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

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

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American Society of Plastic Surgeons In-Service Examination



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

Material released March 2014.

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for the

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Section 1: Comprehensive



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

1. A 60-year-old woman is seen in the hospital for a pressure ulcer in the lumbar region. A photograph is shown. A sponge for negative pressure wound therapy is about to be applied directly to the wound. Which of the following is the most likely complication of this therapy in this patient?
 - A) Enterocutaneous fistula
 - B) Excessive bleeding
 - C) Excessive wound drainage
 - D) Infection
 - E) Retained sponge in wound

The correct response is Option D.

Infection due to retained necrotic tissue would be the most likely complication in this patient. The vacuum-assisted negative pressure wound closure device should not be used in place of good wound care principles such as debridement.

Use of negative pressure wound therapy has been used for pressure ulcers, open

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abdomen, traumatic extremity wounds, chest wounds, burns, and skin grafts. Negative pressure wound therapy works through mechanisms that include fluid removal, drawing the wound together, microdeformation, and moist wound healing. Several randomized clinical trials support the use of negative pressure wound therapy in certain wound types. Serious complications include bleeding and infection.

Negative pressure wound therapy devices should be used with caution in infected wounds. They should not be used until the wounds are adequately debrided. This wound has not been adequately debrided and negative pressure wound therapy should not be used until necrotic tissue has been removed.

Bleeding is the next most common complication, but is usually seen in anticoagulated patients and after debridement. Use of a conventional gauze dressing for several hours after a debridement before placing a sponge-based negative-pressure wound therapy device may decrease the risk of excessive bleeding. Most significant bleeding has occurred secondary to disruption of major vessel grafts, cardiac bypass grafts, or the ventricle itself when sponges are placed directly on the structures. This wound is not near any major blood vessels.

Use of a single sponge or a long roll of gauze within any deep wounds is recommended to avoid retained foreign bodies.

Negative pressure wound therapy has been used to control wound drainage. Increased drainage would be caused by the lack of debridement and infection.

Even in clean wounds, a recent report on abdominal wound closure found the most likely complication to be infection rather than recurrent hernia or enterocutaneous fistula. This wound is on the back and would not be likely to have an enterocutaneous fistula. Although initially contraindicated for use with enterocutaneous fistula, recent reports have shown its use to be safe and effective in selected cases.

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2. An otherwise healthy 35-year-old man is exposed to subzero temperatures for 24 hours. After initial management of hypothermia and rapid rewarming of the hands, bilateral upper extremity frostbite is evaluated. Physical examination shows severe frostbite of the hands and up to the wrists bilaterally. Which of the following is the most appropriate next step in management?
- A) Corticosteroid therapy
 - B) Heparin therapy
 - C) Surgical debridement
 - D) Systemic antibiotic therapy
 - E) Thrombolytic therapy

The correct response is Option E.

The most appropriate next step in management is to consider intra-arterial thrombolytic therapy. The treatment of frostbite has remained essentially unchanged for the past 25 years. Classic management of frostbite injury includes resuscitation, rewarming, and watchful waiting. The outcome is either tissue recovery or progressive gangrene leading to eventual amputation. A variety of maneuvers aimed at advancing the care of patients with frostbite have been attempted, including hyperbaric oxygen, surgical and medical sympathectomy, pharmaceutical agents, and anticoagulation. None of these have resulted in alterations in the management of this disorder. Recent reports have described the use of thrombolytic therapy using urokinase or tissue plasminogen activator (tPA) as a potential therapy for frostbite.

The rationale for this therapy is based on the understanding that tissue injury in frostbite occurs from two distinct components. Initially, tissue freezing and crystal formation occur and then are improved with tissue rewarming. The more significant cause of tissue injury occurs after thawing, and it is the robust local tissue inflammation and coagulation that stimulate microvascular thrombosis and progressive cell death. By reversing local microvascular thrombosis, tPA has been postulated to restore perfusion before irreversible ischemia and necrosis.

Systemic corticosteroids or antibiotics are not indicated at this time. Systemic heparinization is usually employed as an adjunct after intra-arterial thrombolytics have been initiated. However, it is delivered intravenously. Surgical debridement is done in a delayed fashion after the area of frostbite has demarcated, sometimes weeks to months later.

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3. A 15-year-old girl comes to the office because of a 1-day history of infection of the right index finger. Physical examination shows the tip of the finger is tender and swollen over the pulp. There is no history of trauma. Which of the following organisms is the most likely cause of this patient's condition?

- A) *Candida albicans*
- B) *Eikenella corrodens*
- C) *Listeria monocytogenes*
- D) *Pasteurella multocida*
- E) *Staphylococcus aureus*

The correct response is Option E.

Staphylococcus is still the most common organism in hand infections. The most common in felons is *Staphylococcus aureus*. Methicillin-resistant *Staphylococcus aureus* community-acquired (MRSA-CA) infections are now the most predominant strain in hand infections, comprising 60% of *Staphylococcus aureus* infections.

Pasteurella multocida should be considered with most animal bites, although it is most common with cat bites. *Eikenella corrodens* is associated with human bites. There is no history of bites in this case.

Listeria monocytogenes has been reported in flexor tenosynovitis in immunocompromised patients.

Candida albicans is usually associated with chronic paronychia.

