous bypasses
 - E) Vascularized lymph node transfer

The correct response is Option A.

In the evolving area of surgical management of lymphedema, one difficult set of patients is the morbidly obese. In these patients, there is often a component of lymphedema in the bilateral lower extremities, abdominal pannus, or development of focal areas of massive localized lymphedema in the thighs or genitals. A positive Stemmer sign indicates an inability to pinch the base of the dorsum of the second toe. On the basis of her physical examination and lymphoscintigraphy results, this patient has lymphedema of her bilateral lower extremities. Development of lymphedema in the super morbidly obese can occur above a BMI of 50 kg/m^2 , and is likely above a BMI of 60 kg/m^2 . It has been found that the lymphedema may be reversible in up to 50% of these patients with weight loss to a point below a BMI of 50 kg/m^2 . If the patient has not been able to lose weight through nonsurgical interventions, the most appropriate next step is referral to a bariatric center for possible weight loss surgery. While the other options are all considerations for patients with lymphedema at various stages, the most appropriate initial treatment for this patient is weight loss surgery.

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7. A 45-year-old man undergoes excision of a sarcoma from the leg. The resulting wound is 6 x 5 cm in size. Wound closure is not performed so that the margin's status can be assessed with final pathology prior to definitive reconstruction. It is thought that the wound will have heavy drainage because of edema of the limb. Therefore, a dressing with good capacity to absorb exudate is desired. Which of the following is the most appropriate management for this wound?
- A) Foam dressing
 - B) Hydrocolloid dressing
 - C) Hydrofiber dressing
 - D) Hydrogel dressing

The correct response is Option C.

Many different kinds of wound care products are available, each with their own characteristics. The choice of dressing is dependent on the type of wound, product availability, and cost. Hydrofibers are highly absorbent dressings that are composed of hydroxymethyl cellulose fibers. On contact with water, they turn into a gel and thus maintain a moist wound environment. They can be left on the wound for several days, resulting in less frequent need for dressing changes. They are typically used for wounds with moderate-to-high exudate.

Hydrogels are cross-linked hydrophilic polymers with a high (90%) water content. They are available in the form of gels and sheets. They create a moist wound environment. Their highly aqueous nature makes dressing changes atraumatic. They do not absorb exudate. They are used for dry and minimally exudative wounds, like eschars and granulation tissue.

Hydrocolloids consist of cross-linked carboxymethyl cellulose, gelatin, and pectin. They absorb wound exudate and form a gel. However, their absorptive capacity is much less than that of hydrofibers. They are used for mild-to-moderately exudative wounds.

Foams are semi-occlusive dressings that have a porous open-cell architecture. They are usually composed of two layers: an inner hydrophilic absorbent contact layer and an outer hydrophobic protective layer. They maintain a moist wound environment and protect the wound from trauma. Their degree of absorption depends on the thickness of the foam layer. They are used for mild-to-moderately exudative wounds.

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8. An otherwise healthy, 40-year-old woman has a nasal deformity requiring reconstruction. A composite auricular graft is planned. Problems in which of the following anatomic areas of the nose will most likely benefit from this kind of reconstructive method?

- A) Dorsum
- B) Internal nasal valve
- C) Sidewall
- D) Tip
- E) Vestibular lining

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

The correct response is Option E.

The anatomic area of the nose where a composite auricular graft would most likely be used is in the vestibular lining. In the event of alar retraction secondary to vestibular lining shortage, composite grafts have proven to be very effective in providing cartilaginous support in addition to lining. Alar retraction is caused by a shortage of vestibular lining. This shortage may be intrinsic, but more often it is secondary to contraction from scarring or prior surgery. If the alar retraction is caused by a shortage of vestibular lining, replacement or recruitment of nasal lining is required for adequate correction. The auricular composite graft is one method of replacing vestibular lining while also providing cartilaginous support. Following harvest of a composite graft of conchal cartilage and skin, an incision is placed within the vestibule parallel to the alar rim in the area of deficiency. Dissection is carried out to release scarring and facilitate mobility for caudal repositioning of the alar rim. The composite graft is then placed as an intervening graft within the incision and sutured in place.

The other options are usually not areas where such grafts are used.

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9. An otherwise healthy, 32-year-old woman with a history of burns on 20% of the total body surface area of the left upper extremity and chest, returns 1 year after her injury for evaluation of a nonhealing wound over the dorsal elbow and limited range of motion at the joint. X-ray studies show soft-tissue lamellar calcification. Which of the following is the most likely diagnosis?
- A) Chronic osteomyelitis
 - B) Heterotopic ossification
 - C) Hypertrophic scar
 - D) Marjolin ulcer
 - E) Retained foreign body

The correct response is Option B.

The most likely diagnosis is heterotopic ossification (HO). An important complication of massive burn injury (greater than 20 % BSA) is heterotopic ossification, with the elbow region being the most common site of occurrence. This may result in wound issues, stiffness, and nerve injury. HO can occur in 0.2 to 4 % of cases. Prevention of this condition includes radiation therapy and nonsteroidal anti-inflammatory drugs. Surgical excision is the procedure of choice for restoration of range of motion.

Hypertrophic scars present as raised thickened scars following burn injury but do not show ossification within the scar. The most common scenario for development of a Marjolin's ulcer is malignant degeneration of a previous scar, usually squamous cell carcinoma. The latency period for development of this type of malignancy is usually 10 years after the original injury at the earliest. Chronic osteomyelitis would show radiolucency and changes within the bone not the soft tissue. The x-ray finding is not consistent with a retained foreign body.

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10. A 40-year-old transgender woman (assigned male at birth) undergoes penile inversion vaginoplasty for treatment of gender dysphoria. She hopes to gain the ability for penetrative intercourse following surgery. She was counseled on the risks of surgery to include urethral injury, rectal injury, and fistula formation. Which of the following is the most appropriate plane in which to dissect the neovaginal cavity so that those risks may be minimized while obtaining adequate depth for penetrative intercourse?
- A) Anterior rectal fascia
 - B) Prostatic capsule
 - C) Rectoprostatic fascia (Denonvilliers' fascia)
 - D) Rectosacral fascia (Waldeyer's fascia)
 - E) Superficial perineal fascia (Colles' fascia)

The correct response is Option C.

The most appropriate plane in which to dissect the neovaginal cavity in gender affirming vaginoplasty is within Denonvilliers' fascia, also known as the rectoprostatic fascia. This is a relatively avascular plane that separates the rectum and prostate until reaching the peritoneal fold, when performing the dissection perineally. Once the peritoneal fold is reached, a neovaginal cavity with depth compatible with penetrative intercourse is created.

Dissecting along the prostatic capsule may inadvertently lead toward the prostatic urethra. Injury to the urethra at this level may result in a urethrovaginal fistula and urinary incontinence.

Colles' fascia is a superficial perineal plane that is continuous with Scarpa's fascia of the inferior abdomen. Dissection along this plane is necessary initially until the central tendon and perineal body is opened to enter Denonvilliers' fascia. Dissecting through Colles' fascia alone and not through Denonvilliers' fascia will avoid urethral and rectal injury, but will not permit penetrative intercourse in such a short neovaginal cavity.

Dissection along the rectal fascia will expose the longitudinal muscle fibers of the rectum. Not only does this increase the risk of sharp rectal injury during dissection, it will also increase the risk of pressure injury to the rectum when stenting the neovaginal cavity lining

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and in case of a hematoma. This is not the recommended plane for neovaginal cavity dissection.

Waldeyer's fascia, also known as the rectosacral fascia, is a presacral fascia along the posterior aspect of the rectum. This is not an anatomic position to create a neovaginal cavity, and therefore is not the recommended plane for dissection.

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11. When compared with liberal fluid administration for pressure support, vasopressors have which of the following effects on the overall success of deep inferior epigastric artery perforator (DIEP) flap breast reconstruction?

- A) Delay in postoperative patient mobilization
- B) Increase in the risk of total or partial flap loss
- C) Increase in the risk of venous congestion
- D) No difference in the rate of pedicle thrombosis

The correct response is Option D.

Traditionally, the use of vasopressors in free flap surgery has been avoided due to the presumed risk of pedicle vasospasm leading to flap failure. However, recent studies have indicated that this assumption may not be accurate. Additionally, the fear of vasopressor-associated flap complications has led to the practice of liberal fluid administration, which has failed to demonstrate any benefits when compared with a fluid-restrictive vasopressor strategy. Multiple prospective interventional trials and meta-analyses have reported that the use of vasopressors results in no detectable negative impact on flap survival or overall patient outcome. Specifically, intraoperative use of phenylephrine, ephedrine, or calcium chloride as an intravenous bolus does not increase in the risk of total or partial flap loss, delay postoperative patient mobilization or increase the risk of venous congestion. The use of vasopressors in free flap surgery is not contraindicated.

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12. A 52-year-old man is admitted to the intensive care unit (ICU) for monitoring after debridement and anterolateral thigh free flap coverage of a traumatic lower extremity wound. He has a history of smoking and type 2 diabetes mellitus. Which of the following methods of free flap monitoring is associated with the highest salvage rate following microvascular compromise?

- A) Clinical examination
- B) Fluorescent angiography
- C) Hand-held Doppler
- D) Hyperspectral imaging
- E) Near-infrared spectroscopy

The correct response is Option E.

Near-infrared spectroscopy has been shown to detect vascular compromise before it becomes clinically obvious, which likely explains the improved salvage rates seen in studies comparing it with clinical monitoring alone. Implantable Doppler probes have also been shown to result in improved salvage rates when compared with clinical monitoring, but they do have a higher false-positive rate. Hand-held Doppler is part of clinical examination and as such does not itself offer an advantage. Hyperspectral cameras image deoxygenated hemoglobin have shown some promise in preclinical studies, but strong clinical data are lacking. Fluorescent angiography, commonly using indocyanine green, may be useful to predict areas of ischemic compromise during surgery, but this technology has not been established as a method for monitoring free flaps postoperatively.

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13. A 59-year-old right-hand–dominant woman with type 2 diabetes and coronary artery disease undergoes a radial forearm adipofascial perforator flap for palmar contracture release and resurfacing to treat a severely contracted burn scar. Which of the following characteristics is a benefit of this flap choice?

- A) It can be designed as a myofascial flap
- B) It has a distal pivot point at the radial styloid
- C) It has robust, 1.5- to 2-mm perforators
- D) It is a reliably thin, pliable flap
- E) It is a sensate flap

The correct response is Option D.

The radial forearm adipofascial perforator flap is a reliably thin, pliable flap. As such, the flap is a good option for reconstruction of the distal upper extremity when a thin flap is desired, such as for palmar/dorsal hand coverage, revision carpal tunnel/median nerve surgery, and radioulnar synostosis surgery. Other advantages of this flap include avoiding the need to sacrifice the radial artery, shorter operative time compared with free tissue transfer, and low donor morbidity. The vascular supply to the flap is a series of roughly 10 small 0.3- to 0.9-mm septocutaneous radial artery perforators found in the septum between the flexor carpi radialis and the brachioradialis tendons. The most distal perforator arises approximately 1.5 cm proximal to the radial styloid. Therefore, the pivot point for this flap is safely 4 cm proximal to the radial styloid. Since the flap is supplied by the adipofascial perforating vessels superficial to the radial artery, the inclusion of muscle in the flap design is not reliable. During flap elevation, the superficial radial nerve and lateral antebrachial cutaneous nerves are identified and preserved, but are not included into the flap.

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14. A 38-year-old woman, gravida 2, para 2, presents with abdominal laxity and rectus diastasis. An abdominoplasty is planned, utilizing a transversus abdominis plane block for pain control. Which of the following dermatomes will demonstrate the densest level of anesthesia?

- A) L2
- B) L5
- C) T3
- D) T6
- E) T10

The correct response is Option E.

The transversus abdominis plane (TAP) block is a regional anesthetic that blocks sensory afferent nerve fibers that supply the anterior/lateral abdominal wall dermatomes of T7 to L1. The T10 dermatome innervates the abdominal wall at the level of the umbilicus and would demonstrate the highest level of anesthesia out of the dermatome levels listed above. The sensory nerves travel below the internal oblique muscle in the plane above the transversus abdominis muscle. Traditionally, the technique is performed blindly by placing a needle through the triangle of Petit posteriorly until the needle reaches the TAP. Once in the appropriate plane, 20 mL of a long-acting local anesthetic, such as bupivacaine, are injected. More recent modifications include the use of ultrasound guidance to optimize precise placement and the use of diluted long-acting multivesicular liposomal bupivacaine (Exparel). Several studies have demonstrated the benefits of a TAP block during abdominal surgery. These benefits include decreased pain, opioid use, and nausea/vomiting, as well as faster return of bowel function. Complications include potential systemic toxicity due to dose of anesthetic delivered/inadvertent intravascular injection and intraperitoneal injection with possible injury to intra-abdominal organs such as the liver or spleen.

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15. A 25-year-old man presents to the clinic because of a 5-year history of excessive bilateral sweating in the axillae. He states that he uses antiperspirant daily, but despite this, he sweats through his shirts multiple times per day. He finds it embarrassing and distracting at his work. Injection of botulinum toxin type A into each axilla is planned. Which of the following is the most appropriate dosage (per side) of the toxin for this therapy?
- A) 15 units
 - B) 25 units
 - C) 50 units
 - D) 100 units
 - E) 150 units

The correct response is Option C.

The patient presents with primary hyperhidrosis. His complaints suggest that he is a 3 or 4 out of 4 on the hyperhidrosis disease severity scale. He has fulfilled criteria for treatment in demonstrating two of the following: duration greater than 6 months, frequency greater than once weekly, bilateral symmetrical sweating, onset before the age of 25, positive family history, and cessation while sleeping. Additionally, he has failed antiperspirant therapy for at least 6 months, as a result, intervention is indicated at this time. The appropriate dosing for axillary botulinum toxin type A is 50 units per side. Palmar injections use 100 units and plantar injections 150 to 250 units per side. Treatment for axillary hyperhidrosis has been shown to have good improvement, with 90% of patients having relief for at least 3 months.

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16. A 75-year-old man with dilated cardiomyopathy is seen in the intensive care unit (ICU). He was initially admitted for sepsis 6 weeks prior and has remained in the ICU throughout his course. The primary team noticed anorexia, weakness, a diffuse nonpruritic perifollicular rash, and poor wound healing of minor scrapes and bruises. Ascorbic acid (vitamin C) level is 5 $\mu\text{mol/L}$ (N 45 to 90 $\mu\text{mol/L}$). This ascorbic acid level is most likely to impair the properties of lysyl oxidase and which of the following events in the wound-healing cascade?

- A) Collagen cross-linking
- B) Collagen degradation
- C) Collagen protein translation
- D) Procollagen cleavage
- E) Procollagen trafficking

The correct response is Option A.

Wound healing is a dynamic process and is dependent on numerous enzymes to catalyze the formation of new collagen fibrils. Lysyl oxidase is a particularly important enzyme in the wound healing cascade and is required for collagen cross-linking. Procollagen C- and N-proteinases cleave carboxyl- and amino-terminal propeptides of procollagens. It remains unclear which enzymes are involved in procollagen trafficking, but this action is thought to be mediated by COP-I and COP-II transport complexes. Collagen protein translation proceeds via standard ribosomes and degradation is mediated by collagenase.

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17. A 65-year-old man with a spinal cord injury and a chronic ischial pressure sore undergoes preoperative optimization with pressure offloading and nutritional supplementation. Medical history includes type 2 diabetes mellitus and chronic ischial osteomyelitis. The patient undergoes thorough debridement of the ulcer and myocutaneous flap reconstruction with appropriate intravenous antibiotic therapy. Four months after surgery, he presents to the clinic with a new wound in the same region as the previous reconstruction. Which of the following factors most likely led to the recurrence of the ischial pressure wound?

- A) Hemoglobin A_{1c} greater than 6%
- B) Osteomyelitis
- C) Patient age
- D) Prealbumin less than 20 mg/dL

The correct response is Option A.

The presence of poor glycemic control, as indicated by a Hemoglobin A_{1c} greater than 6%, is a predictor of recurrence of pressure ulcers. Age less than 45 years old at the time of surgery is a predictor of recurrence. Older age at the time of surgery appears to be protective against recurrence. The presence of osteomyelitis at the time of surgery does not appear to contribute to disease recurrence. A low prealbumin (less than 20 mg/dL) does not appear to contribute to recurrence when evaluated on multivariate models. Poor glycemic control contributes to disease recurrence as well as early return to the operating room for wound dehiscence.

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18. A 25-year-old woman who is at 16 weeks' gestation has an elevated serum alpha-fetoprotein level. Follow-up ultrasound shows spina bifida with myelomeningocele. Which of the following is the most appropriate next step in management?

- A) Gadolinium-enhanced MRI to further delineate abnormalities
- B) Prenatal repair in the late third trimester
- C) Repair at 1 week of age
- D) Repair at 3 months of age
- E) Repair within 48 hours of delivery

The correct response is Option E.

Postnatal repair of myelomeningocele is performed within the first 48 hours of life. Later repair is associated with worse outcomes.

Myelomeningocele is a protrusion of the meninges and spinal cord via a defect in the caudal neural tube. The higher the level of the defect, the more severe the associated abnormalities, such as bowel and bladder dysfunction, lower limb sensory and motor abnormalities, and structural abnormalities (eg, club feet). Central nervous system problems include hindbrain herniation (Chiari II malformation), tethered cord and hydrocephalus. MRI can be performed to further delineate fetal central nervous system abnormalities. Gadolinium is not given in pregnancy as it is associated with fetal morbidity and mortality.

The neurologic abnormalities caused by myelomeningocele are described by the “two-hit” hypothesis. The failure of the neural tube to close (first hit) results in exposure of the neural elements to amniotic fluid (second hit). Prenatal closure is thought to improve neurologic outcomes by decreasing the duration of exposure of neural elements to amniotic fluid. The management of myelomeningocele study (MOMS) is the only randomized-controlled trial that evaluated the outcomes of fetal surgery for myelomeningocele. The trial was stopped early because of improved outcomes in the prenatal correction group. The biggest difference was in the incidence of shunt-dependent hydrocephalus, which was 82% in the postnatal group and 40% in the prenatal group. The prenatal group also had better outcomes for mental development and motor function. However, there was a higher incidence of preterm labor and uterine dehiscence at delivery in the prenatal surgery group. Prenatal repair is performed between 19 and 27 weeks' gestation.

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Cesarean delivery is the preferred method of delivery for fetuses with myelomeningocele at many centers. This is performed when the fetus reaches term (i.e., 37 weeks' gestation). Cesarean delivery avoids trauma to the neural tube, maintains an aseptic environment, and allows elective scheduling of meningomyelocele surgical correction.

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19. A 43-year-old woman presents to the clinic for evaluation and treatment of excess subcutaneous tissue in the lower abdomen following cryolipolysis treatments 6 months ago in this area. The area is nontender, soft, mobile, and not discrete. Which of the following is the most appropriate recommendation for this patient?

- A) Liposuction
- B) Massage
- C) Repeat cryolipolysis
- D) Steroid injection

The correct response is Option A.

This patient has paradoxical adipose hyperplasia (PAH) which is a rare side effect of cryolipolysis. This rare complication usually presents several months after the initial therapy, and the incidence is less than 1%. Treatment of larger areas of PAH usually involves waiting 6 to 9 months for soft tissue to soften and then performing liposuction and/or abdominoplasty to remove the affected area.

While massage following cryolipolysis is commonly described to improve efficacy, there are no data to support massage for PAH.

There are no data to suggest injection of steroids has any effect on PAH.

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20. A 54-year-old man presents for elective repair of a large, recurrent ventral hernia. Plastic surgery is consulted because of the loss of abdominal domain. Posterior component separation with placement of biologic mesh is planned. Above the level of the arcuate line, which of the following structures come together to form the posterior rectus sheath?
- A) External oblique aponeurosis and internal oblique aponeurosis
 - B) External oblique aponeurosis, internal oblique aponeurosis, and transversus abdominis aponeurosis
 - C) Internal oblique aponeurosis and transversus abdominis aponeurosis
 - D) Transversalis fascia and peritoneum

The correct response is Option C.

A comprehensive understanding of the anatomy of the anterior abdominal wall is critical when performing posterior component separation. Above the arcuate line, the anterior rectus sheath is derived from the external oblique aponeurosis and the anterior component of the internal oblique aponeurosis. The posterior rectus sheath is derived from the posterior component of the internal oblique aponeurosis and the aponeurosis of the transversus abdominis muscle. The rectus abdominis muscle sits between the anterior and posterior rectus sheaths superior to the arcuate line. Below the arcuate line, the anterior rectus sheath is derived from the aponeuroses of all three muscles: the external oblique, the internal oblique, and the transversus abdominis muscles. The posterior rectus sheath does not exist below the arcuate line. The rectus muscle is only separated from the abdominal viscera by the transversalis fascia and the peritoneum.

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21. A 53-year-old man presents with the lower eyelid skin lesions shown in the photograph. The lesions have been slowly growing over the past 12 months. Which of the following treatment options is the most appropriate?
- A) Excision of the mass and overlying skin
 - B) Excision with 1-mm tissue margins
 - C) Excision with 2-mm tissue margins
 - D) Excision with 4-mm tissue margins and sentinel lymph node biopsy
 - E) Mohs micrographic surgery

The correct response is Option A.

The patient presents with xanthelasmata, which are localized accumulation of lipid deposits on the eyelids. Multiple treatment modalities are available, including chemical peels, cryotherapy, and laser ablation. Traditionally, surgical excision has been used and yields excellent cosmetic outcomes. As the lesions are benign, there is no indication for Mohs micrographic surgery and no margins are required.

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22. A 17-year-old transgender man (birth-assigned female) seeks female-to-male (FtM) transgender top surgery. The patient has been receiving testosterone therapy for one year through a pediatric endocrinologist. Patient, legal guardians, medical physician, and care team agree that bilateral mastectomy is indicated. Psychological evaluation for appropriateness for surgical consultation is pending. Which of the following statements correctly describes the patient's ability to consent for FtM top surgery as a minor?
- A) A favorable psychologic evaluation alone can establish the appropriateness of a minor for top surgery
 - B) A minor can consent for surgery without co-signature by another guardian or legal entity
 - C) As a minor, the patient does not require psychologic evaluation before proceeding with surgical consultation
 - D) The consensus agreement of the care team, psychologist, guardian, and patient is sufficient to consider a minor a candidate for top surgery
 - E) The patient is a minor and should not have transgender surgery

The correct response is Option D.

The patient is a minor who presents for consideration of female-to-male (FtM) top surgery. The World Professional Association for Transgender Health (WPATH) describes the criteria for documenting persistent gender dysphoria. A multi-disciplinary team including psychologists, endocrinologists, primary medical physicians, and plastic surgeons are critical to this process.

All patients considering transgender surgery require a psychologic evaluation to determine the appropriateness for surgical consultation whether they are a minor or adult. For minors considering top surgery, it is imperative that the patient, care team, psychologists, and guardians together believe that the delay of top surgery would cause harm. With this criterion satisfied, the addition of the suggested one year of testosterone treatment would further qualify this patient for candidacy for top surgery as a minor. A psychologist alone cannot establish the appropriateness of a patient to undergo a specific operation but can establish that a patient is ready for surgical consultation.

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Breast binders are used by a proportion of FtM patients to conceal their breasts. While this practice can improve social confidence, breast binding stretches the upper pole skin, creating more ptosis and worsening elasticity of the breast.

After confirmation of breast health, mastectomies and skin recontouring are performed for top surgery. Subsequent breast hypertrophy is not a concern as the entire breast gland is removed so surgical intervention, if deemed appropriate, does not need to be delayed until breast hypertrophy is complete.

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23. A 20-year-old woman presents for repair of a significant degloving injury to her dominant right thumb. During the soft-tissue repair, a 4-cm defect is noted in the radial proper digital nerve. Which of the following is the most appropriate technique for nerve repair?

- A) Autologous nerve graft
- B) Autologous vein graft
- C) Collagen conduit
- D) Nerve transposition

The correct response is Option A.

For nerve gaps 3 cm or longer that are not amenable to repair, peripheral nerve grafts are the most reliable choice. Proper microsurgical nerve repair requires meticulous, atraumatic technique with appropriate magnification, instrumentation, and sutures. Primary repair is recommended when a tension-free anastomosis is possible. In this case, primary repair is not possible, even with nerve mobilization or transposition. Use of these autologous grafts is limited by donor site supply and morbidity, loss of sensation, and possible neuroma formation.

Various nerve conduits such as silicone tubes, biologic tubes such as vein grafts, and biodegradable conduits such as collagen or polyglycolic acid are limited to small diameter nerves with shorter nerve gaps (2 to 3 cm). There appears to be no significant regeneration beyond 3 cm. Nerve transpositions are not performed for digital nerve repair.

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24. A 38-year-old electrician suffers an electrical burn to the right hand. Which of the following types of tissue has the lowest inherent resistance?

- A) Bone
- B) Fat
- C) Muscle
- D) Skin
- E) Tendon

The correct response is Option C.

The tissue with the least resistance from the choices provided is muscle. The amount of electrical current that is conducted through tissue is proportional to the voltage and inversely proportional to the tissue's resistance, as is dictated by Ohm's Law, $V=IR$. Therefore, more current will flow through tissue with lower resistance, given all other variables being equal. Other variables that effect current flow include tissue volume and the amount of moisture. The body tissue with the highest inherent resistance is cortical bone, followed by cancellous bone, fat, tendon, skin, muscle, vessel, then nerve. So, in the setting of a high-voltage electrical burn, it is not uncommon to have more underlying structural and organ damage than the visible soft tissue damage may indicate. An EKG, cardiac monitoring, CBC, cardiac enzymes, and urinalysis for myoglobin may, therefore, be necessary for workup.

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25. A 16-year-old boy presents with an unrepaired alveolar cleft. Because he is an athlete, he refuses iliac crest bone grafting. To reduce donor morbidity, a decision is made to proceed with repair using bone morphogenetic protein-2 (BMP-2) in an absorbable collagen sponge carrier. Compared with autologous bone grafting, repair with BMP-2 is more likely to place the patient at increased risk for which of the following postoperative complications?

- A) Heterotopic ossification
- B) Infection
- C) Malignant transformation
- D) Mucosal atrophy
- E) Severe edema

The correct response is Option E.

Bone morphogenetic protein-2 (BMP-2) works via osteoinduction to stimulate osteoprogenitor cells to differentiate into osteoblasts that begin new bone formation. Randomized controlled trials comparing BMP-2 to bone graft controls in alveolar cleft reconstruction have shown variable results, with most showing equivalence. An analysis of 17 randomized controlled trials of BMP-2 showed that severe prolonged edema was the most common complication, in some cases requiring steroid treatment or reoperation or leading to wound dehiscence. The use of recombinant human bone morphogenetic protein-2 (rhBMP-2) in patients younger than 18 years of age remains off-label.

Concerns have been raised about a potential increase in malignancy, infection, and heterotopic ossification (HO) with the use of BMP-2 in spinal surgery. However, in these randomized controlled trials, HO and malignant transformation were not observed and rates of infection were no different. There is no difference in the rate of mucosal atrophy between these techniques.

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26. An otherwise healthy, 45-year-old woman presents for breast reconstruction. She underwent a mastectomy 1 year ago with no immediate reconstruction followed by post-mastectomy radiation therapy. She does not want anything performed to the contralateral breast and does not want to have an implant. She has a history of an abdominoplasty. The plastic surgeon plans to perform stacked profunda artery perforator flaps for the unilateral reconstruction. Which of the following is the most appropriate option for the recipient vessels?

- A) Ipsilateral and contralateral antegrade internal mammary vessels
- B) Ipsilateral antegrade and retrograde internal mammary vessels
- C) Ipsilateral antegrade and retrograde thoracodorsal vessels
- D) Ipsilateral antegrade internal mammary and thoracoacromial vessels
- E) Ipsilateral antegrade thoracodorsal and thoracoacromial vessels

The correct response is Option B.

It has been demonstrated that the retrograde intermammary vessels are a viable and reliable choice for stacked flap reconstruction. The benefit of using these as the recipient vessels is that it does not add another recipient site to the operation.

Ipsilateral and contralateral antegrade internal mammary vessels are incorrect because the patient does not want to have any procedures performed on her contralateral breast, although this has been described as an option for autologous breast reconstruction.

The thoracodorsal vessels, prior to development of the internal mammary vessels as the preferred option for autologous breast reconstruction, were commonly used for recipients, but utilizing these can negate the option of a latissimus dorsi as a salvage procedure in the setting of flap failure, especially if the plastic surgeon were to use the antegrade and retrograde vessels. Ipsilateral antegrade internal mammary and thoracodorsal vessels would be correct as well, but it was not given as an option. Thoracoacromial vessels are not typically used in autologous breast reconstruction, aside from being a lifeboat for venous outflow.

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27. A 20-year-old man undergoes decompressive craniectomy after a traumatic brain injury. He is now recovered from the injury. The soft tissue overlying the cranial defect is healthy and there is no communication with the paranasal sinuses. Cranioplasty with an alloplastic material is planned. A material with good osteoconductive properties is desired. Which of the following is the most appropriate choice?
- A) Hydroxyapatite
 - B) Polyetheretherketone
 - C) Polymethylmethacrylate
 - D) Porous polyethylene
 - E) Titanium

The correct response is Option A.

The ideal material for cranioplasty is biocompatible, radiolucent, heat resistant, inexpensive, and has low risk for infection and extrusion. A healthy and well-perfused soft-tissue envelope is a prerequisite for alloplastic cranioplasty. Moreover, alloplasts in contact with sinuses have a high risk for infection.

Hydroxyapatite (HA) is a calcium phosphate compound with chemical structure similar to that of bone. Of the current alloplastic materials used for cranioplasty, it has the highest capacity for osteoconduction. It is available as a powder that is mixed with liquid to turn it into a malleable form that can be molded to the shape of the defect. Custom made HA ceramic implants can also be produced based on specifications of the defect. The major disadvantage of this material is that it is brittle and may fracture when stressed. It is sometimes used with a titanium mesh underlay to provide more structural stability.

Polymethylmethacrylate (PMMA) is a polymerized ester of acrylic acid. It is the most commonly used alloplastic material for cranioplasty. It is prepared in the operating room via an exothermic reaction; therefore, care has to be taken to protect the dura from thermal injury. Custom implants can also be produced. It can be easily contoured to the shape of the defect and has good mechanical strength. It does not have osteoconductive properties.

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Porous polyethylene (PPE) is composed of high-density polyethylene microspheres with an interconnected porous structure. This allows tissue ingrowth in the implant. PPE is radiolucent and has been found to have an excellent safety profile. It does not have osteoconductive properties.

Polyetheretherketone (PEEK) is a semi-crystalline organic thermoplastic polymer. It is lightweight, strong, radiolucent, and heat resistant. Because of these properties, it is becoming a popular material for cranioplasty as a customized implant. It does not have osteoconductive properties.

Titanium is used as an alloy with aluminum and vanadium. It is biocompatible, non-corrosive, radiopaque, and heat resistant. Titanium mesh can be cut to the shape of the defect. It can also be used as a customized implant. The major advantages are its strength, ease of use, and low infection rate. The major disadvantage is its cost. It does not have osteoconductive properties.

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28. A 45-year-old woman with a history of systemic lupus erythematosus requires a free flap reconstruction of her right lower extremity. She has never had a thrombotic event. She is on corticosteroids for collagen vascular disease. Which of the following perioperative measures is most appropriate ?

- A) Intraoperative and postoperative anticoagulation
- B) Intraoperative anticoagulation alone
- C) Preoperative and postoperative aspirin therapy
- D) Preoperative hypercoagulability workup
- E) Preoperative vitamin A therapy

The correct response is Option D.

The most appropriate management would be to get a formal hematology consult and anticoagulation workup prior to surgery. Collagen vascular diseases target connective tissues and have multiorgan manifestations secondary to deposition of antigen-antibody complexes. Affected patients are intrinsically prone to thrombosis from the inflammation of the connective tissue disorder itself and the synergistic effect of having increased chances of having concurrent hypercoagulability risk factors such as anticardiolipin or lupus anticoagulant.

Therefore, in this patient population with the threat of vascular compromise, it is most prudent to perform preoperative hematologic evaluation, especially if they exhibit a history of previous clotting and flap failure. As a more prudent measure, all of these patients should have a detailed hypercoagulability evaluation, including a detailed history and hematology consultation with a laboratory panel looking for hypercoagulability factors. If positive, steps should be taken perioperatively to decrease the risk of thrombotic complications, and chemical anticoagulation should be considered, but if negative with no history of previous thrombotic complications, then no added chemical anticoagulation is needed. Studies have not shown an increase in thrombotic flap failures in such patients, despite their intrinsic risk of thrombosis.

Aspirin therapy has not been shown to decrease flap loss rates. Vitamin A is indicated in this patient, not to decrease thrombotic flap loss rates, but rather to counteract the immunosuppressive medications.

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29. A 24-year-old man presents to the emergency department after sustaining burns from a workplace fire in a kitchen. He has a suspected inhalation injury. Physical examination shows partial-thickness burns on the forearms and thighs, as well as on one ear. The plan is to use mafenide acetate as a topical antimicrobial dressing. Because of the suspected lung injury, mafenide should be used with caution because it places him at increased risk for which of the following?
- A) Gray discoloration of skin
 - B) Hyperosmolality
 - C) Metabolic acidosis
 - D) Methemoglobinemia
 - E) Pruritis

The correct response is Option C.

The topical use of mafenide acetate, a carbonic anhydrase inhibitor, can prevent the conversion of hydrogen ions in the body to carbonic acid, leading to metabolic acidosis. In patients with an inhalation injury and respiratory acidosis, the use of mafenide acetate over large surface areas can be fatal.

The use of mafenide is common in areas with cartilage, such as the ear. It is also useful for eschar penetration. Common adverse effects include pain with application. Silver sulfadiazine is associated with leukopenia and hyperosmolality. Silver nitrate can also be used, but it causes gray-to-black staining of the wound and can also be associated with electrolyte imbalances. Methemoglobinemia has also been reported with silver nitrate use.

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30. A 67-year-old woman with a large ventral hernia after prior exploratory laparotomy for trauma is scheduled for complex abdominal hernia repair with posterior components separation and mesh. The planned surgical technique involves division of which of the following muscles and locations?

- A) External abdominal oblique lateral to the linea semilunaris
- B) External abdominal oblique medial to the linea semilunaris
- C) Internal abdominal oblique lateral to the linea semilunaris
- D) Transversus abdominis lateral to the linea semilunaris
- E) Transversus abdominis medial to the linea semilunaris

The correct response is Option E.

The posterior components separation technique involves dissection in the retro-rectus plane to release the transversus abdominis muscle medial to the linea semilunaris, allowing medialization of the posterior rectus sheath-transversalis fascia complex. This fascial layer is approximated to form the posterior layer of closure. The anterior layer, consisting of abdominal wall musculature, is approximated at the linea alba. Mesh is usually placed in between these two layers.

In the more commonly performed anterior components separation technique, the external abdominal oblique is released lateral to the linea semilunaris to permit medialization of the rectus abdominis muscle for abdominal closure. The internal abdominal oblique is not released in anterior component separation. The internal abdominal oblique fascia is released medial to the semilunaris in posterior component separation.

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31. When harvesting the profunda artery perforator flap for breast reconstruction, which of the following structures does the perforating vessel travel through in the majority of patients?
- A) Adductor longus muscle
 - B) Adductor magnus muscle
 - C) Gracilis muscle
 - D) Septum between the adductor longus and sartorius muscles
 - E) Septum between the adductor magnus and semimembranosus muscles

The correct response is Option B.

Proximal thigh profunda artery perforators most commonly course through the adductor magnus muscle not the adductor longus muscle. In these cases where musculocutaneous proximal perforators are used, fibers of the adductor magnus muscle will be divided for PAP flap harvest.

The profunda artery perforator (PAP) flap is a fasciocutaneous flap frequently employed for breast reconstruction as an alternative to the deep inferior epigastric artery perforator flap. The PAP flap has also been described for lower extremity resurfacing and burn scar contracture release, as well as pedicled for perineal reconstruction. The PAP flap skin paddle is harvested as either a transverse skin paddle beneath the gluteal and groin crease or with a vertical skin paddle harvested in the frog leg position. The most common donor site skin paddle orientation for breast reconstruction is a transverse ellipse of skin inferior to the gluteal crease to camouflage the donor site scar.

The profunda artery perforators emerge from the profunda vessels longitudinally down the postero-medial aspect of the thigh. Most patients have a proximal perforator that supplies the transverse ellipse of skin and adipose tissue most commonly employed for breast reconstruction. However, enough variability exists in perforator location, that preoperative CT angiography is recommended to confirm the presence of a proximal perforator.

The PAP flap perforating vessel may travel in a septocutaneous plane between the gracilis and adductor magnus at the level of the deep investing fascia and between the adductor longus and magnus closer to its origin but not between the muscles listed as

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alternate septocutaneous choices. The transverse upper gracilis (TUG) flap perforator travels through the gracilis muscle before perfusing the medial thigh skin.

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32. A 32-year-old woman is referred by her dermatologist for evaluation and treatment of a painful skin lesion on her lateral cheek. Examination shows a 5-mm raised skin lesion with a bluish hue. Excisional biopsy with 1-mm margins is performed. Pathologic analysis shows a well-circumscribed tumor arising within the dermis with diffuse dense basophilic cellular proliferation, eosinophilic hyaline deposits, and a lymphocytic infiltrate. The pathologic diagnosis is spiradenoma. Which of the following is the most appropriate next step in management of this lesion?

- A) Chemotherapy targeting lymphocytes
- B) Radiation therapy
- C) Re-excision with 1-cm margins
- D) Sentinel lymph node biopsy
- E) Reassurance and observation

The correct response is Option E.

The most appropriate next step in management of a completely excised spiradenoma is reassurance and observation. Spiradenomas are well-differentiated, benign, dermal neoplasms. Their origin is controversial, with some believing that they originate from sweat glands and others believing that they originate from hair follicles. Most spiradenomas are seen in patients between 15 to 35 years of age. They usually present as small, solitary, painful nodules that can grow to several centimeters, often with a bluish hue. Spiradenomas usually arise on the head, neck, and trunk. There are various morphological subtypes, and they can occur alongside cylindromas, trichoepitheliomas, and/or trichoblastomas. Patients with Brooke-Spiegler syndrome have multiple spiradenomas, cylindromas, and trichoepitheliomas.

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33. A 43-year-old right-hand–dominant man presents with Volkmann flexion contractures of the right hand after sustaining a severe burn injury to the right volar forearm. Reconstruction with an innervated gracilis free myocutaneous flap is planned. During flap elevation, the vascular pedicle is identified approximately 7 cm distal to the pubic symphysis between which of the following structures?
- A) Adductor longus and adductor magnus muscles
 - B) Adductor magnus and vastus medialis muscles
 - C) Sartorius and adductor longus muscles
 - D) Semimembranosus and sartorius muscles
 - E) Vastus medialis and semimembranosus muscles

The correct response is Option A.

The innervated gracilis muscle flap is a useful functional reconstructive tool. Its tendinous distal third makes this flap an attractive choice for finger flexor or extensor tendon reconstruction. The dominant supply to the vascular pedicle to this flap arises from the profunda femoris artery, and the muscle is innervated by the obturator nerve. During harvesting of the flap, the nerve and vascular pedicle can be reliably identified between the adductor longus and adductor magnus muscles, approximately 7 cm distal to the pubic symphysis. When a skin paddle is included, it is recommended to design the skin paddle within the proximal two thirds of the muscle, because skin necrosis is a greater concern over the distal third of the muscle.

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34. A 29-year-old African American man presents with recurrence of an earlobe keloid 16 months after excision and closure. Re-excision followed by hypofractionated electron-beam radiation therapy is planned. Regarding timing of the initiation of radiation, which of the following is associated with the lowest rate of keloid recurrence?

- A) Less than 24 hours after excision
- B) 24 to 48 hours after excision
- C) 2 to 4 days after excision
- D) 7 to 10 days after excision
- E) 30 to 60 days after excision

The correct response is Option A.

The use of hypofractionated electron-beam radiation therapy has been shown to reduce the probability of keloid recurrence after excision. A retrospective study by Shen et al. of 834 keloids treated with 18 Gy in two fractions a week apart showed that intervals of 24 to 48 hours between surgery and radiotherapy (hazard ratio = 1.52, p less than 0.02) and of greater than 48 hours (hazard ratio = 1.77, p less than 0.02) showed an increased relapse rate compared with the interval of less than or equal to 24 hours. Other predictors of relapse included male gender, age less than or equal to 29 years old, keloids greater than 5 cm, keloids in high-tension areas, and keloids that required skin grafts for reconstruction.

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35. A 64-year-old man presents with biopsy-proven squamous cell carcinoma of the tongue. Excision and reconstruction are planned. Allen tests on both sides show complete radial dominance, which is confirmed with non-invasive ultrasound. The plan is to proceed with an ulnar artery perforator flap from the non-dominant hand. When comparing the ulnar artery perforator flap to the radial forearm flap, which of the following is a major benefit of the ulnar artery flap?

- A) It has a larger pedicle artery diameter
- B) It has a longer pedicle length
- C) It has a lower flap thrombosis rate
- D) It is a better choice to incorporate bone as an osteocutaneous flap
- E) It is less likely to result in tendon exposure at the donor site

The correct response is Option E.

On the basis of the more proximal location of the flap, the donor site is able to be closed primarily more commonly than a radial forearm flap. When it is not closed primarily, typically the exposed deeper structures are muscle bellies rather than peritenon or tendon in the more distally located and radially positioned radial forearm flap.

The other options are incorrect. The radial forearm flap has a longer pedicle. The ability to incorporate bone into the flap is better reported in an osteocutaneous radial forearm. The flap thrombosis rates have been shown to be equivalent and the arterial diameter is similar or larger in the radial artery depending on the publication. Another benefit of the ulnar artery perforator flap is that the ulnar side of the arm is less hair-bearing and therefore may serve as better choice for intraoral reconstruction.

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36. A 75-year-old woman presents to the clinic for evaluation of her facial skin and consultation about nonsurgical rejuvenation. In comparison with skin from a younger patient, her skin is most likely to display which of the following?

- A) Dermal thickening
- B) Epidermal thickening
- C) Flattening of dermal-epidermal junctions
- D) Increased capillary density
- E) Increased cellular turnover

The correct response is Option C.

The aging process is variable and complex, and tissue types may age differentially. The skin, in particular, undergoes numerous aging-associated changes. Aged skin has epidermal thinning, decreased cellular turnover, and undergoes considerable atrophy compared with young skin. Keratinocyte proliferation declines, dermal-epidermal junctions flatten, nutrient exchange between layers is reduced, and there is increased fragility. Aged dermis similarly undergoes thinning and atrophy, decrease in cellularity, vascularity, and extracellular matrix. Collagen fibrils become disorganized, fragmented, and reduced in number and diameter. Net collagen reduction results from increased metalloproteinases and decreased neocollagenesis by aged fibroblasts.

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37. A 65-year-old man with a spinal cord injury presents with a right-sided sacral pressure ulcer wound that has been present for 12 months. He has no history of smoking or diabetes. Osteomyelitis has been controlled with oral antibiotics and his nutrition has been optimized. Physical examination shows a 6 × 5 × 4-cm wound overlying the sacrum. Which of the following is the most appropriate reconstructive choice for coverage of the wound?
- A) Biceps femoris V-Y musculocutaneous advancement flap
 - B) Gluteal V-Y musculocutaneous advancement flap
 - C) Pedicled lumbosacral perforator flap
 - D) Pedicled tensor fascia lata flap

The correct response is Option B.

The most appropriate method of reconstruction of a deep sacral pressure wound is a gluteal-based advancement or rotation flap. In general, gluteal-based flaps are preferred for this area for reconstruction. Unilateral or bilateral flaps may be required, and the V-Y flap has the added benefit of being re-advanced for recurrent wounds or wound dehiscence. The pedicled tensor fascia lata flap will not reach a sacral wound. This flap is best used for deep trochanteric pressure ulcers. The biceps femoris V-Y musculocutaneous advancement flap is the mainstay of treatment for a deep ischial pressure ulcer. This is a posterior thigh flap that will not reach the sacral region as a pedicled flap. The pedicled lumbosacral perforator flap is small and is not suitable for deep sacral pressure ulcers. It may be useful for small wounds or superficial wounds, and is based on lumbar perforators.

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38. Cutaneous melanomas arise in which of the following epidermal layers?

- A) Stratum basale
- B) Stratum corneum
- C) Stratum granulosum
- D) Stratum lucidum
- E) Stratum spinosum

The correct response is Option A.

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

Merkel cells are found in the stratum basale. Langerhans cells are found in the stratum spinosum, stratum granulosum and the dermis.

Basal cell carcinomas arise from basal cells in the stratum basale.

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39. A 2-year-old boy is brought to the emergency department after sustaining a bite to the face while playing with his neighbor's dog. The complex laceration is debrided and repaired in the operating room. The patient's mother reports he has a severe penicillin allergy. Which of the following is the most appropriate antibiotic for this patient?

- A) Amoxicillin/clavulanic acid
- B) Ciprofloxacin and metronidazole
- C) Clindamycin and ciprofloxacin
- D) Clindamycin and sulfamethoxazole/trimethoprim
- E) Doxycycline

The correct response is Option D.

The most common pathogens from dog bite injuries are *Pasteurella* spp, *Staphylococcus* spp, *Streptococcus* spp and Gram-negative rod *Capnocytophaga canimorsus*. Therefore, broad-spectrum antibiotics are necessary for appropriate treatment of dog bite injuries.

First-line therapy is typically amoxicillin/clavulanate, but this patient has an allergy to penicillin. The second choice in pediatric patients is clindamycin and sulfamethoxazole/trimethoprim.

Fluoroquinolones and doxycycline are considered generally safe even for pediatric patients, but due to potential concerns for side effects, including teeth discoloration and tendon rupture, they are considered a 3rd line option.

Pregnant women with penicillin allergies can be treated with azithromycin.

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40. A 47-year-old woman comes to the emergency department because of wound separation. History includes immediate prepectoral breast reconstruction with placement of left tissue expander, and she is currently undergoing radiation therapy. Physical examination shows an approximately 0.5-cm area of incisional dehiscence with exposure of the device. Vital signs are stable, and inflammatory markers are mildly elevated. Which of the following is the most appropriate next step in management?
- A) Admit the patient for intravenous antibiotic therapy and monitor the wound
 - B) Apply occlusive dressing and discharge the patient on oral antibiotic therapy
 - C) Close the wound at bedside in the emergency department and discharge the patient on oral antibiotic therapy
 - D) Perform expander removal in the operating room
 - E) Perform operative replacement of the expander

The correct response is Option D.

Studies have shown that postmastectomy radiation therapy almost doubles the risk of complications, including wound breakdown. While attempts at implant salvage are tempting, they are often ultimately unsuccessful and may potentially delay necessary radiation treatments. Therefore, in the event of implant exposure during adjuvant therapy, the device should be removed and the mastectomy pocket closed over a surgical drain. This strategy will allow for the shortest delay in further oncologic treatments and does not preclude reconstruction at a later date. Closure of the wound over an exposed device should not be attempted, as any exposed device is assumed to be colonized, if not grossly infected. Although antibiotics may temporize the infectious process, it is unlikely that successful wound healing and retention of the prosthesis will occur after suppressive antimicrobials are stopped.

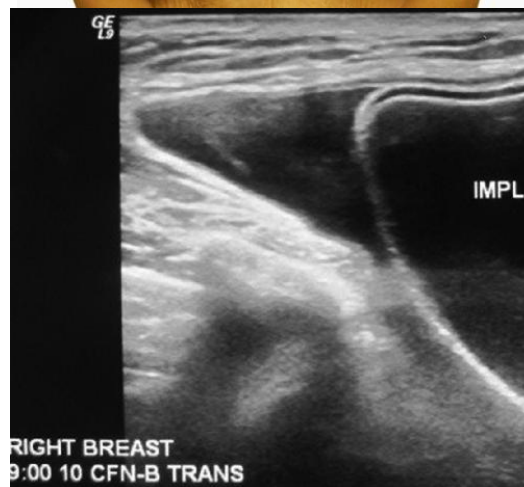
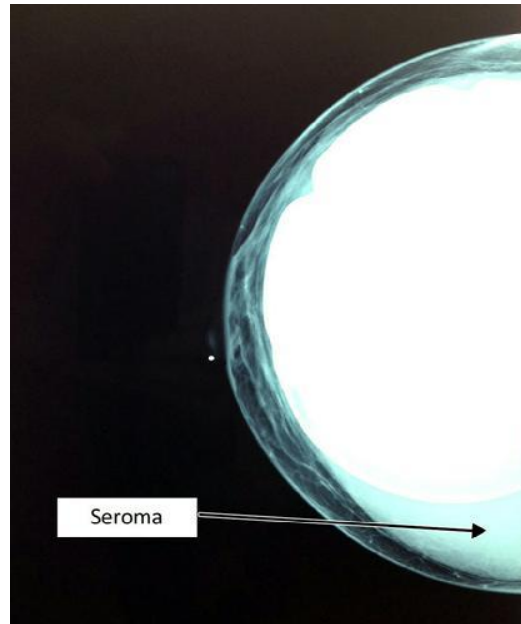
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41. A 37-year-old woman with macrot textured saline implants placed 10 years ago was recently diagnosed with a peri-implant fluid collection. Ultrasound-guided aspiration of the fluid is performed and sent for Wright-Giemsa–stained smears, and cell block immunohistochemistry/flow cytometry testing. Images are shown. Which of the following results would confirm a diagnosis of breast-implant–associated anaplastic large cell lymphoma?
- A) CD30 negative, ALK negative
 - B) CD30 negative, ALK positive
 - C) CD30 positive, ALK negative
 - D) CD30 positive, ALK positive

The correct response is Option C.

This patient has breast implant–associated anaplastic large cell lymphoma (BIA-ALCL) which is a distinct form of CD30-positive T-cell, non-Hodgkin’s lymphoma that arises in association with a breast implant after either reconstructive or cosmetic surgery. The disease is typically contained within the capsule and fluid immediately adjacent to the implant. Patients commonly present with delayed seroma, but can also present with pain, capsular contracture, and/or a palpable mass. BIA-ALCL risk is higher with textured devices and these concerns led to the 2019 FDA recall of Allergan Biocell devices. The recall includes older McGhan and Inamed implants and current Natrelle implants. When patients with suspicious history or symptoms are evaluated, pre-operative imaging (e.g., mammography, ultrasound, and/or MRI) is recommended with aspiration of identifiable fluid or biopsy of mass. Ultrasound is considered the diagnostic modality of choice. Diagnostic evaluation should indicate concern for BIA-ALCL to the pathologist to include cytological evaluation of seroma fluid or mass with Wright-Giemsa stained smears and cell block immunohistochemistry/flow cytometry testing for cluster of differentiation (CD30) and anaplastic lymphoma kinase (ALK) markers. Wright-Giemsa staining shows pleomorphic cells with horseshoe shaped nuclei, nuclear folding and abundant vacuolated cytoplasm. All known cases of BIA-ALCL are CD30-positive and -negative for ALK, distinct from systemic ALCL which is ALK-positive.

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42. An otherwise healthy 41-year-old woman is scheduled to have bilateral prophylactic NSM for a *BRCA1* mutation. Which of the following is an advantage of prepectoral implant reconstruction when compared with submuscular implant reconstruction?
- A) There are significantly more acute postoperative surgical complications
 - B) There is a higher revision rate
 - C) There is a lower rate of animation deformity
 - D) There is a lower rate of upper pole rippling and implant palpability
 - E) There is more pain and functional impairment

The correct response is Option C.

The patient is a young, healthy, thin woman presenting for bilateral breast reconstruction following prophylactic mastectomies because of increased lifetime risk of breast cancer. She will maintain her entire breast skin envelope because she has planned nipple-sparing mastectomies and does not wish to increase her breast size with the operation. She has questions about the plane of implant placement above or below the pectoralis muscle and the answer choices provide the opportunity to counsel her on direct to implant versus staged expander to implant breast reconstruction.

Because of the lack of camouflage afforded by placement of the pectoralis muscle over the upper pole of the breast implant, prepectoral breast reconstruction is associated with increased rippling of the upper portion of the breast. This patient is thin according to BMI and so will have an increased risk of upper pole rippling that can be improved with subsequent fat grafting, provided she has adequate donor sites for fat harvest.

Several patient series reporting on early outcomes after prepectoral breast reconstruction have used a partially submuscular patient cohort as a comparison for acute postoperative complications. The overwhelming majority of these series showed no significant differences in acute postoperative outcomes and revision rates between techniques.

Postoperative functional assessments have demonstrated less pain and earlier return of function after prepectoral implant placement compared to submuscular implant placement. Re-siting of submuscular implants to a prepectoral plane have demonstrated resolution of animation deformity.

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Algorithms for patient selection have slowly evolved over the past five years with the only constant recommendation being that the ideal candidate has a BMI less than 30 kg/m². Earlier series emphasized mastectomy skin flap thickness, whereas more recent studies focus on skin flap viability. Earlier studies considered radiation treatment a contraindication, whereas more recent reports demonstrate the negative impact of radiation on pectoralis major fibrosis in submuscular reconstruction as compared with prepectoral implant placement.

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43. A 5-week-old female infant is evaluated for a 2-cm red lesion on her forehead. The lesion was noted at age 2 weeks and has grown rapidly. There are no other lesions and there was no herald patch at birth. Which of the following factors is most suggestive of infantile hemangioma?

- A) Absence of herald patch
- B) Absence of ulceration
- C) Location
- D) Patient gender
- E) Rate of growth

The correct response is Option E.

Hemangiomas are the most common tumors found in infancy. These vascular tumors are characterized by rapid growth and increased cellular proliferation. Hemangiomas typically present between 2 weeks old and 2 months old. Vascular malformations, on the other hand, are present at birth and grow slowly. The clinical course of a hemangioma is predictable and includes rapid proliferation during the first 9 months of life, followed by gradual involution until 3.5 years of age. Most cutaneous lesions are located in the head and neck, followed by the trunk, and then the extremities. Extracutaneous sites most commonly involve the parotid glands or liver. Reports of nervous system involvement are rare. Most hemangiomas can be diagnosed by history and physical examination alone. About 5% require biopsy or radiologic imaging. The tumor may involve both sexes but is five times more common in females. The onset of a red lesion followed by rapid growth is the *sine qua non* for infantile hemangioma. In 30 to 50% of cases, the hemangioma is preceded by a telangiectasia or bruise-like patch known as a herald patch. Some hemangiomas may ulcerate during their proliferative growth phase.

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44. A 19-year-old man sustains a flexor tendon laceration while cutting an avocado. He presents to the emergency department and subsequently undergoes flexor tendon repair surgery. He is prescribed opioids for post-surgical pain management. Which one of the following has been shown to be a risk factor for prolonged opioid use?

- A) Male gender
- B) Tendon surgery
- C) Trauma surgery
- D) Younger age

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

The correct response is Option D.

In the realm of upper extremity surgery, younger age, bone procedures, mental health disorders, history of substance abuse, and pain disorders have consistently been found to be risk factors for prolonged opioid use. A specific gender has not been consistently shown to be a risk factor of opioid abuse following upper extremity surgery, with some studies pointing to female gender, while others point to male gender. Other factors that have been identified in specific studies include elective versus traumatic hand surgeries, lower versus higher income, and comprehensive insurance coverage versus medicare insurance. Aside from identifying risk factors, the majority of recent studies regarding prolonged opioid use after either upper extremity surgery or plastic surgery point to overprescription of opioids as a common problem. Recent reports demonstrate that narcotics are overprescribed by 40 to 60% after upper extremity surgery.

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45. An otherwise healthy, 76-year-old woman sustains a deep partial-thickness facial burn following scald injury. No acute intervention is performed and the patient follows up in the clinic 6 weeks after the incident. She complains of pain in the right eye as well as frequent tearing. Physical examination of the eye shows 4 mm of lagophthalmos, conjunctival injection, and hypertrophic scarring on the upper lid with restrained motion. The surrounding skin on the cheek and forehead appears erythematous and indurated. Which of the following is the most appropriate treatment for this patient?

- A) Contracture release and forehead flap
- B) Contracture release and full-thickness skin grafting
- C) Contracture release and placement of allograft
- D) Contracture release and split-thickness skin grafting
- E) Scar massage and eyelid taping

The correct response is Option B.

Facial burn injuries in the periorbital area must be quickly treated to support patient comfort and protect vision. Continued lagophthalmos and patient complaints warrant intervention, particularly with the degree of symptoms that the patient is expressing. The need for earlier intervention is specifically discussed in Klifto, *et al.* There is no indication for allograft placement following contracture release in this case, as a surface to graft upon should be present following contracture release in the eyelid. Of note, the contracture release usually occurs superficial to the orbicularis oculi and superior to the tarsal plate. Following contracture release, full-thickness skin grafts, but not split-thickness skin grafts, will minimize contracture after placement. Forehead flap reconstruction of the upper eyelid is a reasonable intervention and may be the most successful in preventing contracture recurrence, but it is not a treatment choice if the donor skin may be involved with the burn injury, as in the case of this patient.

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46. A newborn is evaluated for a congenital melanocytic nevus encompassing the right temporal and parietal scalp and the right hemiface, sparing the nose and lips. There is no family history of melanoma. The parents are interested in discussing treatment options for this condition and ask about the risk of malignant transformation. Which of the following is the approximate risk of melanoma in this patient?
- A) 2%
 - B) 10%
 - C) 15%
 - D) 20%

The correct response is Option A.

Multiple studies have shown that surgical treatment of giant congenital melanocytic nevi does not reduce the risk of melanoma. Overall, the risk of melanoma in this population ranges from 0.7 to 2.9% compared with the 0.6% melanoma risk in the general population. The total number of cases of giant congenital melanocytic nevi is small, as this is a rare condition, and most of these cases do not go on to develop melanoma. Rather, melanoma appears to be generic biologic risk rather than related to the nevus itself. The risk of melanoma is highest in trunk lesions rather than other areas of the body. Furthermore, melanoma does not always occur in the giant congenital nevus itself, but may arise from a satellite lesion instead.

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47. An 80-year-old woman has been diagnosed with lentigo maligna of the cheek. The patient refuses surgical excision. Which of the following is the most appropriate treatment option?

- A) Cryotherapy
- B) Electrodesiccation and curettage
- C) Laser removal
- D) Topical 5-fluorouracil
- E) Topical 5% imiquimod

The correct response is Option E.

Lentigo maligna is the most common type of cutaneous melanoma in situ. It arises in chronically sun-exposed areas such as the face and neck. The lifetime risk of development into invasive lentigo maligna melanoma is approximately 5%. Treatment is excision with 5- to 10-mm margins. Surgical excision is the treatment of choice as it allows assessment of margins. Moreover, up to a third of all lentigo maligna specimens are upstaged to invasive melanoma after definitive excision. For patients who are not candidates for surgery, second-line treatment options are radiation and topical 5% imiquimod.

Imiquimod is an immune response modifier. It induces the immune system by acting on toll-like receptor 7. Imiquimod has a clearance rate of 50 to 93% and a recurrence rate of 24.5% for lentigo maligna. It can also be used for positive or close margins after excision, when re-excision is not possible or would result in unacceptable morbidity. Imiquimod is also used for treatment of warts, actinic keratosis, and basal cell carcinoma.

Topical 5-fluorouracil, cryotherapy, electrodesiccation and curettage, and laser do not have high-quality data supporting their efficacy in lentigo maligna. They are therefore not good treatment options.

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48. An otherwise healthy, 20-year-old transgender woman (assigned male at birth) has received appropriate psychological and hormone suppression therapy since prepuberty. She is now being worked up for male-to-female genital reaffirmation surgery. Which of the following is the most appropriate surgical management if penetrative intercourse is desired?

- A) Intestinal vaginoplasty
- B) Metoidioplasty
- C) Penile inversion vaginoplasty
- D) Radial forearm free flap
- E) Surgery is contraindicated for this patient

The correct response is Option A.

The most appropriate management is intestinal vaginoplasty.

Many techniques are used in the creation of the neovaginal canal. Though there is no single optimal technique, inversion vaginoplasty with penile-scrotal flaps is the preferred and most commonly practiced method among surgeons. However, sufficient penile-scrotal skin is not always available because of limitations in either patient anatomy or patient expectations for vaginal depth. Additionally, it is becoming more common for younger patients to undergo hormonal blockade in anticipation of gender transition. This may limit the amount of tissue for penile-scrotal based vaginoplasty. Rectosigmoid vaginoplasty uses a section of the sigmoid colon to create the vaginal lining. Because this method doesn't rely on penis size for vaginal depth, it is preferred in cases where sufficient penile tissue is lacking (phallus length of less than 4.5 in or 11.4 cm) or in patients who require revision of a failed primary vaginoplasty.

Metoidioplasty and a radial forearm free flap are methods used in the creation of a phallus in a transmale patient. As long as the patient is healthy, the age of consent, and meets the standards set by the WPATH (World Professional Association for Transgender Health), they are candidates for surgery.

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49. A 65-year-old woman presents with a 4 x 4-cm elliptical defect on the vertex of the scalp after resection of a trichilemmal cyst. Local advancement flaps are planned for closure with wide undermining. Division of which of the following layers is important during scalp flap advancement?

- A) Dermis
- B) Galeal aponeurosis
- C) Innominate fascia
- D) Pericranium
- E) Subgaleal fascia

The correct response is Option B.

During a scalp advancement flap, release of the galeal aponeurosis is important, as this layer provides the majority of resistance to scalp advancement. Often scoring of the galea is performed in parallel 1-cm intervals to provide adequate release.

The layers of the scalp include: skin, dense connective tissue, galeal/epicranial aponeurosis, loose areolar connective tissue, and pericranium. Release of the other layers listed is not effective, as they do not provide appreciable resistance. The innominate and the subgaleal fascia are the same layer, otherwise known as the subaponeurotic layer or the loose areolar layer. Release of this layer does not offer appreciable laxity when performing advancement flaps.

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50. A 43-year-old woman with a history of Stage I T1N0 invasive ductal carcinoma of the right breast presents 15 years after undergoing bilateral mastectomy, negative right sentinel lymph node biopsy, and staged expander to implant breast reconstruction. Over the past 3 months, her left reconstructed breast has become significantly larger than her right. On examination, there are no skin lesions, palpable masses, or axillary lymphadenopathy. Which of the following is the most appropriate next step in the workup of this patient?

- A) Ultrasound
- B) Mammography
- C) PET-CT
- D) MRI

The correct response is Option A.

The patient presents 15 years after bilateral mastectomy and staged expander to implant breast reconstruction with a new finding of left reconstructed breast enlargement. This may be due to a large late periprosthetic fluid collection, Baker Classification Grade III and IV capsular contracture can give the impression of breast enlargement because of the increased projection and vertical height of the breast contour. Any patient presenting with a late periprosthetic fluid collection should be evaluated for breast implant-associated anaplastic large cell lymphoma (BIA-ALCL). In this patient, it is unknown what type of implant she has; therefore, radiologic evaluation is warranted.

Physical examination and a breast ultrasound would distinguish between these two causes of perceived enlargement of a breast after implant-based breast reconstruction. Ultrasound can also identify capsular masses and provides an opportunity to aspirate the fluid collection, which often provides symptomatic relief for the patient, as well as an opportunity to perform cytology to analyze lymphocyte numbers and characteristics, in addition to flow cytometry to measure anaplastic lymphoma kinase negativity and CD30 cell surface receptor positivity.

Presentation with BIA-ALCL can take many years to develop, with a median 10 years to fluid collection development. Surgical treatment for BIA-ALCL can vary with the stage of presentation, but BIA-ALCL confined to the periprosthetic fluid can be effectively treated with capsulectomy and implant removal. The majority of cases of BIA-ALCL present with late-onset seroma (66-80%), whereas the second most common presentation is an isolated mass within the capsule around the implant.

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PET-CT is often performed as part of a staging evaluation after the diagnosis of BIA-ALCL is confirmed. Mammography is a breast cancer screening tool, but has no role in post-mastectomy evaluation.

A prone breast MRI (or ultrasound) is recommended 5 to 6 years after silicone breast implant placement and every 2 years thereafter to evaluate the integrity of the implant shell, but has no role in the management of BIA-ALCL.

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Section 2: Hand and Lower Extremity



51. A 12-month-old boy comes to the office for evaluation of a congenital thumb deformity. A photograph is shown. Which of the following is the most appropriate management of the thumb?
- A) First metacarpal distraction osteogenesis
 - B) First web space deepening
 - C) Flexor digitorum superficialis opponensplasty
 - D) Free great toe transfer
 - E) Index finger pollicization

The correct response is Option E.

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This patient has a type IV (floating thumb or *pouce flottant*) thumb hypoplasia best managed with thumb ablation and index finger pollicization. Thumb hypoplasia can range from a minor decrease in size to complete absence. Thumb hypoplasia may also be associated with VACTERL (vertebral abnormalities, anal atresia, cardiac abnormalities, tracheoesophageal fistula or esophageal atresia, renal agenesis and dysplasia, and limb defects), TAR syndrome, Fanconi anemia, and Holt-Oram syndrome. Given the possible association with these conditions, a workup of all potentially affected organ systems should be performed. This includes a renal ultrasound, an echocardiogram, spine x-ray studies, a complete blood count, and a chromosomal challenge test.

Thumb hypoplasia may occur in an isolated fashion or in combination with radial hypoplasia, as seen in this case. The most important and difficult distinction is between types IIIa and IIIb hypoplastic thumbs. A type IIIa thumb has a stable thumb carpometacarpal (CMC) joint, whereas a type IIIb thumb does not. If the child uses the thumb for integrated pinch, the CMC joint is deemed stable. If the thumb is bypassed in favor of scissor pinch between the index and middle fingers, the CMC joint is either unstable or absent; in this case, a pollicization is recommended.

A free great toe transfer is not indicated in children with thumb hypoplasia because the existing thumb CMC is not stable and pollicization would provide a better functional outcome. Flexor digitorum superficialis or abductor digiti minimi opponensplasty are both options for thumb hypoplasia reconstruction in the presence of a stable CMC joint. A first webspace deepening is typically combined with opponensplasty and metacarpophalangeal joint stabilization in children with reconstructible hypoplastic thumbs, but not for children undergoing pollicization. The patient in the image does not have a first metacarpal, and therefore cannot undergo distraction osteogenesis.

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52. A 4-month-old male infant is evaluated because of a deep constriction band of the right lower leg present since birth. There is marked edema of the leg and foot distal to the ring, which has increased substantially over the past several weeks. Which of the following is the most appropriate management for this patient?
- A) Amputation of the lower extremity
 - B) Application of a compression garment
 - C) Band excision
 - D) Collagenase injection
 - E) Limb elevation and observation

The correct response is Option C.

Amniotic band syndrome is a rare congenital anomaly with a sporadic inheritance pattern and a reported incidence that ranges between 1:1200 to 1:15,000 live births. Constriction bands may range from shallow, harmless skin depressions to deep, annular bands that may present with distal edema, neurovascular compromise, or autoamputation. There is a propensity for constriction bands to affect the more distal aspect of the upper and lower limbs (including fingers and toes) in a bilateral, asymmetric fashion. Associated conditions may include: acrosyndactyly, talipes equinovarus (clubfoot), and cleft lip/cleft palate.

In this patient, constriction band excision is the most appropriate management given the increasing edema and its potential associated functional issues. Different strategies have been described for band excision and closure. Although extremity band excision was traditionally performed in two stages, one-stage resection has been performed safely by some surgeons.

Limb elevation and observation is not the best treatment as it will not address the underlying cause of the worsening edema.

Compression garments and collagenase injections do not have roles in the treatment of extremity constriction bands.

Amputation is not the best option and would be considered only in an unsalvageable extremity.

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53. Which of the following histologic findings is most characteristic of giant cell tumor of the tendon sheath?

- A) Histiocytoid mononuclear cells
- B) Lymphocytic infiltration
- C) Myofibroblasts
- D) Spindle cells
- E) Zones of necrosis

The correct response is Option A.

The giant cell tumor of tendon sheath (GCTTS) is the most common benign neoplasm in the hand after the ganglion cyst. It is a slowly growing, usually painless benign lesion of soft tissues. The tumor affects individuals between the ages of 30 and 50 years old and is found more often in women than men. Histologically, it is composed of multinucleated giant cells, histiocytes, fibrotic material, and hemosiderin deposits. Histiocytoid mononuclear cells are the neoplastic component and should always be present on pathologic evaluation of these lesions. Surgery is the main treatment option, but the tumor has a propensity for local recurrence. If untreated, or if the tumor continually recurs, these tumors can result in damage and degeneration of surrounding tissues or structures.

Lymphocytic infiltration, zones of necrosis, spindle cells, and myofibroblasts are not histologic components of GCTTS.

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54. A 45-year-old patient has a slowly growing mass along the flexor sheath of the index finger at the level of the distal interphalangeal joint. The mass does not transilluminate and appears multinodular. It shows generally decreased signal intensity on both T1- and T2-weighted MRI. Which of the following surgical procedures is most likely to be recommended?
- A) Distal interphalangeal level amputation and lymph node biopsy
 - B) Incisional biopsy
 - C) Marginal excision
 - D) Radical excision

The correct response is Option C.

The patient most likely has a giant cell tumor of the tendon sheath. This is a benign nodular tumor that is found on the tendon sheath of the hands. It is also known as pigmented villonodular tumor of the tendon sheath. It is the second most common soft-tissue tumor seen in the hand, following ganglion cyst. There are no known cases of metastasis of this tumor in the literature. The operative treatment is marginal excision, and literature reports a 5 to 50% recurrence rate, more common if the tumor extends into the joints and deep to the volar plate. Local recurrence is usually treated by repeat excision.

Incisional biopsy does not remove the entire tumor and is usually done for diagnosis, not treatment. A radical excision and amputation removes normal structures surrounding the tumor and will lead to unnecessary loss of function.

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55. Surgical reconstruction of the oblique retinacular ligament is primarily used to treat which of the following?

- A) Boutonnière deformity
- B) Flexor digitorum profundus tendon avulsion
- C) Sagittal band rupture
- D) Scapholunate ligament injury
- E) Swan-neck deformity

The correct response is Option E.

Spiral oblique retinacular ligament (SORL) reconstruction is used to address digital swan-neck deformity. The procedure is predicated on surgically recreating the proposed function of the oblique retinacular ligament (ORL); linking proximal interphalangeal (PIP) joint and distal interphalangeal (DIP) joint flexion and extension. The ORL arises from the flexor tendon sheath at the base of the proximal phalanx, extends distally and dorsally over the PIP joint, and fuses with the lateral extensor tendon. Because of the site of the ORL origin and insertion, PIP joint extension places the ORL under tension, which results in DIP joint extension. PIP joint flexion, however, decreases tension in the ORL and allows DIP joint flexion. Although anatomical studies are conflicting regarding the actual presence and function of the ORL, surgically recreating this proposed function has been used to treat swan-neck and mallet deformities. Thompson, Littler, and Upton described the dynamic SORL reconstruction in 1978 as an alternative to static techniques, such as transferring a single lateral band volarly to prevent PIP joint hyperextension. In a SORL reconstruction, a free tendon graft is fixated to the dorsal distal phalanx, passed over the radial aspect of the middle phalanx, and then “spiralled” palmarly across the PIP joint, where it is then secured to the ulnar aspect of the proximal phalanx.

A flexor digitorum profundus avulsion (i.e. Jersey finger) is typically managed by reinserting the tendon into the volar base of the distal phalanx. If delayed greater than 8 to 12 weeks, interposition tendon reconstruction may be necessary. A boutonnière deformity generally occurs as a result of a central slip injury; this leads to a flexed posture of the PIP joint and an eventual hyperextended posture of the DIP joint as the lateral bands translate volarly. If closed, splinting is indicated. If the central slip was lacerated, an open repair is recommended. A sagittal band tear may cause pain and subluxation of the extensor

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mechanism at the MCP joint and can be treated with splinting or repair. A scapholunate ligament tear can be directly repaired if acute, or reconstructed using a variety of techniques in the absence of scapholunate advanced collapse and arthritis of the wrist. If arthritis has developed, then partial or total wrist fusion may be indicated.

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56. A 16-year-old boy develops a severe left first web space contracture 8 months after undergoing skin grafting for a soft-tissue avulsion injury. At the time of contracture release, a pedicled fasciocutaneous flap is planned for coverage of the soft-tissue defect. On the basis of the preoperative markings for the flap in the photographs shown, the flap pedicle is located between which of the following muscles?
- A) Brachioradialis and extensor carpi radialis longus
 - B) Brachioradialis and flexor carpi radialis
 - C) Extensor digiti minimi and extensor carpi ulnaris
 - D) Extensor digiti minimi and the extensor digitorum communis
 - E) Extensor digitorum communis and extensor carpi radialis brevis

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The correct response is Option C.

The photograph illustrates the markings for a reverse posterior interosseous artery (PIA) flap. The reverse PIA flap is a thin, pliable fasciocutaneous flap that can provide reliable coverage of soft-tissue defects involving the dorsal hand, metacarpophalangeal joints, and first web space. Some surgeons report success using this flap for coverage of palmar wounds and soft-tissue injuries of the thumb as well.

Perfusion of the flap is based on retrograde flow through the posterior interosseous artery, which sends septocutaneous perforators to the overlying skin. The axis of the flap can be marked corresponding to a line between the lateral epicondyle and the radial aspect of the ulnar styloid. The location of the posterior interosseous artery pedicle is between the extensor digiti minimi and the extensor carpi ulnaris. Retrograde perfusion through the flap relies on an intact communication of the PIA with the dorsal branch of the anterior interosseous artery, which is present in nearly all cases. This anastomosis is located 2 cm proximal to the radial aspect of the ulnar styloid; therefore, it corresponds to the pivot point of the flap. One of the advantages of this flap is that it does not require sacrifice of a major arterial source of blood to the hand.

The other responses do not correctly describe the location of the PIA. Of note, the interval between the brachioradialis and the flexor carpi radialis represents the location of the radial artery fasciocutaneous flap pedicle.

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57. During flexor tendon repair, which of the following is the optimal distance from the cut end of the tendon for placement of core sutures?

- A) 1 to 2 mm
- B) 3 to 4 mm
- C) 7 to 10 mm
- D) Greater than 15 mm

The correct response is Option C.

The fundamentals of flexor tendon repair are based on primary tendon repair principles, which include easy placement of sutures in the tendon, secure suture knots, smooth juncture of the tendon ends, minimal gapping at the repair site, minimal interference with tendon vascularity, and sufficient strength throughout healing to permit application of early motion stress to the tendon.

These fundamentals are best achieved by incorporating a few basic principles. Handling of the tendon should be minimized to decrease the occurrence of adhesion formation. The strength of the repair is proportional to the number of core sutures and the caliber of the sutures that cross the repair site. The core sutures should be placed 7 to 10 mm from the tendon edge; dorsal placement is biomechanically advantageous.

The distance of the tendon-suture junctions relative to the level of the tendon cut affects the strength of repairs of cut tendons. Strength of repair decreases significantly with purchase distance of less than 4 mm. No increase in strength is seen with purchase distances of greater than 7 mm, and attempts to increase the purchase distance more significantly (greater than 15 mm) will potentially require unnecessary pulley disruption to achieve and will predispose to bunching at the repair site.

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58. Which of the following is the primary advantage of repairing a nail bed laceration with 2-octyl cyanoacrylate compared with suturing?

- A) Better cosmetic outcome
- B) Better functionality
- C) Less pain
- D) Shorter repair time

The correct response is Option D.

Nail bed repair can be performed using suture or with 2-octylcyanoacrylate. In a study by Edwards and Parkinson, functional outcomes were equivalent between the two techniques, but 2-octylcyanoacrylate repair was significantly faster.

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59. A 29-year-old man is evaluated 15 months after a motorcycle collision in which he sustained a left humerus fracture and a complete left brachial plexus avulsion. He has not recovered any motor or sensory function of the left arm but desires the ability to actively flex the elbow. Which of the following procedures is most likely to restore active elbow flexion in this patient?

- A) Free functioning gracilis muscle transfer
- B) Pedicled bipolar latissimus dorsi muscle transfer
- C) Proximal transfer of the flexor-pronator mass onto the humerus
- D) Triceps-to-biceps transfer
- E) Ulnar nerve to musculocutaneous nerve transfer

The correct response is Option A.

Adult traumatic brachial plexus injuries are devastating and life-altering injuries. Evaluation includes a detailed physical examination and radiologic and electrodiagnostic studies. Knowledge of injury patterns, timing of surgery, prioritization in restoration of function, and management of patient expectations are key components of management. In general, options for treatment of brachial plexus injuries include neurolysis, nerve grafting, or nerve transfers and should be performed within 6 months of injury. Free functioning muscle transfers (FFMT) and tendon transfers are typically used in patients who present late (greater than 12 months from injury), because the time for the nerve to regenerate after reconstruction is greater than the survival time of the motor end plates after denervation.

FFMT is the transplantation of a muscle and its neurovascular pedicle to a new location to assume a new function. The muscle is innervated by transferring an intact uninjured donor motor nerve; circulation is restored to the muscle through microsurgical anastomosis of the artery and vein to donor vessels (typically the thoracoacromial artery and cephalic vein). Within 6 to 9 months, the transferred muscle reinnervates, eventually gaining independent function. Although initially indicated in patients who presented late or as a salvage procedure with failed previous nerve reconstruction, the success with FFMT has led to use in early reconstruction to obtain elbow flexion and rudimentary grasp in patients with pan-plexus injuries. The gracilis muscle is the most commonly used donor because of its proximally based neurovascular pedicle and its long tendon length (which can reach distally into the forearm). Spinal accessory or intercostal nerves could be used as donor nerves for a free gracilis transfer.

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Steindler flexorplasty, pedicled latissimus dorsi muscle transfer, triceps-to-biceps transfer, and Oberlin transfer each require remaining function of the brachial plexus and would be contraindicated in this patient with long-standing total brachial plexus palsy.

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60. A 44-year-old woman sustained a second-degree burn to the volar surface of the wrist and palm. She is sent to occupational therapy for fabrication of a splint, placing the wrist and fingers in an intrinsic plus position. Which of the following best describes the position of the wrist and fingers in this splint?

	Wrist	Metacarpophalangeal Joint	Interphalangeal Joints
A)	30 degrees extension	75 degrees flexion	30 degrees flexion
B)	30 degrees extension	0 degrees flexion	0 degrees flexion
C)	30 degrees extension	75 degrees flexion	0 degrees flexion
D)	30 degrees flexion	75 degrees flexion	0 degrees flexion
E)	30 degrees flexion	0 degrees flexion	30 degrees flexion

The correct response is Option C.

The position of safe immobilization (POSI), also called the intrinsic plus position, was described initially by J.I.P. James (British orthopedic surgeon) and is recognized as the correct position in which to immobilize the hand safely following injury or surgery. The wrist is placed in 0 to 30 degrees of extension, metacarpophalangeal (MCP) joints in 70 to 90 degrees of flexion and interphalangeal (IP) joints in full extension. This position creates pretension on the collateral ligaments of the wrist and the MCP and IP joints of the hand, thereby decreasing the risk of stiffness and contracture.

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61. Which of the following is the most appropriate initial management of lower extremity lymphedema?

- A) Charles operation
- B) Compression
- C) Liposuction
- D) Lymph node transfer
- E) Lymphatic venous bypass

The correct response is Option B.

Lymphedema is a chronic condition that creates significant dysfunction and disability. Causes can be developmental or the result of lymphatic injury, such as in oncologic procedures. Although there is no cure for the condition, surgical techniques have demonstrated promise. However, these should be reserved for patients who have failed conservative management with compression therapy, lifestyle modification, and therapeutic exercise. Complete decongestive therapy consistently demonstrated effectiveness in limb volume reduction but requires ongoing treatment and compression to maintain its benefits.

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62. A 32-year-old woman presents with intermittent severe pain of the left ring fingernail that has worsened over the past several years. X-ray studies of the finger show no abnormalities. Which of the following findings on physical examination is consistent with a diagnosis of glomus tumor in this patient?

- A) Pain decreases from pinpoint pressure on the nail
- B) Pain decreases with inflation of a blood pressure cuff
- C) Pain increases in warm temperatures
- D) Pain increases only at night

The correct response is Option B.

A glomus tumor is a small benign mass containing cells from the glomus apparatus. Most (75%) are found in the hand and most of these (65%) are found in the fingertip. Tumors tend to be intermittent but quite painful. The classic triad of symptoms for a glomus tumor of the fingertip is 1) sensitivity to cold, 2) paroxysmal pain (day or night), and 3) pinpoint pain (Love's sign). If a blood pressure cuff is inflated proximally, then pain will diminish in the fingertip (Hildreth's sign). The diagnosis is usually confirmed with an MRI, and treatment is excision. Recurrence rates can be up to 20%.

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63. Which of the following diagnostic findings is most consistent with a recovering motor nerve injury?

- A) Decreased motor unit potential amplitude
- B) Decreased motor unit recruitment
- C) Fibrillation potentials
- D) Nascent potentials
- E) Positive sharp waves

The correct response is Option D.

Electrical studies of a recovering nerve injury would show nascent potentials. This finding usually precedes the onset of clinically evident voluntary movement in the muscles innervated by the injured nerve. Nascent potentials appear several months after injury and result from axonal regeneration. Decreased motor unit potential amplitude, fibrillation potentials, positive sharp waves, and decreased motor unit recruitment are possible diagnostic findings in the setting of a nerve injury, but they are not indicative of recovery. Nerve lesions that spontaneously recover are usually treated nonsurgically, whereas those without recovery are explored and reconstructed. As a general rule, nerve regrowth occurs at approximately 1 inch per month or 1 millimeter per day. Motor endplates degrade at about 1% per week, hence the maximum length that a nerve can grow to restore motor function is approximately 13 to 18 inches. Repairs at the brachial plexus level rarely result in the recovery of any intrinsic muscle function. Sensory end organs, however, remain viable and can be reinnervated even after many years.

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64. A 32-year-old woman sustains a dorsal proximal interphalangeal (PIP) joint fracture-dislocation of the ring finger after a fall from standing. The fracture-dislocation is reduced, and the finger is splinted in the emergency department. Three days after injury, the patient presents to the office. An x-ray study demonstrates a volar lip fracture of the middle phalanx, which measures 40% of the joint. Live fluoroscopy demonstrates PIP joint congruency through an arc of motion of 20 to 100 degrees. Which of the following is the best treatment for this patient?

- A) Dorsal block splint
- B) Hemi-hamate resurfacing
- C) Open reduction and internal fixation
- D) PIP joint transarticular pinning
- E) Volar static splint

The correct response is Option A.

Proximal interphalangeal (PIP) joint fracture-dislocations are generally stratified according to the percentage of middle phalanx articular surface disrupted: 30% or less, presumed stable; 30 to 50%, tenuous stability; and more than 50%, unstable. Stable fracture-dislocations (less than 30% of the middle phalanx palmar lip) are stable in full PIP joint extension. When 30 to 50% of the middle phalanx joint surface is fractured, stability is tenuous and can only be determined by clinical testing. Those fractures that require more than 30 degrees of flexion to maintain reduction are considered unstable and therefore require some form of surgical management for maintenance of reduction (dorsal block pinning, or open reduction and internal fixation).

For all fracture-dislocations, treatment methods are grouped into five broad categories: static immobilization, articular reduction, dorsal extension block splinting, open reduction and internal fixation, and volar plate arthroplasty.

Static immobilization is straightforward but generally avoided in cases of fractures involving the PIP joint, owing to the risk of overwhelming stiffness with prolonged immobilization.

Articular reduction must be serially monitored by x-ray study, and immobilization for more than 3 weeks may result in significant PIP joint stiffness.

Dorsal extension block dynamic splinting can be used for stable or tenuous fracture-dislocations. Dorsal block pinning uses the same concept as dorsal block splinting, but it requires the surgical insertion of a pin into the head of the proximal phalanx to prevent dorsal translocation of the middle phalanx with extension.

Open reduction and internal fixation can be used to fix a noncomminuted fragment that is sufficiently large enough to stabilize with small lag screws or K-wires.

Malerich and Eaton describe a procedure called volar plate advancement (advancement of the volar plate into the middle phalanx fracture defect), simultaneously restoring stability and resurfacing the damaged articular surface. Hastings and Kiefhaber describe hemi-hamate resurfacing arthroplasty (a technique used to resurface the volar lip of the middle phalanx with a hemi-hamate bone graft). Both of these resurfacing techniques (volar plate arthroplasty and hemi-hamate arthroplasty) are salvage procedures, better suited for chronic or subacute unstable fracture dislocations.

The fracture in this scenario involves 40% of the joint and is thus considered tenuous, but it achieves stable reduction at 20 degrees of flexion, allowing for treatments such as dorsal block splinting or pinning. Given a choice, nonoperative management is preferred initially, and surgical correction (dorsal block pin or open reduction and internal fixation) is reserved for those that fail nonoperative management.

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65. A 36-year-old man presents to the clinic 1 year after repair of an isolated brachial artery laceration. Prior to arterial repair, the hand and forearm were dysvascular. Fasciotomies were not performed at the time of repair. The patient is unable to extend his fingers actively or passively with the wrist held in neutral position, but he is able to actively make a full fist. Sensation is intact. Which of the following interventions is most appropriate to improve finger extension and preserve grip strength in this patient?

- A) Flexor pronator slide
- B) Free functional gracilis transfer
- C) Joint release and tenolysis
- D) Splinting

The correct response is Option A.

Volkmann ischemic contracture is a devastating condition with serious motor and sensory functional implications for the upper extremity, most typically the forearm. It is the result of an acute compartment syndrome, following severe soft-tissue trauma and accompanying vascular insult. The patient in the scenario demonstrates a moderate contracture that is best treated with a flexor pronator slide.

When treatment of acute compartment syndrome is delayed or neglected, the muscles of the forearm undergo necrosis and contracture due to secondary fibrosis, causing the typical flexed deformity. This results in impairment of hand and finger function.

Surgical treatment is based on severity of contracture and function of the residual motor units. Mild contractures allow for full passive extension of the fingers with the wrist in volar flexion and can be treated with tendon lengthening and skin release, or selective flexor pronator slide, depending on the source of constraint. Patients with moderate contractures demonstrate an inability to passively extend the fingers with the wrist in flexion but retain flexor muscle function. These contractures require consideration for a flexor pronator slide alone or in conjunction with tendon lengthening. Complete loss of muscle function necessitates consideration of free functional muscle transfer. Superficialis to profundus transfers are a consideration in the setting of significant contracture and functional limitation. It is typically used to facilitate improved hygiene and confers limited function. This would not be as good of an option for the patient in this question as it would compromise his

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strength and function. Neurolysis should be considered in conjunction with any reconstructive procedures. Splinting is an important adjunct to any reconstructive procedure and potentially can be employed as an initial treatment prior to surgical intervention to prevent worsening contracture.

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66. A 19-year-old college baseball player sustained an injury to his left hand when hitting the ball with a bat 6 weeks ago. The patient reports immediate pain in his palm, weakness of grip, and within hours developed tingling into his small and ring fingers, which persisted for 6 weeks despite rest. He reports continued tingling in the ulnar fingers. Standard x-ray studies of the hand show no abnormalities. A CT scan of this patient's hand is likely to show a fracture of which carpal bone?
- A) Capitate
 - B) Hamate
 - C) Lunate
 - D) Pisiform
 - E) Scaphoid

The correct response is Option B.

This college student has sustained a hook of hamate fracture that was missed on standard hand x-ray studies. Impact from the bat or from catching a pitched ball are common mechanisms of injury for a hook of hamate fracture in a baseball player. While fractures of other carpal bones may occur in baseball players, they would not produce the symptom spectrum described in the scenario.

An x-ray study from the carpal tunnel view and a CT scan will likely show the correct diagnosis. At 6 weeks, this patient is unlikely to improve with casting alone. Surgically, he may be offered open reduction and internal fixation versus resection of the bony fragment. During surgery, the flexor tendons to the small finger should be evaluated as they can sustain attritional injury next to the fracture fragment. Nerve irritation to the ulnar nerve (sensory and motor) usually resolves spontaneously after surgery, but the nerve should be examined during surgery.