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4. A 40-year-old man desires correction of the appearance of his nose after traumatic injury 14 months ago. Examination shows collapse of the nasal bones and mid vault. The patient is concerned about additional scarring and donor site pain and requests a procedure with the least amount of donor site morbidity. Which of the following options is most appropriate for this patient?
- A) Bone allograft
 - B) Costal cartilage graft
 - C) Iliac crest graft
 - D) Split calvarial graft
 - E) Temporal fascia graft

The correct response is Option A.

Freeze-dried bone allograft has been used extensively for orthopedic trauma and tumor reconstruction and has been demonstrated to be safe for nasal augmentation. The advantage of allograft is the avoidance of donor site harvesting and morbidity. Fresh autografts probably have more osteoinductive capacity and are likely to incorporate donor bone beds more thoroughly. Although this is important in bone grafting to injured bone, such as in a tibia fracture, it is less important in nasal grafting to a nasal soft-tissue bed. Freeze-dried allografts, much like acellular dermal grafts, are extensively processed to denture all cellular elements and therefore do not elicit immunologic rejection response. Irradiated costal cartilage allografts have also been used with success for nasal reconstruction. There is also a rare chance of disease transmission from the cadaveric donor.

Autologous costal cartilage is one of the more commonly used graft materials for nasal reconstruction, although both donor site scarring and pain are prominent. Iliac crest is a useful graft site for cortical and cancellous bone, though the shape is not ideal for nasal contouring. Donor site pain is an issue as well. The same limitations apply to split calvarial grafts, which are most useful when a bicoronal incision has already been used for craniofacial exposure.

Temporal fascia is a versatile graft source, especially when wrapped around diced cartilage. The resulting graft is pliable, soft, and has been reported to have minimal absorption. Although it is an excellent choice for this case, it does require a scalp donor site, which this patient does not want. Alloplastic materials such as silicone are also used, though they are prone to extrusion over time.

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5. A 17-year-old girl comes to the office for evaluation for an abdominoplasty 1 year after the delivery of her first child. Following evaluation, the patient is deemed a good surgical candidate. The patient is married, but she came to the consultation alone. Which of the following is the most appropriate next step?
- A) Obtain consent from her husband
 - B) Obtain consent from one parent
 - C) Obtain consent from the patient
 - D) Re-evaluate the patient at 18 years of age
 - E) Re-evaluate the patient at 21 years of age

The correct response is Option C.

The most appropriate next step in management is to perform the abdominoplasty without parental consent. Because the patient is married and has a child, she is an emancipated minor and is legally able to consent to medical procedures. The criteria for an emancipated minor generally include: marriage, military service, financial independence, living arrangements apart from the parents, and parenthood. Almost all states allow patients age 18 years or older to give their own consent for a medical procedure; non-emancipated patients younger than age 18 years require the consent of one parent.

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6. A 12-year-old girl has a 7 × 7-cm venous malformation of the thigh that is slowly enlarging and causing pain. The lesion involves the skin, subcutaneous tissue, and muscle. Which of the following is the most appropriate first step in management?

- A) Corticosteroid therapy
- B) Embolization of the lesion
- C) Propranolol therapy
- D) Resection of the lesion
- E) Sclerotherapy

The correct response is Option E.

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

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7. A 22-year-old woman comes to the office for consultation because she is dissatisfied with the appearance of her nose. History includes two cosmetic procedures of the nose. During the consultation, she also expresses dissatisfaction with the appearance of her eyelids, chin, lower abdomen and flanks, and breast size. In this patient with body dysmorphic disorder, which of the following additional findings is most likely?
- A) Anorexia
 - B) Anxiety disorder
 - C) Depression
 - D) Hypochondriasis
 - E) Substance abuse

The correct response is Option C.

The demographic features of body dysmorphic disorder include an onset during late adolescence, and it appears to affect men and women with equal frequency. The clinical features of body dysmorphic disorder most frequently include preoccupation with the appearance of the skin, hair, and nose, although any body part can be a source of concern.

Although several psychiatric comorbidities have been associated with body dysmorphic disorder, depression is the most common. In one study, over 75% of patients with body dysmorphic disorder had a lifetime history of major depression, and over half met criteria for current major depression.

The remaining psychiatric disorders listed also occur with body dysmorphic disorder, but in lower frequencies. Lifetime rates of substance abuse disorders in patients with body dysmorphic disorder have been shown to be close to 30%. Similarly, the lifetime history of an anxiety disorder in patients with body dysmorphic disorder was reported to be more than 6%. The same study reported the lifetime comorbidity rate of anorexia to range from 7 to 14%.

Body dysmorphic disorder and hypochondriasis both involve obsessional thinking and checking behaviors, but the focus of concern in body dysmorphic disorder is on appearance, whereas in hypochondriasis the concerns relate to health status. One study found that only 2% of their body dysmorphic disorder sample had comorbid hypochondriasis.

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

8. A 54-year-old man comes to the office for reconstruction of an 8 × 10-mm defect involving the right nasal margin after excision of basal cell carcinoma. A photograph is shown. The defect involves the skin and cartilage of the alar border. Which of the following one-stage reconstructive options is most appropriate?
- A) Composite auricular graft
 - B) Dorsal nasal flap
 - C) Forehead full-thickness skin graft
 - D) Nasolabial flap
 - E) Primary closure

The correct response is Option A.

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Alar rim defects present a challenging reconstructive problem. The primary reconstructive goals are to reestablish structural support, provide nasal lining if necessary, and provide external skin of similar color and texture. Complications of alar rim reconstruction include poor scars, alar notching, nasal obstruction, and narrowing of the nostril. Several choices are available, but a composite graft from the ear will often obtain an excellent cosmetic result.