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67. A male newborn is evaluated in the newborn nursery because of limited movement of the right arm. Maternal history includes gestational diabetes, but routine prenatal monitoring and ultrasound examinations were normal. The patient's delivery was difficult, and he weighed 10.5 lb (4.8 kg) at birth. He was noted to have no spontaneous movement of the right arm. The right upper extremity was warm, pink, and supple. Pulsations of the radial and ulnar arteries were palpable at the wrist. X-ray studies of the affected shoulder show no obvious fractures. A photograph is shown. Which of the following is the most appropriate next step in management?
- A) Angiography of the extremity
 - B) Anticoagulation
 - C) CT scanning of the extremity
 - D) Measurement of compartment pressures
 - E) Observation

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The correct response is Option E.

This patient has an obstetrical palsy of the right upper extremity. The likelihood of recovery depends on the severity of the injury, but statistically over 70% of patients have complete or near complete recovery of upper extremity function without any surgical intervention. Thus the most appropriate next step for this newborn is observation. MRI of the shoulder and neck are helpful to discern evidence of anatomical injury to the cervical roots and/or portions of the brachial plexus, but CT scanning is unnecessary and of little use in this regard. Angiography and anticoagulation would be appropriate steps if there was clinical evidence of subclavian or brachial artery thrombosis, but the physical examination does not support this diagnosis. Similarly, the examination is inconsistent with neonatal compartment syndrome, a rare condition that usually presents with arm swelling, immobility, reduced arm perfusion, and purple cutaneous areas. Therefore, measurement of compartment pressures is unnecessary.

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68. A 43-year-old woman is evaluated because of lymphedema of the lower extremities. She demonstrates pitting edema, which does not improve with limb elevation. Her skin feels otherwise normal, with no evidence of fibrotic change. Which of the following International Society of Lymphology stages best describes this patient's lymphedema?

- A) 0
- B) 1
- C) 2
- D) 3

The correct response is Option C.

Lymphedema results from congenital or acquired dysfunction of the lymphatic system. It results from changes to the lymphatic vessels, including ectasia and valve dysfunction. This results in reflux of lymphatic fluid into the interstitial space. Lymphatic fluid accumulation leads to chronic inflammation, extracellular matrix remodeling and fibrosis, adipose tissue differentiation, progressive fibrosis/sclerosis, and eventual obliteration of the lymphatic vessel lumen. Over time, accumulation of interstitial lymphatic fluid causes subcutaneous fibroadipose production.

Lymphedema is a chronic condition that slowly worsens over time. It progresses through four stages. Stage 0 indicates a clinically normal extremity but with abnormal lymph transport (identified via lymphoscintigraphy). Stage 1 demonstrates a relative accumulation of fluid high in protein content, which improves with limb elevation. Pitting may occur. Stage 2 represents pitting edema that does not resolve with elevation, but no evidence of fibrotic skin changes. Late in Stage 2, the limb may not pit as excess fat and fibrosis begins. Stage 3 describes fibroadipose deposition and fibrotic skin changes.

The presence of dermal backflow on contrast-enhanced imaging of the lymphatic system is diagnostic for lymphedema, and the severity and distribution of this backflow correlate closely with the pathologic condition of the lymphatic vessels. Indocyanine green fluorescent lymphography enables detailed dynamic functional evaluation of the superficial lymphatic system and can also be used for intraoperative lymph node mapping for vascularized lymph node transplantation.

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69. A 16-year-old girl requires a skin graft to the dorsal forearm after she sustained injuries in a motorcycle accident. Which of the following wound coverage techniques will lead to the LEAST secondary contraction?

- A) Full-thickness skin graft, 1:4 meshed
- B) Full-thickness skin graft, nonmeshed
- C) Healing by secondary intention
- D) Split-thickness skin graft, nonmeshed, 0.010-in thick
- E) Split-thickness skin graft, nonmeshed, 0.014-in thick

The correct response is Option B.

Secondary contraction of a wound depends on various factors. Studies have shown that thicker grafts result in decreased scar depth and secondary contraction, whereas thinner grafts contract more. In terms of numbers, thick split-thickness skin grafts (0.03 in, 760 mm) approach similar final wound sizes as full-thickness skin grafts. Wider meshing results in more secondary contraction.

Myofibroblast differentiation is thought to be a key driver of contraction. Application of full-thickness skin grafts appears to speed up their life cycle, compared with wounds treated with split-thickness grafts. Conversely, thin grafts show a greater expression of alpha-smooth muscle actin, which persists for a longer time after grafting. Other mechanisms include decreased expression of pro-inflammatory genes one week after full-thickness grafting, such as insulin-like growth factor 1 (*IGF1*) and transforming growth factor beta-1 (*TGFB1*), when compared with wounds treated with thin split-thickness grafts.

Healing by secondary intention is associated with greater contraction than use of a graft.

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70. A 10-year-old girl is brought to the office by her mother because of difficulty using her hand. Medical history includes supracondylar fracture 6 months ago treated with a closed reduction and casting. The fingers of the affected hand are held in the intrinsic minus position. Volkmann ischemic contracture following the fracture is suspected. Which of the following muscles is LEAST likely to be affected by Volkmann contracture?
- A) Brachioradialis
 - B) Flexor digitorum profundus
 - C) Flexor digitorum superficialis
 - D) Flexor pollicis longus
 - E) Pronator teres

The correct response is Option A.

Volkmann ischemic contracture results from forearm muscle shortening and fibrosis as a result of ischemia of forearm muscles during increased compartment pressures. Common reasons for increased compartment pressures include gunshot wounds and fractures, particularly supracondylar pediatric fractures. The radial artery is superficially located, whereas the ulnar artery is deeply positioned, traversing deep to the pronator teres muscles. The ulnar artery becomes the common interosseous artery, which divides immediately into anterior and posterior interosseous branches. The muscles dependent on this deep circulatory pattern are more likely to be affected by ischemia during increased compartment pressures. Flexor muscles commonly involved in this process are the flexor digitorum superficialis, flexor digitorum profundus, flexor pollicis longus, and pronator teres. The brachioradialis is not typically affected due to its more superficial radial artery circulation. Patients with significant functional loss may require surgical procedures such as a free gracilis functioning muscle transfer.

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71. A 5-year-old boy presents with deformity of the tip of the left long finger as shown in the photographs. The tip of the finger was amputated one year ago, and the wound was repaired at a local emergency department. Which of the following is the most appropriate method of correcting this deformity?
- A) Coverage with a hypothenar flap
 - B) Distraction lengthening of the distal phalanx
 - C) Free toe transfer
 - D) Nail bed grafting
 - E) Release and augmentation of hyponychium

The correct response is Option E.

This is a classic hook nail deformity and is caused by deficient bone support of the distal nail bed, soft-tissue contracture/deficiency of the tip of the finger, or both. The most appropriate way to correct the deformity is release and shortening of the portion of the nail bed that has no underlying bone support, and augmentation or advancement of the distal soft tissue envelope. There are many correction methods described, including some that add both soft

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tissue and bone support of the overhanging distal nail bed. Regardless of method chosen, the primary goal of correction is to release the tethered nail bed, ensure that it is supported by bone, and provide sufficient soft tissue coverage to negate tension on the distal nail bed. Nail bed grafting alone will not correct this deformity as this does not provide additional bone support for the nail bed. A hypothenar flap is too remote to supply tissue for this problem. Lengthening the distal phalanx using bone grafting or vascularized bone has been described, but the use of distraction osteogenesis is impractical. Because most of the finger remains in place, a free toe transfer is not indicated.

Composite grafting could conceptually address this issue and has been described, but the survival of the graft is not predictable and harvest of the graft leaves a deformity at the donor digit.

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72. A 32-year-old man sustains a burn to his hand, resulting in a first web space contracture. A four-flap Z-plasty is planned for release of the contracture. Which of the following best describes the flap reconstruction for this defect?

	Flap Type	Blood Supply
A)	Advancement	axial
B)	Advancement	random
C)	Rotation	axial
D)	Rotation	random
E)	Transposition	axial
F)	Transposition	random

The correct response is Option F.

Random pattern flaps are generally classified based on the primary motion of the flap. There are three basic types of tissue movement: transposition, advancement, and rotation. Transposition flaps incorporate noncontiguous skin into a defect by lifting the flap over normal skin for inset into a defect. Advancement flaps recruit adjacent tissue to close a defect via soft-tissue movement in a linear direction. Rotation flaps move adjacent tissue around an axis to close a defect, rotating soft tissue into the defect. Advancement and rotation flaps recruit adjacent lax tissue and move in either a linear or arced motion (respectively) to fill the defect. Transposition flaps recruit noncontiguous tissue, which is lifted over intact soft tissue and placed into the defect. Random pattern flaps lack a defined named arterial vascular supply. Because of their lack of an axial vascular supply, they are subject to dimensional restrictions. In general, they are designed to not exceed a length:width ratio of 2:1. An axial pattern flap is a single pedicled flap that has an anatomically named arterial blood supply running along its long axis. Because of the presence of a named arterial blood supply, axial pattern flaps are not subject to the length:width ratio restrictions that apply to random pattern flaps.

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73. A 42-year-old woman undergoes brachioplasty in the Caribbean. Three months later she presents to a clinic in the US with wound drainage, and results of culture confirm *Mycobacterium abscessus*. Which of the following is the most likely cause of an increased incidence of *Mycobacterium abscessus* infections in patients who travel to the developing world for surgery?

- A) Decreased use of perioperative antibiotics
- B) Equipment sterilization with quaternary ammonium solutions
- C) High incidence of mycobacteria in the local water supply
- D) Instrument processing with ethylene oxide gas
- E) Preoperative use of chlorhexidine soap

The correct response is Option B.

Numerous papers have documented an increased incidence of *Mycobacterium abscessus* in patients traveling to developing countries for surgery. Ineffective sterilization of surgical equipment or solutions are thought to be a primary contributor, specifically inexpensive and low-level chemical methods of sterilization such as the use of quaternary ammonium solutions have been implicated.

In comparison, high-level disinfection such as ethylene oxide or autoclaving is known to effectively kill mycobacteria. Alternatively, disposable, single-use equipment obviates the need for complex resterilization. Of note, non-tuberculous mycobacteria are commonly found in potable water in the United States, thus sterilization techniques which kill mycobacteria after washing are important. Typical perioperative antibiotics are not effective against mycobacteria. Skin preparation has not been suggested as a contributor.

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74. A 56-year-old man is evaluated because of high radial nerve palsy 12 months after sustaining a gunshot wound to the upper arm with complete radial nerve transection. To restore wrist and digit extension, tendon transfers are considered. Which of the following transfers is most appropriate for this patient?

- A) Brachioradialis to extensor indicis proprius
- B) Flexor carpi radialis to extensor digitorum communis
- C) Palmaris longus to extensor pollicis brevis
- D) Pronator quadratus to extensor carpi radialis brevis

The correct response is Option B.

Tendon transfers for complete high radial nerve injuries are often performed within weeks after injury and allow restoration of wrist and digital extensor stabilization. If present, the palmaris longus tendon is transferred to the extensor pollicis longus tendon to allow for thumb extension. The flexor carpi radialis is transferred to the extensor digitorum communis for finger extension. The pronator teres is transferred to the extensor carpi radialis brevis to add support for wrist extension.

The brachioradialis is not generally a good transfer in a high radial nerve palsy as it is typically weak. The extensor indicis proprius does not usually receive a tendon for transfer as the extensor digitorum communis will provide extension to all digits, including the index. The extensor pollicis brevis does not normally receive a tendon transfer since thumb MP joint extension (in addition to IP joint extension) is normally restored with transfer to the extensor pollicis longus tendon.

Pronator quadratus is not used for tendon transfers for wrist extension and cannot reach the extensor carpi radialis brevis.

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75. A 25-year-old man has an acute fracture of the third metacarpal on his dominant hand. An x-ray study shows a displaced oblique fracture with shortening and rotation. During open reduction, which of the following muscles is most likely attached to the fracture fragments?

- A) Abductor digiti minimi
- B) Extensor digiti minimi
- C) Extensor indicis proprius
- D) Interosseous
- E) Lumbrical

The correct response is Option D.

The correct answer is the second dorsal interossei radially and third dorsal interossei ulnarly. There is little variation in anatomic origins of the interosseous muscles. All interossei originate from the corresponding metacarpal shafts. The extensor indicis proprius and extensor digiti minimi muscle bellies are located in the forearm. The abductor digiti minimi muscle is attached to the 5th metacarpal.

The lumbrical originates on the flexor digitorum profundus tendon and not on the bone.

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76. A 45-year-old carpenter presents with a six-month history of an ulceration of the ring fingertip and pain at rest. Digital brachial index is 0.45, and angiography demonstrates occlusion of the ulnar artery. The patient has tried three months of calcium channel blockers and aspirin without relief. Which of the following is the most appropriate treatment for this patient?
- A) Amputation of the fingertip
 - B) Chemical sympathectomy
 - C) Reconstruction of the ulnar artery
 - D) Stellate ganglion block
 - E) Surgical sympathectomy

The correct response is Option C.

Conservative treatment includes smoking cessation, calcium channel blockers, anticoagulation therapy, stellate ganglion block, and behavior modification. Nonoperative management is generally considered first-line treatment, because most patients will have at least partial resolution of their symptoms. With that said, 70% of those treated nonoperatively had partial resolution of their symptoms, and only 12% had complete resolution. Of patients treated operatively, 42% had complete resolution of their symptoms and 42% had partial resolution.

For patients with evidence of more advanced disease such as digital ulceration, chronic resting pain, or conservative management failure, operative intervention may be considered. Preoperative noninvasive vascular studies can be used to determine which patients may require reconstruction versus simple excision and ligation. Studies have suggested that a digital brachial index less than 0.7 indicates reconstruction may be warranted. An index of less than 0.5 suggests critical ischemia, which may result in tissue loss.

Surgical options fall into two basic groups: resection of the involved arterial segment with ligation, and vascular reconstruction with or without interposed graft. Graft occlusion is reported in as high as 78% of patients. Despite a high percentage of occlusion, patients remained satisfied. Patients with occluded reconstructions did not experience worsening of symptoms in comparison with the patent reconstructions. Preoperative digital brachial index values, although informative as to the patient's digital perfusion, do not mandate a particular

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operative intervention. The general treatment algorithm is to perform surgery on patients who have failed on medical management and local treatment to heal any digital soft tissues. A decision on ligation versus reconstruction can be made with the assistance of information gathered by preoperative angiography and noninvasive vascular studies, as well as intraoperative assessment of ulnar digital perfusion with temporary occlusion of the ulnar artery. Poor perfusion following temporary occlusion mandates reconstruction of the artery, whereas adequate perfusion, despite occlusion, can be treated with simple excision or ligation of the diseased ulnar artery segment.

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77. A 22-year-old man who is a competitive bodybuilder desires calf augmentation. Which of the following techniques is associated with the lowest overall complication rate?

- A) Fat grafting
- B) Subcutaneous implant augmentation
- C) Subfascial implant augmentation
- D) Submuscular implant augmentation
- E) Subperiosteal implant augmentation

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

The correct response is Option D.

In patients desiring calf augmentation, the submuscular implantation has been associated with the lowest frequency of complications.

In a meta-analysis of over 2629 cases of calf augmentation, 118 complications were recorded. Submuscular implant placement was associated with 0.9% of complications, fat grafting included 1.5% of complications, and subfascial implant placement (which was the most commonly used) had 5.7% of complications. Around a third of the total number of complications in aggregate were seromas.

Importantly, the frequency of complications may not be as important as the specific complications that occur:

- Calf augmentation with subfascial implants was most commonly complicated by seroma, but also by implant migration, dehiscence, compartment syndrome, and implant rupture and extrusion.
- Fat grafting presented a global complication rate of 1.5%, but the complications were relatively minor including hyperpigmented scars and transient hypoesthesia. No major complications, such as fat embolism or donor-site seroma, were recorded.

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- For calf augmentation with submuscular implant placement, the total complication rate was 0.92%, including wound dehiscence (0.46%), upward migration (0.23%), and one case of necrotizing fasciitis (0.23%).

The subperiosteal technique, although historically performed, is less popular because of the need for fasciotomies and the degree of dissection. Subcutaneous techniques are not used.

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78. A 7-year-old boy falls and sustains the fracture in the x-ray study shown. He undergoes closed reduction and percutaneous pinning of the fracture that night. Postoperatively, he cannot flex his thumb at the interphalangeal joint or his index finger at the distal phalangeal joint. He has normal sensation of his thumb and other fingers. Which of the following nerves was most likely injured in the fall?

- A) Anterior interosseous
- B) Musculocutaneous
- C) Posterior interosseous
- D) Radial
- E) Ulnar

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The correct response is Option A.

The median nerve travels ulnarly to the brachial artery at the distal humerus. Because of the close proximity of the median and anterior interosseous nerves, they can be injured in pediatric supracondylar humerus fractures. This is often the result of strain on the brachial artery and median nerve at the time of injury, and nerve injuries occur in 11 to 16% of these fractures. Contusions of the median and anterior interosseous nerves often recover over time with conservative management. Patients can present with pure median nerve injury, pure anterior interosseous nerve injury, or injury to both nerves. In some cases of pulseless supracondylar humerus fractures, exploration is warranted. In this patient, motor deficits are indicative of an anterior interosseous nerve contusion.

Given the maintained sensation of the hand, the median nerve would be incorrect. The ulnar nerve does not provide motor innervation for thumb IP or index DIP flexion. The radial and posterior interosseous nerves do not innervate the flexor pollicis longus or index finger (flexor digitorum profundus) muscles and do not cross over the volar humerus. Also, the musculocutaneous nerve has no motor innervation distal to the elbow and is only sensory to the forearm.

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79. A patient presents with a traumatic heel loss. The surgeon decides on an innervated medial plantar artery flap. The medial plantar nerve is a terminal branch of which of the following other nerves?

- A) Common peroneal
- B) Lateral plantar
- C) Saphenous
- D) Sural
- E) Tibial

The correct response is Option E.

The answer is tibial nerve. The sciatic nerve comes off the sacral plexus, then it branches into sural nerve, common peroneal nerve, and tibial nerve. The tibial nerve terminal branches are the medial sural cutaneous nerve, medial plantar nerve, and lateral plantar nerve. The medial plantar nerve innervates the abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and first lumbrical muscle. The cutaneous branches innervate the skin of the medial 2/3 of the sole of the foot as well as plantar digital toes. There are also terminal branches to the intertarsal and tarso-metatarsal joints. The flap is supplied by the medial plantar artery off the posterior tibial artery. The artery is found between the abductor hallucis and flexor digitorum brevis. It travels along the medial border of the foot and anastomosis with the first plantar metatarsal artery. Next, the perforators run between the abductor hallucis muscle and the plantar aponeurosis to the skin of the instep.

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80. A 21-year-old man is evaluated after he fell onto his outstretched hand while snowboarding, resulting in edema and pain of the wrist. On the basis of examination, the plastic surgeon suspects a scapholunate ligament injury. Which of the following is the most appropriate x-ray study for evaluation of the suspected injury, and what finding would be considered abnormal?

	View	Finding
A)	Clenched fist	scapholunate diastasis of 1.5 mm
B)	Clenched fist	scapholunate diastasis of 5 mm
C)	Clenched fist	scaphocapitate diastasis of 1.5 mm
D)	Lateral	scapholunate angle of 50 degrees
E)	Lateral	scapholunate angle of 30 degrees

The correct response is Option B.

Scapholunate injuries frequently occur following falls onto an outstretched hand or other wrist trauma. Patients may develop pain and edema about the wrist, and physical examination should include a scaphoid shift test. In the setting of a scapholunate injury, lateral views of plain x-ray studies often demonstrate a scapholunate angle greater than 60 degrees (normal range, 30 to 60 degrees), and clenched fist views frequently demonstrate a scapholunate diastasis greater than 2 cm. A scapholunate interval of 1.5 cm is normal, and the scaphocapitate interval is not used for determination of a scapholunate ligament injury. Additional imaging modalities include MRI and diagnostic arthroscopy.

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81. Under normal conditions, the intrinsic muscles of the hand move the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints in which of the following ways?

	Metacarpophalangeal Joint	Proximal Interphalangeal Joint	Distal Interphalangeal Joint
A)	Extend	extend	flex
B)	Extend	flex	extend
C)	Extend	flex	flex
D)	Flex	extend	extend
E)	Flex	extend	flex
F)	Flex	flex	extend

The correct response is Option D.

The intrinsic muscles are those with an origin and insertion within the hand and include the muscles of the thenar and hypothenar compartments, interossei, and lumbricals. They account for approximately 53% of grip strength and 85% of pinch strength. In general, the intrinsic muscles produce metacarpophalangeal joint flexion and interphalangeal joint extension, which occurs because the tendons of lumbrical and interosseous muscles are volar to the metacarpophalangeal axis of rotation but dorsal to the interphalangeal axis of rotation. The exception is when the metacarpophalangeal joint is hyperextended when the dorsal interosseous tendon is capable of producing extension. Tightness of these intrinsic muscles can be evaluated by the Bunnell-Littler test, whereby the force required to passively flex the proximal interphalangeal joint increases with extension of the metacarpophalangeal joint.

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82. A 60-year-old man with a history of smoking requires near total mandibular reconstruction with a free vascularized fibula. During dissection of the flap, the surgeon should encounter which of the following muscles prior to incising the interosseous septum from an anterior approach?

- A) Extensor hallucis longus
- B) Flexor hallucis longus
- C) Soleus
- D) Tibialis anterior
- E) Tibialis posterior

The correct response is Option A.

Just prior to incising the interosseous septum, the surgeon would be in the anterior compartment of the leg. The muscle lying just anterior to that septum would be the extensor hallucis longus. The tibialis anterior is medial to the plane of dissection for a fibula flap. The flexor hallucis longus and tibialis posterior are located in the deep posterior compartment while the peroneus brevis is found in the lateral compartment. The soleus is located in the superficial posterior compartment.

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83. A 55-year-old woman who is an administrative assistant is referred because of a 2-month history of numbness of the middle finger on the dominant hand. Splinting has not improved the symptoms. Electrodiagnostic studies show borderline mild carpal tunnel syndrome. Which of the following is the most appropriate next step in management ?

- A) Carpal tunnel release
- B) Corticosteroid injection
- C) Exercises with tendon and nerve gliding
- D) Guyon canal release
- E) Transcutaneous electrical nerve stimulation (TENS)

The correct response is Option B.

The answer is corticosteroid injection. A 3-month history of persistent symptoms is one indication for surgical intervention; the patient in this scenario has a history of 2 months. The patient has not had a trial of nonsurgical management. The electrodiagnostic studies show borderline or mild positive carpal tunnel syndrome. Corticosteroid injection has shown improvement in 32% of affected patients who did not have to go on to surgery. Corticosteroid injection should therefore be considered prior to surgical intervention. Transcutaneous electrical nerve stimulation as well as exercise has not been shown to be beneficial in the management of carpal tunnel syndrome. Besides corticosteroid injections, nonsurgical splinting by an occupational therapist and ultrasound have also been shown to improve symptoms of carpal tunnel syndrome.

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84. A patient presents with an unresectable sarcoma of the proximal forearm. An elective transhumeral amputation is planned. Which of the following are the main advantages of performing targeted muscle reinnervation at the time of amputation in this patient?
- A) Decreased pain in residual limb and improved control of myoelectric prosthesis
 - B) Greater length of residual limb and improved soft-tissue coverage over bone
 - C) Improved sensation in residual limb and greater range of motion in native elbow
 - D) Improved shape of residual limb and greater range of motion in native shoulder
 - E) Increased muscle bulk of residual limb and improved control of myoelectric prosthesis

The correct response is Option A.

Targeted muscle reinnervation (TMR) has been a major advance in the care of amputees and involves nerve transfers in the residual limb. Benefits of targeted muscle reinnervation include improved control of myoelectric prostheses for transhumeral amputees and an improvement in residual limb pain for amputees. There appears to be greater effect when TMR is performed acutely at the time of amputation. With this and other contemporary techniques for amputees, the nerves are provided a functional destination. TMR does not substantially alter the range of motion in the shoulder or elbow, and does not provide additional length of the limb. It does not appear to increase the muscle bulk in the residual limb.

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85. A 65-year-old man presents with the rapidly growing, painful dorsal hand lesion shown in the photographs. It is not fixed to the underlying structures and the tendon and bone are not involved. He is a kidney transplant recipient and has been on immunosuppression for the past 10 years. Eighteen months ago, he was treated for a previous squamous cell carcinoma on the contralateral hand. Which of the following are the most appropriate surgical margins and depth of excision for this lesion?
- A) 1-cm peripheral margins, excision to the deep dermal level
 - B) 1-cm peripheral margins, excision to the deep subcutaneous level
 - C) 1-mm peripheral margins, excision to the deep dermal level
 - D) 1-mm peripheral margins, excision to the deep subcutaneous level

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The correct response is Option B.

Squamous cell carcinoma that arises in immunocompromised patients tends to behave more aggressively than tumors in immunocompetent patients. Resection with at least 6-mm margins (some recommend up to 10-mm margins), extending into the subcutaneous tissue, is recommended. Cure rates with Mohs surgery and with frozen section margin control are similar to those for wide local excision.

One-mm surgical margins are too narrow for squamous cell carcinoma, and would lead to a high rate of reoperations for positive microscopic margins. Furthermore, the entire dermis must be completely excised, along with at least part of the subcutaneous tissue, as lesions like this are likely to penetrate to that depth.

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86. A 40-year-old man fell on his outstretched right wrist while snowboarding 12 months ago. His injury is displayed in the posteroanterior view of the right wrist on the x-ray study shown. Assuming a pattern of dorsal intercalated segment instability, a lateral view of the wrist is most likely to show the lunate bone in which of the following positions relative to the adjacent carpal bones?

- A) Lunate anatomic, scaphoid extended
- B) Lunate extended, scaphoid flexed
- C) Lunate flexed, scaphoid extended
- D) Lunate flexed, triquetrum anatomic
- E) Lunate flexed, triquetrum extended

The correct response is Option B.

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The posteroanterior x-ray study of the right wrist demonstrates static scapholunate (SL) dissociation with more than 3 mm of widening between the scaphoid and lunate bones. In a normal wrist, with radial to ulnar deviation of the wrist, the proximal carpal bones go into flexion then extension. With ulnar deviation, the hamate bone pushes the triquetrum into relative extension, while the scaphotrapezium-trapezoid (STT) ligament pulls the scaphoid into extension. The lunate follows the direction of its counterparts. With radial deviation, loading across the STT joint pulls the scaphoid into flexion; the lunate and triquetrum follow while translating dorsally and pronating.

When there is complete dissociation between the scaphoid and lunate, the dorsal SL ligament and secondary stabilizers (such as the dorsal intercarpal ligament) have failed. Dorsal intercalated segment instability (DISI) describes the abnormal position of the lunate relative to the long axis of the radius. Secondary to the loss of the SL and associated stabilizers, the scaphoid falls into a position of flexion and pronation, while the triquetrum pulls the lunate into the triquetrum's preferred position of extension given the intact lunotriquetral ligament. Additionally, the lunate's configuration with a narrower dorsum and volarly inclined radial joint surface plays a role. Volar intercalated segment instability (VISI) describes the pattern of lunate flexion with disruption of the lunotriquetral ligament; the lunate is pulled into flexion with the scaphoid while the triquetrum falls into its normal tendency to extend. The dorsal radiocarpal ligament has been implicated as well in VISI pattern deformity.

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87. A 53-year-old woman is evaluated for stiffness of the right index finger. On physical examination, the range of motion of the proximal interphalangeal (PIP) joint is 0 to 45 degrees when the metacarpophalangeal (MCP) joint is in extension (at 0 degrees). With the MCP joint in flexion (at 90 degrees), the PIP joint range of motion is 0 to 80 degrees. Which of the following conditions is most likely to account for these findings?

- A) Contracture of the PIP joint capsule
- B) Extensor tendon shortening
- C) Flexor tendon adhesions
- D) Intrinsic tightness
- E) Palmar fascia hypertrophy

The correct response is Option D.

The condition most likely to account for these examination findings is intrinsic tightness.

This patient exhibits exam signs consistent with stiffness as a result of intrinsic tightness. The Bunnell test for intrinsic tightness involves comparing flexion at the proximal interphalangeal (PIP) joint with the metacarpophalangeal (MCP) joint extended, to flexion at the PIP joint with the MCP joint flexed. In cases of intrinsic tightness, PIP joint flexion will decrease when the MCP joint is extended, and there is increased flexion of the PIP joint when the MCP joint is flexed.

The intrinsic muscles are responsible for flexion at the MCP joints and extension at the PIP joints. When these are tight, PIP joint motion is decreased when the MCP joint is held in extension. There is increased PIP joint flexion possible when the MCP joint is placed in a flexed position because of the decreased tension on the intrinsic muscles that results with MCP flexion, allowing for improved PIP range of motion.

In cases of extensor tendon shortening or tightness (extrinsic extensor tendon contracture), the opposite effect is seen. MCP joint flexion will place additional tension on the extensor mechanism, tightening it and resulting in decreased flexor function at the PIP joint, when compared with an extended MCP joint.

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Flexor tendon adhesions and contractures of the PIP joint capsule can result in stiffness but would give equal limitations to PIP flexion regardless of MCP joint position. Palmar fascia hypertrophy is seen in Dupuytren contracture. This contracture could potentially limit PIP extension, which might vary with MCP position, but would not limit flexion of the PIP joint as described in this item.

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88. A patient undergoes a free latissimus dorsi musculocutaneous flap for coverage of a lower extremity soft-tissue defect. Which of the following shoulder functions is most likely to be affected by harvest of this patient's entire latissimus dorsi muscle?

- A) Abduction, extension, and internal rotation
- B) Abduction, flexion, and internal rotation
- C) Adduction and external rotation only
- D) Adduction, extension, and internal rotation
- E) Adduction, flexion, and external rotation

The correct response is Option D.

Patients undergoing latissimus dorsi musculocutaneous flap harvest typically have minimal donor site morbidity postoperatively. Some patients may develop shoulder weakness and inability to perform specific functions, including shoulder adduction, extension, and internal rotation. Abduction, flexion, and external rotation are not controlled by the latissimus muscle. Fasciocutaneous flaps have gained popularity because of decreased functional donor site morbidity compared with muscle flap harvest. To avoid potential morbidity of a full latissimus flap harvest, a partial superior latissimus flap harvest could also be considered.

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89. A 3-month-old female infant diagnosed with Apert syndrome is referred to the office for evaluation of both hands. Which of the following clinical findings is most likely to be present?

- A) Camptodactyly
- B) Complex syndactyly
- C) Floating thumb
- D) Macroductyly
- E) Ulnar clinodactyly of the thumb

The correct response is Option B.

Apert syndrome (acrocephalosyndactyly) is a syndrome associated with an *FGFR2* gene mutation and characterized by craniosynostosis, mid-face hypoplasia, and complex syndactyly of the hands and feet. Characteristics of the Apert hand deformity include complex syndactyly of the index, middle, and ring fingers; simple syndactyly of the ring and small fingers; and a varying degree of first web space syndactyly. The Apert hand deformity has been classified into three subtypes on the basis of the increasing degree of thumb involvement and the appearance of the central digital mass.

In the Apert hand deformity, the thumb may be short and radially deviated (radial clinodactyly).

The other responses are not associated with Apert syndrome. Floating thumb ("pouce flottant") is a form of thumb hypoplasia (Blauth Type IV) in which there is a rudimentary digit attached to the hand only by skin and neurovascular bundle. Camptodactyly is a painless flexion contracture of the proximal interphalangeal joint most commonly involving the small finger. Macroductyly is a rare congenital condition in which there is overgrowth of the underlying bone and soft tissue of the finger.

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90. A 28-year-old man presents to the emergency department with acute pain in the left wrist after a motorcycle collision. X-ray studies of the left wrist are shown. Which of the following ligaments maintains its attachment to the lunate?

- A) Dorsal intercarpal
- B) Lunotriquetral
- C) Radioscaphocapitate
- D) Scapholunate
- E) Short radiolunate

The correct response is Option E.

This patient has type IV perilunate dislocation, or lunate dislocation. This represents a complete disruption of the ligamentous stabilizers about the lunate except for the maintained short radiolunate ligament that the lunate rotates on. These injuries are high energy and can be ligamentous only (lesser arc injuries) or include fractures (greater arc injuries), and they are then termed perilunate fracture dislocations. The mechanism of injury involves wrist extension, ulnar deviation, and intercarpal supination. Mayfield described the stages of injury progressing from radial to ulnar in type IV dislocation, including disruption of the scapholunate ligament and radioscaphocapitate ligament, disruption of the lunocapitate joint,

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disruption of the lunotriquetral ligament, dislocation of the lunate from its fossa at the radiocarpal joint volarly into the carpal tunnel, and disruption of the dorsal radiocarpal ligament. The volar location of the lunate implies a rupture of any dorsal attachments. On the posteroanterior view of the x-ray study of the wrist, there will be disruption of Gilula lines. On a lateral x-ray study, a "spilled teacup" sign is seen.

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91. A 57-year-old woman is seen in the emergency department after sustaining a closed crush injury to the dorsum of the right hand. X-ray studies are negative for fracture or dislocation. Examination shows swelling and an inability to actively extend the middle finger at the metacarpophalangeal joint from a flexed position. However, when the finger is placed in extension by the examiner, the patient is able to maintain the finger in extension and resist force. Injury to which of the following structures is the most likely explanation for these findings?

- A) Central extensor tendon
- B) Juncturae tendinum
- C) Lumbrical muscle
- D) Oblique retinacular ligament
- E) Sagittal band

The correct response is Option E.

Injury to the sagittal band is most likely to account for these findings.

The patient has sustained a closed injury to the dorsum of the hand, resulting in a sagittal band rupture. The sagittal bands are responsible for maintaining the position of the extensor tendon dorsally over the metacarpophalangeal (MCP) joint. When this band is ruptured (commonly either via trauma or in rheumatoid arthritis), the extensor tendon can migrate laterally to the MCP joint and fall into the sulcus, causing difficulty in active initiation of extension. However, if the finger is placed in extension passively, the extensor tendon will resume its correct position and will then be able to hold the finger in extension and resist force.

Injury to the central extensor tendon will result in loss of active extension as well as an inability to maintain extension and resist force.

The juncturae tendinum connect the extensor tendons to each other at the dorsum of the hand. Pull via the juncturae may allow for some degree of extension function even in the presence of extensor tendon laceration, but injury to the juncturae should not create a deficit in extension if the tendon remains intact.

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The lumbrical muscle is one of the intrinsic hand interosseous muscles. It functions to create flexion at the MCP joint and extension at the interphalangeal joints. Injury to the lumbrical muscle will not cause an extensor deficit at the MCP joint.

The oblique retinacular ligament is in the finger, originating at the base of the proximal phalanx and inserting into the distal phalanx. It is believed to coordinate proximal interphalangeal and distal interphalangeal motion but should have no bearing on motion at the MCP joint.

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92. A 55-year-old woman undergoes biopsy of a suspicious lesion on the dorsal hand. Which of the following is the most common malignant skin tumor of the hand?

- A) Basal cell carcinoma
- B) Keratoacanthoma
- C) Melanoma
- D) Merkel cell carcinoma
- E) Squamous cell carcinoma

The correct response is Option E.

Malignant tumors are uncommon in the hand, and squamous cell cancer is by far the most common malignant tumor. Approximately 75% of malignant skin lesions on the hand are squamous cell cancer and appear as crusty, scaly raised lesions predominantly on the dorsal skin. They will occasionally ulcerate. Basal cell cancer is a common malignant skin tumor but only accounts for about 10% of hand skin cancers. Melanoma is unusual on the hand; it is responsible for about 3% of hand tumors. Merkel cell carcinoma of the hand is rarely found. Keratoacanthoma is a mimicker of squamous cell carcinoma with a much more rapid growth rate and spontaneous remission.

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93. A 30-year-old man who works as an executive presents with a Zone II flexor tendon laceration. He undergoes immediate four-strand core suture flexor tendon repair and epitendinous suture. In the early postoperative period, which of the following approaches is recommended to optimize the outcome in this patient?

Method of Immobilization	Rehabilitation Protocol
A) Cast	no range of motion
B) Dorsal block splint	early active range of motion
C) Kleinert dynamic elastic traction splint	early passive flexion and active extension
D) None	unrestricted use of the hand
E) Relative motion extension splint	immediate controlled active motion

The correct response is Option B.

Advances in primary flexor tendon repair techniques and postoperative mobilization protocols have improved functional results for Zone II injuries. Repair strength has been shown to be related to the number of strands that cross the repair site. Other factors that contribute to repair strength include suture caliber, adequate core suture purchase (at least 0.7 to 1.0 cm), and the use of an epitendinous repair in addition to core suture placement. A forearm-based dorsal block splint is placed to protect flexor tendon repairs. Compared with passive mobilization protocols, early active mobilization protocols demonstrate better functional outcomes without a significantly increased rate of tendon rupture. A minimum of a four-strand core repair is necessary to tolerate an early active mobilization protocol. In this patient, a six-strand core repair with an epitendinous repair is appropriate for an active motion protocol. Although the flexor repair described in this scenario is strong enough to tolerate protected early active motion, complete absence of a protective splint with unrestricted use of the hand would be inappropriate and risks tendon rupture. The Kleinert splint is a dorsal extension block splint that allows active extension and utilizes rubber bands for passive flexion. This is not considered an early active flexion protocol. A relative motion extension splint with immediate controlled active motion is used following extensor tendon repairs/injuries. Cast immobilization following flexor repair would not be appropriate in this scenario if the goal is to maximize flexor function, but it may have a role in the postoperative management of flexor injuries in children or unreliable adults.

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94. A 75-year-old woman with a medical history significant for rheumatoid arthritis presents with painless loss of extension of the thumb and all digits of the left hand. When she attempts wrist extension, the wrist deviates radially while actively extending. When the examiner passively flexes the wrist, the thumb and fingers extend. Which of the following best describes the likely cause of this patient's functional deficit?
- A) Dorsal ulna prominence; rupture of multiple extensor tendons
 - B) Ligamentous laxity; subluxation of multiple metacarpophalangeal joints
 - C) Proliferative synovitis of the radiocapitellar joint; compression of posterior interosseus nerve
 - D) Scaphoid bone osteophyte; rupture of flexor pollicis longus muscle
 - E) Weakening of extensor hood; dislocation of extensor tendon

The correct response is Option C.

This patient demonstrates posterior interosseus nerve (PIN) syndrome. She has loss of active thumb and finger extension while maintaining active wrist extension with radial deviation. Proliferative synovitis secondary to rheumatoid arthritis of the radiocapitellar joint or within the radial tunnel is traditionally the culprit at the proximal forearm. Rheumatoid arthritis is characterized by cartilage degradation, synovial expansion, ligamentous laxity, and bony erosion. All joints and tendon sheaths can be involved.

The PIN branch of the radial nerve is a motor nerve. It provides innervation to the extensor carpi radialis brevis (although this can be innervated by the radial nerve proper), supinator, extensor carpi ulnaris, extensor digitorum communis, extensor pollicis longus and brevis, abductor pollicis longus, extensor indicis proprius, and extensor digiti minimi muscles. In compression or entrapment of the PIN nerve, the extensor carpi radialis longus is traditionally spared, as it is innervated by the radial nerve proper, proximal to the level of compression. Thus, active wrist extension with radial deviation is maintained.

Dorsal subluxation of the ulna is secondary to attenuation of surrounding capsular ligaments, and erosion of the distal radioulnar joint leads to dorsal subluxation of the ulna. The dorsally placed ulna can result in attritional rupture of extensors, traditionally affecting the ulnar-most digital extensors first. Multiple extensor ruptures at the level of the wrist would not

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demonstrate intact extension on tenodesis examination. Attenuation of extrinsic and intrinsic wrist ligaments in rheumatoid arthritis leads to carpal volar subluxation, supination, and ulnar translocation. Wrist collapse leads to metacarpal radial deviation and eventual ulnar drift of the fingers. Further volar and ulnar subluxation of the fingers at the metacarpophalangeal joints (MCPJs) is a result of asymmetry of the metacarpal heads, flexor-extensor-intrinsic imbalance, attenuation of the extensor hood, and attenuation of collateral ligaments. MCPJ subluxation would not result in an intact examination with tenodesis and would not affect wrist extension with radial deviation posture. Weakening of the extensor hood would result in extensor tendon subluxation ulnarly. Classically in the situation of extensor tendon subluxation at the level of the MCPJ, if the joints are not fixed and the examiner passively reduces the joints, the patient is able to maintain active MCPJ extension. Wrist extension should not be impacted.

Scaphoid osteophytes in rheumatoid arthritis can result in attritional rupture of the flexor pollicis longus (FPL), termed the Mannerfelt lesion. FPL rupture should impact the thumb interphalangeal joint with loss of active flexion.

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95. A 64-year-old man undergoes surgical treatment for Dupuytren contracture of the left hand. During the course of the operation, the digital neurovascular bundle is found to be displaced from its typical position. Which of the following cords is most likely responsible for the displacement?

- A) Central
- B) Natatory
- C) Retrovascular
- D) Spiral

The correct response is Option D.

The cord most likely to be responsible for the displacement is the spiral cord.

The spiral cord begins centrally in the digit, travels deep to the neurovascular bundle heading toward the border of the digit, then finally passes superficial to the neurovascular bundle heading back toward the center of the digit. This spiral path causes the neurovascular bundle to be displaced volarly, proximally, and centrally as it contracts. This displacement can place the neurovascular bundle at risk during surgery for Dupuytren contracture. This cord is composed of contributions from the pretendinous band, spiral band, lateral digital sheet, and Grayson ligament.

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 individuals of northern European descent.

A number of different types of cords may result from thickening of various aspects of the normal fascial bands within the hand fascia.

The central cord is the distal extension of the pretendinous cord on the volar aspect of the digit and can give rise to metacarpophalangeal and proximal interphalangeal joint contractures.

The natatory cord occurs in the web spaces and can cause web space contractures.

The retrovascular cord runs dorsal to the neurovascular bundle and can cause distal interphalangeal contractures.

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96. A 65-year-old man presents to the office with symptoms and examination findings consistent with bilateral carpal tunnel syndrome. Medical history includes recent rupture of the left biceps tendon and several trigger fingers. Biopsy of the tenosynovium is performed during carpal tunnel release and the pathology report shows a positive Congo red stain. Which of the following diagnoses is most likely and should prompt further consultation?

- A) Amyloidosis
- B) Diabetes mellitus
- C) Fibromyalgia
- D) Malingering
- E) Rheumatoid arthritis

The correct response is Option A.

A recent study showed that 10% of men over 50 years old and women over 60 years old with bilateral carpal tunnel syndrome had positive tenosynovial biopsies for amyloid. This can be a devastating disease if left to affect the heart or other organs and can be diagnosed with a simple biopsy during carpal tunnel release. Other findings suggestive of amyloidosis include a spontaneous biceps rupture, trigger finger, and spinal stenosis.

Patients with diabetes and rheumatoid disease have a higher incidence of carpal tunnel syndrome than the general population but the mention of biceps rupture points to the diagnosis of amyloidosis. Fibromyalgia and malingering have not been shown to be related to carpal tunnel syndrome.

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97. A 23-year-old man presents with a deep volar distal forearm laceration after striking a window. He is taken emergently to the operating room for repair of multiple flexor tendon, nerve, and arterial transections. Which of the following best describes the anatomical relationship of the flexor digitorum superficialis tendons so that the proximal and distal stumps can be correctly matched and repaired?
- A) Index and middle superficialis tendons are volar to the ring and small superficialis tendons
 - B) Index and small superficialis tendons are volar to the middle and ring superficialis tendons
 - C) Index, middle, ring, and small superficialis tendons are arranged side-by-side
 - D) Middle and ring superficialis tendons are volar to the index and small superficialis tendons
 - E) Ring and small superficialis tendons are volar to the index and middle superficialis tendons

The correct response is Option D.

The superficial location of numerous, tightly packed vital structures at the volar aspect of the wrist/distal forearm makes them susceptible to injury with penetrating trauma. The patient presents with a "spaghetti wrist," a term used to describe these devastating injuries that may result in transection of multiple flexor tendons and neurovascular structures.

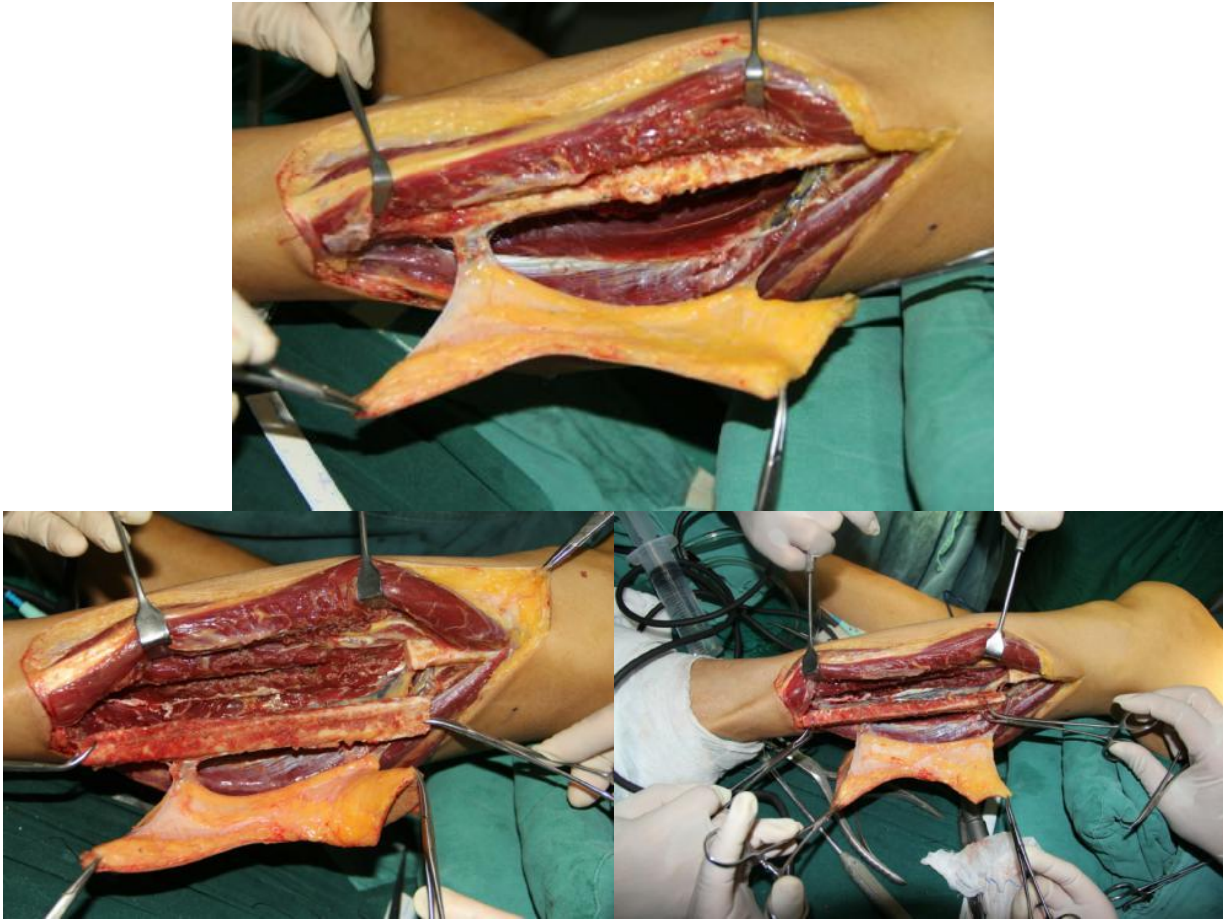
A thorough knowledge of the anatomy in this region is required in order to appropriately align and repair all transected critical structures. In particular, the flexor digitorum superficialis tendons are arranged such that the middle and ring superficialis tendons are superficial to the index and small finger superficialis tendons. Of note, the flexor digitorum profundus tendons are arranged in a side-by-side fashion deep to the superficialis tendons. The median nerve is located between the superficialis and profundus musculotendinous units at this level.

The other options do not describe the correct arrangement of the superficialis tendons at the distal forearm/wrist level.

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98. A 20-year-old man undergoes harvest of the lower extremity free flap as shown in the photographs. A long length of bone is required for the reconstruction. With proximal dissection and osteotomy, which of the following nerves is at the highest risk for injury?

- A) Common peroneal
- B) Lateral femoral cutaneous
- C) Saphenous
- D) Sural
- E) Tibial

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The correct response is Option A.

The fibula is a long, thin triangular bone of the lower extremity. The fibula can be harvested as a free osseous or free osteoseptocutaneous flap with primary blood supply from the peroneal artery. Preservation of 4 to 6 cm of length proximally and 6 cm distally is important for the maintenance of stability of the knee and ankle. The peroneal nerve should be identified prior to proximal dissection as it wraps around the fibular neck. At this level, the nerve can be palpated and marked out to avoid injury during proximal dissection.

The common peroneal nerve arises from the sciatic nerve, running along the biceps femoris toward the posterior fibular head. It wraps around the proximal fibula at the neck, continuing laterally through a fibrous tunnel comprised of the aponeurosis of the peroneus longus, lateral gastrocnemius, and soleus muscles. Under the peroneus longus, the nerve branches into the superficial and deep branches; the superficial branch runs under the peroneus longus to innervate the peroneus longus and peroneus brevis, and it provides cutaneous sensation for the foot dorsum. The superficial peroneal nerve can be injured during anterior dissection for the skin paddle at the mid lower leg.

The deep peroneal nerve can be identified after deep dissection through the interosseus membrane into the anterior lower leg compartment. This nerve can be found between the extensor hallucis longus and extensor digitorum longus muscles. The deep peroneal nerve provides innervation to the muscles of the anterior compartment and sensation to the first web space.

The tibial nerve branches from the sciatic nerve, running through the popliteal fossa, sitting lateral to the neurovascular bundle, then proceeds deep to the gastrocnemius and soleus muscles. It then proceeds to run along the medial ankle posterior to the medial malleolus and provides sensory innervation to the plantar foot. Along its path, it provides innervation to the posterior compartments and intrinsic muscles.

The sural nerve is a sensory nerve, traditionally a confluence of the medial sural nerve from the tibial nerve and a lateral sural cutaneous nerve from the common peroneal nerve. The nerve is found superficial to the superficial posterior compartment in the posterior calf at the midline, lateral to the Achilles tendon; then it veers laterally in the ankle. This nerve provides sensation to the dorsolateral foot.

The saphenous nerve is the terminal sensory nerve of the femoral nerve; it perforates the femoral canal and becomes superficial and descends with the saphenous vein. It descends along the medial lower leg from the medial epicondyle region to the medial malleolus. Sensation is provided for the anteromedial lower leg. This nerve is unlikely to be injured in free fibula harvest given its medial leg location.

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The lateral femoral cutaneous nerve arises from the posterior divisions of the L2 and L3 spinal nerves. The nerve usually exits from the lateral psoas muscle, heading towards the anterior superior iliac spine. It exits below the inguinal ligament and bifurcates. The sensory distribution is the skin of the anterolateral and lateral thigh. Given the proximal location, this nerve should not be in the region of dissection.

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99. A 19-year-old man reports severe, worsening arm pain and finger swelling accompanied by distal numbness. He sustained a circumferential burn to the arm 12 hours ago. The area of burned skin itself is noted to be leathery and insensate. Examination demonstrates loss of distal pulses. Which of the following is the most appropriate next step?

- A) Angiography
- B) CT scanning
- C) Duplex ultrasonography
- D) Escharotomy
- E) Fasciotomy

The correct response is Option D.

The most appropriate next step is escharotomy.

The patient exhibits signs of vascular compromise due to tight restrictive burn eschar arising from a circumferential full-thickness burn. Edema following a burn due to inflammation and fluid resuscitation can cause increased swelling of the tissues, and the presence of tight circumferential eschar can give rise to vascular compromise. Release of the burn eschar (escharotomy) is indicated to relieve pressure on the tissues and allow for restoration of blood flow.

Burns are classified into partial thickness and full thickness, and into different degrees based on the depth of injury. In the case of full-thickness (third-degree or fourth-degree) burns, the area of burned skin is insensate and may appear charred or leathery. Eschar formation in circumferential burns can lead to a tourniquet effect, with impaired circulation. In some cases, circumferential burns of the torso may even give rise to respiratory compromise or abdominal compartment syndrome.

Escharotomy differs from fasciotomy in that the incision is made more superficially, to open the thick burn eschar, and does not need to extend deep to the fascia.

Angiography would be useful in evaluating vasculature and blood flow, but would not be needed in this situation and would delay treatment.

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

Duplex ultrasonography can evaluate the presence of deep vein thrombosis, which could cause pain and swelling. However, in this case, the clinical scenario suggests that circulatory restriction is due to the circumferential burn scar.

Fasciotomy is recommended in the case of increased compartment pressures, which may also present with pain, paresthesia, and loss of pulses, although in this instance the presence of a circumferential burn would indicate escharotomy as the treatment.

Fasciotomy is advised if compartment pressure exceeds 30 mmHg, or if the difference between intracompartmental pressure and diastolic blood pressure is less than 30 mmHg.

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100. A 27-year-old man is evaluated because of chronic right wrist pain after a motor vehicle collision. X-ray studies show no fractures and normal carpal bone alignment. Watson's scaphoid shift test is positive. Which of the following modalities offers the highest sensitivity and specificity for the diagnosis of this injury?

- A) Anteroposterior x-ray study
- B) Arthroscopy
- C) Clenched fist x-ray study
- D) CT scan
- E) MR arthrogram

The correct response is Option B.

The correct answer is wrist arthroscopy. Arthroscopy is considered the gold standard for the diagnosis of scapholunate and other intercarpal ligament injuries as the injury is directly visualized. The scapholunate ligament is generally best visualized through the 3,4 portal, and midcarpal joint arthroscopy is also recommended to make the diagnosis. Arthroscopy is the standard that all other modalities are compared against.

Standard x-ray studies should be performed for any patient with suspected wrist pathology. In addition to posteroanterior, lateral, and oblique films, both scaphoid and clenched fist views should be obtained. Dynamic scapholunate instability will have normal x-ray studies, and it can take 3 months or longer to see any evidence of scapholunate instability, such as scapholunate diastasis greater than 3 mm or an increased scapholunate angle greater than 70 degrees.

Noncontrast MRI is a common method of evaluation for intercarpal ligament tears. The accuracy of MRI is improved with a 1.5-T or greater magnet, thin slices, use of a wrist coil, and reading by a fellowship-trained musculoskeletal radiologist. Studies show that MRI is only about 70% sensitive but highly specific (close to 100%) for scapholunate ligament tears. Arthrography, both conventional CT and MR, can improve the accuracy of imaging. Contrast extravasation to the midcarpal joint is diagnostic of a complete tear but does not examine the extent of the lesion. Arthrography sensitivity and specificity is approximately 95% and 85%, respectively.

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Section 3: Craniomaxillofacial

101. A 9-year-old boy with a history of a Veau class II cleft palate presents with hypernasality and stigmatizing speech. His surgical history includes a double opposing Z-plasty palatoplasty at 12 months of age. His palate is short, but it elevates appropriately. A palatal lengthening procedure with posteriorly based bilateral buccinator musculomucosal flaps is planned. This flap's blood supply is based on branches from which of the following arteries?

- A) Anterior ethmoid
- B) Facial
- C) Greater palatine
- D) Internal carotid
- E) Internal maxillary

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

The correct response is Option E.

The use of buccal musculomucosal flaps has gained in popularity for both primary palate repair and secondary speech surgery. The many advantages of adding these flaps to palate surgery include the ability to posteriorize the levator muscles, eliminate dead space, and lengthen the palate. The patient described, who has great palate function but a short palate, is an ideal candidate for buccinator musculomucosal flaps rather than a pharyngoplasty, which may lead to obstructive sleep apnea. Understanding the blood supply is critical to performing this flap in a reliable fashion.

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102. A 23-year-old man sustains a severe right orbital floor fracture in a physical altercation. Reconstruction with a pre-bent orbital floor plate and intraoperative CT scanning is planned. Which of the following is the most likely to be optimized using this imaging modality intraoperatively?

- A) Operative time
- B) Plate positioning
- C) Rate of corneal abrasion
- D) Rate of plate extrusion
- E) Risk for lid malposition

The correct response is Option B.

Use of intraoperative computed tomography has been gaining traction in maxillofacial trauma. Stated benefits include decreased re-operation rate, improved accuracy of plate positioning, and decreased postoperative enophthalmos. Although the use of intraoperative CT scans may increase time in the operating room, it has no effect on rates of corneal abrasion, lid malposition, or plate extrusion.

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103. A newborn female presents to the neonatal intensive care unit with failure to thrive and dysmorphic features. Initial evaluation demonstrates cloverleaf skull deformity, midface retrusion, severe exorbitism, respiratory compromise, and broad thumbs. Which of the following procedures in the neonatal period will best decrease this patient's risks for irreversible sequelae due to her disease?

- A) Monobloc osteotomy with external fronto-facial distraction
- B) Posterior vault distraction osteogenesis
- C) Temporary tarsorrhaphies and mandibular distraction osteogenesis
- D) Tongue-lip adhesion and fronto-orbital advancement
- E) Tracheostomy, decompressive craniectomy, and temporary tarsorrhaphies

The correct response is Option E.

Cloverleaf skull deformity (Kleeblattschädel) associated with Pfeiffer syndrome poses significant challenges to the craniofacial surgeon. Fusion of the coronal, lambdoid, and sagittal sutures significantly increases the risk for intracranial hypertension, necessitating urgent surgery to release the fused sutures to allow the brain to grow. Additionally, patients with severe exorbitism may require a temporary tarsorrhaphy early in life to prevent exposure keratopathy and globe prolapse. Tracheostomy should also be performed at this time to allow for adequate ventilation. Tongue-lip adhesion is not adequate to treat this patient's respiratory compromise. Fronto-orbital advancement and monobloc distraction should not be performed in the neonatal period. Posterior vault distraction would not address this patient's orbital exposure or critical airway.

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104. A 9-year-old boy with a history of cleft lip and palate is brought for evaluation by his parents because they have a strong desire for their son to undergo nasal revision this summer. The patient is otherwise healthy, communicative, and developmentally appropriate. Physical examination shows that he has mild nasal tip asymmetry; his nasal airway is patent; his midface is well-projected; Cupid's bow is balanced and symmetric, as is his vermillion. The patient states he does not want to have surgery. Which of the following is the most appropriate initial course of action?
- A) Openly discuss the disparity between the parents' and patient's goals to better understand their respective motivations
 - B) Refer the parents and child to family counseling to address their competing interests
 - C) Schedule the patient for surgery this summer; the parents have medical decision-making authority
 - D) Set aside the parents' desires; the child does not want surgery
 - E) Surgery is not indicated; refer the case to child protective services

The correct response is Option A.

Informed consent in the pediatric surgical patient can present a pediatric plastic surgeon with complex ethical issues. This is especially true when minor children and their legal guardians disagree about surgical decisions. In this common scenario described, the parents are interested in cleft nasal revision, whereas the patient is not. In such a scenario, it is important to understand both stakeholders' viewpoints. Is the patient worried about missing vacation or a sporting activity over the summer or does his deformity not bother him? Do the parents have perspective they have not shared or do they have an unreasonable expectation for their child? These are all important considerations. Of the answer choices, only open discussion starts to bring the competing parties closer together.

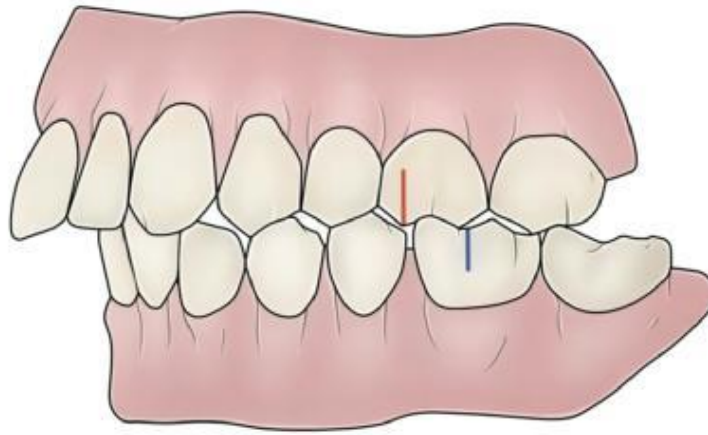
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105. A 30-year-old woman presents with the dental findings shown in the diagram. Which of the following best describes the dental relationship?

- A) Angle class I
- B) Angle class II
- C) Angle class III
- D) Negative overjet
- E) Overbite

The correct response is Option B.

The images show an Angle class II relationship. The Angle classification system describes the relative positions between the mesial buccal cusp of the maxillary first molar and the buccal groove of the mandibular first molar. Angle class I molar relationship implies that the mesiobuccal cusp is in line with the buccal groove. In an Angle class II molar relationship, the maxillary mesiobuccal cusp is anterior to the mandibular buccal groove. Class II is

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subdivided into two divisions. In class II, division 1, patients have minimal crowding of the maxillary teeth and proclination of the upper central incisors, and a significantly increased overjet. In a class II, division 2 relationship, the central incisors are retroclined. An Angle class III molar relationship exists when the maxillary mesiobuccal cusp lies posterior to the mandibular buccal groove.

An overbite refers to a vertical overlap between the incisal surfaces of the central maxillary and mandibular incisors. An overjet refers to a horizontal discrepancy in the position of the maxillary and mandibular central incisal surfaces.

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106. Which of the following is the normal anatomic position of the levator veli palatini muscle?

- A) It originates from the floor of the mouth and runs anterior to the palatine tonsils
- B) It originates from the lateral aspect of the Eustachian tube and inserts onto an aponeurosis in the anterior 25% of the velum
- C) It originates from the medial aspect of the Eustachian tube and inserts onto the posterior aspect of the hard palate and tensor aponeurosis
- D) It originates from the medial aspect of the Eustachian tube and runs transversely in the middle 50% of the velum
- E) It originates from within the posterior palate and runs posterior to the tonsillar fossa

The correct response is Option D.

Velopharyngeal port (VP) function results from the coordinated effort of the musculature of the velum and pharyngeal wall. The levator veli palatini muscle is the key muscle responsible for elevation of the soft palate, which is necessary for VP closure. In patients with a cleft palate or submucous cleft palate, clefting of the muscle and its abnormal insertions result in loss of the normal levator sling that elevated the palate. Reconstruction of this levator sling through an intravelar veloplasty (IVVP) is a critical component of palatoplasty procedures to ensure optimal VP function and speech development.

In its normal anatomic relationship, the levator veli palatini muscle has a muscular origin from the petrous temporal bone, the carotid canal, and cartilaginous Eustachian tube. The muscle forms a muscular sling by joining with its paired contralateral muscle running in a transverse orientation in the middle 50% of the velum.

The pathologic orientation of the levator muscle is seen in a cleft palate. The muscles are not transversely oriented. Instead of joining with the contralateral levator muscle in the midline, the muscles are instead oriented more sagittally and insert into the posterior edge of the hard palate and tensor aponeurosis laterally.

The tensor veli palatini muscle originates from the greater wing of the sphenoid and lateral aspect of the cartilaginous and membranous Eustachian tube. The majority of its fibers pass around the pterygoid hamulus as a tendon and insert into the tensor aponeurosis, which

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occupies the anterior 20 to 30% of the velum. This muscle acts as a shock absorber for the velum and primary dilator of the Eustachian tube.

The palatoglossus muscle is also a paired muscle of the velum that descends in the anterior faucial pillar anterior the palatine tonsil and inserts into the dorsolateral aspect of the posterior tongue. It contributes to velar depression and glossal elevation.

The palatopharyngeus muscle originates from the posterior palate and runs posterior to the tonsillar fossa. These muscles are often used for sphincter pharyngoplasty.

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107. A 26-year-old man presents to the emergency department because of jaw pain and malocclusion. He has normal dentition. CT scan shows an isolated, noncomminuted left-sided angle fracture of the mandible. Which of the following treatment methods is likely to have the lowest complication rate?
- A) Closed reduction with arch bars
 - B) Open reduction through an intraoral approach with one miniplate
 - C) Open reduction through an intraoral approach with two miniplates
 - D) Open reduction through a submandibular incision with a 2.7-mm reconstructive plate

The correct response is Option B.

Treatment options for mandibular fractures are varied and include closed reduction and external fixation with intermaxillary fixation, as well as open reduction and internal fixation through either intraoral or extraoral approaches. Internal fixation strategies include non-rigid fixation with wire osteosynthesis, internal fixation with single or multiple miniplates, compression plate fixation, and locking reconstruction plates.

Intermaxillary fixation represents the historic standard for treating mandible fractures. Closed treatment of fractures with interdental fixation alone or combined with non-rigid internal fixation does not stabilize movement of the proximal segment in unstable and/or unfavorable angle fractures and results in an approximately 17% risk for infection or malunion.

Comparative studies and recent meta-analyses have demonstrated the lowest complication rates when treating isolated, noncomminuted mandibular angle fractures via open reduction and internal fixation with a single noncompression miniplate.

The addition of a second plate results in increased soft tissue and infection complications, likely because of the increased need for periosteal stripping and devascularization of the fractured segments.

Open reduction and fixation through an extraoral approach with a locking reconstruction plate results in slightly higher, but comparable, risk for complication. This treatment mandates a visible scar and carries increased risk for facial nerve injury. This treatment is indicated in comminuted fractures, fractures with loss of bone stock, and atrophic mandibles, but it is unnecessary in a patient with intact dentition and a noncomminuted, isolated fracture.

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108. A patient with unilateral complete cleft lip and palate presents for discussion of alveolar bone grafting. The permanent lateral maxillary incisor is absent. Which of the following is the most accepted time period to perform an alveolar bone graft in this patient?
- A) Before eruption of the central incisors
 - B) Following eruption of the permanent canine
 - C) In infancy, at the time of primary lip repair
 - D) In mixed dentition, before eruption of the permanent canine

The correct response is Option D.

Reconstruction of the cleft alveolus seeks to close any remaining oronasal fistulae, stabilize the maxillary segments into a single dental arch, and provide bone for eruption of teeth adjacent to the cleft with optimal periodontal support.

Primary bone grafting involves placement of a bone graft at the time of the initial cleft lip repair in the neonatal period. It is different from performing a gingivoperiosteoplasty (GPP), in which soft tissue repair of the alveolus is performed to close the anterior palatal fistula and encourage bone formation in the gap. Primary bone grafting has fallen out of favor in most American cleft centers, as several studies have shown diminished maxillary growth, poor arch relationships, and greater need for orthognathic surgery following this procedure. Secondary bone grafting can be performed at various times during dental development. Many children with cleft lip and palate have a poorly formed or missing lateral incisor. When a normal lateral incisor is present, a compelling argument can be made for earlier secondary bone grafting prior to its eruption to optimize the periodontal health and longevity of this tooth. The child in the clinical vignette is missing a lateral incisor on the side of the alveolar cleft.

Bone graft material will only heal successfully to adjacent bone. Exposed periodontal ligament, dentin, and enamel from erupted teeth do not adhere/heal to bone graft, and graft material adjacent to these structures will resorb. Growth following secondary bone grafting between 8 and 12 years of age has been shown to be equivalent to growth seen in patients with similar clefts that remained ungrafted. Additional studies have shown decreased success rates for bone grafts performed after the eruption of the secondary canine. Optimal bone graft success seems to result when grafting is performed when the secondary canine root is one-

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half to two-thirds developed, which allows the canine to erupt through the graft. The maxillary canine erupts between 11 to 12 years of age. Due to the need to graft before canine eruption and the variability in dental eruption in children with clefts, the optimal timing for alveolar bone grafting is often between 8 and 12 years of age, but treatment must be tailored to the patient's chronological and dental age.

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109. Which of the following structures is formed from the same branchial arch as the vagus (X) nerve?

- A) Inferior parathyroid glands
- B) Lesser horn of hyoid
- C) Levator veli palatini
- D) Maxillary artery
- E) Styloid process

The correct response is Option C.

Each of the six branchial arches gives rise to a branch of the aortic arch, a cranial nerve, muscular structures, and skeletal structures. The fourth branchial arch gives rise to the right proximal subclavian artery, the aortic arch, the vagus (X) nerve, the superior laryngeal nerve, the intrinsic muscles of the levator veli palatini, cricothyroid muscles, laryngeal cartilages, and the superior parathyroid glands.

The styloid process is derived from the second branchial arch, along with the stapedial and hyoid arteries, the facial (VII) nerve, the muscles of facial expression, the stapes, the lesser horn of the hyoid bone, and the crypts of the palatine tonsils.

The maxillary artery is derived from the first branchial arch, along with the trigeminal (V) nerve, the muscles of mastication, anterior belly of the digastric muscle, tensor tympani, tensor veli palatini, mylohyoid, mandible, incus and malleus, maxilla, vomer, zygoma, and temporal bone.

The inferior parathyroid glands are derived from the third branchial arch, along with the common carotid artery, internal carotid artery, glossopharyngeal (IX) nerve, stylopharyngeus muscle, greater horn of the hyoid bone, and thymus.

The lesser horn of the hyoid bone is derived from the second branchial arch.

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110. During dissection of the nasal mucosal flap in a Furlow palatoplasty procedure for correction of velopharyngeal insufficiency, the surgeon inadvertently makes a large defect in the nasal mucosal flap, leading to the inability to transpose the nasal lining flap for closure. Which of the following closure options will provide the least donor site morbidity for this patient?

- A) Buccal fat pad flaps
- B) Hard palate myomucosal flap
- C) Sphincter pharyngoplasty
- D) Superiorly based pharyngeal flap
- E) Vomer mucosal flap

The correct response is Option A.

Buccal fat pad flaps are a technically simple, quick option for closure of mucosal defects in palatal closure. Their use has not been associated with significant donor site morbidity, and they are able to reach across the transverse maxillary arch, even in wide clefts, which makes them useful in closure or reinforcement of mucosal defects in palatoplasty.

A superiorly based pharyngeal would not only create more donor site morbidity than using a buccal fat pad flap, but using the pharyngeal flap could also cause obstructive sleep apnea, and therefore is best used as a secondary or tertiary procedure in case of persistent velopharyngeal insufficiency (VPI), not as an adjunct in primary palatoplasty.

A hard palate myomucosal flap would not adequately address the problem of nasal mucosal loss, and attempting to use one to cover nasal lining would likely cause significant donor site complications, such as exposure of the hard palate maxillary bone.

Sphincter pharyngoplasty is not an option for nasal mucosal closure, since this procedure is designed to augment the posterior pharynx and tighten the oronasal aperture.

Vomer flaps are useful in nasal lining closure for the hard palate, but are not useful for closure of the nasal lining of the soft palate.

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111. A 2-year-old boy is evaluated because of a soft, nontender, noncompressible glabellar mass that has progressively grown since birth. A photograph is shown. Which of the following is the most appropriate next step in management before scheduling surgery?

- A) Corticosteroid injections
- B) MRI
- C) Plain film x-ray study
- D) Propranolol trial
- E) Observation

The correct response is Option B.

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The differential diagnosis for a lesion in this location with the findings described include dermoid cyst, hemangioma, and encephalocele. Osteoma, which is a benign bony tumor, is unlikely because of patient age and examination findings. The noncompressible quality of the lesion makes hemangioma and encephalocele less likely. Propranolol therapy after 12 months of age is unlikely to help, even if the lesion is a hemangioma. If the lesion is a hemangioma, then observation would be appropriate, but because the lesion is still growing, this diagnosis is questionable. Corticosteroid injections are only moderately helpful in treating a hemangioma, but they are contraindicated for dermoid cysts and encephalocele. Diagnosis is the next step with a goal of ruling out intracranial communication, as it will impact the surgical approach. MRI is the best option. Plain x-rays films would not provide adequate information for management.

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112. Surgical excision of an involuted infantile hemangioma is planned for residual deformity. Which of the following immunohistochemical markers is most specific for the suspected diagnosis?

- A) D2-40
- B) GLUT-1
- C) HER2/neu
- D) PROX-1
- E) VEGFR-3

The correct response is Option B.

GLUT-1 immunostain positivity is the defining feature in distinguishing infantile hemangioma from other vascular anomalies.

HER2/neu is a marker that is used in breast cancer pathological studies. HER2 is a tyrosine kinase receptor that is part of the human epidermal growth factor family. Overexpression is found in approximately 30% of breast cancers and is associated with a more aggressive clinical course with higher recurrence.

VEGFR-3 marker positivity is observed in lymphatic malformations.

PROX-1 marker positivity is observed in lymphatic malformations, as well as tufted angioma and Kaposiform hemangioendothelioma.

D2-40, like PROX-1, is a marker for lymphatic origin, and would not be expected to be broadly positive within an infantile hemangioma.

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113. A 12-year-old girl with Parry-Romberg syndrome presents to the office for treatment. She has mild symptoms of facial soft-tissue atrophy, but is otherwise well, and has not undergone any formal workup. Which of the following next steps is likely to provide the most helpful and useful information for long-term management of her disease?

- A) Blood draw to evaluate complete blood count
- B) Lumbar puncture to evaluate cytology
- C) Nerve conduction studies to evaluate trigeminal (V) nerve divisions
- D) Referral to ophthalmology for complete eye examination
- E) Referral to orthopedic surgery for bone age studies

The correct response is Option D.

Workup of Parry-Romberg syndrome requires multidisciplinary evaluation in order to provide the patient with the best care. Evaluation by an ophthalmologist is required to determine if the patient has any ocular involvement, as these patients can suffer visual impairment if they have unrecognized disease. Because many patients can have ocular involvement and still be asymptomatic, it is important that they undergo a full ocular examination to fully understand the extent of disease.

While a complete blood count is used liberally for the workup of new health problems, it is not specific or helpful in the diagnosis or management of Parry-Romberg syndrome.

Lumbar puncture may be helpful in patients who have Parry-Romberg syndrome, but only if they have seizures.

Consultation with orthopedic surgery would not be helpful in this patient, and is not a common part of management of patients with Parry-Romberg syndrome. Because this disease is believed to have an autoimmune etiology, referral to a rheumatologist would be far more appropriate.

Nerve conduction studies are not a standard part of a workup for Parry-Romberg syndrome because they would not furnish clinically useful information.

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114. An 11-year-old boy presents to the office after sustaining injury during a fall from his scooter. Orthopantomogram panoramic x-ray study shows displaced fracture of the body of the mandible on the left side, in the line of the first premolar. On clinical examination, the permanent lateral incisor appears longer than the lateral incisor on the right side. The permanent second molars have not yet erupted. Which of the following statements regarding management of this patient's injury is most accurate?
- A) Circummandibular wiring is contraindicated in pediatric mandible fracture because the wires can damage tooth buds
 - B) Maxillomandibular fixation with arch bars is contraindicated in pediatric patients during primary and mixed dentition
 - C) Plate fixation of mandibular fractures during mixed dentition should never be performed
 - D) A tooth in the fracture line is indicated for removal
 - E) A tooth that has been luxated from its socket is indicated for removal

The correct response is Option E.

The longer-appearing lateral incisor is an example of an extrusive luxation (versus an intrusive luxation where the tooth is impacted).

A recent study by Naran et al reviewed 154 mandibular fractures in children in primary or mixed dentition and found no disturbances to permanent dentition with the use of archbars. Therefore, it is not contraindicated.

The Arbeitsgemeinschaft für Osteosynthesefragen, or AO, foundation has listed indications for tooth removal in the setting of facial fractures, and these include: fractured tooth roots, a tooth that has been luxated from its socket, a tooth that is interfering with reduction of the fracture, advanced dental caries that would carry risk for infection/abscesses, advanced periodontal disease, teeth with pre-existing abnormalities.

A tooth in the line of fracture alone is not an indication for removal (Kumar).

Circummandibular wiring can be used in pediatric mandible fractures as well as the edentulous mandible fracture.

Plate fixation during mixed dentition can be performed, depending on the location, after the permanent dentition has erupted. For example, plating of the symphyseal region is possible after eruption of permanent incisors, and the parasymphyseal region after eruption of permanent canines.

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115. A 26-year-old Korean woman reports that she is unhappy about the “square appearance of her jawline” and desires a softer facial shape without surgical intervention. Treatment with botulinum toxin type A is recommended. Which of the following is true as it relates to botulinum for masseteric hypertrophy?
- A) Botulinum toxin type A injection is approved by the Food and Drug Administration for the treatment of masseter hypertrophy
 - B) Effects are invariably short-term
 - C) Headaches, while infrequently reported, usually are reported to occur several weeks after injection
 - D) Muscle bulk will not show significant volume reduction on CT scan
 - E) Temporary decrease in mastication force is the most common effect

The correct response is Option E.

A recent study by Shome et al demonstrated that after a series of botulinum toxin injections, masseter volume reduction lasted up to 4 years. Therefore, this treatment's effects are not only short-term.

In a review by Peng et al, 30% of patients reported temporary decrease in mastication force after botulinum injection. Headaches, while infrequently reported, happen immediately after injection and resolve within 2 to 4 days after injection. When patients’ masseter volumes were measured before and after treatment, there was significant reduction in masseter volume (Chang et al).

Currently, botulinum toxin injection is an off-label use in treatment of masseter hypertrophy. Botulinum toxin is approved by the Food and Drug Administration for use in bladder dysfunction, migraine, glabellar lines, primary axillary hyperhidrosis, blepharospasm, strabismus, cervical dystonia, and upper limb spasticity.

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116. During embryological development, which of the following structures is derived from the same pharyngeal arch as the antihelix?

- A) Mandible
- B) Maxilla
- C) Mylohyoid
- D) Stapes
- E) Tensor veli palatini

The correct response is Option D.

The pharyngeal arches are created during embryological development by the migration of the neural crest cells and the surrounding pharyngeal endoderm and mesoderm. The first four pharyngeal arches are the most prominent and have unique nervous, arterial, muscular, and bony components. The muscular components of the first pharyngeal arch are innervated by the trigeminal nerve (cranial nerve V) and include the muscles of mastication, as well as the anterior digastric, mylohyoid, tensor tympani, and tensor veli palatini. The maxillary artery supplies blood to the components of the first pharyngeal arch. The greater wing of the sphenoid, as well as the incus, the malleus, maxilla, zygomatic, mandible, and temporal bones comprise the bony components of the first pharyngeal arch. The second pharyngeal arch is innervated by the facial nerve (cranial nerve VII) and receives blood supply from the stapedia artery. The bony components of the second pharyngeal arch include the stapes, styloid process, stylohyoid ligament, lesser horn, and upper body of the hyoid. The muscular components of the second pharyngeal arch include the muscles of facial expression, as well as the posterior digastric, stylohyoid, and stapedius.

During embryological development of the external ear, the antihelix, antitragus, and lobule are derived from the three posterior hillocks of the second pharyngeal arch, while the tragus, the root of the helix, and the superior helix are derived from the three anterior hillocks of the first pharyngeal arch.

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117. A 6-year-old boy presents with a right-sided craniofacial cleft involving the medial third of the upper eyelid with canthal involvement and orbital malposition. Which of the following best represents the Tessier cleft classification for this patient?

- A) No. 3
- B) No. 5
- C) No. 11
- D) No. 13

The correct response is Option C.

The number 11 cleft is the cranial extension of the number 3 facial cleft. The cleft originates in the medial orbit and often involves the upper lid as a coloboma or a blepharon. The cleft may also extend into the eyebrow and up to the frontal hairline with a projection of hair extending into the medial third of the forehead.

The number 13 cleft is the paramedial extension of the number 1 facial cleft. The eyelid, eyebrow, and canthal structures are intact in the number 13 cleft, but the medial brow may be displaced inferiorly. There may be V-shaped paramedial projection of the frontal hairline as well as a frontal encephalocele. The skeletal abnormality of the cleft occurs between the nasal bone and the frontal process of the maxilla, causing hypertelorism and widening of the ethmoids, as well as frontal soft tissue and bony abnormalities.

The number 5 cleft begins medial to the lateral oral commissure, proceeding cephalad toward the middle third of the lower eyelid. There is frequently a soft tissue deficiency between the mouth and the lower lid, increasing the risk for corneal exposure. The skeletal defect of the cleft originates in the alveolus, lateral to the canine, and extends through the maxillary sinus to the inferolateral orbit, lateral to the infraorbital foramen.

The number 3 Tessier cleft is often referred to as the oro-naso-ocular cleft. When isolated to the lip, the number 3 cleft can mimic a common cleft lip, beginning at Cupid's bow peak and extending to the lateral nasal sill. The cleft can extend through the lateral ala to the lower eyelid between the medial canthus and the inferior punctum. A significant soft tissue deficit of the midface may be present with inferior displacement of the lower lid and globe, as well as microphthalmia of the globe. The skeletal defect of the number 3 cleft originates in the alveolus, between the lateral incisor and canine, and extends cephalad to the lateral piriform

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aperture and medial orbit, terminating in the lacrimal groove of the inferior medial orbit.

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118. A 54-year-old woman is evaluated because of lower lip dysfunction after rhytidectomy. The surgeon asks the patient to perform a full-denture smile and then to pout, depressing and everting the lower lip. Asymmetry is observed during both functions, with a decreased lower tooth show on the left on full-denture smile, as well as no eversion of the left lower lip when pouting. Which of the following branches of the facial nerve is most likely injured?

- A) Left cervical
- B) Left marginal mandibular
- C) Right cervical
- D) Right marginal mandibular

The correct response is Option B.

Injury to both the marginal mandibular and cervical branches of the facial nerve will impair lower lip depression, causing decreased lower tooth show on full-denture smile. However, only injury to the marginal mandibular branch, with its innervation of the mentalis muscle, will impair lip eversion. Therefore, only injury to the left marginal mandibular nerve would cause unilateral decreased lower tooth show on full-denture smile and absence of eversion of the lower lip when pouting.

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119. A 2-month-old female infant is evaluated for the ear anomaly shown in the photograph. Which of the following most accurately describes the anomaly?

- A) Anotia
- B) Crumple ear
- C) Cryptotia
- D) Lop ear
- E) Stahl ear

The correct response is Option C.

This is cryptotia, a deformity of the ear in which the superior helical rim is buried beneath the skin of the scalp. Some studies report successful treatment with early ear molding, but this often requires elevation of the helical rim and application of a skin

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graft or regional flap to line the posterior aspect.

Anotia refers to complete absence of the ear structures, while lop ear is an ear that is typically constricted and has an overhang or hooding of the superior helical rim. Crumple ear is a form of constricted ear with variable cartilage abnormalities that give it an irregular appearance. Lastly, Stahl ear refers to an otherwise normal-sized ear with a third crus, usually accompanied by an evagination of the helical rim.

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120. A 50-year-old man receives preoperative radiation therapy for a large calvarial osteosarcoma that will require a 9-cm² craniectomy. Which of the following is the most appropriate material to use for reconstruction?

- A) Bone allograft with bone morphogenic protein (BMP)
- B) Calcium phosphate
- C) Polyether ether ketone (PEEK) implant
- D) Titanium mesh

The correct response is Option C.

Any calvarial defect greater than 6 cm² should be reconstructed. Titanium mesh can be used for craniectomy reconstruction; however, radiologic surveillance of disease recurrence can be challenging with the degree of artifact seen on imaging. Polyether ether ketone (PEEK) implants are radiolucent and therefore do not produce artifact on surveillance imaging and can be customized based on the size of the planned resection. Bone allograft with bone morphogenic protein (BMP) is contraindicated in cases of malignancy since BMP is a growth factor that induces bone formation and is involved in tumorigenesis. Calcium phosphate can be used for smaller calvarial defects, but it is associated with a high risk for infection and would be contraindicated in a patient who received preoperative radiation therapy.

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121. A 3-week-old newborn with unilateral complete cleft lip and palate is brought to the clinic for initial evaluation. The parents are very concerned about dental development. Which of the following permanent teeth is most likely to be congenitally absent as a result of the clefting?

- A) Canine
- B) Central incisor
- C) First premolar
- D) Lateral incisor
- E) Second premolar

The correct response is Option D.

Although all of the teeth listed have been described as being affected in patients born with cleft lip and palate, studies demonstrate that the permanent lateral incisor is most prone to be affected in the area of the cleft. It is frequently congenitally missing. It may also be hypoplastic or demonstrate a delay in root development and eruption. The other teeth can all be affected by alveolar clefting, but not to the degree to which the lateral incisor is affected. The lateral incisor is congenitally absent in up to 56% of patients with unilateral cleft lip and palate.

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122. A newborn female presents with a large intraoral mass arising from alveolar mucosa of the lower jaw that does not cause any airway obstruction. Photographs are shown. Which of the following is the most likely pathology of the lesion?

- A) Congenital epulis
- B) Hemangiopericytoma
- C) Odontogenic keratocyst
- D) Rhabdomyosarcoma
- E) Teratoma

The correct response is Option A.

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Congenital epulis is a rare, benign tumor of the oral cavity that is found in newborns. They are considered a form of granular cell tumor that can lead to mechanical obstruction, resulting in respiratory distress or difficulty eating. Surgical excision is the treatment of choice and recurrence after excision is rare. The female-to-male ratio is 10:1. It is observed three times more frequently on the maxilla than the mandible. They are solitary in most cases, but can be large and multiple.

Teratomas and rhabdomyosarcomas of the mandible are even more rare and are usually seen in the older patient population; they are not seen in the neonatal population.

Hemangiopericytomas are rare, vascular neoplasms that originate from vascular pericytes. They can occur anywhere in the body, including the mandible. They are slow-growing and present in the older patient population. The likelihood of presentation in a neonate is exceedingly low.

Odontogenic keratocysts are rare and benign, but locally aggressive lesions of the posterior mandible. They most commonly present in the third decade of life. They make up 19% of jaw cysts.

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123. A 5-year-old girl presents to the office for surgical correction of right microtia. After discussing various treatment options, her parents decide to proceed with porous polyethylene reconstruction with temporoparietal fascial flap. Which of the following complications is most likely to occur?

- A) Exposure
- B) Hematoma
- C) Implant fracture
- D) Infection
- E) Pneumothorax

The correct response is Option A.

The most common complication after porous polyethylene-based microtia reconstruction is exposure of the implant. In a series of over 1000 reconstructions with porous polyethylene, implant fracture was reported at 25% in the early-case series and 1.5% in the late-case series. Implant exposure was 44% and 4% in the same paired case series, respectively. Hematoma and infection are rare complications associated with implant-based reconstruction. Pneumothorax is associated with autologous reconstruction, not implant-based reconstruction.

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124. An 18-year-old woman presents to the office with complaints of worsening facial asymmetry, which began when she was 12 years of age. Physical examination shows significant atrophy of soft tissues of the left side of her face. The plastic surgeon elects to perform reconstruction of the defect with a parascapular flap. Which of the following is the most likely short-term complication for this patient?

- A) Cellulitis
- B) Facial skin slough
- C) Flap loss
- D) Hematoma

The correct response is Option D.

This patient has hemifacial atrophy, or Parry-Romberg syndrome. Parry-Romberg syndrome is a progressive hemifacial atrophy that can be associated with ocular and neurologic symptoms. The treatment of Parry-Romberg syndrome varies depending on the degree of bony and soft-tissue defect. Fat grafting, alloplastic implants, and free tissue transfer have all been described for correction of the deformity. For larger soft-tissue defects, free tissue transfer may be required. In a study of 177 free flaps, the most common short-term complication associated with free tissue transfer for Parry-Romberg syndrome is hematoma, which occurred in 7% of patients. Flap loss (partial or complete), cellulitis, and facial skin slough were noted in less than 1% of the patients. Overcorrection and the need for debulking/refinement is an expected outcome for this procedure.

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125. A 58-year-old man requires free tissue transfer for soft-tissue reconstruction of a head and neck defect. Which of the following surgical interventions is most likely to improve flap survival?

- A) End-to-end anastomosis
- B) Multiple perforators
- C) Muscle flap only
- D) Supercharging
- E) Venous coupler

The correct response is Option E.