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

Skin along the alar rim, soft triangle, and columella is quite thin and firmly attached to the lower lateral cartilages. Likewise, skin along the helical rim is firmly attached to the underlying cartilage and useful for replicating the delicate topography of the columella, soft triangle, and nostril margin. Composite grafts are typically harvested from the helical root, but can be harvested from throughout the ear.

Composite cartilage grafts only interface with the recipient bed around the graft's

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

Primary closure would yield a poor result and distortion of the alar rim. The other options do not provide a cartilage support, which would result in likely alar notching and potential collapse. Additionally, the skin from these donor sites would be too thick to replace the thin skin that normally inhabits this location.

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9. A 14-year-old girl with Fitzpatrick Type V skin comes to the office for evaluation of a nevus on the right side of the face. Physical examination shows a macular, bluish grey, irregular area of hyperpigmentation involving the right infrapalpebral region, nasolabial fold, and zygomatic region. Pigmentation of the right sclera is noted. Which of the following is the most appropriate treatment for this lesion?
- A) Camouflage therapy
 - B) Cryotherapy
 - C) Dermabrasion
 - D) Mohs micrographic excision
 - E) Q-switched ruby laser

The correct response is Option E.

This patient has the acquired form of nevus of Ota, also known as nevus fuscoceruleus ophthalmomaxillaris or oculodermal melanocytosis, a dermal melanocytic hamartoma that demonstrates bluish hyperpigmentation along the ophthalmic and maxillary divisions of the trigeminal nerve. The failure of complete embryonic migration of melanocytes from the neural crest to the epidermis results in dermal nesting with the resultant dermal melanin causing the Tyndall effect. This disorder primarily affects darker-pigmented individuals and is more prevalent in females. It has a bimodal age incidence, with a peak at 1 year of age and a second around puberty. The lesion tends to become increasingly prominent with age, puberty, and postmenopausal state. Most patients have no family history. Ophthalmologic examination is recommended because of a reported 10% association with ipsilateral glaucoma. Malignant degeneration to melanoma occurs in approximately 4% of reported cases and is more frequent in lighter-skinned individuals. Diagnosis is mainly clinical with confirmatory biopsy indicated when the diagnosis is uncertain or in rapidly expanding or nodular lesions suggestive of malignancy.

The most effective treatment option is laser therapy, particularly with a Q-switched laser with ruby (694 nm), alexandrite (755 nm), or neodymium: yttrium-aluminum-garnet (1064 nm). The wavelength, pulse duration, and energy densities inherent in the Q-switched laser provide the desired parameters for melanin photothermolysis. Dyspigmentation is a possible complication, although it is mostly transient.

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Before the advent of laser therapy, treatment options were suboptimal. Makeup or camouflage therapy offered only temporary improvement. Dermabrasion followed by cryotherapy had the potential for dermal scarring and atrophy and was ineffective for those lesions with deep dermal melanocytes. Surgical excision options were also associated with scarring. Mohs micrographic excision has not been described for excision of these lesions.

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10. A 40-year-old woman with a history of severe postoperative nausea and vomiting is scheduled for exchange of bilateral breast tissue expanders for permanent silicone implants. Use of which of the following medications is most likely to decrease the chance of postoperative nausea?
- A) Bupivacaine
 - B) Fentanyl
 - C) Isoflurane
 - D) Midazolam
 - E) Nitrous oxide

The correct response is Option A.

Addition of local anesthetics during general anesthesia, whether by subcutaneous, tumescent, or regional block infiltration, can result in decreased dosage requirements of the common sedatives and analgesics that can result in nausea and emesis.

Common anesthetic agents that promote nausea and emesis include opioids (fentanyl, hydromorphone, morphine) and inhalationals (halothane, isoflurane, nitrous oxide). Propofol is currently the most commonly used intravenous agent. It does not appear to directly result in nausea, but it has limited analgesic effects. Therefore, effective anesthesia with propofol requires addition of opioid narcotics (which cause nausea) and/or local anesthetics such as lidocaine and bupivacaine (which may decrease the narcotic requirement).

Midazolam is a sedative-hypnotic that has anxiolytic and amnesic effects, both of which are helpful adjuncts to the surgical patient experience. Nausea is possible with midazolam, but less commonly reported than with narcotic and inhalational agents.

The cause of postoperative nausea and vomiting is multifactorial and not fully understood. Strategies for prevention include:

- Recognition of high-risk patients (females, nonsmokers, history of motion sickness, previous postoperative nausea, general anesthesia)
- Pre- and postoperative treatment with multiple modalities (such as scopolamine, ondansetron, aprepitant, corticosteroids)
- Supplemental intraoperative oxygen and hydration

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11. A 35-year-old man is admitted to the burn unit after sustaining superficial partial-thickness burns involving 25% of the total body surface area. Medical history includes an allergy to sulfonamide. The burns are cleaned, and silver nitrate-soaked dressings are applied. Which of the following is most likely in this patient?

- A) Hyponatremia
- B) Metabolic acidosis
- C) Neutropenia
- D) Painful application
- E) Thrombocytopenia

The correct response is Option A.