In a recent study of 2296 head and neck free tissue transfers, Chang et al demonstrated that the use of a venous coupler had a significantly decreased complication rate compared with performing a hand-sewn anastomosis. Further analysis yielded no significance in survival rates with supercharging, use of multiple perforators, or orientation of anastomosis. They noted an increased risk for failure with muscle-only flaps compared with fasciocutaneous or osteocutaneous flaps. Other authors have demonstrated the benefits of venous couplers in head and neck free tissue reconstruction as well.

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126. An 82-year-old man is referred by his Mohs micrographic surgeon for reconstruction of a nasal defect after margins are cleared. The 8 mm × 8 mm defect is full-thickness at the alar rim and soft triangle, and involves skin, cartilage, and lining. The plastic surgeon plans to use a composite graft from the ear in a single-stage reconstruction under local anesthetic. Which of the following is the most appropriate ear donor site for reconstruction of the defect?
- A) Bilobed flap for skin and anterior conchal bowl graft for cartilage and lining
 - B) Full-thickness harvest of tragus
 - C) Full-thickness helical root composite graft with cartilage limb extensions
 - D) Full-thickness helix wedge with primary closure
 - E) Posterior ear skin and concha cartilage composite graft

The correct response is Option C.

In this case, all three layers require reconstruction. Cartilage support and careful selection of grafts can decrease alar notching. The helical root provides three-layer reconstruction in a simple full-thickness composite graft. Three-layer composite grafts are most successful when less than 1 cm. Helical cartilage can be harvested extending beyond the skin boundaries to decrease notching and provide enhanced rim support. The attached skin on the deep surface is similar to lining and the outer skin layer is more fibro-fatty like the alae/tip skin. This donor site is rarely heavily sun damaged and can be closed primarily without significant cosmetic issues.

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127. A 32-year-old woman is attacked by a stray dog and sustains multiple bites to the face and arms, including deep lacerations to the cheek and nose. Rabies vaccination has not been verified and the dog is not available for observation. Which of the following is the best way to manage the patient's risk for rabies?
- A) Have the emergency department physician inject immunoglobulin intramuscularly into a large muscle group, such as the deltoid or gluteus, before the patient is discharged
 - B) Inject human rabies immunoglobulin into the wound after cleaning, but before repair of the lacerations
 - C) Repair the laceration in the emergency department and have the emergency department consult infectious disease to start the rabies vaccination series for the patient
 - D) Tell the patient to follow up with her primary care physician and vaccinate within 30 days after the bite

The correct response is Option B.

A significant dog bite from an aggressive dog may be due to rabies. Since rabies is life-threatening, patients should be treated with human rabies immunoglobulin (HRIG) if rabies vaccination in the dog cannot be confirmed. The HRIG should be injected into the wounds and the patient vaccinated. Post-exposure prophylaxis (PEP) should not be delayed more than 7 days and ideally should be given on the day of the bite. Copious cleaning and irrigation is the first line of defense followed by HRIG injected into the wounds and completion of vaccination. The Immunoglobulin starts immunity before the vaccination.

Animal owners may not have accurate vaccination records or the animal may be unavailable, and unless there is immediate proof of vaccination, then PEP is warranted.

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128. A 4-year-old boy is seen following a pitbull bite to his face. The periorbital findings are shown in the photograph. A stent is placed and the ends of the stent are advanced across the canaliculus. The ends of the stent will enter the nasal cavity in which of the following locations?

- A) Above the superior turbinate
- B) Below the superior turbinate
- C) Above the middle turbinate
- D) Below the middle turbinate
- E) Above the inferior turbinate
- F) Below the inferior turbinate

The correct response is Option F.

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Reconstruction of the lacrimal apparatus is a critical step in addressing this patient's periorbital wounds. Failure to properly manage this aspect of the injury will lead to epiphora and the inevitable need for a secondary procedure to manage tear drainage. Delayed reconstruction of this injury would likely require a conjunctivodacryocystorhinostomy, a surgically created conduit between the eyelid and the nose. The best initial management of this lacrimal apparatus disruption is as described—placement of a stent through the canaliculi, into the lacrimal duct (contained within the maxillary bone), and into the nose. The exit point of the nasolacrimal duct is via the valve of Hasner, below the inferior turbinate. It is here that the ends of the stent can be identified and retrieved, although this is often quite challenging.

The frontal, maxillary, and anterior ethmoid sinus cells drain into the middle meatus, just below the middle turbinate. The sphenoid sinus and posterior ethmoid sinuses drain into the sphenoethmoid recess, between the nasal septum and the superior turbinate.

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129. A 17-year-old boy is diagnosed with an infected molar and scheduled for dental extraction. Before the day of surgery, he is brought to the emergency department because of drooling, protruding tongue, bilateral woody edema of the submandibular region, and tenderness of the neck. Which of the following is the most likely diagnosis?

- A) Ludwig angina
- B) Periapical abscess
- C) Peritonsillar abscess
- D) Primary mononucleosis
- E) Reactive lymphadenopathy

The correct response is Option A.

Drooling, protruding tongue, and woody edema (non-fluctuant) of the submandibular region are classic signs for Ludwig angina, or deep space infection of the floor of the mouth. The source is frequently dental periapical abscess, often molar in origin where the mandible bone is thinner, allowing the infection to spread to the floor of the mouth. Treatment includes ICU monitoring of the airway for possible impending intubation, antibiotics, and surgical drainage (and in this case, extraction of the tooth as well).

Mononucleosis is not characterized by woody edema. Peritonsillar abscess is more frequently unilateral with lateral pharyngeal space symptoms without woody edema. Periapical abscess of the tooth involves localized symptoms without generalized bilateral submandibular symptoms, although this can eventually lead to Ludwig angina.

Reactive lymphadenopathy is the result of head and neck infection and does not result in the symptoms described in this scenario.

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130. A 25-year-old man sustains a clean cheek laceration that includes transection of the facial nerve. Which of the following is the maximum time after which primary repair is unlikely to result in restored facial nerve function?
- A) 3 weeks
 - B) 6 weeks
 - C) 6 months
 - D) 12 months
 - E) 24 months

The correct response is Option D.

Extracranial facial nerve injuries generally follow the principles of peripheral nerve injury and repair. For a clean, gapless, tension-free, primary repair, optimal motor nerve function outcomes are optimal if the nerve repair occurs within 3 to 6 months from the time of injury.

In contrast to peripheral motor nerve repairs, facial nerve injuries in young patients can tolerate repair at a later date, even up to 12 months post injury. Twelve months is the maximum time of delay where functional recovery would be expected with a tension-free primary repair of a facial nerve transection.

Muscle degeneration (from denervation) usually occurs around 24 months, so primary nerve repair is not even considered at that point, and muscle transfer options need to be considered by then.

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131. During orbital dissection in preparation for orbital box osteotomy, which of the following anatomical landmarks serves as the starting point for lateral wall osteotomy?

- A) Anterior ethmoid foramen
- B) Dacryon
- C) Inferior orbital fissure
- D) Optic foramen
- E) Superior orbital fissure

The correct response is Option C.

The inferior orbital fissure serves as the starting and ending point of the orbital box osteotomy since only temporal fat is within this fissure. No critical nerves or blood vessels are in this fissure more peripherally. Major structures, such as the infraorbital nerve, travel for a short distance across the apex of the infraorbital fissure as it exits the foramen rotundum and enters the infraorbital canal. Dacryon marks the posterior border of the lacrimal sac. The optic nerve is within the optic foramen, and cranial nerves III, IV, and VI travel in the superior orbital fissure.

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132. A man presents to the emergency room with a complicated mandibular third molar infection. He has limited range of motion of the jaw (trismus) and point tenderness above the zygomatic arch. The infection is most likely in which of the following anatomic spaces?

- A) Buccal
- B) Prevertebral
- C) Pterygomandibular
- D) Submasseteric
- E) Temporal

The correct response is Option E.

There are four separate compartments that comprise the masticator space, including masseteric or submasseteric space, pterygomandibular space, deep temporal space, and superficial temporal space. The submasseteric space is bordered by the masseter muscle and ascending ramus of the mandible. The pterygomandibular space is formed by the medial pterygoid muscle and ascending ramus. The superficial temporal space is formed by the temporalis fascia and temporalis muscle. The deep temporal space is formed by the temporalis muscle and calvarium. These four spaces function as “subspaces” of the masticator space, but they can all become involved rapidly once one compartment is affected. The submasseteric and superficial temporal spaces are separated by the zygomatic arch. The pterygomandibular and deep temporal spaces are separated by the lateral pterygoid muscle.

An infection in the prevertebral space would not present with the signs and symptoms of tenderness above the zygomatic arch, and would be more likely to present with neck rigidity or dysphagia.

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133. A 50-year-old man undergoes a total glossectomy for tongue cancer. A microvascular free flap reconstruction is planned with an anterolateral thigh free flap. After a vertical thigh incision is made, no perforators are found between the rectus femoris and vastus lateralis muscles. Exploration of the medial thigh demonstrates a large perforator between the rectus femoris and vastus medialis muscles. Which of the following is the most likely origin of this perforator?
- A) Ascending branch of the lateral circumflex femoral artery
 - B) Common femoral artery
 - C) Descending branch of the lateral circumflex femoral artery
 - D) Medial circumflex femoral artery
 - E) Profunda femoris artery

The correct response is Option C.

An adequate perforator is not found on dissection of the anterolateral thigh (ALT) free flap in up to 5% of cases. When an ALT flap perforator traveling between the rectus femoris and vastus lateralis or through the vastus lateralis to supply the anterolateral thigh skin is not found, there is a higher chance of finding a perforator that supplies the anteromedial thigh skin. This perforator, present in about 50% of thighs, most commonly arises from the descending branch of the lateral circumflex femoral artery, via a branch that supplies the rectus femoris muscle. This perforator can take a course through the rectus femoris or between the rectus femoris and vastus medialis. Alternately, one or more anteromedial thigh perforators may arise directly from the superficial femoral artery.

When an ALT perforator cannot be located, the surgeon may salvage the situation by changing to an anteromedial thigh (AMT) free flap rather than exploring another donor site. Another alternative is to harvest a tensor fascial lata free flap, based on the ascending branch of the lateral circumflex femoral artery. The medial circumflex femoral artery, common femoral artery, and profunda femoris artery do not give rise to previously described cutaneous perforator flaps.

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134. A 45-year-old woman with no history of smoking presents with a 1.4-cm squamous cell carcinoma of the left anterior mandibular gingiva and an upper cervical neck mass. Full-thickness cortical invasion of the tumor into the superior mandible as well as a single enlarged lymph node is observed on CT scan. In addition to neck dissection, which of the following is the most appropriate surgical treatment?
- A) Marginal mandibulectomy
 - B) Radiation therapy
 - C) Segmental mandibulectomy
 - D) Transoral laser surgery
 - E) Wide local excision with periosteal stripping

The correct response is Option C.

The most appropriate surgical treatment for transcortical invasion of the mandible is a segmental mandibulectomy, in which a full-thickness portion of the mandible is excised. Marginal mandibulectomy is reserved for cases in which the cancer stops at the periosteum or does not penetrate full-thickness through the cortex of the mandible. Wide local excision with or without periosteal stripping, and transoral laser surgery are not adequate treatment for this lesion. Radiation therapy for this advanced stage cancer is also not adequate. Combined surgery followed by postoperative radiation therapy is indicated.

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135. For total laryngopharyngeal defects, which of the following is an advantage of performing reconstruction with the jejunal free flap instead of the anterolateral thigh free flap?

- A) Better voice production with tracheoesophageal puncture prosthesis
- B) Greater feeding-tube independence
- C) Less donor site morbidity
- D) Lower flap loss rates
- E) More straightforward inset

The correct response is Option E.

Both the jejunal free flap and the anterolateral thigh (ALT) free flap have been used to restore continuity of the hypopharynx and cervical esophagus following laryngopharyngectomy and have shown superior functional results and lower complication rates than previously used pedicled flap techniques. The jejunal free flap has become less popular in many centers in recent years because the ALT free flap has lower donor site morbidity, a higher rate of feeding tube independence, and equivalent or lower flap loss rates. Additionally, voice production with a tracheoesophageal puncture (TEP) prosthesis is considered superior with the ALT. The TEP speech with the jejunal flap is characterized as wet and cavernous and, therefore, more difficult to understand. As a pre-formed tube, the jejunal flap is more straightforward to inset. The surgeon only has to perform a superior (base of tongue) and inferior (esophagus) mucosal anastomosis, whereas the ALT is a rectangular skin flap that must be tubed. The additional (vertical) suture line theoretically raises the risk for fistula formation. In a comparative study, Yu et al found the fistula rate to be 8% for the ALT free flap and 3% for the jejunal free flap. While the jejunum has inherent peristaltic activity, some studies have suggested that this movement does not improve bolus transit, but instead contributes to regurgitation and dysmotility.

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136. A 6-month-old female infant presents with a bifid uvula, notch of the hard palate, and zona pellucida. The infant is feeding well with no signs of airway obstruction. Which of the following is the most appropriate next step in management?

- A) Initiation of speech therapy
- B) Nasoendoscopy
- C) Palatal elevator
- D) Palate repair at 1 year of age
- E) Re-evaluation with cleft team in 1 year

The correct response is Option E.

The patient has the three classic clinical features of submucous cleft palate. The overall incidence of overt submucous cleft palate is exceedingly rare (0.02 to 0.08%). Although there is some ongoing debate regarding the timing of surgical management, it is agreed that only a small number of patients will need surgical intervention for good speech outcomes.

Velopharyngeal insufficiency (VPI) refractory to speech therapy is the most widely accepted indication for surgical correction. Speech cannot be adequately assessed until age 2.5 years at the earliest, and speech therapy cannot be initiated before this age.

A typical course of management is diagnosis of VPI and initiation of speech therapy for 6 to 12 months. When therapy is found to be refractory, surgical intervention is planned. Surgical options are: excision with primary closure of the submucous cleft, pharyngeal flap, palatal pushback, palate repair with intravelar veloplasty, Furlow Z-plasty, or combined techniques. The approach is often tailored to the patient.

In this case of a 6-month-old patient, it is too early to consider surgical intervention. The patient should be followed by a cleft palate team. When VPI is diagnosed by the speech therapist, therapy should be initiated, and if improvement is refractory to therapy, surgery should be planned. Nasoendoscopy can be used as a preoperative assessment to plan for surgery. There is no role for palatal elevators in the management of the submucous cleft palate.

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Speech outcomes are best if surgery is performed before age 7 years. Before age 7, 84% of patients go on to develop normal speech or occasional hypernasality versus only 64% of patients have an equivalent outcome when the operation is performed after age 7 years.

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137. A 10-year-old boy is evaluated because of a 6-month history of a slow-growing mass of the left cheek that is soft, nonfixed, and measures 4 cm in diameter. There is no associated adenopathy. Fine-needle aspiration confirms the diagnosis of pleomorphic adenoma; it is anterior/outside of the parotid gland. After complete excision, the parents should be counseled that the recurrence rate is most likely which of the following?
- A) 1%
 - B) 10%
 - C) 20%
 - D) 40%

The correct response is Option B.

Pleomorphic adenoma is an uncommon lesion, and when it does occur, it is usually in the parotid gland. It does occur in the submandibular, sublingual, and other minor salivary gland locations in decreasing order of frequency. Pleomorphic adenoma is a benign lesion, but the recurrence rate is 6 to 15%. Given the location, wide margins are ideal, but care must be taken to spare the branches of the facial nerve.

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138. A newborn female presents with a lesion on the occipital scalp/posterior neck. A photograph and x-ray are shown. MRI has been performed. It is most appropriate to order which of the following studies before formulating a treatment plan?

- A) Brain MRI to rule out structural anomalies
- B) Doppler ultrasonography to assess flow of the lesion
- C) Echocardiography to assess cardiac function
- D) Incisional biopsy for genetic analysis
- E) Lymphatic mapping with isosulfan blue to identify the sentinel lymph node

The correct response is Option C.

This patient has a rapidly involuting congenital hemangioma (RICH). These are often large and fast-flow and can cause high-output cardiac failure. Therefore, it is important to assess cardiac function to ascertain whether this patient needs cardiac support (eg, digoxin). While Doppler ultrasonography may have been indicated as a first-line imaging study, the MRI and magnetic resonance angiography demonstrated the extent of the lesion and flow; Doppler ultrasonography will not give additional information at this time. Incisional biopsy may be indicated if there are concerns about the diagnosis. However, performing a biopsy to obtain tissues for genetic analysis is not indicated, as the genetic information will not give information to direct treatment. Brain MRI to rule out structural anomalies is indicated when

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a patient is suspected of having posterior fossa brain malformations, hemangioma, arterial lesions, cardiac abnormalities, and eye abnormalities (PHACE) syndrome, a large segmental infantile hemangioma in the face. Lymphatic mapping for sentinel node is used for head and neck malignancies and has no role here.

In this case, the patient did develop mild cardiac failure. This lesion was embolized one day before she underwent resection of this lesion.

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139. A 4-year-old boy is referred for evaluation after failing a hearing test. His mother reports that she has difficulty understanding his speech, and that liquids come out of his nose when he drinks beverages. Medical history also includes obstructive sleep apnea that was confirmed via sleep study. There is no history of previous surgery. Physical examination shows a bifid uvula. Which of the following indications is the primary reason to recommend a velopharyngeal insufficiency (VPI) procedure for this patient?

- A) Conductive hearing loss
- B) Hypernasal speech
- C) Presence of a submucous cleft palate
- D) Reflux of liquids through the nose
- E) Snoring

The correct response is Option B.

The bifid uvula is a marker for a submucous cleft palate, but neither the bifid uvula or the submucous cleft palate are an indication for surgery in isolation. Children with a cleft palate will often have hearing loss, but this is not addressed with VPI procedures. Snoring will likely be made worse by the VPI procedure and is not an indication for this procedure.

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140. A 17-year-old boy with a history of unrepaired submucous cleft palate comes to the office for follow-up evaluation 3 months after undergoing a Le Fort I procedure. The parents report difficulty understanding his speech since the surgery. Nasometry discloses hypernasal speech. Which of the following would necessitate a pharyngeal flap compared to a Furlow palatoplasty or a sphincter pharyngoplasty?
- A) Le Fort I advancement of 10 mm
 - B) Poor lateral wall motion on nasopharyngoscopy
 - C) Postoperative nasopharyngeal depth of 25 mm
 - D) Preoperative soft palatal length of 32 mm
 - E) Velopharyngeal gap of 12 mm on maximum phonation

The correct response is Option E.

A Le Fort I procedure is needed in 25 to 40% of patients with cleft lip and palate, and velopharyngeal insufficiency (VPI) is often seen postoperatively. Preoperative soft palatal length and postoperative pharyngeal depth have been associated with the need for a VPI procedure. In a 17-year-old, the normal soft palatal length is 32 mm and the normal nasopharyngeal depth is 24 mm. A significant velopharyngeal gap of greater than 5 mm cannot be adequately corrected with a Furlow palatoplasty or sphincter pharyngoplasty. Poor lateral wall motion alone would be a finding that supports a sphincter pharyngoplasty. The Le Fort I advancement distance has not been directly related to the need for a specific type of procedure.

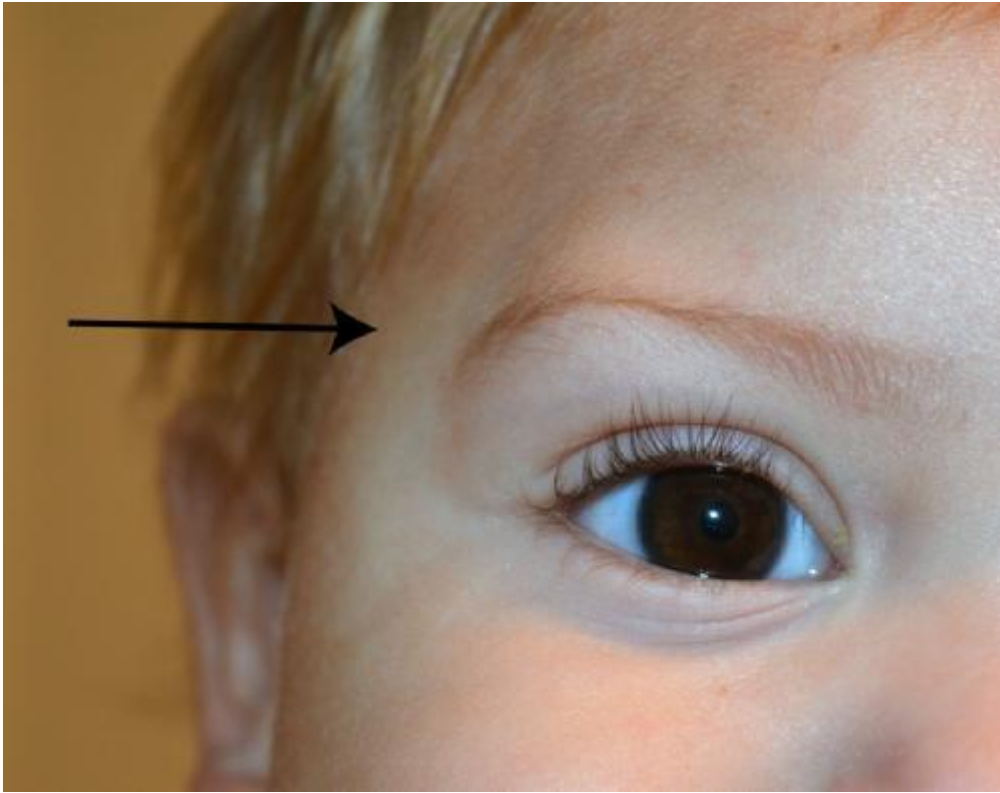
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141. A 12-month-old boy presents for evaluation of a soft, fixed lateral brow mass that has been enlarging since it was first noted at 2 months of age. A photograph is shown. The parents report that the mass does not change in size during crying or activity, nor did it change in size during recurrent pink eye infections. Which of the following is the most likely diagnosis?

- A) Branchial cleft cyst
- B) Dermoid cyst
- C) Hemangioma
- D) Lacrimal gland
- E) Lymphatic malformation

The correct response is Option B.

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Dermoid cyst is the correct answer and the most common cause of a lateral brow mass in an infant. If it were a hemangioma, its size would change during crying or any activity that increases blood flow. Lacrimal gland ptosis is unlikely in a child but can be seen in the adult population, and can be ruled out if the mass is above the orbital rim, as seen in the photograph. The mass is not in the distribution of any of the different types of branchial cleft cysts. Lymphatic malformations typically change in size during infections.

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142. Which of the following cranial nerves develops within the first branchial arch?

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

The correct response is Option D.

The trigeminal nerve (cranial nerve V) develops from the first branchial arch and gives rise to the malleus and incus. The ligaments associated with the first branchial arch are the anterior ligament of the malleus and the sphenomandibular ligament. The muscles of the first branchial arch include the muscles of mastication (masseter, temporalis, medial pterygoid, lateral pterygoid), tensor veli palatini, tensor tympani, mylohyoid, and the anterior belly of the digastric. The first pouch is associated with the external auditory canal and middle ear space.

The facial nerve (cranial nerve VII) develops from the second branchial arch and gives rise to the stapes, styloid, and the upper body of the hyoid. It includes the stylohyoid ligament. The associated muscles are facial expression muscles, stapedius, stylohyoid, and the posterior belly of the digastric. The second pouch is associated with the tonsillar fossa.

The glossopharyngeal nerve (cranial nerve IX) develops from the the third branchial arch and gives rise to the lower body of the hyoid. Its muscle is the stylopharyngeus, and the pouch is associated with the inferior parathyroid gland and the thymus.

The fourth branchial arch is associated with the larynx. The muscles associated with this arch are the laryngeal, pharyngeal, and soft palate. The pouch is associated with the superior parathyroid gland and the thyroid gland.

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143. Which of the following otoplasty techniques is most appropriate to create the antihelical fold in patients with prominent ears?

- A) Barbed resorbable suture
- B) Bolster dressing with external suture
- C) Furnas suture
- D) Mustarde suture
- E) Vertical mattress suture with resorbable suture

The correct response is Option D.

Otoplasty is commonly performed to correct prominent ears. Some consider prominent ears to be caused by the inadequate formation of the postauricular muscles in utero, which leads to a failure to form the antihelical fold and adequate setback of the auricle. This can result in psychosocial issues in children and adults. Since most of the ear formation occurs by age 5 years, most otoplasties are performed after that age.

Two basic concepts are associated with otoplasty: cartilage cutting and cartilage scoring. Each has its proponents and some use both techniques in reshaping the ear.

Correction of the antihelical fold is most commonly performed using the Mustarde suture. It is a non-absorbable suture placed over a weakened cartilage structure to create the antihelical crease. Stentrom described scratching the posterior cartilage to weaken the memory of the cartilage prior to application of the Mustarde suture to allow it to fold and stay folded more easily.

Furnas described the conchal setback suture to rotate the ear and decrease the angle between the concha and mastoid to approximately 25 to 35 degrees.

Vertical mattress sutures are not used for creation of the antihelical fold.

The bolster dressing with an external suture is more appropriately used after drainage of an auricular hematoma.

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144. A 57-year-old man undergoes resection of a malignant lesion involving the mandible. He does not smoke cigarettes. Which of the following flaps is most appropriate to use for reconstruction of the resulting mandibular defect from ramus to ramus?

- A) Cadaveric bone graft with scapular free flap
- B) Fibular free flap
- C) Lateral thigh flap with rib graft
- D) Myocutaneous pectoralis major flap with reconstructive plate
- E) Osteocutaneous radial forearm free flap

The correct response is Option B.

The most appropriate flap for a large defect from ramus to ramus is a fibular free flap. It allows a large segment of vascularized bone and a skin paddle to be used for reconstruction.

The osteocutaneous radial forearm free flap is good for limited osteocutaneous defects, and has less bone available for reconstructing the mandibular defect than the fibular flap. It is not the best choice in this instance, because the bone defect is much larger than this flap can reliably provide.

The myocutaneous pectoralis flap has been used historically in mandibular reconstruction; however, it is prone to break down over the reconstruction plate, and is a less ideal choice than a free fibular flap to reconstruct the described defect.

A scapular free flap requires repositioning the patient and would not provide adequate vascularized bone to reconstruct the described mandibular defect. It is not typically used, even with cadaveric bone, to reconstruct large mandibular defects.

The anterolateral thigh flap is also used in soft tissue reconstruction, but does not provide vascularized bone for reconstructing the large bony defect in this particular case, and non-vascularized rib graft would not be a good substitute for a large mandibular defect.

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145. A patient undergoes extraction of a fully impacted mandibular third molar. During corticotomy of the mandible, protection of the adjacent soft tissue is necessary to avoid injury to which of the following nerves?

- A) Facial
- B) Hypoglossal
- C) Inferior alveolar
- D) Infraorbital
- E) Lingual

The correct response is Option E.

Protection of the lingual border of the mandible during extraction of mandible wisdom teeth is critically necessary because of the close proximity of the lingual nerve to the lingual border of the mandible. This nerve can be inadvertently injured if not routinely protected during third molar extractions.

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146. A 54-year-old man with a nodule in the soft palate undergoes evaluation with CT scan and biopsy. Results show a malignant oropharyngeal tumor. In order to stage the cancer and determine treatment, which of the following must be performed?

- A) Dental evaluation via panoramic x-ray study (Panorex)
- B) p16 status via immunohistochemistry
- C) Perineural invasion
- D) Smoking status via urine cotinine
- E) Speech evaluation via video nasoendoscopy

The correct response is Option B.

Oropharyngeal cancer affects the base of the tongue, soft palate, tonsils, and posterior pharyngeal wall. The most recent National Comprehensive Cancer Network (NCCN) staging guidelines require HPV status to determine staging. HPV status is determined by p16 status via immunohistochemistry on the biopsy sample. The other answers are incorrect because perineural invasion is an important prognostic factor, but is not included in current staging criteria; smoking is related to cancer, but its status is not required for cancer staging; and dental evaluation and speech evaluation are clinically indicated if needed and are not for cancer staging.

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147. A 50-year-old man sustained multiple visceral injuries, prolonged loss of consciousness, and a fracture of the orbital floor in an accident 3 months ago. He deferred repair of the orbital floor fracture at the time of injury, but is now seeking help for symptoms related to the fracture. The patient is alert and oriented. Orbital floor fracture repair is most likely to achieve correction of which of the following findings in this patient?
- A) Blindness
 - B) Ectropion
 - C) Enophthalmos
 - D) Globe volume
 - E) Vertical restriction

The correct response is Option C.

Orbital floor fractures risk the pathoanatomy of changing the volume of the orbit, which can affect the position of the globe, as well as entrapping the inferior rectus muscle, leading to restriction of globe movement. Therefore, indications for surgery include: vertical globe dystopia (vertical change in globe position from inferior displacement of floor), enophthalmos (retro-positioning of globe from increased orbit volume), and globe entrapment (inability for globe to look up).

For this patient 3 months after unrepaired orbital floor fracture, enophthalmos would be the most likely correctable by delayed orbital floor repair, which reduces the orbital volume closer to its pre-injury state, thereby restoring the globe to its pre-injury position.

Blindness would be from optic nerve injury, which would not be improved by orbital floor fracture repair.

Ectropion would usually be from lower eyelid contracture, which would not be improved by orbital floor fracture repair.

Globe volume refers to volume of the globe itself (not the orbit volume), which would not be improved by orbital floor fracture repair.

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Vertical restriction could be due to muscle entrapment, which needs to be repaired urgently otherwise permanent damage to the muscle could result. This patient is presenting 3 months after injury for delayed repair, therefore orbital floor fracture repair would no longer be able to repair a permanently damaged muscle entrapment scenario.

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148. A 17-year-old girl presents for correction of Angle class II malocclusion, 8 mm of overjet, and retrognathia/retrogenia. Mandibular advancement and genioplasty are planned. Which of the following is the most likely outcome of this procedure?

- A) Decreased presence of the nasolabial folds
- B) Decreased prominence of the labiomental crease
- C) Increased area of the glossopharyngeal opening
- D) Increased area of the velopharyngeal opening
- E) Increased cervicomental angle

The correct response is Option C.

Understanding the anatomic changes after orthognathic surgery is crucial in helping to select the appropriate intervention as well as for informing patients about their expected results. Patients undergoing mandibular advancement (bilateral sagittal split osteotomy [BSSO]) and genioplasty surgery can expect predictable outcomes. The labiomental crease becomes deeper, while the cervicomental angle becomes more acute. Intraorally, the glossopharyngeal opening enlarges as the tongue is brought forward with the mandible. This can improve airway symptoms in patients with obstructive sleep apnea. Neither the nasolabial folds nor the velopharyngeal opening is affected with a mandibular advancement surgery.

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149. A 9-month-old infant undergoes repair of the palatal defect shown in the photograph using a Furlow palatoplasty. Which of the following best represents this patient's risk for developing a palatal fistula postoperatively?

- A) 5%
- B) 10%
- C) 15%
- D) 20%
- E) 25%

The correct response is Option A.

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This cleft involves both the soft and posterior hard palate, but does not extend into the alveolus or primary palate (Veau class II). Based on several recent studies, including a large systematic review, the rate of fistula formation following a Furlow repair of a Veau class II palatal cleft is 5% or less.

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150. A plastic surgeon is on a global surgery mission for primary cleft repairs in a developing country. It is most appropriate to perform a single-stage primary cleft lip and palate repair in which of the following patients?
- A) Developmentally normal 1-year-old, 4 kg (8.8 lb), hemoglobin concentration of 8 g/dL
 - B) Developmentally normal 2-year-old, 8 kg (17.6 lb), hemoglobin concentration of 7 g/dL
 - C) Developmentally normal 4-year-old, 17 kg (37.5 lb), hemoglobin concentration of 11 g/dL
 - D) Syndromic, globally-delayed 2-year-old, 10 kg (22 lb), hemoglobin concentration of 10 g/dL
 - E) 67-Year-old woman, 55 kg (121.2 lb), hemoglobin concentration of 11 g/dL

The correct response is Option C.

In the United States, most patients undergo cleft lip repair at age 3 to 6 months and cleft palate repair between age 9 and 18 months. Some children may undergo repairs earlier or later because of surgeon or patient factors. Most children in the United States undergo staged repairs, but it may be indicated to perform combination surgery of primary cleft palate and cleft lip surgery at the same setting. Combination surgery may occur in cases of older children adopted from developing countries who need both speech improvement and aesthetic reconstruction, and are healthy enough for the combined surgeries.

In global surgery, there is increasingly more information about patient outcomes and more data collection to guide decision making. Still, the role of the surgeon's clinical decision-making is important and patient factors are relevant. If access to care is limited for a patient who is very healthy, then combination cleft lip and palate surgery may be indicated. Complications are more likely when the two surgeries are combined. Palate bleeding and surgical blood loss may be increased in combination surgery, and blood transfusions are more often necessary than in single-staged surgery.

Many global surgery programs in developing countries recommend that patients have a hemoglobin concentration of 10 g/dL or greater in order to safely undergo cleft palate surgery. Cleft lip surgery generally involves less blood loss than cleft palate surgery, and some surgeons/programs may safely proceed with lip surgery alone when a patient's hemoglobin concentration is less than 10 g/dL.

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Combination surgery requires longer surgical times than single-staged surgery. The longer anesthetic time may be a factor for patients with other medical conditions or for syndromic patients.

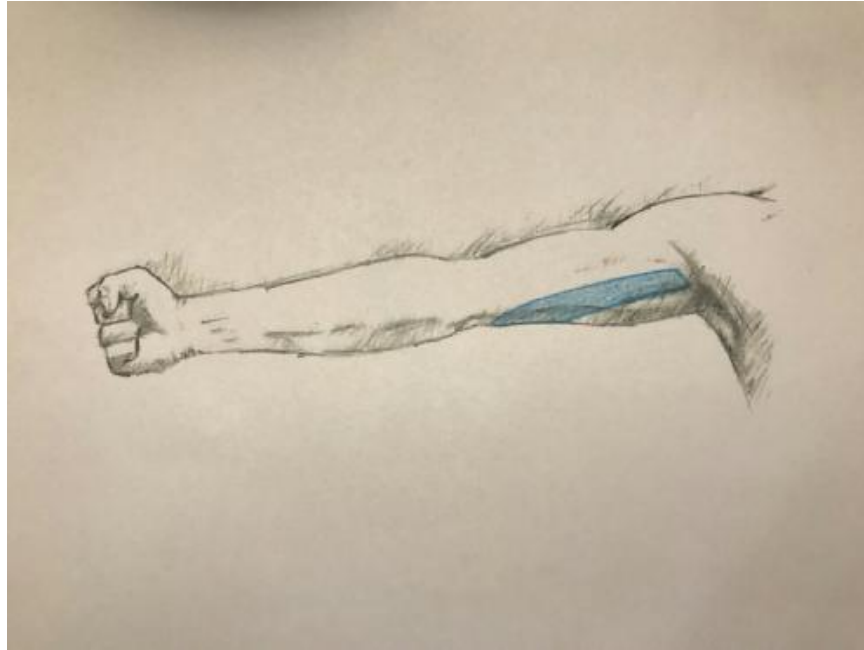
Underweight, young children with a hemoglobin concentration less than 10 g/dL are not good candidates for combined cleft lip and palate surgery. Staged surgery would be safer for those children. Administration of blood transfusion before surgery to increase the hemoglobin is not recommended.

Cleft palate repair in elderly patients is unlikely to lead to a meaningful improvement in quality of life regarding speech, and these patients may have bleeding and healing difficulties. Therefore, palate repair in elderly patients is not recommended in combination surgery. Aesthetic reconstruction of the lip can often be safely performed under local anesthesia if the patient is otherwise healthy.

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Section 4: Breast and Cosmetic



151. A 36-year-old woman developed numbness in the distribution identified in the picture shown. Which of the following nerves was most likely injured?

- A) Lateral antebrachial
- B) Medial antebrachial
- C) Medial brachial
- D) Posterior antebrachial
- E) Posterior brachial

The correct response is Option C.

The posterior brachial nerve innervates the dorsal aspect of the upper arm. The lateral antebrachial nerve innervates the radial side of the forearm. The medial antebrachial nerve innervates the ulnar side of the forearm and medial upper arm.

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The medial brachial nerve innervates the medial aspect of the upper arm between the medial antebrachial cutaneous (MABC) and intercostobrachial nerves.

The posterior antebrachial nerve innervates the lateral posterior aspect of the forearm.

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152. A 71-year-old woman presents to the office for rhytidectomy and platysmaplasty. Medical history includes rhytidectomy 12 years ago. She desires a second rhytidectomy and neck lift. A photograph is shown. In addition to rhytidectomy, which of the following facial ancillary procedures is recommended to most improve the overall surgical result in this patient?

- A) Brow lift
- B) Fat grafting
- C) Laser resurfacing
- D) Liposuction
- E) None, it is unprofessional to bring up surgery that a patient has not asked about

The correct response is Option B.

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Fat grafting is an essential addition for improved facial rejuvenation in the patient.

This patient has severe facial fat atrophy. Her jowling and neck laxity will be improved with a face-lift; however, without reversing the signs of fat compartment atrophy, she will continue her aged appearance.

Brow lift will uncover an already hollow appearance. Removing fat with liposuction would exacerbate her aged appearance. Laser resurfacing can help her skin texture but would be a more minor improvement.

This patient desires facial rejuvenation. Many patients do not realize that fat grafting is an ancillary option that can significantly improve their result. As such, it is appropriate to discuss these ancillary procedures that work in harmony with a face-lift.

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153. Which of the following structures is associated with the anatomical boundaries of the internal nasal valve?

- A) Anterior edge of the vomer
- B) Anterior middle turbinate
- C) Caudal border of the upper lateral cartilage
- D) Cephalic border of the lower lateral cartilage
- E) Foot plate of the medial crus

The correct response is option C.

The internal nasal valve is the narrowest point along the upper airway. Its cross-sectional area is determined by the anatomical boundaries. These comprise the caudal border of the upper lateral cartilage superiorly, the anterior inferior turbinate posteriorly, the caudal septum medially, the nasal floor inferiorly and the pyriform margin laterally. Numerous techniques have been described to stabilize internal nasal valve narrowing by graft/stabilization of the upper lateral cartilage to prevent collapse medially.

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154. An otherwise healthy 26-year-old man with a receding hairline presents for hair restoration of the frontal scalp. Which of the following phenomena most accurately describes features associated with this patient's condition?

- A) Absence of vellus hairs
- B) Decreased duration of telogen
- C) Eosinophilic perifolliculitis
- D) Increased duration of anagen
- E) Miniaturization of hair follicles

The correct response is Option E.

Male androgenic alopecia is determined by a genetic predisposition. The normal anagen-catagen-telogen cycle is disturbed, and the anagen:telogen ratio is altered. This is due to the lengthening of the telogen denominator in this ratio. Additional aspects include gradual replacement of the normal hair shafts with vellus hair, miniaturization of the hair follicle, and an activated T-cell lymphohistiocytic perifollicular inflammation.

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155. Lactiferous ducts in the human embryo are derived from which of the following types of cell populations?

- A) Endodermal
- B) Epithelial
- C) Mesenchymal
- D) Neural crest
- E) Pluripotential

The correct response is Option B.

As early as 6 weeks of gestation, discrete areas of epithelial proliferation occur on the ventral thorax. These areas evolve into buds that then canalize and form secondary buds that give rise to lactiferous ducts. These, along with secretory acini that originate in puberty, constitute the parenchyma of the breasts. These ducts are surrounded by mesodermal-derived mesenchymal cells, which in turn develop into the breast stroma composed of smooth muscle cells, capillary endothelial cells, and adipocytes. Neural crest cells give rise to pigmented cells and other structures but are not involved with embryogenesis of the breasts. Endodermal cell lines produce the lining of the gut and contribute to development of the liver and pancreas but not the breasts. Pluripotential cells do not comprise the parenchyma nor the stroma of the developing breast.

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156. A 45-year-old woman presents for rhinoplasty evaluation. The patient is dissatisfied with the downward movement of her nasal tip when she smiles. Which of the following muscles is responsible for this motion?

- A) Alar nasalis
- B) Depressor septi nasi
- C) Levator labii superioris alaeque nasi
- D) Procerus
- E) Transverse nasalis

The correct response is Option B.

The muscles of the nose contribute to its dynamic motion. The depressor septi nasi originates from the incisive fossa of the maxilla and inserts into the nasal septum and posterior aspect of the alar nasalis. It depresses the nasal septum and causes the nasal tip to move downward on animation and narrows the columellar labial angle. Release of this muscle during rhinoplasty will reduce the nasal tip depression during animation, but can also cause upper lip ptosis.

The nasalis muscle consists of two parts: the alar nasalis and the transverse nasalis. The alar nasalis, also called the pars alaris or dilator naris, originates from the maxilla and inserts along the lateral crura. It has variable development and helps to open the external nasal valve. The transverse nasalis originates from the maxilla and traverses the nose, with a thin aponeurosis over the midline. It elongates the nose and constricts the nostrils. The levator labii superior alaeque nasi originates from the nasal bone and inserts into the nostril and upper lip, and dilates the nostrils and elevates the upper lip. It is also known as Otto's muscle, and is the longest-named mammalian muscle. The procerus muscle depresses the glabella and assists in nostril flare.

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157. Which of the following hormones in the mammary gland is critical for breast development during puberty?

- A) Cortisol
- B) Insulin-like growth factor-1 (IGF-1)
- C) Platelet-derived growth factor (PDGF)
- D) Prolactin
- E) Vascular endothelial growth factor-C (VEGF-C)

The correct response is Option B.

While pubertal breast development depends on an estrogen surge, it is important to remember that breast development occurs downstream. The surge triggers pituitary growth hormone to stimulate mammary gland production of insulin-like growth factor-1 (IGF-1). IGF-1, in turn, causes proliferation and anti-apoptosis through a signaling cascade. Disruption of any factor along this pathway will result in abnormal breast development. Laron syndrome, for example, is an autosomal recessive disorder in which growth hormone insensitivity can cause delayed puberty as well as short stature. While high levels of prolactin can cause breast growth (and are thought to be responsible for ultimate breast development in Laron syndrome), prolactin is not in the mammary glands themselves.

In addition to the critical role IGF-1 plays during breast development, it also plays an important role in breast development during pregnancy. High levels of IGF-1 are also associated with increased breast volume and early-onset breast cancer. High serum levels of IGF-1 are associated with both bad prognosis and increased mortality in breast cancer. Cortisol is a stress hormone not related to breast development. Platelet-derived growth factor has a primary role in blood vessel development, as does vascular endothelial growth factor (VEGF). VEGF-C has a function in lymphangiogenesis.

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158. A 15-year-old girl presents for evaluation of hypoplasia of the right breast. Examination shows an underdeveloped left breast, superiorly displaced nipple-areolar complex, and sunken-appearing chest wall. The pectoralis major muscle and sternum are normal. Which of the following is the most likely diagnosis?

- A) Amastia
- B) Amazia
- C) Anterior thoracic hypoplasia
- D) Athelia
- E) Poland syndrome

The correct response is Option C.

Anterior thoracic hypoplasia is characterized by hypoplasia of the breast in the context of normal sternum and normal pectoralis major muscle. It is on the differential diagnosis of congenital breast deformities, and is distinguished from Poland syndrome by the normal pectoralis major muscle. Pectus excavatum is another condition of the chest wall; it is characterized by abnormal development of the sternum and ribs, and does not affect breast growth, although it can cause medial displacement of the breasts. Pectus excavatum is more common in males than females. Treatment of the breast in Poland syndrome and anterior thoracic hypoplasia depends on the degree of deformity and the goals of the patient; both implant-based reconstruction and fat grafting have been used.

Amazia is an absence of the mammary gland with a present nipple areolar complex, and amastia is complete absence of the mammary gland and nipple areolar complex.

Athelia is an absence of the nipple.

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159. A 34-year-old woman desires improvement of the appearance of her breasts and abdomen. Physical examination shows a supernumerary nipple with a small bud of breast tissue just under the fold of the left breast. The embryologic origin and development of this accessory structure occur as a result of which of the following?

- A) Incomplete differentiation of the ectodermal ridge
- B) Incomplete differentiation of the mesodermal ridge
- C) Incomplete involution of the ectodermal ridge
- D) Incomplete involution of the mesodermal ridge

The correct response is Option C.

In utero, the breasts develop from paired mammary ridges of thickened ectoderm which extend from the axillae to the inguinal regions. The ectoderm will give rise to the nipple and ductal elements, while the mesoderm will eventually give rise to the connective tissue and vascular structures of the breast. Polythelia, or supernumerary nipples, occur as a result of incomplete involution of one of the many epithelial buds along the mammary ridge.

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160. An otherwise healthy 29-year-old woman is scheduled to undergo bilateral reduction mammoplasty. Medical history includes symptomatic macromastia and significant breast hypertrophy. The operative plan includes a Wise pattern, inferior pedicle breast reduction, and infiltration of the incisions and parenchyma with a dilute epinephrine solution at a concentration of 1:500,000. The benefit of infiltration of the operative sites is to decrease which of the following?
- A) Intraoperative blood loss
 - B) Operative time
 - C) Postoperative drainage
 - D) Risk of hematoma
 - E) Risk of infection

The correct response is Option A.

The use of epinephrine-containing wetting solutions has been used extensively in plastic surgery to minimize blood loss complications in many types of surgery, including breast reduction. Injection of a dilute epinephrine wetting agent can significantly reduce blood loss. No change in operative time, risk for infection, hematoma or postoperative bleeding, or drainage outputs has been shown.

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161. A 54-year-old woman presents for follow-up examination after undergoing left mastopexy for improved symmetry 6 months ago. Medical history includes breast cancer. The patient reports some discomfort overlying a firm 1.5-cm mass that is palpable in the subcutaneous plane of the left breast. Which of the following is the most appropriate next step in management?

- A) Fine-needle aspiration
- B) Surgical excision
- C) Ultrasound imaging
- D) Warm compresses
- E) Observation only

The correct response is Option C.

The most appropriate next step in management is to obtain imaging. Ultrasound can identify and characterize lesions such as fat necrosis, which is the most likely cause of this patient's palpable mass in the postoperative period. Such imaging can confirm the physical examination findings and guide the best course of treatment (ie, aspiration versus excision). Observation or warm compresses are inadequate in addressing these findings or in obtaining a diagnosis. Once the benign nature and characteristics of the lesion are better understood, then treatment with bedside aspiration or formal excision of the mass can be undertaken.

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162. An otherwise healthy 29-year-old woman presents for improvement of the appearance of her buttocks with added volume and projection throughout. Liposuction of the abdomen, flanks, and back is performed. Gluteal augmentation with autologous fat grafting is planned. The fat has been prepared and aliquoted into 60 mL syringes with a 5-mm-caliber blunt injection cannula attached. In order to both maximize the aesthetic results and decrease the risk for fat macroembolism, the injection cannula should be directed within which of the following tissue planes?

- A) Intramuscular only
- B) Subcutaneous inferiorly and superficial muscular superiorly
- C) Subcutaneous medially and superficial muscular laterally
- D) Subcutaneous only

The correct response is Option D.

Based on the Aesthetic Surgery Education and Research Foundation (ASERF) task force recommendations and knowledge of gluteal anatomy, the risk of fat macroembolism and subsequent mortality with gluteal fat grafting is greatest when fat is injected intramuscularly, cannulas smaller than 4 mm in diameter are utilized, and/or the cannula is directed in a downward (deeper) trajectory. Conceptually, placement of fat grafts into the subcutaneous plane only will likely avoid cannulation of or injury to the gluteal vein(s) and the risk of fatal pulmonary fat macroembolus.

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163. A 43-year-old woman comes to the office to discuss a circumferential body lift. Medical history includes massive weight loss following Roux-en-Y gastric bypass surgery 3 years ago. Current medications include a daily multivitamin. The patient has not consistently kept follow-up appointments with her gastric bypass team and reports that she has not rigorously adhered to diet and supplementation recommendations. Which of the following nutrients is most likely to be deficient in this patient?

- A) Folate
- B) Iron
- C) Magnesium
- D) Vitamin B₆ (pyridoxine)
- E) Vitamin E

The correct response is Option B.

Iron deficiency is common after Roux-en-Y gastric bypass and is difficult to correct with only multivitamin supplementation. Folate deficiencies after gastric bypass are usually corrected by multivitamin supplementation. While other B-complex vitamin deficiencies are encountered after gastric bypass, vitamin B₆ deficiencies have not been linked to gastric bypass. Magnesium deficiencies are not commonly encountered as a result of gastric bypass. Vitamin E, while a fat soluble vitamin, is not routinely noted to be deficient following gastric bypass, unlike the other fat-soluble vitamins.

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164. A 28-year-old man presents for consultation about the excess tissue of his chest. Medical history includes no weight change and no comorbidities. BMI is 26 kg/m². Physical examination shows the nipple position is preserved in the craniocaudal dimension and firm soft tissue underlying the central breast bilaterally. Which of the following is the most appropriate surgical approach?

- A) Horizontal scar breast reduction with nipple-areola grafting
- B) Inverted-T pattern breast reduction with inferior pedicle
- C) Liposuction alone
- D) Periareolar access for open central glandular excision with liposuction
- E) Skin-sparing mastectomy with nipple-areola tattoo

The correct response is Option D.

Scar minimization is a priority when possible in patients with gynecomastia. The patient's acceptable BMI, absence of weight change, and physical description imply minimal skin excess, making him a candidate for limited scar techniques. Direct excision of the central gland through periareolar incision with liposuction for marginal contouring would address the patient's condition without excess scarring. Liposuction alone is unlikely to adequately address the firm central glandular tissue under the nipple-areola complex. The other techniques such as inverted-T pattern breast reduction with inferior pedicle, horizontal scar breast reduction with nipple-areola grafting, and skin-sparing mastectomy with nipple-areola tattoo would all unnecessarily increase scarring.

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165. An 18-year-old woman presents for surgical repair of an under-developed left breast. On physical examination, the left side shows concave chest wall, absent anterior axillary fold, and a hypoplastic and superiorly displaced nipple. The left upper extremity is most likely to demonstrate which of the following findings in this patient?

- A) Acrosyndactyly
- B) Arachnodactyly
- C) Macroductyly
- D) Polyductyly
- E) Symbrachyductyly

The correct response is Option E.

The patient described meets criteria for Poland syndrome. This complex includes breast and/or nipple-areola complex hypoplasia, absence of the sternal head of the pectoralis major, rib abnormalities, and syndactyly or symbrachyductyly, fused and shortened digits. Polyductyly (multiplication of digits), macroductyly (overgrowth and enlarged digits), arachnodactyly (long fingers), and acrosyndactyly (fusion of distal aspects of digits only) are not usually associated with Poland syndrome.

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166. A 20-year-old woman presents with concerns about the appearance of her breasts. Examination shows unilateral herniation of the nipple-areola complex and a constricted lower pole. Which of the following maneuvers is most likely to address this patient's concerns?

- A) Elevation of the inframammary fold
- B) Radial release of parenchymal bands
- C) Skin grafting of nipple-areola complex
- D) Vertical mastopexy
- E) Wise pattern reduction mammoplasty

The correct response is Option B.

The patient description is consistent with tuberous breast deformity. Surgical intervention usually includes reduction of the periareolar herniation with periareolar incisions and radial release of parenchymal bands. Reduction would not address the issues associated with a tuberous breast. Vertical mastopexy alone through standard approaches would potentially further constrict the lower pole. Skin grafting of the nipple-areola complex would not address the tissue herniation. Elevation of the inframammary fold would not address the tuberous deformity and might exacerbate it.

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167. An otherwise healthy 55-year-old woman with Fitzpatrick Type II skin desires facial rejuvenation. Phenol-croton oil (Hetter) peel with simultaneous extended superficial musculoaponeurotic system rhytidectomy and transconjunctival lower blepharoplasty is planned. Which of the following anatomic areas is at greatest risk for healing complications after this procedure?

- A) Forehead
- B) Lateral cheek
- C) Lower eyelid
- D) Nasal dorsum
- E) Perioral

The correct response is Option B.

In general, non-undermined skin can be safely peeled at the time of a facelift. So the “T-zone” of forehead, nose, and perioral and labiomandibular fold areas are not at increased risk for resurfacing during a facelift.

Undermined skin, particularly when flaps are thin, is risky for delayed wound healing and scarring with concurrent peeling. Peeling of the thin preauricular flap, raised during the facelift, would be the most risky of the choices listed.

Zins and associates showed that croton oil peeling was safe and effective in a series of patients with simultaneous lower eyelid surgery, including both transconjunctival blepharoplasty and the pinch technique of skin excision. Again, the peel was not performed on areas of skin undermining.

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168. According to Poiseuille's law, with all other factors being equal, which of the following is the approximate amount of fat extraction per unit time through a 5-mm liposuction cannula compared with a 4-mm cannula?

- A) 1.25 times more
- B) 1.5 times more
- C) 2 times more
- D) 2.5 times more
- E) 4 times more

The correct response is Option D.

Poiseuille's law governs the flow of liquids through a tube. Flow is related to the radius of the tube to the fourth power. Doubling the radius of a tube increasing flow by a factor of 16. Thus the ratio can be calculated as $(r_1 / r_2)^4$.

In this case, the calculated answer is $(2.5/2)^4$ is 2.44, or approximately 2.5 times more flow. Thus, during liposuction, smaller cannulas extract the fat more slowly, allowing for finer work.

In practice, calculation of the actual fat extraction rate also varies with the cannula tip design, length of tubing and homogeneity of the fatty aspirate. Computerized models for flow calculations exist.

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169. A 60-year-old woman presents to the emergency department with severe pain and pressure in her right eye. She is 12 hours postoperative from a transcutaneous lower blepharoplasty performed elsewhere. Her pain and pressure began very early postoperatively. Although she called the clinic to report her symptoms, she was told to "take more pain medication." On physical examination, there is bruising around the right eye with proptosis, diminished range of motion of the eye with diplopia, and decreased visual acuity compared with the left eye. Which of the following is the most likely diagnosis?

- A) Acute glaucoma
- B) Extraocular muscle entrapment
- C) Orbital cellulitis
- D) Retrobulbar hematoma
- E) Superior orbital fissure syndrome

The correct response is Option D.

This patient is presenting with signs and symptoms compatible with retrobulbar hemorrhage following her blepharoplasty procedure. This is an emergency requiring prompt treatment. Symptoms and signs include: severe pain and pressure, decreased visual acuity, and decreased range of motion of her extraocular muscles, which may cause diplopia and nausea. She has marked bruising and proptosis.

Retrobulbar hematoma is the most common cause of visual loss after blepharoplasty. Other eye emergencies, such as extraocular muscle entrapment and superior orbital fissure syndrome, typically occur in the setting of trauma, with orbital bony fractures. While acute glaucoma can present with a painful red eye with diminished visual acuity, especially in elderly patients, it is not typically seen in the early postoperative period following blepharoplasty. Orbital cellulitis is an urgent soft-tissue infection that usually presents with fever, as well as a painful, swollen eye. It has been rarely reported after blepharoplasty but presents about 4 to 6 days following the procedure.

Nahai and associates estimate the risk of visual loss following blepharoplasty at 1:20,000, based on a survey of members of American and British aesthetic surgeons. They found that 82% of patients developed symptoms within the first 24 hours, with more than half of these

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occurring in the first 6 hours postoperatively. Hypertension and use of aspirin were the two most common comorbidities. When a retrobulbar hemorrhage is suspected, suture removal and even lateral canthotomy should be performed at the bedside while the patient awaits an operating room.

Parallel to surgical measures, medical treatment can be commenced to lower intraocular pressure. Acetazolamide (500 mg intravenously), 20% mannitol (1.5 to 2 g/kg; 12.5 g over 3 min), methylprednisolone (100 mg), betaxolol hydrochloride ophthalmic suspension (one drop then twice daily), and 95% oxygen/5% carbon dioxide can be administered for this purpose. At the same time, an ophthalmology consult should be initiated. Prompt decompression of the orbit is required to avoid permanent visual loss.

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170. A 65-year-old woman presents for follow-up 1 week after undergoing a superficial musculoaponeurotic system face lift and neck lift. On examination, an asymmetric smile is noted. She is able to whistle and pucker her lips normally, but she has asymmetry of the lower lip when trying to make a “full denture” smile. Which of the following is LEAST likely?

- A) Botulinum toxin A may be used to improve symmetry during the recovery period
- B) It is related to injury of a cervical branch of the facial nerve
- C) It will typically make a full recovery in 1 to 6 months without exploration
- D) The lower teeth are more visible on the affected side during smiling
- E) Mentalis function is typically maintained

The correct response is Option D.

This patient has an injury of the cervical branch of the facial nerve, due to undermining during the neck portion of the procedure. It presents with an asymmetric lower lip when the patient attempts a “full denture smile,” due to injury of the cervical branches innervating the platysma muscle. Typically, the mentalis muscle function is preserved and allows differentiation from marginal mandibular nerve branch injury, as the patient can evert the lower lip or pout/pucker.

The lower teeth are less visible on the affected side, as retraction of the lower lip is impaired. Botulinum toxin A may be used on the normal side, to improve symmetry, with injection into the depressor labii inferioris (DLI).

In a classic paper, Owsley noted 34 cases in his personal series of 2002 face lifts (1.7%) with use of his superficial musculoaponeurotic system (SMAS)-platysma multivector technique, which incorporates subplatysmal dissection for correction of the neck. He noted a 100% recovery rate in 3 weeks to 6 months.

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171. When comparing the traditional bicipital groove brachioplasty with the posterior-incision approach, which of the following statements is most accurate?

- A) Excision-site liposuction should not be used with the posterior incision brachioplasty
- B) Injury to the medial antebrachial cutaneous nerve is unlikely with the posterior incision brachioplasty
- C) Most patients rate the postoperative scar appearance as "unsatisfactory" with the posterior incision brachioplasty
- D) A posterior-incision brachioplasty cannot be easily extended down the lateral chest wall, if needed, to deal with lateral chest laxity
- E) Tailoring of skin excess is more complex with the posterior incision approach

The correct response is Option B.

Posterior-incision brachioplasty has a number of advantages over the standard design. The incision runs from the posterior elbow region, straight up the midline posterior surface of the arm, when marked with the arm abducted at 90 degrees and the elbow flexed. The incision is placed in the posterior axillary fold, not the dome of the axilla, extending down the posterior surface of the arm. A simple ellipse of skin is resected, making tailoring of the skin excess straightforward. Preliminary liposuction of the excisional site is helpful, and a skin-only excision may be performed, sparing deeper structures and facilitating closure. The design may be extended down the lateral chest, when needed for patients with skin excess in that region. The medial antebrachial cutaneous nerve (MABC) is unlikely to be injured with this incision design. Concurrent liposuction of the arm with the posterior incision brachioplasty can facilitate shaping and skin resection with predictable results and good outcomes, as published by Nguyen and Rohrich. Elkhatib's study found an 88.8% patient satisfaction rating with the quality of the resultant incisional scar.

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172. Which of the following is the recommendation for the minimum tumor-to-nipple—
areola complex distance in nipple sparing mastectomy?

- A) 0.5 cm
- B) 1 cm
- C) 2 cm
- D) 3 cm
- E) 4 cm

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

The correct response is Option B.

A tumor involving the nipple-areola complex (NAC) is an absolute contraindication to this procedure. Traditional oncologic tumor-to-NAC distance has been 2 cm, but current data has suggested a 1-cm distance as oncologically safe. Current evidence suggests that patients with tumors farther than 1 cm are candidates for nipple sparing mastectomy.

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173. A 44-year-old woman comes to the office for evaluation of an injury to the tip of the nose from a dog bite. Physical examination shows a 3-cm soft-tissue defect involving most of the nasal tip and sidewall. In addition to resecting the remaining tissue of the nasal tip, which of the following methods of reconstruction is most likely to provide an optimal aesthetic outcome in this patient?
- A) Bilobed flap
 - B) Dorsal nasal (Rieger) flap
 - C) Forehead flap
 - D) Full-thickness skin graft
 - E) Nasolabial flap

The correct response is Option C.

The nose has nine topographic subunits, including the nasal dorsum, tip, columella, paired sidewalls, ala, and soft triangle. This classification system facilitates nasal reconstruction because scars can be inconspicuously placed between the subunits. Possessing knowledge about the physical and aesthetic characteristics of each subunit enhances the ability to choose replacement tissue of appropriate thickness and contour. For nasal defects that involve more than one half of an aesthetic subunit, it is best to reconstruct the entire subunit rather than covering the defect. For nasal tip defects, scars should not be placed directly on the tip itself. A full-thickness skin graft will contract and show a different skin color and quality than the surrounding skin, making it aesthetically unacceptable. Bilobed and nasolabial flaps are appropriate methods of reconstruction for smaller tip and alar defects; however, reconstruction of the entire nasal tip is not possible with either of these flaps. A forehead flap is the appropriate method of reconstruction for a complete nasal tip defect. Dorsal nasal (Rieger) flap is generally used for defects 2 cm or smaller. Reconstruction of a large defect with a Rieger flap would provide a less aesthetic outcome than a forehead flap and may lead to upward rotation of the tip complex and would not address sidewall deficits.

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174. Male pattern baldness is characterized by which of the following growth phase disturbances?

	Telogen Phase	Anagen Phase
A)	Increased	decreased
B)	Increased	increased
C)	Decreased	decreased
D)	Decreased	increased

The correct response is Option A.

Male pattern baldness follows an X-linked dominant inheritance pattern. The anagen phase of hair growth is the active growth phase and lasts approximately 1000 days in men. In the anagen phase, follicular cells are actively multiplying and becoming keratinized. In men with normal hair growth, 85 to 90% of hairs are in this phase, with hair growing 1 cm per month. The catagen phase is known as the transitional or degradation phase and typically lasts 2 to 3 weeks and is characterized by atrophy of the bulb, with keratinization of the hair base, and separation of the hair base from the dermal papilla. The telogen phase of hair growth usually lasts 3 to 4 months and is also known as the resting phase and is characterized by the inactivation of the hair follicle, cessation of hair growth and hair shedding.

In men with normal hair growth, 10% of hair follicles are in the telogen phase, causing approximately 50 to 100 hairs to be shed on average per day. In male pattern baldness there is an increased percentage of hairs in the telogen phase and a decreased percentage of hairs in the anagen phase.

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175. A 52-year-old man underwent a single session of cryolipolysis. BMI before the session was 28.5 kg/m². The session lasted 1 hour and a large applicator was used over the infraumbilical abdominal region. After the procedure, mild edema with cutaneous erythema was noted. Two months after cryolipolysis, the treated area progressively increased in size. The area was painless but firmer and thicker than the surrounding abdominal tissue. These findings are most suggestive of which of the following conditions?

- A) Hematoma
- B) Lymphocele
- C) Paradoxical adipose hyperplasia
- D) Seroma
- E) Weight gain

The correct response is Option C.

Cryolipolysis is a minimally invasive technique for decreasing localized areas of adiposity using thermal cooling. It was approved for use on the abdomen by the Food and Drug Administration in 2010. Paradoxical adipose hyperplasia (PAH) is a known complication of cryolipolysis and is usually characterized by localized hypertrophy of fat in a treated area. Risk factors identified that increase the development of PAH include male sex, large applicator size, abdominal treatment and previous history of cryolipolysis in the area being treated.

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176. An otherwise healthy, 24-year-old woman presents for breast augmentation consultation. Physical examination shows polythelia. On the basis of this finding, which system is most likely to have associated abnormalities?

- A) Gastrointestinal
- B) Hematological
- C) Pulmonary
- D) Renal
- E) Vertebral

The correct response is Option D.

The presence of a supernumerary nipple occurs in 2-6% of females. Polythelia is the presence of two or more supernumerary nipples. A correlation exists between renal disease and polythelia. It is associated with 19% of patients with renal adenocarcinoma and 16.5% of patients with end-stage renal disease. Regular physical examination and urinalysis should be performed in patients with polythelia and any noted abnormality should alert the physician to the need for a renal ultrasound.

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177. A 36-year-old woman presents for cosmetic rhinoplasty. Examination shows a retracted columella, underprojection, and underrotation of the nasal tip, along with a prominent dorsal hump. An open rhinoplasty is planned. Which of the following grafts is most likely to preserve tip rotation with time in this patient?

- A) Batten
- B) Columellar strut
- C) Onlay
- D) Septal extension
- E) Spreader

The correct response is Option D.

Nasal tip refinement is one of the most critical aspects of rhinoplasty surgery. Control of the position is critical for long-term results. It is influenced by surgical approach, maneuvers, and postoperative healing. Tip support is reliant on not only the crura and ligaments holding them together, but also on the grafts utilized to support the repair. The two most common grafts that provide a great deal of support for the tip are the columellar strut graft and the septal extension graft. Although both will result in some degree of loss of projection and rotation in the immediate postoperative period, both will have similar preservation of tip projection. However, the septal extension graft is noted to have better preservation of tip rotation with time in comparison with the columellar strut graft. The remaining grafts listed do not affect the projection and rotation of the nasal tip as powerfully. Septal extension graft will more effectively lengthen a shortened caudal septum more effectively than a columella strut alone.

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178. A 19-year old woman presents with concerns about the appearance of her breasts. Examination shows asymmetrical breasts with grade III ptosis, small breast footprint of both breasts, and a large nipple-areola complex with herniation of breast tissue. Which of the following characteristics of the tuberous breast deformity contributes to the physical findings in this patient?

- A) Hyperplasia of one or more quadrants
- B) Hyperplasia of only medial quadrants of the breast
- C) Hypoplastic areola
- D) Low inframammary fold
- E) Periareolar ring constriction

The correct response is Option E.

Tubular breasts are caused by connective tissue malformations and occur in puberty. Clinical characteristics include breast asymmetry, dense fibrous rings around the areola, hernia bulging of the areola due to hypoplastic fascial support, hypoplasia of one, two or more quadrants, narrowing of the breast base, and a high location of submammary folds.

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179. A 38-year-old man undergoes upper back lift and subcutaneous mastectomy with free nipple graft. Medical history includes a 90.7-kg (200-lb) weight loss 3 years ago. Intraoperatively, the serratus muscle fascia is violated near the axilla on the right side. Nine months later, the patient reports persistent numbness of the medial and posterior aspects of the right upper arm. Which of the following nerves was most likely injured during the procedure?
- A) Axillary superior lateral cutaneous
 - B) Intercostobrachial
 - C) Medial antebrachial cutaneous
 - D) Medial brachial cutaneous
 - E) Posterior brachial cutaneous

The correct response is Option B.

The intercostobrachial nerve (ICBN) is an extension of the lateral cutaneous branch of the second intercostal nerve. Unlike the other intercostal nerves, the ICBN does not divide into an anterior and a posterior branch. The ICBN courses by piercing the intercostalis externus and the serratus anterior, crosses the axilla to the medial side of the arm, and joins with a branch from the medial brachial cutaneous nerve. Sensation to the skin of the upper half of the medial and posterior part of the arm is provided by the ICBN and can be inadvertently divided in body contouring procedures when dissection is aggressive to the level of the serratus muscle. Sensation to the cutaneous region supplied by the nerve can be affected. The medial antebrachial cutaneous nerve provides sensation to the skin on the medial brachial side of the arm and extends along this ulnar axis to the wrist. The medial brachial cutaneous nerve is distributed to the skin on the medial brachial side of the arm. The axillary superior lateral cutaneous nerve courses around the posterior boarder of the deltoid muscle and supplies the skin over the lower two thirds of the posterior part of this muscle, as well as that covering the long head of the triceps muscle. The posterior brachial cutaneous nerve is a branch of the radial nerve that provides sensory innervation for the majority of the skin on the back of the arm. It arises in the axilla and during its course it crosses behind and communicates with the ICBN.

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180. A 43-year-old man presents to the office after being treated with botulinum toxin type A for concerning horizontal rhytids in the forehead 3 weeks ago. The patient reports that he is dissatisfied with the results and can barely open his eyes. Physical examination shows ptosis of the left upper eyelid. Apraclonidine 0.5% eye drops are prescribed and the patient reports temporary improvement. Which of the following muscles is most likely the target of the eye drops and involved in the improvement of this patient's condition?

- A) Corrugator supercilia
- B) Frontalis
- C) Levator palpebrae superioris
- D) Orbicularis oculi
- E) Superior tarsal (Müller) muscle

The correct answer is E.

The superior tarsal muscle is a smooth muscle and also known as Müller's muscle. An adverse effect of the injection of botulinum toxin type A into the upper third of the face is ptosis, or lid droop, and can occur up to 2 weeks after injections. Ptosis results from migration of the botulinum toxin type A to the levator palpebrae superioris muscle. The levator allows the eyelid to open properly and fully. To avoid ptosis, injections should occur at least 1 cm above the eyebrow.

The superior tarsal muscle originates on the underside of the levator palpebrae superioris and inserts on the superior tarsal plate of the eyelid. The superior tarsal muscle receives its innervation from the sympathetic nervous system. Post-ganglionic sympathetic fibers originate in the superior cervical ganglion, and travel via the internal carotid plexus, where small branches communicate with the oculomotor nerve as it passes through the cavernous sinus. The sympathetic fibers continue to the superior division of the oculomotor nerve, where they enter the superior tarsal muscle on its inferior aspect. The superior tarsal muscle works to keep the upper eyelid raised after the levator palpebrae superioris has raised the upper eyelid. Apraclonidine is an α_2 -adrenergic agonist, which causes Müller muscles to contract, quickly elevating the upper eyelid 1 to 3 mm.

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In this situation, the frontalis muscle was the target of the botulinum toxin to temporarily alleviate cosmetic concerns of horizontal rhytids in the forehead. The patient was injected too close to the brow likely in an attempt to treat all forehead lines. Eyedrops would not help the frontalis muscle contract and elevate the brow. The levator palpebrae superioris is the primary elevator of the upper eyelid. Ptosis results from migration of the botulinum toxin to the levator palpebrae superioris muscle. This skeletal muscle is innervated by the oculomotor nerve (cranial nerve III) and not susceptible to activation by an alpha adrenergic agonist. The orbicularis oculi muscles is facial muscle responsible for closing the eye. The corrugator supercilii is a small, narrow, pyramidal muscle located at the medial end of the eyebrow, beneath the frontalis and just above the orbicularis oculi muscle. This muscle draws the eyebrow downward and medially, producing the vertical wrinkles of the forehead. This muscle when activated would not elevate the upper eyelid.

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181. A 32-year-old woman comes to the office 2 years after undergoing bilateral breast augmentation with 350-cc smooth, round saline implants. The patient reports chronic fatigue and joint pain. Physical examination shows soft, symmetrical, and nontender breasts. There are no palpable masses and no axillary adenopathy. Which of the following is most appropriate next step in management?

- A) Exchange saline implants for cohesive gel implants
- B) Order MRI
- C) Perform en bloc removal of the implants
- D) Perform stereotactic biopsy of capsule
- E) Request autoimmune disease evaluation

The correct response is Option E.

Breast implant illness (BII) is a term used to describe a multitude of symptoms seen in patients with breast implants. These symptoms may include the following (as well as others): fatigue, anxiety, headaches, brain fog, anxiety, photosensitivity, hormonal issues, rash, and hair loss. There is no definitive link between these symptoms and breast implants. Research is ongoing.

It is important that all patients with these symptoms are evaluated. BII has been self reported by patients with all types of implant characteristics including silicone, saline, textured surfaces, and smooth-walled implants.

Before undergoing surgery, evaluation of these patients is important. Many of these symptoms can be associated with known autoimmune diseases and should be evaluated for this possibility, either by a rheumatologist or other medical professional. If a known autoimmune disease is diagnosed, then traditional treatment for this known disease should be tried before explantation surgery.

Women who underwent explantation for possible BII had varying degrees of improvement including no improvement, temporary improvement, and permanent resolution of symptoms. In one study, patients with documented autoimmune disease showed no improvement following explantation.

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MRI would not initially be needed with a normal physical examination and saline implants.

Stereotactic biopsy would be indicated for palpable masses or breast mass evaluation, not symptoms of BII.

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182. A 27-year-old woman presents with a multicolored decorative tattoo on her leg. She is interested in laser tattoo removal. On physical examination, over 80% of her tattoo has red and orange colors. Which of the following laser treatments would be most effective on the orange and red areas?

- A) 755-nm Q-switched alexandrite
- B) 532-nm Q-switched Nd:YAG
- C) 1064-nm Q-switched Nd:YAG
- D) 694-nm Q-switched ruby

The correct response is Option B.

Successful tattoo removal can be performed using different types of laser wavelengths. The 532-nm Q-switched Nd:YAG would be used for targeting red, yellow, and orange color tattoos. Black pigments can be effectively removed with Q-switched Ruby 694-nm, 755-nm Alexandrite, or 1064-nm Nd:YAG lasers. Purple ink responds best to the Q-switched 694-nm ruby laser and green ink best removed with the Q-switched 755-nm Alexandrite laser. The Q-switched Ruby 694 nm laser creates a red light that is highly absorbed by green, blue, and dark tattoo pigments.

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183. Which of the following locations contains the extraocular muscle that is most likely to be injured during transconjunctival lower eyelid blepharoplasty?

- A) Between the central and lateral compartments
- B) Between the nasal and central compartments
- C) Medial to lateral compartment
- D) Medial to nasal compartment
- E) Superior to central compartment

The correct response is Option B.

The inferior oblique muscle is the most commonly injured extraocular muscle during lower blepharoplasty and lies between the nasal and central fat pads. Injury can lead to diplopia typically seen postoperatively between 1 and 6 weeks. Initial treatment is conservative. Surgical repair can be attempted only after improvement stops.

Inferior oblique muscle is not found in the other locations.

The arcuate expansion of Lockwood ligament is located between the central and lateral fat pads.

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184. Which of the following treatments for inferior turbinate hypertrophy is most likely to preserve mucosal function while maximizing symptom relief?

- A) Electrocautery
- B) Laser cautery
- C) Partial turbinectomy
- D) Submucous resection
- E) Turbinate outfracture

The correct response is Option D.

Submucous resection of the inferior turbinate is the most likely treatment to provide symptom relief and preserve function.

The inferior turbinate warms and moisturizes the air during breathing. Surgery is indicated for patients who have nasal obstruction refractory to medical management. Surgical treatment has focused on tissue reduction.

Submucous resection removes some of the underlying bone with preservation of overlying mucosa. It provides the largest improvement in nasal airflow, and it is the only treatment that has been shown to restore mucociliary clearance and secretory production. Complications include synechiae, crusting, and bleeding.

Partial turbinectomy involves selectively trimming of the inferior turbinate. It provides long-lasting relief but it does not preserve the function of the mucosa and has high a complication rate.

Turbinate outfracture attempts to lateralize the inferior turbinate with a blunt instrument. No objective data have been found to support long-term improvement. Early recurrence occurred in more than 50% of cases.

Electrocautery and laser cautery work by creating tissue injury and subsequent fibrosis. Long-lasting results have not been reported.

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185. A 45-year-old woman presents to the plastic surgeon's office with complaints of dryness of the eyes and a burning sensation 1 week after a bilateral upper blepharoplasty with skin and muscle excision only by another surgeon. Her pre-operative history included use of contact lenses for over 20 years and laser-assisted in situ keratomileusis (LASIK) 3 months prior to surgery. Her pre-operative examination showed dermatochalasis of both upper eyelids, positive orbital vector, and normal upper eyelid position, and corneal protectors are used intraoperatively. Which of the following is the most likely cause of her postoperative symptoms?

- A) Blepharoplasty technique used
- B) History of contact lens use
- C) History of laser-assisted in situ keratomileusis (LASIK)
- D) Positive vector orbit
- E) Use of intraoperative corneal protectors

The correct response is Option C.

Blepharoplasty should not be performed before 6 months following LASIK surgery. This delay is necessary to allow sensation to return to the cornea. The dryness is from the lack of sensation and decreased blinking leading to increased evaporation.

Transient dry eyes occur in up to 26% of patients after blepharoplasty. Initial treatment of dry eye consists of ocular lubrication. Patients with proptosis, exophthalmos, horizontal lid laxity, or a negative vector orbit are more prone to dry-eye syndrome.

Patients who wear contact lenses without difficulty have adequate tear production. If patients have been advised to not wear contact lenses, they should be evaluated for inadequate tear production.

Patients with prominent eyes have a negative vector orbit and are at increased risk of dry eyes. Positive vector indicates a posterior relationship of the anterior cornea to the malar eminence and does not increase the risk of dry eyes.

Blepharoplasty, upper or lower, will increase the risk of developing dry eye postoperatively. The risk is unrelated to technique and upper blepharoplasty may have less

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risk compared to lower blepharoplasty. When patients have risk factors for dry eyes postoperatively and want upper and lower blepharoplasty, consider staging the upper and lower blepharoplasties.

Intraoperative use of corneal protectors and lubricant is protective because it decreases ocular exposure.

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186. A 7-year-old boy is scheduled to undergo repair of a congenital right ear deformity. On examination, the superior helix is not visible but is palpable under the scalp. There is no sulcus of the superior ear. Which of the following is the most appropriate treatment for this patient?

- A) Application of scaphoconchal sutures
- B) Apply ear molding for the following 3 months
- C) Excision of helical skin
- D) Excision of skin and cartilage from scapha
- E) Incisional release with skin grafting

The correct response is Option E.

This patient has cryptotia, which occurs when the superior aspect of the ear is buried under the skin. The auricular cartilage can be normal under the skin. Surgical treatment involves a superior incision to release the cartilage and then resurfacing the posterior defect with local tissue or full-thickness skin grafting.

Scaphoconchal sutures, or Mustarde sutures, are used in the treatment of the prominent ear. Prominent ears typically have flattened antihelix and may have conchal bowl hypertrophy. Scaphoconchal sutures are used to recreate the antihelical fold.

Excision of helical skin is used to treat mild forms of constricted ears. Constricted ear occurs when the helical rim is deficient in circumference for the scapha, which creates a cupped shape. In mild forms, the overhanging skin of the helix can be excised. More severe forms require lengthening of the helix and scaphoconchal sutures to pull the ear back.

Ear molding is not indicated for cryptotia.

Excision of skin and cartilage from the scapha is used to treat macrotia, or large ears. The helical rim tends to be too long after the skin and cartilage is excised, therefore, a wedge of the helical rim is typically excised.

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187. A 36-year-old woman undergoes treatment of forehead wrinkles. Preoperative examination shows transverse rhytides when raising the eyebrows. Her eyebrows are 1 cm above the supraorbital rim. The central forehead is treated with 24 units of botulinum toxin type A. Two weeks later, the patient is unsatisfied with the appearance of her eyebrows. On examination, the medial eyebrow is located 1 cm above the supraorbital rim. Lateral eyebrows are raised significantly, creating an abnormal arch. Injection of additional botulinum toxin type A into which of the following muscles is the most appropriate treatment at this time?

- A) Corrugator supercilia
- B) Lateral frontalis
- C) Levator palpebrae
- D) Orbicularis oculi
- E) Procerus

The correct response is Option B.

This patient has a “Spock’s eyebrow” deformity which occurs when the eyebrow has an excessive arch—the lateral brow is significantly higher compared the medial brow. This can happen when the medial frontalis is overtreated, resulting in a paradoxical effect on the lateral brow and an unnatural elevation of the lateral brow. Treatment of the deformity is with botulinum toxin type A injection into the lateral frontalis muscle (2 cm above the brow) which will allow the lateral brow to descend.

Facial rhytids are classified as static or dynamic. Botulinum toxin type A injections are useful for treating dynamic rhytids, which occur during muscle contraction. The effects of botulinum toxin type A are usually seen within 3 to 10 days and lasts for 3 to 6 months.

The frontalis muscles are brow elevators and are the only elevators in the upper face.

The glabella is a commonly treated area and includes the corrugator supercilia and procerus muscles. Contraction of procerus results in horizontal rhytids and contraction of corrugators result in vertical rhytids. Both are brow depressors.

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The orbicularis oculi muscle is targeted for the treatment of “crow’s feet lines” or lateral canthal lines along the lateral orbital rim. The orbital portion of the orbicularis oculi depresses the eyebrows.

The levator palpebrae is a muscle in the upper eyelid and functions to elevate and retract the upper eyelid. Eyelid ptosis can occur with botulinum toxin type A treatment of the glabella if there is diffusion of botulinum toxin type A that effects the levator palpebrae.

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188. Which of the following is the dominant blood supply to the nipple-areola complex in a superomedial pedicle breast reduction?

- A) Anterior lateral perforators
- B) Dermal plexus
- C) Internal mammary perforators
- D) Lateral thoracic system perforators

The correct response is Option C.

The vascular supply to the nipple areola complex in a superomedial breast reduction is perforators of the internal mammary artery.

Anterior lateral perforators are divided during superomedial pedicle technique.

Lateral pedicle (Skoog technique) is relied on lateral thoracic system perforators.

Dermal plexus could be perfuse by any of the above arteries but it finally depends on which artery has not been sacrificed during the creation of the pedicle. In superomedial pedicle technique, the lateral thoracic and anterior intercostals have been already sacrificed.

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189. A 35-year-old woman undergoes a right dacryocystorhinostomy procedure with an incision in the inner canthus on the right side. Postoperatively, she has poor closure of the right upper eyelid. Which of the following is most likely responsible for the poor eyelid closure?
- A) Interruption of the buccal branches of the facial nerve that supply the extracanthal orbicularis oculi
 - B) Interruption of the buccal branches of the facial nerve that supply the inner canthal orbicularis oculi
 - C) Interruption of the temporal branches of the facial nerve supplying the orbicularis oculi
 - D) Interruption of the zygomatic branches of the facial nerve that supply the extracanthal orbicularis oculi
 - E) Interruption of the zygomatic branches of the facial nerve that supply the inner canthal orbicularis oculi

The correct response is Option B.

The extracanthal orbicularis oculi is innervated by the zygomatic branch, which squeezes the eyelid, permits animation and expression, and protects the eye from debris and flying objects. The inner canthal orbicularis oculi is innervated by the buccal branches, which are responsible for blinking, eyelid closure, lower lid tone and position, and lacrimal pump function. Interruption of the buccal branches of the facial nerve that supply the inner canthus can profoundly affect blinking, eyelid closure, the tone and position of the lower lid, and the tear-pump mechanism. The temporal branches of the facial nerve do not supply any meaningful innervation to the orbicularis oculi.

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190. A 50-year-old woman with Fitzpatrick type II skin and deep perioral rhytides is interested in nonsurgical rejuvenation for her perioral rhytides. Which of the following treatment options is most likely to have the best outcome in a single treatment?

- A) Jessner peel
- B) 0.4% Croton oil (Hetter) peel
- C) 20% glycolic acid peel
- D) 20% trichloroacetic acid (TCA) peel
- E) 88% phenol peel

The correct response is Option B.

The patient is noted to have deep perioral rhytids, and for adequate resolution, a stronger peel is required. Deeper peels, however, will have a longer recovery time.

The glycolic peel is the lightest, followed by the Jessner and trichloroacetic acid (TCA).

While TCA can be used for a perioral peel, it would require a concentration of 35 to 40% to be effective in this scenario. A 20% TCA peel would not give the desired outcome.

In a Hetter peel, the Croton oil is the active peeling agent, not the phenol. Strengths of 0.4% to 0.8% Croton oil are typically used in the perioral area. With this technique, lighter concentrations of Croton oil in phenol are used for more delicate areas, like the lower eyelids or neck, medium concentrations for the cheeks, and heavier concentrations for the perioral area.

Of note, phenol by itself (88% USP), when unoccluded, only gives a light to moderate peel. It is not as strong as the 0.4% Croton oil peel.

Glycolic acid peels are superficial peels and are not effective for deep perioral rhytides.

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191. A 5-year-old boy presents to the office for evaluation of ear deformity. Examination shows an abnormal bar of cartilage, extending from the antihelix to the helix at approximately the junction between the upper and middle thirds of the ear. Which of the following is the most likely diagnosis?
- A) Constricted ear
 - B) Cryptotia
 - C) Microtia
 - D) Question mark ear
 - E) Stahl ear

The correct response is Option E.

In Stahl ear, there is an abnormal bar of cartilage (sometimes called the third crus), extending from the antihelix to the helix at approximately the junction between the upper and middle thirds of the ear. If that abnormal cartilage is obvious, it must be excised.

In a constricted ear, the fundamental abnormality is that the helical rim is deficient in circumference for the scapha to which it is attached. The inadequate length of the helix “constricts” the ear and forces it into a cupped shape that protrudes from the head.

In cryptotia, the superior aspect of the ear is hidden beneath the temporal scalp. In some cases, the auricular cartilage is normal and requires only to be extracted from its hiding place. Lateral traction on the ear will reveal a normal auricle.

In the question mark ear, there is excess scapha in the upper portion of the ear and a deficiency at the junction of the middle and lower thirds, resulting in a “question mark” shape.

Microtia is a congenital condition in which the cartilage of the outer ear is underdeveloped or absent.

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192. A 58-year-old woman with a history of rosacea is scheduled to undergo Er:YAG laser resurfacing to improve the appearance of perioral rhytids. When compared with a carbon dioxide laser, for which of the following does the Er:YAG laser have a greater affinity?

- A) Hair follicle
- B) Hemoglobin
- C) Melanin
- D) Papillary dermis
- E) Water

The correct response is Option E.

Use of nonsurgical skin rejuvenation has increased exponentially over the past 20 years, with over 4.6 million cases performed annually. This increase has led to expansion of different types of devices for resurfacing. The use of lasers for facial resurfacing has been discussed since the 1980s, initially with carbon dioxide lasers and then with erbium-doped yttrium aluminium garnet (Er:YAG) lasers in the late 1990s. Ablative laser treatments have been used to target actinic skin damage and moderate to heavy rhytides.

Lasers work by means of a wavelength of light being absorbed by specific targets (chromophores) in the tissue, causing thermal damage. The targeted chromophore absorbs energy, which is converted to heat. Tissues that are heated to 60° to 70°C (140°F to 158°F) coagulate; above 100°C (212°F), vaporization occurs. The carbon dioxide laser has a wavelength of 10,600 nm with a target chromophore of water. In the mid 1990s, the ability to deliver increasing power over shorter amounts of time allowed temperatures to be reached that would allow ablation of the epidermis. However, even with ablation there was a zone of coagulation surrounding the ablation that ranged between 70 and 120 µm. The Er:YAG laser has a wavelength of 2940 nm. The peak absorption of water is nearly 2900 nm, which means that an Er:YAG laser has an absorption 12 - to 16-fold greater than carbon dioxide laser.

Because of this unique feature, the ablation threshold of Er:YAG is only 1 J/cm² compared with the carbon dioxide laser's ablation threshold of 5 J/cm². The clinical relevance is that a much higher percentage of targeted tissue is ablated rather than heated, so that the resultant surrounding coagulation zone is only 5 to 20 µm of tissue.

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It is a common mischaracterization of full-field resurfacing options to state that “erbium is more superficial than carbon dioxide.” This is only true for a single pulse and equivalent energies, as the erbium wavelength is rapidly absorbed in water at a rate 11 to 16 times higher than carbon dioxide. However, such a statement is contrary to the fact, as erbium allows ablation of the dermis and the epidermis, unlike carbon dioxide, which can only ablate epidermis. Erbium can easily ablate the dermis on successive pulses until the skin, muscle, and even bone can be totally obliterated. Carbon dioxide can only affect deep tissue by stacking pulses and creating “bulk heat” that melts the tissue rather than ablating, and is both imprecise and dangerous.

Erbium provides a controlled depth of ablation with a minimal underlying thermal zone of coagulation. This decrease in thermal injury leads to a faster recovery following erbium laser ablation compared with carbon dioxide laser. The smaller coagulative zone results in a lower rate of hypopigmentation and allows for a more controlled depth with each pass. Carbon dioxide lasers can have variable depth of penetration, especially after the first pass when the dermis is exposed, and the residual thermal injury creates a “char,” which becomes thicker with each pass, making penetration increasingly difficult.

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193. A 54-year-old man with Fitzpatrick type II skin is scheduled to undergo photoaging treatment with a carbon dioxide fractional laser. Which of the following measures is most likely to decrease this patient's risk of hypertrophic scarring?

- A) Decreasing fluences
- B) Heat stacking
- C) Increasing surface area coverage
- D) Treating the neck skin
- E) Using multiple laser passes

The correct response is Option A.