Because of the skin's important function as a microbial barrier, prevention of infection after burn injury is still one of the most difficult challenges in caring for burn patients. The development of effective topical antimicrobial agents has markedly reduced the incidence of invasive burn wound infection and sepsis. Topical therapy should be started after the initial wound debridement. The three most common topical antimicrobial agents are silver sulfadiazine (Silvadene), silver nitrate, and mafenide acetate (Sulfamylon).

Silver nitrate is typically delivered as a 0.5% solution as a wet dressing. Silver nitrate has excellent antibacterial properties and is effective for most *Staphylococcus* species and most gram-negative aerobes, including *Pseudomonas*. This agent is typically used when there is a history of sulfonamide allergy or when sensitivity to the other agents has developed. A common use of silver nitrate is in the setting of toxic epidermal necrolysis. Application is painless, but tissue penetration is poor. Concentrations above 5% are cytotoxic to healthy tissues. Because leaching of sodium, potassium, and calcium is common, this effect should be anticipated and replaced appropriately.

Painful application is associated with mafenide acetate (Sulfamylon). Mafenide acetate is delivered as suspension in a water-soluble base. As a result of its solubility, it has excellent tissue penetration and is often used in heavily contaminated wounds with thick eschar. Because of excellent cartilage penetration, it is also the agent of choice with ear burns. Mafenide acetate is highly effective against gram-negative organisms. Adverse effects include hypersensitivity reactions (7% of patients) and inhibition of carbonic anhydrase with a resultant hyperchloremic metabolic acidosis.

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Silver sulfadiazine is the most common topical antimicrobial agent used. It has intermediate tissue penetration secondary to its limited water solubility. This agent has a good antibacterial spectrum, a low incidence of development of resistant organisms, and is applied painlessly. Transient leukopenia is a common adverse effect of silver sulfadiazine. This condition is self-limited and does not appear to increase mortality in burn patients. Switching to a different topical agent for a few days will allow the white blood cell count to return to normal.

Thrombocytopenia is not associated with silver nitrate.

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12. A 38-year-old woman with symptomatic macromastia comes to the office because she desires reduction mammoplasty. A medical assistant obtains the patient's history, and the plastic surgeon performs a brief history and comprehensive physical examination. The patient is considered a good candidate for surgery, and without further discussion the medical assistant is left to obtain a generic hospital consent form. The patient signs the form without a witness present. The surgeon is at increased medico-legal risk because of which of the following?
- A) Lack of a specific plastic surgery consent form
 - B) Lack of verbal discussion of the risks of reduction mammoplasty
 - C) Lack of a witness signature on the consent form
 - D) Use of a medical assistant in the consultation
 - E) The physician is not at risk because the patient signed a consent form

The correct response is Option B.

This surgeon is at increased medico-legal risk due to the fact that there was a lack of verbal discussion of the risks of reduction mammoplasty. Three components must exist for a patient to give informed consent: disclosure, capacity, and voluntariness. In this case, the lack of verbal communication regarding the risks of reduction mammoplasty represents a lack of disclosure. Use of a medical assistant is accepted practice and does not increase the physician's risk in and of itself. One cannot rely on written documents alone, which may or may not be read or understood by the patient. Although a witness signature is required by many hospitals, the presence of a witness is not a central component of the informed consent process. A specific plastic surgery consent form can be helpful, but only if the risks pertaining to the plastic surgery procedure are discussed in person with the patient. Use of a generic hospital consent form is common and acceptable, provided a verbal discussion of the particular risks associated with the proposed procedure occurs and is documented elsewhere in the medical record.

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13. An 87-year-old Caucasian man comes to the office with multiple 5- to 6-mm lesions on the forehead. He has a long history of sun exposure. Physical examination shows the lesions are erythematous, rough, and scaly. Which of the following is the most appropriate treatment?
- A) Dexamethasone
 - B) Docosanol
 - C) Imiquimod
 - D) Isotretinoin
 - E) Observation with 1-month follow up

The correct response is Option C.

This patient's lesions are most consistent with actinic keratoses. Actinic keratoses are most commonly seen in fair-skinned individuals in areas that have had long-term sun exposure. They are the most common skin lesions to demonstrate malignant potential and may progress to squamous cell carcinoma.

Given the propensity of actinic keratoses to malignant transformation, treatment is generally recommended over observation. For multiple lesions, topical agents are generally effective and well tolerated. Imiquimod is thought to exert its effects by inducing a local immune response as well as apoptotic pathways. Other effective treatments include photodynamic therapy, cryotherapy, 5-fluorouracil, and diclofenac gel.

Dexamethasone is a corticosteroid typically used for inflammatory or autoimmune skin conditions. Isotretinoin is used to treat cystic acne. Docosanol is an antiviral medication used for herpes simplex.

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14. A 45-year-old woman comes to the office 10 years after undergoing subglandular implantation of textured silicone implants for augmentation mammoplasty. Physical examination shows swelling of the left breast. She is concerned about cancer. Increased incidence of which of the following malignancies is associated with breast implants?
- A) Acute myeloid leukemia
 - B) Anaplastic large cell lymphoma
 - C) Angiosarcoma
 - D) Infiltrating ductal carcinoma
 - E) Malignant fibrous histiocyoma

The correct response is Option B.

Several reports have suggested an association between breast implants and anaplastic large cell lymphoma (ALCL), which is an extremely rare malignancy. In these cases, ALCL has usually occurred several years after implantation as swelling or a mass around the implant and is often associated with a periprosthetic seroma. Treatments have included capsulectomy with implant removal and chemotherapy and/or radiation therapy, though there is no defined consensus regimen. Despite evidence of an increased risk of ALCL in breast implant patients, the absolute risk remains extremely low.