Fractional laser resurfacing of photo-damaged or acne-scarred skin has supplanted traditional carbon dioxide ablative laser devices while diminishing the incidence of adverse effects and effecting a more rapid recovery. However, hypertrophic scarring (HTS) is a noteworthy complication that requires the utilization of preventive measures to minimize its occurrence. Conservative treatment of the neck is foremost among these measures. Use of lower fluences (energy density, defined as Joules/cm²) treating reduced surface areas, abstinence from heat stacking, and avoiding multiple passes by a carbon dioxide laser all contribute to less incidence of HTS. Patient selection, preoperative education, and preparation for treatment of this complication are appropriate adjunctive measures as well.

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194. A 72-year-old woman presents for evaluation of bilateral upper eyelid ptosis. Medical history includes cataract surgery 9 months ago. Repair of the dehiscence of the levator muscle is planned. During surgery, the levator aponeurosis is reattached to which of the following structures?

- A) Gray line
- B) Lockwood ligament
- C) Müller's muscle
- D) Tarsal plate
- E) Whitnall ligament

The correct response is Option D.

The Levator aponeurosis attaches to the tarsal plate. In patients with senile ptosis, the levator muscle becomes either detached or attenuated from its insertion into the tarsal plate. Similarly, during cataract surgery the muscle can become detached from the tarsal plate because of the placement of a retractor to hold the eye open for the procedure. Procedures performed to address this attenuation or detachment will suture the levator to the tarsal plate.

The gray line is a surface anatomical landmark on the eyelid margin that corresponds to the muscle of Riolan.

The Whitnall ligament is a structure of the upper eyelid. It attaches the superior aspect of the aponeurosis of the levator muscle to the orbital roof. This structure does not attach to Whitnall's tubercle.

The Lockwood ligament is a structure of the lower eyelid. This corresponds to the Whitnall ligament of the upper eyelid. The Lockwood ligament is a fascial hammock that supports the globe. It is an expansion of the fascia of the inferior rectus and inferior oblique muscles and extends to the medial and lateral orbital walls.

Müller's muscle is an accessory levator of the upper eyelid. It is located interior to the levator muscle.

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195. A 27-year-old woman presents to the office because of difficulty breathing. Medical history includes closed rhinoplasty with dorsal hump removal and septoplasty 3 years ago. Physical examination shows a narrowed mid vault with an inverted V deformity. Which of the following grafts is most likely to correct the patient's condition?

- A) Alar batten
- B) Dorsal onlay
- C) Dorsal sidewall onlay
- D) Shield
- E) Spreader

The correct response is Option E.

This patient has collapse of the upper lateral cartilages onto the nasal septum. This is the result of the dorsal hump reduction that released the upper lateral cartilages from the septum and then unsupported allows the upper lateral cartilages to collapse inward. The inverted V deformity is the result of the upper lateral cartilages collapsing inward away from the nasal bones, exposing their underlying shape (the inverted V shape of the piriform aperture). This also results in narrowing of the lateral dorsal aesthetic lines of the nose. This narrowing of the mid-vault of the nose is seen internally as a narrowing of the internal nasal valve.

The placement of spreader grafts between the septum and upper lateral cartilages will correct the inverted V deformity, widen the dorsal aesthetic lines, and open the internal nasal valve.

Placement of an alar batten graft, dorsal onlay graft, dorsal sidewall onlay graft, and/or shield grafts will not correct the inverted V deformity, dorsal aesthetic lines, or open the internal nasal valve. Thus their placement will not correct the aesthetic or functional issue seen in this patient.

An alar batten graft can be used to support and strengthen the alae. They often will be used to strengthen an overresected lateral crura. These grafts can also correct collapse of the external nasal valve.

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A dorsal onlay graft is used to augment the dorsum or hide asymmetries.

A dorsal sidewall graft is used to camouflage depressions or asymmetries of the upper lateral cartilages. These grafts, however, will not open the internal nasal valve and will not have an effect on breathing.

A shield graft is used to improve nasal tip aesthetics. It can project the tip and create tip defining points.

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196. A 67-year-old woman presents for consultation to address deep facial rhytides and dyschromias. Medical history includes Fitzpatrick Type II. A chemical peel is planned. For which of the following chemical peeling agents is cardiac monitoring recommended?

- A) Glycolic acid
- B) Phenol
- C) Resorcinol
- D) Salicylic acid
- E) Trichloroacetic acid

The correct response is Option B.

Phenol is absorbed through the skin and into the bloodstream. Most is excreted through the urine. Cardiac dysrhythmias are associated with phenol peels. There are no reported deaths related to phenol toxicity in the literature. As a result, it is recommended that patients who undergo a phenol peel have electrocardiographic monitoring and intravenous access.

The dysrhythmias can include supraventricular tachycardia, premature ventricular contractions, atrial fibrillation, and ventricular fibrillation. Although infrequent, they are associated with higher concentrations of phenol and full-face treatments. It is recommended that the treatment be performed in aesthetic units, allowing for 15 minutes to elapse between the treatment of each unit.

Resorcinol and salicylic acid are components of Jessner's solution.

Cardiac arrhythmias are not a reported risk with trichloroacetic acid, salicylic acid, glycolic acid or resorcinol.

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197. A 55-year-old man presents for correction of periorbital puffiness under the eyes with a tear-trough deformity. Transconjunctival lower lid blepharoplasty, with release of the tear trough ligament, and fat redistribution are planned. Which of the following anatomical landmarks indicates entrance into the premaxillary space and release of the tear-trough?

- A) Levator labii superioris
- B) Levator labii superioris alaeque nasi
- C) Orbicularis oculi
- D) Zygomaticus major
- E) Zygomaticus minor

The correct response is Option A.

Through a transconjunctival approach, the dissection begins in a preseptal plane and is then converted into a supraperiosteal dissection over the anterior orbital rim until the levator labii superioris is visualized. This ensures release of the tear-trough ligament and entrance in the premaxillary plane. Orbicularis oculi is the muscle that is released and is found more superficial, as are the zygomaticus major and minor, and levator labii superioris alaeque nasi.

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198. A 45-year-old woman with macromastia presents for breast reduction surgery. BMI is 34 kg/m². Physical examination shows grade III ptosis with bilateral bra strap grooving. A photograph is shown. Breast reduction mammoplasty of approximately 1000 g per breast using a Wise pattern and inferior pedicle technique is planned. Which of the following factors is most likely to increase this patient's risk for perioperative complications?

- A) BMI
- B) Degree of ptosis
- C) Inferior pedicle
- D) Resection volume
- E) Wise pattern

The correct response is Option D.

According to the Breast Reduction Assessment: Value and Outcomes (BRAVO) study, the overall complication rate for breast reduction was 43% with delayed healing as the most common. This complication was correlated directly with average preoperative breast volume, average resection weight/breast, and smoking, and was correlated inversely with age. Analysis associated resection weight as the sole variable for increased risk of complications and with absolute number of complications (greater than 847 g). Each 10-fold increase in resection weight increased the risk of complication 4.8 times and increased the risk of delayed healing 11.6 times. Degree of ptosis was not correlated with delayed healing. Vertical incision techniques were associated with an increased complication frequency without a link to specific complications.

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199. An otherwise healthy, 54-year-old woman desires full-body contouring after undergoing massive weight-loss surgery. She has complaints of skin rashes and difficulty with daily activities. A photograph is shown. BMI is 35 kg/m^2 and has been stable for the past 6 months. Which of the following factors places this patient at highest risk for postoperative venous thromboembolism?

- A) Abdominoplasty
- B) BMI
- C) Mastopexy with concurrent brachioplasty
- D) Non-clean wound classification
- E) Patient age

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

The correct response is Option B.

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The incidence of thromboembolism associated with body contouring was found to be 0.56%. A review of the literature showed that a BMI of 35 kg/m² or more significantly increases the risk for venous thromboembolism (VTE), which also has been elucidated in the plastic surgery literature and in other patient populations. While patient age over 45 years, trunk contouring, two regions contoured and non-clean wound classifications are all risk factors for VTE, none compare with the World Health Organization obesity classification of 2 (35–39.9 kg/m²).

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200. A 35-year-old woman presents for liposuction of the anterior and posterior trunk under general anesthesia. Using a super-wet infiltration technique, 4 L of fat/liquid will be aspirated. The plastic surgeon plans to administer tranexamic acid 10 mg/kg intravenously as an off-label treatment to further reduce intraoperative blood loss. Which of the following is a contraindication to the use of tranexamic acid?
- A) Active menorrhagia
 - B) Color blindness
 - C) Elevated liver enzymes
 - D) Known allergy to milk products
 - E) von Willebrand disease

The correct response is Option B.

Tranexamic acid (TXA) is a powerful antifibrinolytic agent that can be administered intravenously, orally, topically, or by injection, mixed with local anesthetic. While approved by the Food and Drug Administration for the treatment of heavy menstrual bleeding, it has many off-label uses in surgery, including cardiac surgery, spinal surgery, total-knee arthroplasty, and elective cesarean delivery. In plastic surgery, preliminary studies have shown TXA to be effective in reducing blood loss in craniofacial surgery, orthognathic surgery, and reduction mammoplasty. In aesthetic surgery, it has been found to be useful in face lift, rhinoplasty, and liposuction to reduce bleeding and hematoma. In one randomized study of super wet liposuction, blood loss in the liposuction aspirate was reduced by 37% in the TXA-treated group.

Transient changes in color vision have been reported following administration of TXA, and ophthalmologic monitoring, including color vision assessment, should be a part of care for patients who receive TXA for longer than a few days as a part of toxicity monitoring. Because patients with color blindness cannot be monitored for changes, the manufacturer lists color blindness as a contraindication to TXA use.

Other contraindications to TXA use include known allergy to TXA, intracranial bleeding, known history of venous or arterial thromboembolism or active thromboembolic disease. Renal insufficiency may require dosage adjustment.

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TXA can be used in the treatment of certain bleeding disorders, including von Willebrand disease. Milk allergy and elevated serum liver enzyme levels are not contraindications.

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Section 5: Core Surgical Principles

201. An 18-year-old woman with right-sided Poland syndrome requests improvement in the appearance of her chest. Physical examination shows absence of an anterior axillary fold on the right side and a pectus excavatum deformity with an overlying hypoplastic right breast. The nipple-areola complex is small, lateral, and raised by about 3 cm compared with the left side. Which of the following thorax, breast, nipple-areola complex (TBN) classifications best characterizes this patient's Poland syndrome deformity?
- A) T1, B1, N1
 - B) T1, B2, N1
 - C) T2, B1, N2
 - D) T3, B2, N3

The correct response is Option C.

Poland syndrome is likely a multifactorial genetic syndrome related to the embryologic timing and development of the subclavian arch. Its unifying finding is absence of the pectoralis major muscle but is variable in other manifestations of underdevelopment of the chest wall, breast, and ipsilateral upper extremity. Poland syndrome is most often reported as more frequent in males, but some series show equal expression in males and females. Additionally, up to 10% of patients may have associated dextrocardia.

Having a way to describe or classify a deformation in an organized fashion is helpful in planning reconstruction, determining results and outcomes, and discussing cases with colleagues. The thorax, breast, nipple-areola complex (TBN) system was proposed and published by Romanini et al. to do just that. Since that publication, further research by the group based on the TBN classification has been published and others have suggested modifications to include the presence or absence of ipsilateral upper extremity anomalies.

Thorax

T1: absence of all or part of pectoralis

T2: T1 + pectus excavatum or carinatum

T3: T1 + rib aplasia (usually 3 and 4)

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T4: T1 + T2 + T3

Breast

B1: hypoplastic breast

B2: breast aplasia (amastia)

Nipple-areola complex

N1: hypoplastic NAC less than 2 cm displaced

N2: hypoplastic NAC more than 2 cm displaced

N3: athelia

The patient in the scenario is best described by the TNB classification as T2 (no pectoralis, pectus excavatum), B1 (breast hypoplasia) and N2 (hypoplastic NAC greater than 2 cm displaced). According to this classification, she is probably best served by correction of the pectus first, then correction of the breast.

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202. A 37-year-old woman comes to the office desiring breast augmentation mammoplasty, mastopexy, and abdominoplasty. The surgeon is trying to promote “mommy-makeover” procedures and asks the patient if she would be willing to participate in a video recording of her operation to be posted on social media. Which of the following statements is correct regarding the informed consent process when obtaining and posting a video to social media that includes protected health information and reveals patient identity?
- A) ASPS guidelines recommend that surgeons should not participate in the posting of sensitive content via social media because of the inherent risks to patient privacy
 - B) A detailed consent documenting the dynamic nature of individual social media sites should be formally discussed and documented in the patient’s medical record prior to proceeding
 - C) Standard hospital or surgery center consent can be modified to include language about social media and should release the physician for unrestricted use of content on any platform
 - D) Verbal consent should be obtained the day of the operation and must be witnessed by a nurse

The correct response is Option B.

The most correct answer is that a detailed consent documenting the dynamic nature of individual social media sites should be formally discussed and documented in the patient’s medical record prior to proceeding.

In the systematic review and ethical analysis of current plastic surgery publications regarding posting of online video content, Dorfman et al. describe in detail their recommendations for posting sensitive content online.

Although there are no consensus guidelines documented in the American Society of Plastic Surgeons (ASPS) Code of Ethics, social media continues to evolve as an important part of a plastic surgery practice, as more patients report searching online to find their physicians.

Authors document five ethical principles to follow when posting content online in order to “protect patients, surgeons, and the public perception of our specialty.”

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1. Ask the patients about posting the content online and obtain a formal written consent. Full disclosure with the patient must involve specific social media sites and that the patient will have the ability to withdraw consent at any time. Legal advice may improve the quality of the consent form.
2. In understanding the dynamic between the physician and patient and possibility for coercion, the patient must be made aware that they may refuse consent without any punishment, penalty, and delivery of an inferior product, i.e., worse operative result.
3. The patient must be made aware of the dynamic nature of social media platforms, and must be fully aware that their videos will become public and permanent at the time of publishing online. Withdrawal of consent does not equate to removal of online content because even if the surgeon removes the video, it may persist online indefinitely.
4. Always follow the standards of professionalism published by the ASPS Code of Ethics.
5. The surgeon is ultimately responsible for all content disseminated online.

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203. Patients who receive immunosuppressive therapy after undergoing allograft transplantation are most likely to develop infections from opportunistic pathogens during which of the following postoperative (posttransplantation) periods?

- A) After the first month and within 1 year
- B) After the first week and within 1 month
- C) After the first year
- D) Between days 3 and 7
- E) Within 48 hours

The correct response is Option A.

Patients receiving immunosuppressive therapy after allograft transplantation are most likely to develop infections caused by opportunistic pathogens after the first month and within 1 year after transplantation.

Classically, infections in immunosuppressed patients after organ transplantation occur in three distinct time periods. 1) During the first month after transplantation, most infections are typical postoperative nosocomial infections, although donor-derived and pre-existing recipient infections can also occur. 2) During the period of peak immunosuppression, typically between 1 and 12 months after transplantation, most infections are classic opportunistic infections, including cytomegalovirus, herpes simplex virus, herpes zoster, Epstein-Barr virus, *Aspergillus*, *Nocardia*, and *Pneumocystis*. Use of prophylaxis may result in a later onset of opportunistic infections. 3) After 12 months posttransplantation, recipients with satisfactory allograft function will tolerate decreased maintenance immunosuppression, with a lowered risk for developing infections by classic opportunistic agents, although they may still occur. Community-acquired infections are most typical during this period, as healthy recipients suffer community-based epidemiological exposures. These infections may be more prolonged and result in more complications than in otherwise healthy patients.

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204. An otherwise healthy, 24-year-old woman presents to the emergency department after a motorcycle accident. Emergency medical services reported significant blood loss from a right lower extremity open fracture, and the patient was actively resuscitated while being transported to the hospital. Which of the following is most likely to be first observed as this patient develops hypovolemic shock?

- A) Confusion
- B) Elevation of pulse rate
- C) Reduction in diastolic blood pressure
- D) Reduction in respiratory rate
- E) Skin vasoconstriction

The correct response is Option B.

Hemorrhage is one of the most common causes of shock in trauma and it is important to recognize early hemodynamic changes and warning signs of shock. Among the signs of hemorrhagic shock listed in the question, elevation of pulse rate is usually the first one to be noticeable.

Although difficult to document in the usual clinical setting, studies have shown that typically the first clinical sign of hypovolemia is an increase in the diastolic blood pressure causing narrowing of the pulse pressure (systolic minus diastolic pressures).

Skin vasoconstriction, decrease in blood pressure (systolic and diastolic), confusion, and increase in respiratory rate are all associated with higher blood volume loss.

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205. A surgeon is tasked with designing a prospective research study investigating whether there is any causality between breast implants and the development of breast implant illness (BII). The surgeon plans to study a group of women with implants and a group without implants and determine whether they develop BII. Which of the following best describes this type of study?

- A) Case series study
- B) Case-control study
- C) Comparative cohort study
- D) Cross-sectional study
- E) Randomized controlled trial

The correct response is Option C.

A comparative cohort study investigates a particular exposure (implants or no implants) to determine correlation to a disease (breast implant illness [BII]).

A case-control study retrospectively identifies cases (BII) and controls (no BII) from the same source population (women) to investigate differences in exposures or risk factors (implants or no implants).

A randomized controlled trial randomly assigns participants into an experimental or control group.

A cross-sectional study is an observational study that analyzes data from a population at a specific time point.

A case series study is one that tracks participants who have received an exposure and tracks outcomes.

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206. A 42-year-old woman undergoes wide local excision and sentinel node biopsy of an invasive melanoma of the forearm. After uneventful induction of general anesthesia, 1 mL of isosulfan blue dye is injected intradermally around the healing biopsy site on the forearm. The operation begins with excision of the axillary sentinel lymph node, which is identified high in the axilla. During removal of the sentinel node, blood pressure decreases to 60/40 mmHg. After discontinuing the procedure and administering a bolus of intravenous fluid, which of the following is the most appropriate next step?

- A) Administer dexamethasone
- B) Administer diphenhydramine
- C) Administer lipid emulsion
- D) Administer phenylephrine

The correct response is Option D.

Isosulfan blue has many uses. It is used to identify sentinel nodes in melanoma and Merkel cell skin cancer as well as in breast cancer. It is used in reverse axillary mapping in order to preserve extremity lymph nodes while harvesting those that drain the breast. Allergic reactions to this dye occur in up to 1.6% of patients.

These adverse events are unexpected and occur with unpredictable severity. There is no current validated method to detect or decrease the risk of allergic reaction. It is important for the plastic surgeon to be able to quickly recognize and treat complications. The most common allergic reactions are urticaria, blue hives, and skin rash. Anaphylaxis has been reported, but much less commonly.

In this scenario, the first sign of anaphylactic reaction is the sudden and severe drop in blood pressure. This can occur immediately or unexpectedly later during the surgical procedure. After halting the operation and starting a fluid bolus, a vasopressor should be administered to counteract the hypotension. Once this is done, both a corticosteroid (dexamethasone) and an antihistamine (diphenhydramine) should be given to counteract the allergic reaction. Changing the fraction of inspired oxygen will not help the allergic reaction. A needle thoracostomy would be indicated if dissection high in the axilla resulted in a tension pneumothorax, but that is not the case here. Administration of lipid emulsion is appropriate for local anesthetic toxicity.

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A commonly suggested alternative to isosulfan blue, without the risk of anaphylaxis, is methylene blue. However, there is a significantly higher rate of wound healing complications with the use of methylene blue, which is why isosulfan blue is preferred in plastic surgical procedures, specifically skin grafting.

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207. A 55-year-old man presents to the emergency room with a 24-hour history of productive cough and fever. History includes ventral hernia repair with component separation one week ago. Temperature is 39.4°C (102.9°F), blood pressure is 90/40 mmHg, heart rate is 120 bpm, and respiratory rate is 32/min. Physical examination shows an unremarkable abdominal surgical site. Chest x-ray study shows opacification of the right middle lobe of the lung. Intravenous antibiotics should be administered to this patient within a maximum of how many hours?

- A) 1
- B) 3
- C) 6
- D) 12
- E) 24

The correct response is Option A.

The 2016 Surviving Sepsis Campaign guidelines strongly recommend that administration of intravenous antibiotics be initiated as soon as possible after recognition and within one hour for both sepsis and septic shock.

In the presence of sepsis or septic shock, increasing delays in administration of appropriate antibiotics are associated with increased mortality and detrimental effects on secondary end points, such as length of hospital stay, acute kidney injury, acute lung injury, and the Sepsis-Related Organ Assessment score.

Although data suggest that optimal outcomes are achieved by the earliest possible administration of appropriate antibiotics following recognition of sepsis, one hour was recommended as a reasonable shortest target, considering multiple patient and organizational factors that may cause delay.

In the Campaign's 2018 update, the Hour-1 Bundle was modified to reflect the need to begin resuscitation and management of patients with sepsis and septic shock immediately upon presentation. The Hour-1 bundle includes:

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- Measure the lactate level. Remeasure if initial lactate is more than 2 mmol/L
- Obtain blood cultures prior to administration of antibiotics
- Administer broad-spectrum antibiotics
- Rapidly administer 30 mL/kg crystalloid for hypotension or lactate greater than or equal to 4 mmol/L
- Apply vasopressors if the patient is hypotensive during or after fluid resuscitation to maintain a mean arterial pressure greater than or equal to 65 mmHg

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208. The inferior oblique muscle of the orbit is innervated by which of the following cranial nerves?

- A) Oculomotor (III)
- B) Trochlear (IV)
- C) Trigeminal (V)
- D) Abducens (VI)
- E) Facial (VII)

The correct response is Option A.

The inferior oblique muscle receives its nerve supply from the oculomotor nerve, or cranial nerve III. The other voluntary muscles within the orbit that receive their innervation from the oculomotor nerve are the levator palpebrae superioris, superior rectus, medial rectus, and inferior medial rectus muscles. The superior oblique muscle is innervated by the trochlear nerve (cranial nerve IV). The lateral rectus muscle is innervated by the abducens nerve (cranial nerve VI).

The inferior oblique is the only one of these muscles that does not arise from the apex of the orbit. It originates from the medial floor of the orbit just posterior to the infraorbital rim. It runs laterally, posteriorly, and upward, crossing inferior to the inferior rectus, and inserting on the posterior half of the globe beneath the lateral rectus insertion. Its action is to elevate the globe, producing upward gaze of the pupil. Risk of iatrogenic injury to the inferior oblique is greatest with transconjunctival surgical approach to the orbit. Therefore, with this procedure, care must be exercised to place the periosteal incision along the anterior aspect of the infraorbital rim.

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209. A recent graduate of an ACGME-accredited plastic surgery residency has set up a private practice for herself. She has applied for and received hospital privileges, state licensure, and malpractice insurance, and has started seeing patients in her clinic and is advertising her practice. In terms of advertising, which of the following aligns with the guidelines and values set forth by the ABPS?

- A) ABPS does not have established guidelines
- B) A candidate for Board Certification with the ABPS is responsible for all advertising, including third-party employers or physician rating websites
- C) Active practice websites are permitted prior to graduation of residency
- D) Alcoholic beverages are permitted at marketing events where injectables, procedures, or operations are performed
- E) Candidates are permitted to advertise as board eligible for 10 years

The correct response is Option B.

In keeping with the values established and published by the ABPS in the Booklet of Information, candidates for board certification with the ABPS are responsible for all advertising, including third-party employers or physician rating websites. All other answers do not align with the values set by the ABPS.

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210. A 65-year-old woman undergoes breast reconstruction with a free superficial inferior epigastric artery (SIEA) flap. The vascular pedicle is 1.5 mm diameter, including both the artery and vein. The second/third intercostal perforators on the left chest are prepared as the recipient vessels. The surgeon performs a hand-sewn microvascular arterial anastomosis with 9-0 suture and a 1.5-mm anastomotic coupler for the vein. This patient is at increased risk for which of the following?

- A) Arterial occlusion
- B) Interposition vein graft
- C) Kinking of the vascular pedicle
- D) Vasospasm
- E) Venous thrombosis

The correct response is Option E.

This patient has a high risk for venous thrombosis given that the 1.5-mm anastomotic coupler was used. In a large retrospective study, Hansen et al, found that based on 5643 reconstructions, the 1.5-mm diameter coupler had an overall thrombosis rate of 6.9%. This is significantly higher than all other coupler sizes. In another study, Jandali et al, found that using the anastomotic coupler in breast reconstruction is safe. In fact, these authors demonstrated a 0.6% flap loss rate in 1000 cases of autologous breast reconstruction. When encountered with a recipient vein that is less than 2.0 mm, the surgeon should either perform a hand-sewn anastomosis or find different recipient vessels.

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211. A 64-year-old, left-hand–dominant man presents with Dupuytren contracture of the hand. Physical examination shows joint contractures of the small finger metacarpophalangeal (MCP) joint (35 degrees), proximal interphalangeal (PIP) joint (30 degrees); and ring finger MCP joint (30 degrees) and PIP joint (15 degrees). Needle aponeurotomy is planned to correct the deformity. Which of the following disease-related factors is most predictive of re-intervention following this procedure?

- A) Dominant hand involvement
- B) MCP contracture severity
- C) Older age
- D) PIP contracture severity
- E) Presence of a natatory cord

The correct response is Option D.

The disease-related factor most strongly predictive of recurrence is the degree of PIP contracture. In a retrospective review of 848 interventions for Dupuytren contracture, authors noted that degree of PIP contracture and a younger age at time of initial intervention were most predictive of re-intervention. They looked at a cohort of 350 patients over an 11-year period in which multiple surgeons performed interventions for varying degrees of contracture of both the MCP and PIP joints. Comparisons between needle aponeurotomy, collagenase, and partial fasciectomy were performed. They reported 2-year re-intervention rates of 24%, 41%, and 4% respectively. Based on cumulative number of re-intervention, total direct surgical costs were \$1,540, \$5,952, and \$5,507 respectively (Leafblad et al.).^[1]

MCP contracture severity was not an independent predictor of re-intervention. Natatory cords are responsible for webspace contractures and do not independently result in MCP or PIP contractures. Younger age at time of initial intervention was predictive of re-intervention and older age was preventative. They found no differences in contracture re-intervention when comparing dominant to non-dominant hand.

In a prospective, randomized trial, investigators compared needle aponeurotomy to collagenase in patients with isolated PIP joint contracture. Patients were followed for 2 years following intervention. Primary outcome was reduction in contracture by at least 50%. At 2-

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year follow-up, 7% of collagenase patients had maintained improvement as compared to 29% of patients who underwent needle aponeurotomy, suggesting that collagenase treatment of Dupuytren disease leading to PIP contracture is not superior to needle aponeurotomy (Skov et al.).^[2]

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212. A physician is considering different locations to perform a specific medical procedure. According to the Centers for Medicare & Medicaid Services, a higher number of relative value units would be attained by performing this procedure in which of the following places of service?

- A) Ambulatory surgical center
- B) Community mental health center
- C) Inpatient hospital
- D) Outpatient hospital
- E) Physician's office

The correct response is Option E.

A physician will obtain a higher number of relative value units (RVUs) for a specific medical procedure by performing it in a "non-facility" or "office" setting, such as a physician's office, compared with performing it in a "facility" setting (hospital, ambulatory surgical center, community mental health center, etc.), according to the fee schedule by the Centers for Medicare & Medicaid Services (CMS).

Physician services are described by CPT codes and Healthcare Common Procedure Coding System codes. CMS determines the number of RVUs assigned for each physician service by adding three subcategories of RVUs:

1. Physician Work RVUs: reflect the relative time and intensity associated with furnishing a specific medical service. It may reflect not only the "intra-service" time, but also the time needed to prepare for the service beforehand and to document it afterwards.
2. Practice Expense RVUs: reflect the costs of maintaining a practice (such as renting office space, buying supplies and equipment, and staff costs).
3. Malpractice RVUs: reflect the costs of medical liability insurance.

When a physician provides a service in a facility (eg, hospital, ambulatory surgical center), the costs of clinical personnel, equipment, and supplies are incurred by the facility, not the physician's practice. Therefore, CMS assigns to these services a "facility-based" Practice

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Expense RVU amount that excludes the practice expenses and is typically lower than the "office-based" Practice Expense RVUs for the same service.

CMS uses a formula to determine payment amounts for each covered medical service. First, each of the three RVU subcategories is multiplied by the corresponding geographic practice cost indices, which are designed to account for geographic variations in the costs of practicing medicine in different areas of the country. Then the three adjusted RVU subcategories are added together and multiplied by a conversion factor in dollars.

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213. The ABPS Continuous Certification Program in Plastic Surgery includes yearly self-assessment and assessment of knowledge and skills. Which of the following additional criteria need to be met in order to maintain certification?

- A) 300 continuing medical education (CME) credits within 3 years
- B) Oral board exam after 5 years of practice
- C) Verification of unrestricted state medical license
- D) Written exam every 10 years

The correct response is Option C.

The ABPS Continuous Certification Program, previously known as MOC-PS, includes continuous yearly self-assessment and learning throughout the certification period(s). The requirements include four basic components: (1) professionalism, (2) life long learning and self-assessment, (3) assessment of knowledge, judgment, and skills, and (4) improvement in medical practice. Therefore, an unrestricted state medical license is mandatory, and 150 continuing medical education credits on a 3-year cycle are needed.

Of note, medical specialty certification in the United States is a voluntary process.

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214. A 43-year-old woman is scheduled to undergo bilateral mastectomies and immediate tissue-expander–based reconstruction for breast cancer. To decrease the postoperative pain and requirement for narcotics, preoperative ultrasound-guided pectoral nerve (PECS) 1 and 2 regional blocks with liposomal bupivacaine are planned. The PECS 1 block is administered. Which of the following is the most appropriate location for infiltration of the local anesthetic when performing the PECS 2 block?
- A) Between the breast parenchyma and pectoralis major
 - B) Between the pectoralis major and pectoralis minor
 - C) Between the pectoralis minor and the serratus anterior
 - D) Between the serratus anterior and the latissimus dorsi

The correct response is Option C.

The pectoral nerve (PECS) 1 and PECS 2 anesthetic blocks have become increasingly common methods for regional anesthesia to decrease postoperative pain in many early recovery after surgery (ERAS) protocols. The PECS blocks are thoracic regional fascial plane blocks that typically require ultrasound guidance for proper infiltration of the anesthetic between the muscles of the thoracic wall.

A PECS 1 block is performed between the pectoralis major and pectoralis minor muscles and anesthetizes the lateral and medial pectoral nerves. A PECS 2 block, in addition to the PECS 1 block, involves an additional injection of anesthetic between the pectoralis minor and serratus anterior muscles and blocks the intercostal and intercostobrachial nerves. The serratus plane block is another thoracic regional fascial plane block requiring injection of local anesthetic between the serratus anterior and latissimus dorsi muscles in order to block the long thoracic and thoracodorsal nerves.

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215. A 165.3-lb (75-kg), 76-year-old woman is scheduled to undergo wide local excision of a large, invasive basal cell carcinoma of the cheek with flap reconstruction during general anesthesia. Medical history includes nonvalvular atrial fibrillation, hypertension, and an embolic stroke 3 months ago. Current medications include warfarin. Renal function is normal. Which of the following is the most appropriate preoperative anticoagulation management for this patient?
- A) Discontinue warfarin 5 days prior to the procedure and initiate low-molecular-weight heparin bridging 3 days prior to the procedure
 - B) Discontinue warfarin 5 days prior to the procedure without bridging
 - C) Discontinue warfarin 7 days prior to the procedure and initiate low-molecular-weight-heparin bridging 3 days prior to the procedure
 - D) Immediately initiate low-molecular-weight heparin bridging and discontinue warfarin 5 days prior to the procedure
 - E) Do not discontinue warfarin

The correct response is Option A.

This patient has a very high thromboembolic risk and a high bleeding risk. Recommended heparin bridging is 3 days before a planned procedure (ie, two days after discontinuing warfarin), when the prothrombin time and international normalized ratio (PT/INR) has started to drop below the therapeutic range.

Atrial fibrillation accounts for the highest percentage of patients for whom perioperative anticoagulation questions arise. Importantly, patients with atrial fibrillation are a heterogeneous group; risk can be further classified according to clinical variables such as age, hypertension, congestive heart failure, diabetes, prior stroke, and other vascular disease.

Bridging anticoagulation may be appropriate in patients who will have a very high thromboembolic risk with prolonged interruption of their anticoagulant (generally a vitamin K antagonist). Individual patient comorbidities that increase bleeding risk may also need to be considered because an increased postoperative bleeding risk may be a reason to avoid bridging. Suggested use of bridging in individuals taking warfarin includes:

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- Embolic stroke or systemic embolic event within the previous three months
- Mechanical mitral valve
- Mechanical aortic valve and additional stroke risk factors
- Atrial fibrillation and very high risk of stroke (eg, systemic embolism within the previous 12 weeks, concomitant rheumatic valvular heart disease with mitral stenosis)
- Venous thromboembolism (VTE) within the previous three months (preoperative and postoperative bridging)
- Recent coronary stenting (e.g. within the previous 12 weeks)
- Previous thromboembolism during interruption of chronic anticoagulation

The other answer choices are not appropriate strategies for this patient.

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216. A 50-year-old woman with a history of hypertension is brought to the hospital 1.5 hours after sustaining burn injuries in a house fire. Initial examination shows deep, second-degree burns (partial-thickness) to 35% of the trunk, non-circumferential third-degree burns (full-thickness) to 5% of the left forearm, and first-degree burns to 2% of the head. In addition to time from injury, which of the following common aspects of the burn evaluation should be used in both the Parkland formula and Brooke formula for determining fluid resuscitation in this patient?
- A) Total body surface area (TBSA) (determined by first-, second-, and third-degree burns), gender, weight
 - B) TBSA (determined by first-, second-, and third-degree burns), weight
 - C) TBSA (determined by second- and third-degree burns), age, weight
 - D) TBSA (determined by second- and third-degree burns), gender, weight
 - E) TBSA (determined by second- and third-degree burns), weight

The correct response is Option E.

While there are different resuscitation formulas for initial burn resuscitation, such as the Brooke formula or the Parkland formula, they rely on giving a certain amount of fluid multiplied by total body surface area (as determined by partial- and full-thickness burns) and weight in kilograms of the patient. The fluid is then given initially as determined from time of injury, and divided into half given in the first 8 hours of injury and then half in the next 16 hours. This is a guideline only and resuscitation can be altered based on physiologic response, such as urine output. Gender and age are not a consideration and first-degree burns are not used in the calculation of total body surface area.

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217. Which of the following is most likely to be specified in a durable power of attorney document?

- A) Agreement to donate organs and tissue
- B) Appointment of a health care proxy
- C) Do not resuscitate (DNR) orders
- D) Permission for mechanical ventilation
- E) Withholding of artificial nutrition and hydration

The correct response is Option B.

An advance directive allows a person to express his or her desires related to end-of-life medical care. There are two types of advance directive: power of attorney and living will. A durable power of attorney is a document which allows a person to appoint an individual, known as a health care proxy or agent, who can make decisions regarding medical care for that person, in the event that he or she is no longer able to make those decisions for himself or herself. A living will, on the other hand, is a document that outlines a person's values and preferences for life-sustaining treatments. These may include use of particular equipment (mechanical ventilator or dialysis machine), instructions in the use of CPR, preferences regarding artificial hydration and nutrition (such as tube feeding or withholding nutrition), palliative or comfort care, and tissue and organ donation wishes.

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218. A 30-year-old woman is scheduled to undergo liposuction of the abdomen, anterior and posterior flanks, and inner and outer thighs, with an estimated lipoaspirate volume of 5.5 liters. The plastic surgeon has an in-office operating room that is accredited by the American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) and has certified registered nurse anesthetists (CRNAs) performing general anesthesia. In order to meet AAAASF requirements for a Class C facility, this case must adhere to which of the following guidelines?
- A) General anesthesia must be administered by an anesthesiologist
 - B) Intravenous sedation must be administered by an anesthesiologist
 - C) Pathology services must be available to manage all tissues removed from patients
 - D) Patient must be monitored overnight at the facility if more than 5 L of lipoaspirate are removed
 - E) The in-office operating room must have a state certificate of needed

The correct response is Option D.

The American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) is an accrediting body that certifies that an accredited facility meets nationally recognized standards for safety. The facility is surveyed every 3 years. There are different classes of facilities.

According to their Basic Mandates:

In a Class A facility, procedures "may be performed under topical or local anesthesia only; only minimal sedation levels are permitted, and no more than 500 cc's of aspirate can be removed via liposuction."

In a Class B facility, "parenteral sedation, field and peripheral nerve blocks and dissociative drugs (excluding propofol) may be administered by a/an physician, certified registered nurse anesthetist (CRNA) with physician supervision, anesthesia assistant under direct supervision of an anesthesiologist or registered nurse (RN) under qualified physician supervision. The use of propofol, spinal and epidural anesthesia, endotracheal intubation, laryngeal mask airway, and/or inhalation general anesthesia is prohibited. No more than 5L of aspirate can be removed via liposuction unless the patient is monitored overnight in the facility."

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In a Class C facility, "all types of anesthesia listed above can be administered including general anesthesia (with or without endotracheal intubation or laryngeal mask airway), and propofol can be administered by a/an physician, CRNA with physician supervision, anesthesia assistant under direct supervision of an anesthesiologist or RN under qualified physician supervision. No more than 5L of aspirate can be removed via liposuction unless the patient is monitored overnight in the facility."

Certificate of need relates to insurance cases and is not a mandate of the AAAASF. There is no mandate requiring pathologic examination availability.

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219. A 30-year-old man sustained a third-degree burn to his right arm from a flame while cooking over a grill. The burn is 5% total body surface area (TBSA). Two days after the injury, he undergoes debridement of the dorsal wrist and forearm. The paratenon is not present after the debridement. A bilaminate neodermis (Integra) graft is selected and placed on the wound. Use of this graft is associated with which of the following?

- A) Decreased cost to the hospital
- B) Decreased number of hospital stays
- C) Decreased number of surgeries
- D) Decreased risk for hypertrophic scar
- E) Increased skin sensation after reconstruction

The correct response is Option D.

The literature states that there is a decrease in hypertrophic scarring associated with the use of bilaminate neodermis (Integra) with burn reconstruction. The cost of the product is high. Use of the product requires a second surgery for the skin graft. There has not been any literature supporting improved sensation following use of the graft. The downside to the graft is that it can result in longer hospital stays for the patient in order to get the second surgery completed.

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220. A 12-year-old boy with a thyroglossal duct cyst undergoes a Sistrunk procedure. Which of the following structures are resected during this procedure?

- A) Cyst and cyst tract only
- B) Cyst, cyst tract, and middle third of the cricothyroid cartilage
- C) Cyst, cyst tract, and middle third of the hyoid bone
- D) Cyst, cyst tract, and middle third of the thyroid cartilage
- E) Cyst, cyst tract, and the pyramidal lobe of the thyroid

The correct response is Option C.

The Sistrunk procedure is the operation of choice for thyroglossal duct cysts. This operation involves resection of the cyst, the cyst tract, and the middle third of the hyoid bone. In the Sistrunk procedure, the thyroid cartilage is not removed, nor is the cricothyroid cartilage. If, upon exploration, the distal tract is found to be in communication with the pyramidal lobe of the thyroid, then the communication should be excised. Despite this, resection of the pyramidal lobe of the thyroid is not a standard component of the Sistrunk procedure.

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221. According to the 2017 US breast cancer mortality data, three states with appropriately powered data achieved statistically equivalent mortality rates between non-Hispanic African American and non-Hispanic Caucasian women. Which of the following factors was most likely implicated in the improvement in mortality rates in the non-Hispanic African American women in these states?
- A) Non-Hispanic African American women are more affluent
 - B) Non-Hispanic African American women are younger
 - C) Non-Hispanic African American women have fewer “triple-negative” aggressive breast cancers
 - D) Non-Hispanic African American women have more access to screening mammography and in situ diagnosis

The correct response is Option D.

Social determinants of health include where a person resides, what exposures are present, what diet is eaten, how much stress is present, and other lifetime experiences. Social determinants of health affect who gets disease and how well they can be cared for when they have disease.

According to the 2020 cancer statistics, death from female breast cancer has declined overall by 40% in the United States since 1989.

The 2017 breast cancer statistics look at breast cancer in a state-by-state fashion demonstrating that those gains in survival have not been uniformly spread among the populations, with non-Hispanic African American women suffering higher death rates by age group, staging, and oncotyping groups.

While there are no data to discuss why non-Hispanic African American women tend to develop cancer younger or develop more “triple negative” breast cancers, there has been evidence presented in the 2017 breast cancer statistics that better access to care may improve the stage at diagnosis. In seven states, the mortality rates were statistically the same. In three of those states—Massachusetts (an early state to establish mandatory health insurance), Connecticut, and Delaware—there were sufficient cohort numbers of non-Hispanic African American women with an in situ diagnosis, which is used as a proxy for access to screening mammography. In the four other states, there was statistical equivalence, but they were

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underpowered. The implication of these data is that better access to mammography/care lowers mortality for non-Hispanic African American women with breast cancer. These studies did not address affluence, but they did rule out age as a factor.

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222. A 42-year-old woman is scheduled to undergo autologous breast reconstruction. Which of the following is the most likely effect of steroid use in this patient?

- A) Long-term corticosteroid use is associated with increased risk of free flap failure
- B) Single perioperative corticosteroid dose is associated with transient hyperglycemia
- C) Single perioperative corticosteroid dose negatively affects wound healing
- D) The use of vitamin E counteracts the negative effects of corticosteroids on wound healing

The correct response is Option B.

The effects of corticosteroids on wound healing have been extensively studied. A single perioperative dose has not been associated with wound healing problems or complications. There is, however, a mild increase in glycemia, even in patients without diabetes.

The long-term use of corticosteroids has been associated with increased wound complications in susceptible individuals. It depends on the dose and duration of corticosteroid treatment.

The use of vitamin A, not E, has been shown to counteract the negative effects of corticosteroids on wound healing.

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223. A 7-year-old girl is evaluated because of a 1.5-cm, slow-growing, isolated, firm subcutaneous mass on the posterolateral neck that has been present for the past year. Examination of a specimen obtained on excisional biopsy results in a diagnosis of pilomatrixoma. The specimen is most likely to have a mutation of which of the following genes?

- A) *CTNNB1*
- B) *GLUT1*
- C) *NF1*
- D) p57

The correct response is Option A.

Pilomatrixoma (also known as pilomatricoma or calcifying epithelioma of Malherbe) is a benign, slow-growing skin tumor of the hair follicle. These tumors are most commonly found in children, although they have been increasingly found in patients of all ages. They tend to develop in the head and neck region but can also be found in the trunk and extremities, and they are usually not associated with any other isolated signs and symptoms. Pilomatrixomas can rarely become cancerous via transformation to the malignant pilomatrix carcinoma. Mutations in the *CTNNB1* gene have been found in at least 75% of isolated pilomatrixomas. The *CTNNB1* gene is needed to regulate cell growth and attachment, and mutation in this gene directly implicates beta-catenin/LEF dysregulation as the major cause of hair matrix cell tumorigenesis in this condition.

The *GLUT1* gene mutation is associated with infantile hemangioma, while the *NF1* and p57 gene mutations are associated with neurofibromatosis 1 and Beckwith-Wiedemann syndrome, respectively.

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224. A 63-year-old woman presents with a 2.3-cm moderately differentiated infiltrating ductal carcinoma of the left breast and clinically negative axilla. Partial mastectomy and sentinel lymph node biopsy are planned. Preoperative injection is performed with blue dye and technetium sulfur colloid. Intraoperatively, no sentinel lymph node is identified. Which of the following is the most appropriate next step in management?
- A) Closure of the axilla and continuous surveillance
 - B) Intraoperative ultrasonography and excision of any enlarged nodes
 - C) Level I and II axillary node dissection
 - D) Reinjection with technetium sulfur colloid and blue dye
 - E) Total mastectomy

The correct response is Option C.