Several large epidemiologic studies have demonstrated a similar or lower incidence of breast cancer (infiltrating ductal carcinoma) among patients who have undergone prosthetic augmentation mammoplasty surgery compared with those who have not. Most cases of ALCL have been in textured implants.

Angiosarcoma and malignant fibrous histiocyoma are two sarcomas that may arise in the breast. Angiosarcoma may be caused by radiation therapy for breast cancer. Neither of these sarcomas has been associated with breast implants.

Acute myeloid leukemia may be associated with radiation treatment to the breast but has not been associated with breast implants.

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15. An otherwise healthy 37-year-old woman presents for delayed microsurgical breast reconstruction. Which of the following is associated with use of tamoxifen?

- A) Hemodynamic instability
- B) Impaired wound healing
- C) Increased bleeding
- D) Seroma formation
- E) Thromboembolic events

The correct response is Option E.

Breast cancers that are estrogen receptor positive may be responsive to adjuvant chemotherapy with selective estrogen receptor modulators such as tamoxifen, which can reduce recurrence and mortality. Tamoxifen is associated with thromboembolic events, such as deep venous thrombosis and pulmonary embolism. This prothrombotic effect has been postulated to be secondary to the effect of tamoxifen on estrogen receptors that are abundant within vascular endothelium.

Tamoxifen has been shown to be associated with increased rates of total flap loss and decreased rates of flap salvage when taken within 28 days of microsurgical breast reconstruction, which represents two half-lives of the active metabolite of tamoxifen (*N*-desmethyl tamoxifen, $t_{1/2}$ =14 days). It has therefore been recommended that in patients undergoing microsurgical breast reconstruction, tamoxifen be held for at least 28 days preoperatively. Some authors have further advised holding the medication postoperatively in addition to preoperatively.

Tamoxifen is not associated with impaired wound healing, increased bleeding, hemodynamic instability, or seroma formation.

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16. An 18-year-old woman who sustained a flame burn involving 50% of the total body surface area is resuscitated to a stable cardiovascular and respiratory status. Four days after injury, she undergoes tangential excision and xenografting of all burned areas. Following surgery, the patient returns to the ICU intubated and ventilated. She has thick pulmonary secretions. She received 2 units of packed red blood cells during surgery. Vital signs are as follows:

Temperature	99.5°F (37.5°C)
Heart rate	130 bpm
Respiratory rate	22/min
Blood pressure	80/50 mmHg

Oxygen saturation is 96% on 40% FiO_2 . Cardiac output is 6 L/min, and urine output is 0.1 mL/kg/h. Which of the following is the most likely explanation for these abnormal findings?

- A) Acute respiratory distress syndrome
- B) Hypovolemic shock
- C) Pneumonia
- D) Pulmonary embolism
- E) Sepsis

The correct response is Option B.

The most likely explanation for this patient's abnormal physiology is hypovolemic shock. The patient just underwent tangential excision of a 50% total body surface area burn, and marked blood loss is to be expected. She received 2 units of packed red blood cells, but this is unlikely to be adequate for such a large burn excision. In addition, her vital signs are typical for hypovolemic shock. Sepsis and acute respiratory distress syndrome (ARDS) are often seen in patients with large burns, but they are usually seen later in the hospital course. Sepsis is associated with fever and a high cardiac output. ARDS is associated with previous large-volume transfusions and lung injury, and should not cause hypotension in isolation. It is also associated with more severe hypoxia. Pneumonia and pulmonary embolism are also associated with a more profound hypoxia than this patient exhibits and are usually seen later in a burn patient's hospital course.

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17. A 60-year-old woman undergoes bilateral hand transplantation. Within 12 hours of the procedure, the transplanted tissues show evidence of rejection. Despite aggressive medical and surgical management, the transplants fail. Which of the following is the most likely type of tissue rejection in this patient?

- A) Acute cellular
- B) Acute humoral
- C) Chronic
- D) Hyperacute

The correct response is Option D.

The most consistent clinical stage of rejection in this case is hyperacute rejection. In hyperacute rejection, the transplanted tissue is rejected within minutes to hours because of preformed antibodies in the recipient. These antibodies are usually induced by previous blood transfusions, multiple pregnancies, or previous transplantation. The antigen-antibody complexes activate the complement system, causing massive thrombosis in the capillaries, which prevent the vascularization of the graft. If the graft is not removed, severe systemic complications such as systemic inflammatory response syndrome will result.

Acute humoral rejection is also primarily mediated by antibody and complement, similar to the hyperacute form of rejection. However, these antibodies are not preexisting, but rather are rapidly induced after exposure to the graft. This usually takes a few days, and the rejection appears in about 3 to 7 days. Another important difference between the hyperacute and acute form of rejection is that there is no known treatment for the former, while the latter may be reversed by plasmapheresis and treatment with anti-B-cell reagents.

Acute cellular rejection is mediated by T cells that have been activated against donor antigens, primarily in the lymphoid tissues of the recipient. This is the most common form of rejection treated by clinicians and usually occurs in the first 3 to 6 months of the transplant. Acute cellular rejection is usually treated with increased doses of standard immunosuppressive drugs or anti-lymphocytic antibodies.