Recent data from the ACOSOG Z0011 trial and others have diminished the role of axillary node dissection in the treatment of breast cancer. Yet at times it is still the appropriate choice. Proper staging of the axilla is very important, and when it cannot be obtained via sentinel lymph node biopsy, per the updated National Comprehensive Cancer Network (NCCN) guidelines, level I and II axillary dissection should be performed for staging purposes. Total mastectomy would not provide nodes for staging. The remaining options are not standard approaches per the NCCN guidelines.

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225. An otherwise healthy 60-year-old woman underwent breast reconstruction with right free transverse rectus abdominis musculocutaneous (TRAM) flap 1 day ago. Cardiac monitoring shows no P waves and an irregular QRS complex. The patient is asymptomatic. Blood pressure is 120/80 mmHg and heart rate is between 130 and 139 bpm. Which of the following is the most appropriate first-line therapy for this patient?
- A) Amiodarone
 - B) Digoxin
 - C) Diltiazem
 - D) Metoprolol
 - E) Propafenone

The correct response is Option D.

Atrial fibrillation manifests as irregularly irregular QRS complexes without P waves on ECG. Postoperative atrial fibrillation (POAF) is multifactorial in origin, and occurs in 5 to 10% of patients undergoing non-cardiothoracic surgery. In the largest trial to date comparing rate versus rhythm control (Atrial Fibrillation Follow-Up Investigation of Rhythm Management [AFFIRM]), rhythm control was associated with a greater number of hospitalizations, torsades de pointes, pulmonary events, gastrointestinal events, bradycardia, and QT prolongation events. Rate control is the treatment strategy of choice, with the goal of 80 to 100 bpm. Metoprolol is the preferred beta blocking agent due to its efficient conversion between IV and oral routes, low cost, and clinician familiarity. Diltiazem (non-dihydropyridine calcium channel blocker) is a second-line therapy, and is intended for use if first-line therapy is ineffective at rate control at maximum doses or the first-line therapy is contraindicated. Digoxin is considered when other options are ineffective or contraindicated because of its narrow therapeutic window. Amiodarone has both beta-blocking and calcium channel blocking properties in addition to its antiarrhythmic effects. Amiodarone can be used in patients with decreased ejection fractions. It is associated with acute pulmonary toxicity.

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226. A 52-year-old woman undergoes preoperative mammogram. Medical history includes symptomatic macromastia. Suspicious calcifications are identified, and a core-needle biopsy is performed. Which of the following results necessitates an excisional biopsy prior to proceeding with the reduction mammoplasty?

- A) Atypical lobular hyperplasia
- B) Fibroadenoma
- C) Papilloma without atypia
- D) Pseudoangiomatous stromal hyperplasia
- E) Radial scar

The correct response is Option A.

National Comprehensive Cancer Network (NCCN) protocol recommends excisional biopsy following detection of the following high risk lesions: papillomas with atypia, atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH), and ductal carcinoma in situ (DCIS). These lesions, initially diagnosed on vacuum-assisted core-needle biopsy, progress to carcinoma of the breast on excisional biopsy in 10% to 39% of cases. Also, any proliferative lesion with atypia or any biopsy result that is discordant with its radiologic image should also undergo excisional biopsy. If a radial scar has been completely excised and definitively diagnosed, it does not require an excisional biopsy.

Once a lesion has been confirmed benign, it is safe to proceed with reduction mammoplasty. It is important to note that a woman with a history of ADH, ALH, or lobular carcinoma in situ (LCIS) will have an increased risk for developing in situ or invasive breast carcinoma over her lifetime. These patients should, at a minimum, undergo yearly mammographic screening as well as possible breast magnetic resonance imaging and risk reducing strategies including endocrine therapy.

Pseudoangiomatous stromal hyperplasia (PASH) is a benign breast lesion characterized histologically by dense collagenous stroma with spindle cell-lined spaces that appear like capillaries. Microscopic disease may be found incidentally, or it may be associated with a palpable mass. It has not been demonstrated to increase risk for subsequent breast carcinoma development.

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227. A 63-year-old man undergoes ventral hernia repair with component separation. On the third postoperative day, his serum potassium level is 6.7 mEq/L. Vital signs are stable. Electrocardiography discloses sinus rhythm with flattened P waves and peaked T waves. Initial therapy should include the administration of which of the following drugs?
- A) Albuterol
 - B) Calcium gluconate
 - C) Dextrose and insulin
 - D) Furosemide
 - E) Sodium bicarbonate

The correct response is Option B.

Intravenous calcium gluconate should be given to this patient with severe hyperkalemia and associated electrocardiographic changes.

Hyperkalemia causes a decrease in the resting membrane potential, leading to increased myocardial excitability and cardiac arrhythmias, including ventricular fibrillation and asystole. Electrocardiographic changes associated with progressive hyperkalemia include peaked T waves, prolonged P-R segment, flattening/loss of P waves, widening of QRS complex, ectopic beats, ventricular fibrillation, conduction blocks, and asystole.

Neither a specific serum potassium level threshold nor an electrocardiographic pattern that predisposes patients to life-threatening cardiac arrhythmias has been well established. However, the initial therapy for patients presenting with a serum potassium level greater than 6 mEq/L and hyperkalemia-related electrocardiographic changes should focus on stabilizing the myocardium to prevent or reverse cardiac arrhythmias by intravenous administration of a calcium salt (gluconate or chloride). The onset of action is nearly immediate, but the duration of the protective effect is only 30 to 60 minutes. Therefore, repeat administration may be required.

Interventions to shift potassium intracellularly (intravenous dextrose and insulin, with or without nebulized albuterol/beta-2 agonist; intravenous sodium bicarbonate) or eliminate it from the body (intravenous furosemide, rectal or oral potassium-binding agents,

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hemodialysis) should be carried out as soon as possible after intravenous administration of calcium.

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228. A 71-year-old man with chronic obstructive pulmonary disease (COPD) is transferred to the hospital with multiple facial lacerations and fractures following a fall. He has increasing confusion on arrival at the hospital. His wife mentions that he had bled a significant amount after the fall. Laboratory studies show:

pH	7.22 (N 7.35–7.45)
PO ₂	62 mmHg (N 75–105 mmHg)
PaCO ₂	83 mmHg (N 35–45 mmHg)
Na ⁺	141 mEq/L (N 136–146 mEq/L)
K ⁺	4.6 mEq/L (N 3.5–5.0 mEq/L)
Cl ⁻	93 mEq/L (N 95–105 mEq/L)
HCO ₃ ⁻	35 mEq/L (N 22–28 mEq/L)
Total CO ₂	34 mEq/L (N 23–29 mEq/L)
Urea	23 mg/dL (N 7–20 mg/dL)
Creatinine	0.8 mg/dL (N 0.5–1.5 mg/dL)
eGFR	greater than 60 mL/min/1.73m ² (N greater than 90 L/min/1.73m ²)
Hemoglobin	15.5 g/dL (N 12–18 g/dL)

On the basis of these findings, this patient's primary metabolic disorder is which of the following?

- A) Metabolic acidosis due to exacerbation of his COPD
- B) Metabolic acidosis due to hemodilution from bleeding
- C) Metabolic alkalosis due to exacerbation of his COPD
- D) Metabolic alkalosis due to hemodilution from bleeding

The correct response is Option A.

The pH is low, indicating an acidosis, while the bicarbonate is high, indicating that a respiratory acidosis with metabolic compensation is present. The pH is low so the primary problem is an acidosis and is likely to be respiratory in nature. The PaCO₂ is very high and indicates a respiratory acidosis is present. The very high PaCO₂ level seen here is typical of a person with respiratory disease that results in retention of CO₂, (ie, the primary clinical problem is respiratory failure due to chronic obstructive pulmonary disease). The most likely

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cause for this acid-base abnormality is an acute exacerbation of chronic obstructive pulmonary disease.

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229. A 65-year-old man presents to the office for panniculectomy evaluation. Medical history includes anxiety, controlled hypertension, hyperlipidemia, and borderline diabetes that is controlled by diet only. Current medications include lisinopril, carvedilol, atorvastatin, zolpidem, and sertraline. After consultation, the surgeon determines the patient is a good candidate for panniculectomy. It is most appropriate for the patient to stop taking which of the following medications the night before surgery?

- A) Atorvastatin
- B) Carvedilol
- C) Lisinopril
- D) Sertraline
- E) Zolpidem

The correct response is Option C.

All the medications listed are safe for use the night before surgery with the exception of an ACE inhibitor. While there have been some questions in the past regarding the safety of selective serotonin reuptake inhibitors (SSRIs) like sertraline due to bleeding concern, the current consensus is that it is safe to take.¹ Beta blockers can have a beneficial effect for the cardiovascular system before surgery and thus, patients may take them even the morning of surgery.² Lisinopril, however, can lead to hypotension during surgery and anesthetic management, and should be stopped the night before surgery. As an ACE inhibitor, it may counter the medications the anesthesiologist uses for blood pressure control.

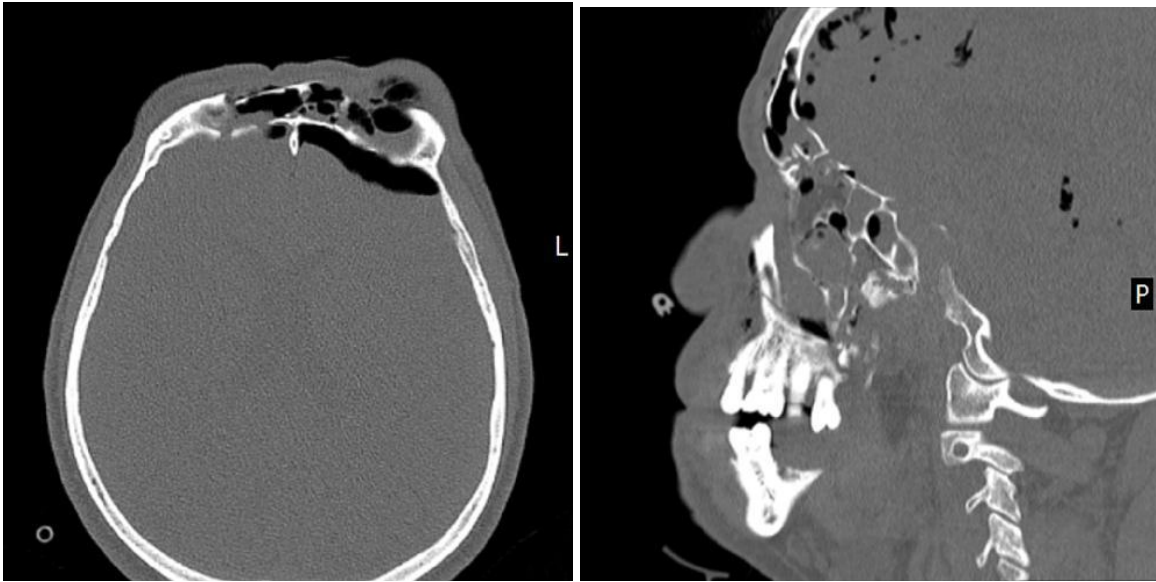
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230. A 48-year-old man is evaluated after a motor vehicle crash, and CT scanning of the head shows a moderately displaced anterior/posterior frontal sinus fracture. The images are shown. The patient also has associated rhinorrhea; the fluid is sent for analysis. Which of the following is the most sensitive diagnostic finding that would indicate treatment of the fracture with cranialization and surgical repair of the dural tear?
- A) High bacterial contamination
 - B) High glucose content
 - C) Low hemoglobin percentage
 - D) Positive beta-2 transferrin level
 - E) Salty postnasal drainage

The correct response is Option D.

A frontal sinus fracture involving the anterior and posterior tables with displacement greater than one table width and associated cerebrospinal fluid (CSF) leak mandates treatment with cranialization and repair of the dural tear. While minimally displaced posterior table fractures with CSF leak may be observed for spontaneous resolution of the leak, any significant

displacement will likely not allow the dural tear to adequately heal and significantly increases the risk for bacterial contamination and meningitis.

Accurately diagnosing the presence of a CSF leak in conjunction with significantly displaced posterior table frontal sinus fractures is important in deciding the ultimate management of these complex injuries. The beta-2 transferrin level is the most sensitive test for diagnosis of a true CSF leak. While CSF fluid does tend to have a high glucose content, this could also be seen in bloody rhinorrhea as well and is not as sensitive as a beta-2 transferrin test. Likewise, although CSF rhinorrhea often presents as a salty tasting postnasal drainage, this finding is more subjective and has poor sensitivity. Low hemoglobin concentrations are unlikely after acute fractures but can also be present without CSF leak. High bacterial contamination of the rhinorrhea does not correlate with CSF leak, but the risk for bacterial contamination of the meninges leading to meningitis is the reason for aggressive treatment of displaced posterior table frontal sinus fractures with associated CSF leak.

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231. A right-hand–dominant, 72-year-old man presents with clicking, locking, and pain deep to the distal palmar crease of the right ring finger. Four weeks prior he had a 40 mg triamcinolone injection with incomplete resolution of his symptoms. How long should he wait after the corticosteroid injection before performing an A1 pulley release in order to mitigate the increased risk of surgical site occurrence?
- A) 1 week from injection
 - B) 4 weeks from injection
 - C) 8 weeks from injection
 - D) 12 weeks from injection
 - E) There is no increased risk of surgical site occurrence

The correct response is Option D.

The risk of surgical site occurrence is mitigated at approximately 80 days (~12 weeks) from corticosteroid injection. In a retrospective review of 999 patients who underwent corticosteroid injection for trigger digit and subsequently underwent surgery, they carefully scrutinized rates of surgical site occurrence. Charts were queried for infection/occurrence by identifying “infection,” “suture abscess,” “worrisome for infection,” or “return to the operating room for infection.” Those who did not develop an infection had a significantly longer time between corticosteroid injection and surgery (mean 260 days vs mean 79 days, p less than 0.05). There were no differences in infection rates between those who underwent one or multiple corticosteroid injections prior to surgery (Ng et al.).¹

In male patients with a single involved digit, the average success rate for corticosteroid injection alone is low (35%). One may suggest that surgery is indicated in this patient population prior to attempting corticosteroid injection. When evaluating the treatment of trigger digit from a cost perspective, males with single digit involvement or multiple digit involvement and women with multiple digit involvement should forgo corticosteroid injection because of low success rates (35%, 37%, and 56%, respectively) (Brozovich et al. and Wojahn et al).^{2,3}

The decision to treat trigger digit with corticosteroid injection versus surgery may also be a personal decision by the patient after informed discussion with the surgeon. It is important to remember that corticosteroid injection preceding surgery may increase the risk for surgical site occurrences.

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232. A study compares a new injectable neuromodulator drug against placebo for the treatment of glabellar lines. The authors of the study report that if this drug performs no differently than placebo, there is a 0.4% chance that repeating the study will show the same or greater calculated differences between the two groups. Which of the following terms refers to this concept?

- A) Alpha
- B) p-value
- C) Power
- D) Type I error
- E) Type II error

The correct response is Option B.

The p-value is a calculated value that quantifies the probability of obtaining data equal to or more extreme than the data observed on a study, should the null hypothesis be true (eg, the new drug in reality is NOT more efficacious than placebo).

Type I error is the erroneous rejection of a true null hypothesis (eg, a study shows that a new drug is more efficacious than placebo, when in reality it is not).

Alpha is the probability of making a type I error (rejecting a true null hypothesis). It is an assigned value determined by the researcher. A value of 5% is often chosen in medical literature.

Type II error is the failure to reject a false null hypothesis (eg, a study shows that a new drug is no different than placebo, when in reality it is more efficacious). Beta is an assigned value by the researcher that represents the probability of making a type II error.

Power of a test of statistical significance is the probability that it will reject a false null hypothesis. It decreases as beta increases ($\text{power} = 1 - \text{beta}$). Power of a test may be influenced by multiple factors, including sample size and magnitude of the measured effect.

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233. A 55-year-old woman has ductal carcinoma in situ located approximately 6 cm from the nipple on the lateral upper quadrant of the left breast. Which of the following is the minimum margin of excision if she decides to proceed with lumpectomy followed by radiation therapy?

- A) 1 mm
- B) 2 mm
- C) 5 mm
- D) 1 cm
- E) 2 cm

The correct response is Option B.

Consensus guidelines recommend a 2-mm minimum margin for patients undergoing breast-conserving therapy. Margins over 2 mm are not associated with further risk of local recurrence.

Primary treatment options for women with ductal carcinoma in situ (DCIS) are lumpectomy plus whole breast radiation with or without boost, total mastectomy - with or without SLNB with optional reconstruction, or lumpectomy alone. For patients with DCIS treated with breast conserving therapy, which includes lumpectomy followed by radiation, margins of at least 2 mm are associated with a reduced risk of ipsilateral breast tumor recurrence relative to narrower negative margin widths. However, a negative margin width wider than 2 mm is not supported by the evidence. An analysis of specimen margins and specimen radiographs should be performed to ensure that all mammographically detectable DCIS has been excised. In addition, a postexcision mammogram should be considered where appropriate.

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234. For a cleft palate and craniofacial team to be credentialed and approved, the American Cleft Palate-Craniofacial Association requires a minimum core of providers that includes a surgeon, speech and language pathologist, and which of the following providers?

- A) Audiologist
- B) Geneticist
- C) Orthodontist
- D) Psychologist
- E) Social worker

The correct response is Option C.

A cleft palate and craniofacial team accredited by the American Cleft Palate-Craniofacial Association (ACPA) must have, as a minimum core, health care providers from the speech-language pathology, surgery, and orthodontics specialties. These providers must participate in team meetings as appropriate for specific patient needs. The participation of these individuals should be documented in each patient's team reports.

The ACPA team must also have access to professionals in the disciplines of psychology, social work, audiology, genetics, general and pediatric dentistry, otolaryngology, and pediatrics/primary care. However, these providers are not considered core providers.

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235. A 20-year-old man is brought to the emergency department after sustaining a stab wound to the neck during a violent assault. Physical examination shows an expanding neck hematoma and stridor. Intraoperative exploration shows a deep laceration to the anterior lateral neck at the level of thyroid cartilage and profuse extravasation of blood from the carotid sheath. According to anatomical zone-based classification of penetrating neck injuries, which of the following zones is involved?

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

The correct response is Option B.

"Penetrating neck injury represents 5-10% of all trauma cases. It is important for clinicians to be familiar with management principles, as mortality rates can be as high as 10%."

Penetrating neck injury describes trauma to the neck that has breached the platysma muscle. The most common mechanism of injury worldwide is a stab wound from violent assault, followed by gunshot wounds, self harm, road traffic accidents, and other high velocity objects. The neck is a complex anatomical region containing important vascular, aerodigestive, and neurological structures that are relatively unprotected. Arterial injury occurs in approximately 25% of penetrating neck injuries; carotid artery involvement is seen in approximately 80% and vertebral artery in 43%.

Hard signs indicating immediate explorative surgery in penetrating neck injury:

- Shock
- Pulsatile bleeding or expanding hematoma
- Audible bruit or palpable thrill
- Airway compromise
- Wound bubbling
- Subcutaneous emphysema
- Stridor
- Hoarseness

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- Difficulty or pain when swallowing secretions
- Neurological deficits

The assessment and management of penetrating trauma to the neck has traditionally centered on the anatomical zone-based classification first described by Monson et al. in 1969

Zone 1 extends from clavicles to cricoid, zone 2 from cricoid to angle of mandible, and zone 3 from angle of mandible to skull base.

There are only 3 zones in penetrating neck injuries.

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236. Compared with oropharyngeal squamous cell carcinomas associated with tobacco and alcohol, which of the following is true about oropharyngeal squamous cell carcinomas associated with human papillomavirus (HPV)?

- A) They are associated with active HPV infection in the partner
- B) They are more resistant to radiation therapy
- C) They have a better prognosis, stage for stage
- D) They more frequently occur in the hypopharynx
- E) They occur more frequently in women

The correct response is Option C.

An estimated 53,260 cases of head and neck squamous cell carcinomas (HNSCCs) were anticipated in 2020 in the United States. 70% of the cases (38,380) will be in men. More cases in both women and men will be associated with human papillomavirus (HPV), and it is anticipated that HNSCCs associated with HPV will soon outnumber cases of HPV-associated cervical cancer.

Interestingly enough, partners of patients with HPV-associated HNSCCs screened for the HPV16 subtype have the same occurrence rate as the general population (1.2 to 1.3%). HPV-associated HNSCCs are associated with a greater number of lifetime sexual partners ($N \geq 9$) and a greater number of partners involved with orogenital sex ($N \geq 4$).

HPV-associated HNSCCs typically occur in the oropharynx, whereas lesions on the larynx and hypopharynx are associated with the larger field affected by tobacco smoke and alcohol.

Stage for stage, the prognosis is better for HPV-associated HNSCCs. To prevent over-treatment (or to encourage less aggressive treatment), the eighth edition of the Cancer Staging Manual of the American Joint Committee on Cancer has revised the tumor, node, metastasis (TNM) classification of HNSCCs to differentiate between HPV-positive and HPV-negative tumors.

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237. A 52-year-old man presents with a chronic soft-tissue ulcer of the plantar surface of the first metatarsal head. Medical history includes type 2 diabetes mellitus. Examination shows the wound is not infected, and there is no evidence of peripheral vascular disease. Which of the following is the most appropriate initial treatment?

- A) Achilles tendon lengthening
- B) Creation of a custom-molded shoe insert
- C) Hyperbaric oxygen therapy
- D) Knee-high total contact casting
- E) Metatarsal head resection

The correct response is Option D.

For the noninfected, nonischemic, neuropathic diabetic foot ulcer, pressure reduction through offloading measures is of critical importance. The International Working Group on the Diabetic Foot strongly recommends the use of a non-removable knee-high offloading device as first line treatment. This is supported by high-level quality evidence and multiple studies. These non-removable knee-high offloading devices include the use of total contact casts and non-removable knee-high walker devices. Removable offloading devices, such as custom molded and other therapeutic shoe inserts, as well as multiple therapeutic shoe designs, have consistently been shown to be less effective in healing chronic wounds than non-removable devices. This may be largely because of patient non-compliance. Surgical interventions that may decrease plantar pressures, such as Achilles tendon lengthening, metatarsal head resection, and metatarsal-phalangeal joint arthroplasty, may be of less utility and should only be considered when nonsurgical methods have failed. Hyperbaric oxygen therapy may play a significant role in Wagner grade III (bone involvement) or greater diabetic foot wounds in terms of increased healing and decreased amputation rate; however, evidence is lacking to suggest its routine use in soft-tissue-only diabetic foot ulcers.

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238. A healthy 48-year-old woman comes to the office for consultation regarding laser resurfacing of fine facial wrinkles in the perioral region. Her skin color is light brown and she states that she rarely gets sunburned (Fitzpatrick Type IV). Examination shows rhytides in the perioral region, on the forehead, and in the lateral canthal region. Compared with a patient who has a lighter skin color (Fitzpatrick Type I-III), which of the following is this patient at increased risk for after laser resurfacing in the perioral region?

- A) Freckles
- B) Herpetic lesions
- C) Hypertrophic scars
- D) Post-treatment hyperemia
- E) Postinflammatory hyperpigmentation

The correct response is Option E.

Understanding the potential complications after facial resurfacing is important to know, especially those complications that occur in patients with darker skin. Traditionally, the Fitzpatrick Scale is used to assess skin tone and risk for both the development of skin cancer and also response to post-treatment pigmentation issues. Herpetic lesions can develop in individuals with any skin color after laser treatment. While hyperemia can develop in any patient after laser resurfacing, post-inflammatory hyperpigmentation is of greatest concern in those with darker skin color, especially in an individual like the one described, who has a Fitzpatrick Type IV skin type. While there are different ways to mitigate the issue of pigmentation both before and after treatment, it is a risk factor that should be discussed with patients undergoing skin resurfacing, especially in darker skin individuals. Laser therapy has been used to treat hypertrophic scars and freckles.

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239. A 35-year-old man with a history of below-knee amputation comes to the office for chronic pain on the lateral portion of the amputation stump. He is diagnosed with a common peroneal neuroma. Targeted muscle reinnervation (TMR) transferring the transected peripheral nerves to recipient motor nerves of residual muscle to reestablish muscle innervation is planned. Which of the following CPT codes is most appropriate for this procedure?
- A) 64708: Neuroplasty of major peripheral nerve
 - B) 64772: Transection of other spinal nerve
 - C) 64787: Burial of neuroma in muscle
 - D) 64859: Suture of major peripheral nerve
 - E) 64905: Nerve pedicle transfer; first stage

The correct response is Option E.

The targeted muscle reinnervation procedure involves transecting a sensory or mixed motor nerve and transferring it in an end-to-end fashion to the smaller motor nerve in a nearby muscle. Since the surgeon is connecting two different nerves together, this is treated as a nerve transfer procedure. The suture of a major peripheral nerve is used to code for a repair of a laceration of nerve. While the common peroneal neuroma is being transected, the proximal stump of the nerve is not being buried in an innervated muscle; therefore, the burial of the neuroma code is not appropriate. Also, while the surgeon is transecting the common peroneal nerve to resect the neuroma, the transection code cannot be billed, since it would be included in the nerve transfer code. Also, the neuroplasty code is bundled in the nerve transfer code under normal circumstances.

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240. A 67-year-old woman is scheduled to undergo carpal tunnel release under monitored anesthesia care with local anesthetic. Her comorbidities include type 1 diabetes mellitus (recent hemoglobin A_{1c} is 7.4%), current everyday smoking, and rheumatoid arthritis, for which she takes methotrexate. Which of the following is the most appropriate antibiotic therapy to reduce this patient's risk for surgical site infection?
- A) Intravenous cefazolin, 30 minutes prior to induction, cephalexin 500 mg four times a day for 7 days postoperatively
 - B) Intravenous cefazolin, 30 minutes prior to induction, with no postoperative therapy
 - C) Intravenous cefazolin, 60 minutes prior to induction, cephalexin 500 mg four times a day for 7 days postoperatively
 - D) Intravenous cefazolin, 60 minutes prior to induction, with no postoperative therapy
 - E) No antibiotics indicated

The correct response is Option E.

Several studies have shown that timing of antibiotic delivery does impact the rate of surgical site infection (SSI). Current recommendations suggest that, when indicated, antibiotics should be given between 1 and 2 hours before surgery. There are no data to support a reduction in SSI risk when antibiotics are given within 30 minutes of surgery.

In the retrospective review by Bykowski et al, authors reported the SSI rates in patients undergoing elective soft-tissue surgery. Rates of SSI did not differ between patients who received preoperative antibiotics and those who did not (0.54% versus 0.26%, p less than 0.05). When a subgroup analysis was performed, SSI infection rates for patients who were active smokers, diabetics, and with procedure length greater than 60 minutes showed no difference with or without antibiotic administration.

Traditionally, patients with rheumatoid arthritis are viewed to be at higher risk for infection following surgery. There are no data to suggest that there is a risk reduction with the use of preoperative and/or postoperative antibiotics. Also, methotrexate does not increase one's SSI risk and is therefore not an indication for perioperative antibiotic therapy.

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241. Which of the following virilizing changes is reversible if testosterone therapy is discontinued after the post-puberty male phenotype is achieved in affirmed male patients who were assigned female at birth?

- A) Cessation of menses
- B) Clitoromegaly
- C) Lowered pitch of voice
- D) Male-pattern baldness

The correct response is Option A.

The use of hormone replacement therapy for medical transitioning in transgender individuals is considered generally safe in the short- and medium-term settings, but many answers about lifetime therapy remain unknown, particularly in the arenas of cancer and aging effects. When counseling patients about the benefits, risks, and consequences of medical transitioning, it is essential that the practitioner is honest about the limitations of knowledge at this time.

Most guidelines for the use of testosterone in transgender men note that there are short-term changes in BMI, systolic blood pressure, and, potentially, liver chemistry that should be watched closely initially. Long-term monitoring centers on lipids (HDL, LDL) and polycythemia.

The initial virilizing effects of testosterone manifest in lowering of the voice, increased muscle mass with decreased body fat, development of acne, cessation of menses, and development of increased body hair and facial hair. While changes can start to appear in 3 to 6 months, it may take up to 5 years for the full post-puberty male phenotype to be achieved. Removing testosterone at this point is not generally recommended and continued hormone therapy for life is considered reasonable.

If hormones are stopped after reaching post-pubertal male phenotype, lowering of voice, growth of clitoris, increased hair distribution, and male pattern hair loss that have occurred will not be reversed. Menstruation can resume. Long-term effects on fertility are unknown, but pregnancy has been achieved by transgender men in their late 20s. Use of testosterone and cessation of menses IS NOT sufficient birth control to prevent pregnancy.

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242. A 56-year-old woman with breast cancer undergoes bilateral mastectomy and immediate breast reconstruction with deep inferior epigastric perforator (DIEP) flaps. She has an uneventful recovery and is discharged home on postoperative day 4. Which of the following best describes the expected postoperative changes to the lower extremity venous system during this patient's hospital stay?

- A) There is decrease in diameter of the common femoral vein
- B) There is increase in flow velocity of the common femoral vein
- C) There is no change to the venous circulation
- D) There is persistent venous stasis through the day of discharge
- E) There is venous stasis, influenced by unilateral versus bilateral flap reconstruction

The correct response is Option D.

There is an increased risk of deep venous thrombosis associated with autologous breast reconstruction. Studies have tried to correlate autologous breast reconstruction with decreased venous return and stasis.

When compared with baseline levels, the common femoral veins have increased diameter and decreased flow velocity. These changes persist through the day of discharge. Since lower abdominal tissue is harvested and tight abdominal closure is performed in both unilateral and bilateral autologous breast reconstruction, there is no difference in venous stasis postoperatively when comparing both groups.

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243. Which of the following legislative acts mandates insurance coverage of breast reconstruction after total mastectomy as well as coverage of any associated symmetry procedures for the contralateral breast?

- A) Affordable Care Act
- B) Breast Cancer Patient Education Act
- C) SB-255 Amendment to the Knox-Keene Health Care Service Plan Act
- D) Women's Health and Cancer Rights Act

The correct response is Option D.

The Women's Health and Cancer Rights Act of 1998 (WHCRA) is a federal law that mandates the coverage of breast reconstruction after mastectomy as well as coverage of any associated symmetry procedures for the contralateral breast. Although this federal law was enacted more than 20 years ago, there are still significant disparities in access to breast reconstruction and a lack of education regarding the options available for breast reconstruction.

The Breast Cancer Patient Education Act of 2015 is a federal law that requires the Secretary of Health and Human Services to implement an educational campaign to inform breast cancer patients about access, availability, and options for breast reconstruction after mastectomy. SB-255 is an amendment in the state of California to the Knox-Keene Health Care Service Plan Act that includes "lumpectomy" for treatment of breast cancer in the definition of "mastectomy" and mandates access to insurance coverage of breast reconstruction after lumpectomy in the state of California. It is important to note that the WHCRA only mandates coverage of breast reconstruction after mastectomy, not after breast conservation therapies such as lumpectomy. In fact, there is no current legislation mandating insurance coverage for all types of breast reconstruction, including breast reduction, mastopexy, or implant complications after aesthetic surgeries.

The Affordable Care Act (ACA) is a comprehensive health care reform law enacted in March of 2010. The three primary goals of the ACA are to make affordable health insurance available to more people, to expand the Medicaid program to cover all adults with income below 138% of the federal poverty level, and to support innovative medical care delivery methods designed to lower the costs of health care generally. There is nothing specifically in reference to breast cancer or breast reconstruction care within the ACA.

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244. An otherwise healthy 35-year-old woman is scheduled to undergo routine full abdominoplasty while receiving conscious sedation and local anesthesia. Which of the following intravenous sedation regimens is most likely to reduce this patient's pain and anxiety while minimizing the risk for respiratory depression?

- A) Fentanyl alone
- B) Ketamine and fentanyl
- C) Midazolam alone
- D) Midazolam and fentanyl
- E) Midazolam and propofol

The correct response is Option D.

The advantage of using this combination is that midazolam has excellent anxiolytic and amnesic effects, whereas fentanyl is an excellent short-acting analgesic. A recent multicenter, randomized study demonstrated that the combination of fentanyl and midazolam is superior to midazolam alone in decreasing the patient's subjective report of pain and anxiety.

The main drawback of fentanyl is respiratory depression; however, it does have a very short half-life. Midazolam, in contrast, has minimal effects on the respiratory system except in some older patients, in whom lower doses must be used. Continuous oxygen saturation monitoring and checking the patient's respiratory status and other vital signs every 5 minutes are important for patient safety. Medications are only administered in small doses at each 5-minute interval (no more than 50 mg of fentanyl and 2 mg of midazolam at a time). This helps achieve a steady-state effect. Both of these medications have antagonists that are able to reverse their effects. Flumazenil and naloxone, the antagonists of midazolam and fentanyl, respectively, should be readily available in the operating room. The surgeon should be familiar with their dosage and administration.

Ketamine would not resolve anxiety in this patient.

Use of propofol in combination with an opiate and benzodiazepine can be used for conscious sedation; however, the disadvantage of this combination is the higher risk of respiratory depression and the lack of a reversing agent for propofol. Because a deeper level of sedation

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can be maintained, this technique is preferable for selected patients who are very anxious. A recently published series of abdominoplasty with sedation using propofol used monitored anesthesia care by an anesthesiologist or nurse anesthetist.

Propofol and benzodiazepines have no significant analgesic effect.

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245. A healthy 25-year-old man presents to the emergency department after being bitten on the left forearm by a friend's dog. The patient reports that the attack was unprovoked. The injury is washed out and sutured, the patient's tetanus status is updated, and he is given an antibiotic (amoxicillin/clavulanate [Augmentin]). The dog is up-to-date with its rabies vaccine and in the custody of its owner. In terms of rabies precaution, which of the following is the most appropriate management?
- A) Call local authorities and give rabies prophylaxis, as this was an unprovoked attack
 - B) Call local authorities and quarantine the dog for 10 days of observation
 - C) Proceed with rabies prophylaxis, as this was an unprovoked attack
 - D) No further action is needed, as animal is up-to-date with the rabies vaccine

The correct response is Option B.

Rabies is a preventable disease, as long as the victim is treated as soon as it is determined that either this was a high risk exposure or the animal is confirmed to have rabies. Left untreated, rabies is uniformly fatal In the United States of America with few exceptions.¹ While domestic animals now rarely cause transmission of rabies and most exposures come from wild animals such as bats and raccoons, transmission is still possible in an attack. As well, even though the rabies vaccine in domesticated animals is very effective, there are case reports noting rabies developing in vaccinated animals, albeit quite rare.² Regulations can vary state to state on reporting requirements; however it is always a good idea to contact local authorities. Rabies prophylaxis, while life-saving, can have significant discomfort and side effects during and after administration, thus should not be given lightly. As well, local authorities will be able to help assess risk for rabies in the patient's location and how to best proceed. A 10-day quarantine has been very effective and to date, there is no report of an animal observed to be healthy for 10 days and actually transmitting rabies. Only in situations where the risk is determined to be high or the animal cannot be found should prophylaxis be given. Thus, the correct answer is to seek guidance from local authorities and a 10-day observation or humane euthanization of the animal with pathology would be the appropriate answer. In this case, the animal is in possession of the friend and can be safely observed for 10 days.^{1,3}

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246. A 72-year-old man presents with a 2-cm, nontender, rapidly growing, violaceous intradermal papule of the cheek. Current medications include tacrolimus following renal transplantation. Biopsy of the lesion shows small, round, blue cells with large prominent nuclei that stain positive for cytokeratin 20. Which of the following is the most likely diagnosis?

- A) Amelanotic melanoma
- B) Basal cell carcinoma
- C) Keratoacanthoma
- D) Merkel cell carcinoma
- E) Squamous cell carcinoma

The correct response is Option D.

Merkel cell carcinoma (MCC) is an uncommon and extremely aggressive cutaneous malignancy that is challenging to diagnose. Up to one half of patients will eventually develop a recurrence or a metastasis. There are approximately 2500 cases of MCC diagnosed per year in the United States. Eighty percent of MCCs are caused by the Merkel cell polyomavirus and the remaining 20% by extensive ultraviolet-mediated damage.

MCC is most common on sun-damaged areas, with half located on the head and neck and nearly 40% on the extremities. They usually present as nontender, rapidly growing, painless, single, red to violaceous, firm intradermal papules or nodules. The epidermis overlying the tumor is usually preserved, but ulceration or crusting is not uncommon. Their doubling time can be as short as 12 days. The clinical features of MCC are summarized in the acronym AEIOU: asymptomatic, expanding, immunosuppressed, older than 50 years, and ultraviolet-exposed fair skin. They are differentiated histologically by the small, round, blue cells that stain positive for cytokeratin 20.

The surgical treatment of MCC consists of wide local excision with one to two centimeter margins, inclusive of the underlying fascia. Management of regional disease is critical with this tumor. A clinically negative nodal basin will be evaluated with a sentinel node biopsy while a patient with a clinically positive nodal basin will be offered a therapeutic complete lymph node dissection. Postoperative radiation is offered to patients with tumors greater than 1 cm, close/positive margins, or nodal involvement.

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Melanoma cells stain positive for S100 and HMB-45. Basal cell carcinomas stain positive for Ber-EP4. Squamous cell carcinomas stain positive for AE1/AE3.

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247. A 29-year-old right-hand–dominant man presents with a right distal radius fracture after falling on his outstretched hand. He reports increasing pain and a pins-and-needles feeling in the right hand and fingers. Distal capillary refill is less than 2 seconds, and radial and ulnar arteries are readily palpable, but the patient has severe pain on passive extension of the fingers. Early compartment syndrome is suspected. Which of the following compartments is most likely to have the most increased measured pressures in this case?

- A) Deep volar
- B) Dorsal
- C) Lateral
- D) Superficial volar

The correct response is Option A.

Compartment syndrome is a devastating condition in which bleeding and/or edema within a muscle compartment surrounded and restricted by fascia can result in increased pressures leading to neurovascular compromise and muscle death. Sequelae of compartment syndrome include loss of function, Volkmann ischemic contracture, and even amputation. It typically presents with pain out of proportion to clinical examination, as well as increased pain with passive extension of the muscle bellies within the affected compartment. Signs of neurovascular compromise are often not seen until much later in the process. Compartment syndrome is most commonly associated with traumatic fractures.

Distal radius fractures are the most common cause of compartment syndrome in the forearm. The forearm musculature is contained in four separate compartments: dorsal, lateral (or mobile wad), superficial volar, and deep volar. The deep volar compartment is the most likely to develop the highest interstitial pressures early in acute compartment syndrome after traumatic distal radius fracture. This compartment houses the flexor digitorum profundus and flexor pollicis longus muscles, which are the muscles most likely to be affected with untreated compartment syndrome and responsible for distal interphalangeal flexion of the phalanges and interphalangeal flexion of the thumb, respectively.

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248. A 26-year-old man is scheduled to undergo septorhinoplasty following a nasal bone fracture 3 years ago. He has mild von Willebrand disease. The day of the operation, the surgeon administers 0.3 µg/kg of 1-deamino-8-D-arginine-vasopressin before and after the surgery to help decrease postoperative bleeding. Which of the following is the initial mechanism by which the administered medication facilitates hemostasis in this patient?
- A) Activating the Factor V Leiden molecule in the clotting cascade
 - B) Cleaving the fibrinogen molecule to fibrin
 - C) Inducing the release of von Willebrand factor from its storage sites in endothelial cells
 - D) Irreversibly blocks the formation of thromboxane A₂ in platelets
 - E) Supporting complex formation with tissue factor, thereby providing enough thrombin to form fibrin plugs to stop minor bleeds

The correct response is Option C.

This patient is suffering from a bleeding disorder called von Willebrand disease (VWD), which occurs when the von Willebrand factor (VWF) is deficient or qualitatively abnormal.

Von Willebrand factor (VWF) works by mediating the adherence of platelets to one another and to sites of vascular damage. It also binds to Factor VIII, keeping it inactive while in circulation since Factor VIII rapidly degrades when not bound to VWF.

VWD is the most common of the inherited bleeding disorders, with an estimated prevalence in the general population of 1 percent by laboratory testing. Patients will often present with signs of easy bruising, extensive bleeding after dental work, heavy or long menstrual periods, and prolonged nose bleeds. Patients with a history of abnormal bleeding should always be properly worked up prior to surgery. There has been an extensive discussion over the years about the treatment of patients suffering from von Willebrand's disease and rhinoplasty procedure.

The recommended treatment of patients suffering from VWD undergoing rhinoplasty procedure is 0.3 µg/kg of 1-deamino-8-D-arginine-vasopressin (Desmopressin). Desmopressin is an analogue of vasopressin that exerts a substantial hemostatic effect, by

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inducing the release of von Willebrand factor from its storage sites in endothelial cells. Patients with the mild form of VWD have lower than normal levels of VWF, and the release of the additional proteins from the endothelial cells aids with clotting.

Factor V Leiden is a mutated form of human Factor V, which condition that result in a hypercoagulable state. Due to this mutation, Protein C, an anticoagulant protein which normally inhibits the pro-clotting activity of factor V, is not able to bind normally to Factor V, leading to a hypercoagulable state. Desmopressin does not have a direct interaction on this molecule.

Thrombin is an enzyme that converts fibrinogen to fibrin, and a reaction that leads to the formation of a fibrin clot. There are several thrombin products commercially available.

Hemophilia is a condition that is deficient in Factor VII. Recombinant activated factor VII.

Aspirin irreversibly blocks the formation of thromboxane A₂ in platelets, producing an inhibitory effect on platelet aggregation.

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249. A 38-year-old woman is undergoing a routine abdominoplasty at an outpatient surgery center under general anesthesia. Thirty minutes into the operation, the anesthesiologist reports high end-tidal CO₂ production and tachycardia. Which of the following is the most appropriate first step in management?

- A) Administer dantrolene
- B) Discontinue volatile anesthetic agents
- C) Infusion of lipid emulsion
- D) Switch to total intravenous anesthesia
- E) Treatment of arrhythmia

The correct response is Option B.

Malignant hyperthermia is an anesthetic crisis that is potentially fatal if not appropriately managed. The mechanism of malignant hyperthermia is an accelerated release of calcium from the sarcoplasmic reticulum. The increasing release of calcium surpasses uptake and leads to an inability to control the intracellular calcium level. The symptoms of malignant hyperthermia include unexplained high end-tidal CO₂ levels, tachycardia, increasing body temperature, masseter muscle rigidity, and skeletal muscle rigidity. The first step in the management of malignant hyperthermia is discontinuing the volatile anesthesia. The subsequent steps in management include administering dantrolene, switching to IV anesthesia, and treatment of arrhythmia. Depolarizing muscle relaxants can cause malignant hyperthermia and these drugs should be immediately discontinued and not administered. Infusion of lipid emulsion is done for lidocaine toxicity.

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250. A 19-year-old man presents to the emergency department with malocclusion sustained during an assault. Examination shows isolated mandibular subcondylar fracture. A photograph is shown. Which of the following is the most likely location of the mandibular fracture?

- A) Left
- B) Right
- C) Bilateral
- D) Not possible to determine with information provided

The correct response is Option A.

Posterior mandibular fractures, such as those of the subcondylar subunit, cause foreshortening of the vertical height of the mandible and early contact of the molar teeth on the ipsilateral side of the fracture. This results in an open bite on the anterior contralateral side of the fracture as demonstrated in the picture (right open bite).

A displaced right subcondylar fracture usually presents with a left open bite.

The malocclusion pattern from bilateral subcondylar fractures is more difficult to predict. If displaced, they may present with an anterior open bite, caused by early contact of the molar teeth on both sides of the face.

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In-Service Examination

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153	(A) (B) (C) (D) (E)
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203	(A) (B) (C) (D) (E)
204	(A) (B) (C) (D) (E)

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American Society of Plastic Surgeons
In-Service Examination

205	(A) (B) (C) (D) (E)
206	(A) (B) (C) (D)
207	(A) (B) (C) (D) (E)
208	(A) (B) (C) (D) (E)
209	(A) (B) (C) (D) (E)
210	(A) (B) (C) (D) (E)
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212	(A) (B) (C) (D) (E)
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218	(A) (B) (C) (D) (E)
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220	(A) (B) (C) (D) (E)
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247	(A) (B) (C) (D)
248	(A) (B) (C) (D) (E)
249	(A) (B) (C) (D) (E)
250	(A) (B) (C) (D)

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