Chronic rejection develops months to years after acute rejection episodes have subsided. Chronic rejections are both antibody- and cell-mediated. The use of immunosuppressive drugs and tissue-typing methods has increased the survival of allografts in the first year, but chronic rejection is not prevented in most cases.

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18. Which of the following individuals is at highest risk of dissatisfaction with the surgical outcome?
- A) A 25-year-old man with a large amount of excess skin following a 100-lb (45-kg) weight loss who comes to the office for body contouring
 - B) A 35-year-old woman who comes to the office for facial rejuvenation surgery in order to advance her career as a news anchor
 - C) A 42-year-old woman who comes to the office with a large nasal dorsal hump and bulbous tip who is requesting an improved appearance
 - D) A 45-year-old mother of three with marked deflation and ptosis of the breasts who is looking for an improved appearance
 - E) A mother of a 3-year-old girl who brings the child in for surgery for a large congenital nevus

The correct response is Option B.

One of the psychological contraindications to plastic surgery is when a patient gauges the success of surgery on realization of a specific goal (i.e., a job promotion). Others include the patient who is unable to contemplate an imperfect result, uncertain as to which aspect to change, under emotional stress during consultation, motivated to have surgery at the request of others, and a doctor-shopper dissatisfied with the results of multiple previous procedures.

There are multiple contraindications to surgery: some anatomical and some psychological. One of the most important decisions by a surgeon is whether to perform the requested surgery. The plastic surgeon has to identify a correctable deformity or concern first. This then has to be balanced against the importance that the patient places on this deformity. According to Gorney, the patient with minor deformity but extreme concern is most likely dissatisfied with whatever the outcome. Additionally, the surgical outcome has little to do with the emotional stress.

The dissatisfied patient, once discovered postoperatively, must be handled carefully. This patient must be seen frequently and offered compassion and concern. Allow the patient to see you as the ally that you are. Offer a waiting period before performing any other operations. Consider an offer to revise an operation only if you concur with the patient's complaints and you think you can improve the appearance. Also, sit with the patient and have a frank discussion of his/her complaints.

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All the other options in the question present patients with real identifiable, correctable problems with reasonable expectations.

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19. An 18-year-old woman with a history of cleft lip and palate presents for secondary alveolar bone grafting. An iliac crest bone graft is planned. Which of the following characteristics of iliac crest bone graft is an advantage over the use of bone morphogenetic protein in this patient?

- A) Greater volume of graft material
- B) Osteoconductive properties
- C) Osteoinductive properties
- D) Reduced operative time
- E) Reduced recovery time

The correct response is Option B.

The majority of cleft lip and cleft palate patients undergo secondary bone grafting of the alveolar cleft between the ages of 8 and 12 years. A commonly used source of graft material, iliac crest bone, is associated with morbidity including significant pain, impaired ambulation, and prolonged recovery. Some authors have proposed the use of bone morphogenetic protein for alveolar cleft closure. Advantages to this technique include reduced operative time, quicker recovery, and a greater volume of graft material, which can be limited when harvesting iliac crest bone graft in smaller children. Osteogenesis requires both osteoconductive materials and osteoinductive factors. Iliac crest bone graft displays necessary properties, while bone morphogenetic protein provides significant osteoinductive properties, but requires an additional carrier, such as demineralized bone putty, for osteoconduction. Bone morphogenetic protein is not FDA-approved for patients younger than 12 years of age.

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20. A 43-year-old electrician sustains a high-voltage electrical injury and undergoes multiple debridement procedures of the right upper extremity. The hand, ulnar aspect of the forearm, and medial upper arm are spared. Two weeks following the injury, a final debridement is performed leaving a 6-cm segment of the brachial artery and median nerve exposed in the proximal forearm. Which of the following is the most appropriate method for wound coverage?
- A) Above-elbow amputation
 - B) Dermal substitute followed by skin graft
 - C) Free tissue transfer
 - D) Local tissue flap
 - E) Split-thickness skin graft

The correct response is Option D.

The most appropriate method for wound coverage is a local tissue flap, which could come from the intact medial upper arm and/or ulnar aspect of the forearm. A split-thickness skin graft is not appropriate coverage for vital structures. The time it takes for a dermal substitute to vascularize and form the basis of subsequent grafting is too long to leave such vital structures exposed. Free tissue transfer is an option; however, this patient is 2 weeks out from injury and the associated hypercoagulable state is a relative contraindication if local tissues are available. Above-elbow amputation is not an appropriate option as the hand is spared and there are viable coverage options for this young manual laborer.

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

21. An 8-month-old male infant is evaluated for a lip mass. A photograph is shown. Treatment with propranolol is initiated. Which of the following adverse effects is most important to monitor?
- A) Drooling
 - B) Hypertension
 - C) Hypoglycemia
 - D) Lethargy
 - E) Tachycardia

The correct response is Option C.

Vascular anomalies are a common source of pediatric morbidity, potentially resulting in cosmetic and functional abnormalities. Two main categories of lesions are hemangiomas and vascular malformations. Vascular malformations are generally named after the vessel types that are involved and are further subdivided into low-flow and high-flow lesions. Low-flow lesions include capillary, lymphatic, venous, and mixed lesions. High-flow lesions include arteriovenous malformations. Both high- and low-flow vascular malformations are almost always present at birth and either grow commensurately with the child or slowly enlarge over a period of years.

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Treatment is guided by the degree of functional impairment, and many require surgical therapy.

Hemangiomas are rarely present at birth. They tend to appear between 2 and 8 weeks of life and grow rapidly. These lesions comprise of rapidly proliferating endothelial cells and follow a predictable clinical course. They usually undergo an aggressive proliferative phase that lasts several months before reaching a plateau phase, when they grow very little. Finally, at about 1 year of life, hemangiomas begin a process of spontaneous involution which may last for up to 4 years. Completion of involution does not mean complete involution, and many hemangiomas may leave cosmetically unacceptable residua. Hemangiomas found in inconspicuous areas can be observed. Those noted in cosmetically or functionally sensitive areas require more aggressive treatment. Treatment options have included topical, intralesional, and systemic corticosteroids, laser treatment, interferon-alfa, and surgical resection. However, each of these treatments carries marked risks and still does not provide consistent, reliable success.

In June 2008, a French group reported rapid resolution of hemangiomas in children treated with propranolol for pediatric cardiomyopathy. This serendipitous finding led to a landmark paper and has resulted in a paradigm shift in the clinical care of these patients. Many groups have now confirmed their findings with very promising results. The use of propranolol for hemangiomas remains off-label, but there are centers of excellence with institutional review board protocols in place to further study its clinical effects. Recommended doses vary but frequently start at 0.5 mg/kg/day divided three times daily and slowly titrated over 1 to 2 weeks to 2 mg/kg/day. Most centers recommend obtaining pretreatment electrocardiography (ECG); if normal, then therapy can be initiated on an outpatient basis. If the ECG is abnormal, then pretreatment cardiology evaluation is warranted. Dose titration, blood pressure, and heart rate are checked regularly. The most common adverse effect is lethargy. Other adverse effects include hypoglycemia, hypotension, and bradycardia. All children drool, and this has not been reported as a complication of propranolol administration. Hypoglycemia can be a potentially life-threatening complication that can also cause seizures. Parents are counseled to give food with medication. Many centers regularly check blood glucose.

An image of a child with upper lip hemangioma treated with propranolol for 14 months is shown.

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22. A 56-year-old woman who has been undergoing treatment for breast cancer has pain around the port site 6 hours after the extravasation of paclitaxel from a subcutaneous tunneled subclavian vein catheter. The patient is hemodynamically stable and breathing comfortably. Moderate swelling and tenderness are observed between the port and clavicle. Which of the following is the most effective management?
- A) Application of calcium gluconate gel
 - B) Application of topical collagenase
 - C) Line change over a wire
 - D) Line removal and observation
 - E) Operative debridement

The correct response is Option D.

This patient has paclitaxel extravasation due to a malpositioned or leaking catheter with minimal symptoms; therefore, removal of the line and observation is warranted. Calcium gluconate gel is indicated after generously washing areas exposed to hydrofluoric acid as it neutralizes the fluoride ion. Topical collagenase is indicated in wounds with limited tissue necrosis and thus has no role in this patient. Changing this patient's line over a wire is contraindicated as the catheter is either malpositioned or broken. Although operative debridement is sometimes indicated in extravasation injuries, it is unusual, and expectant management is the norm. As this patient has no acute signs of compartment syndrome or tissue necrosis, line removal and observation are indicated.

The incidence of extravasation is 0.01 to 6%. Chemotherapeutic agents that cause reactions are classified as irritants or vesicants. Irritants cause immediate and typically limited local reactions such as erythema, warmth, and tenderness. Common irritants are: bleomycin, carboplatin, carmustine, cisplatin, dacarbazine, etoposide, ifosfamide, and thiotepa. Vesicants can cause erythema, blistering, and skin necrosis. Itching in the absence of pain is common. In addition, vesicants can cause delayed ulceration that is self-perpetuated when the vesicant is rereleased upon lysis of affected cells. Common vesicants are: dactinomycin, daunorubicin, epirubicin, idarubicin, mechlorethamine, mitomycin, mitoxantrone, paclitaxel, vinblastine, vincristine. Paclitaxel is derived from the bark of the Pacific yew tree and induces microtubular assembly and stabilization, which leads to cell death. It is a vesicant,

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and if extravasation occurs, symptoms can range from localized pain, swelling, and erythema to severe skin necrosis and ulceration requiring surgical debridement. The vast majority of extravasations are managed non-operatively.

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23. A 62-year-old man is diagnosed with osteosarcoma involving the mandible. Microsurgical reconstruction with a free osseocutaneous flap using iliac bone is planned. The vascular pedicle to this flap is which of the following?
- A) Deep circumflex iliac vessels
 - B) Deep inferior epigastric vessels
 - C) Superficial circumflex iliac vessels
 - D) Superficial femoral vessels
 - E) Superficial inferior epigastric vessels

The correct response is Option A.

The deep circumflex iliac artery (DCIA) arises from the lateral aspect of the external iliac artery. From its takeoff point, it travels toward the anterior superior iliac spine (ASIS) between the transversalis fascia and transversus abdominis muscle. Just medial to the ASIS, it gives off an ascending branch which supplies the internal oblique muscle. Lateral to the ascending branch, the DCIA courses through the transversalis fascia along the inner lip of the iliac crest, where it lies in the line of fusion between the iliacus and transversalis fascia, and supplies the iliac crest bone.

The deep inferior epigastric vessels supply transverse rectus abdominis myocutaneous (TRAM) and deep inferior epigastric artery perforator (DIEP) flaps. The superficial circumflex iliac vessels supply the groin flap. The superficial inferior epigastric vessels supply the superficial inferior epigastric artery (SIEA) flap, which comprises the skin and subcutaneous tissue only of the lower ipsilateral hemi-abdomen. The superficial femoral vessels supply flaps such as the sartorius muscle flap.

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24. A 38-year-old right-hand–dominant man is evaluated in the emergency department 4 hours after amputating the left thumb and index finger with a circular saw. Microvascular replantation surgery is planned. Which of the following is first in the sequence of repair?

- A) Artery
- B) Bone
- C) Nerve
- D) Tendon
- E) Vein

The correct response is Option B.

When multiple digits are amputated, thumb replantation takes priority. If the amputated thumb is not suitable for replantation, the best available finger is replanted in its position. If there are injuries to other fingers or parts of the hand, they should be repaired first before replantation. In a mutilated hand, functional preservation takes priority. Procedures that ensure maximal function must be done first because the hand should not be disturbed after replantation. The sequence of repair of structures in multi-digit replants can be performed either digit-by-digit or structure-by-structure. While structure-by-structure is more efficient, warm ischemia time tends to be longer. If the thumb is involved, it is preferred that the thumb be replanted first followed by the remaining digits.

After debridement, vessels and nerves should be identified and tagged because they may be more difficult to locate after bone fixation. The sequence usually is bone fixation, tendon repair, and then vessel and nerve repair. Bone shortening facilitates repair of structures without tension. Bone fixation is performed first and should be stable enough to undergo the rigors of hand therapy. After bone fixation, the volar structures are repaired by structure type (i.e., flexor tendon, then the artery and nerves) followed by the dorsal structures (extensor tendon and veins).

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25. A male newborn has a large macrocystic lymphatic malformation of the neck. Which of the following is the most appropriate first step in management?

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

The correct response is Option E.

The most appropriate first step in management is sclerotherapy. Lymphatic malformation is a type of vascular anomaly that results from aberrant formation of lymphatic vessels. Lymphatic malformation most commonly affects the neck and axilla. There are two major types of lymphatic malformations: macrocystic and microcystic. Macrocystic lesions have cysts large enough to be cannulated by a needle and treated with sclerotherapy. Microcystic lesions have cysts that are too small for treatment with sclerotherapy. First-line management of macrocystic lymphatic malformations is sclerotherapy, which is the injection of an inflammatory substance into the lesion that causes scarring of the cyst walls together and shrinkage of the malformation. The most commonly used sclerosants are doxycycline, sodium tetradecyl sulfate, and ethanol.

Prednisolone and propranolol are drugs used to treat problematic proliferating infantile hemangioma, and have no efficacy for vascular malformations. Embolization is used to treat arteriovenous malformations and involves delivering a substance through an artery to occlude blood flow.

Resection is second-line therapy for a problematic macrocystic lymphatic malformation. Extirpation can cause marked morbidity (i.e., bleeding, nerve injury, infection, wound breakdown). In addition, excision leaves a cutaneous scar and recurrence is likely because a lymphatic malformation can rarely be completely removed. Resection is considered if a lesion remains symptomatic following sclerotherapy, or for microcystic lymphatic malformations that cannot be sclerosed.

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26. A 33-year-old woman sustains trauma to the right thigh. She undergoes debridement of the wounds. Two days later, the right anterior thigh has a 15 × 25-cm wound with areas of exposed fat and muscle. Which of the following is the most appropriate intervention to achieve wound closure?
- A) Free latissimus dorsi flap
 - B) Full-thickness skin graft
 - C) Local fasciocutaneous flap
 - D) Negative pressure wound therapy
 - E) Split-thickness skin graft

The correct response is Option E.

Split-thickness skin grafts can provide wound coverage over a large area. A mechanical dermatome is often used for obtaining split-thickness skin grafts. Typical thicknesses may range from 8/1000th of an inch to 14/1000th of an inch. The graft can be meshed in various ratios such as 1:1.5, 1:2, and 1:3 to allow for a larger area of coverage per unit of harvested skin. It is important that the underlying wound bed be viable and free of necrotic tissue or infection in order to allow for healing of the skin graft (“skin graft take”). Adequate immobilization of a skin graft is important for take of the graft, and can be achieved with negative pressure wound therapy, or tie-over-bolster dressing. The thigh has an abundant amount of soft tissue and muscle, which is why skin grafts are often sufficient for wound coverage rather than flaps.

The patient has a complex wound of the anterior thigh that is best described as a degloving injury in which the skin has been sheared off of the underlying tissues. Undermining of the skin is a hallmark of this type of injury. This type of injury disrupts the blood supply to the skin and can result in tissue ischemia and necrosis. In the acute period, it can be difficult to determine the extent of tissue injury as the skin viability evolves over this time such that areas of marginal blood supply may worsen and progress to full-thickness necrosis. Before definitive wound closure can be achieved, it is critical to debride all devitalized tissue such that there is a healthy viable wound bed. Hence, performing repeat debridement is often necessary. In some cases, debriding the surrounding skin as well as the underlying fat and muscle is required to remove all necrotic tissue. Debridement should continue until healthy tissue is encountered, which can be identified by visual inspection and the presence of punctate bleeding.

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The surgeon must consider several things when deciding between a flap and a graft. The reconstructive ladder may be used as a guide for management in this case. The defect is too large to achieve primary closure. The use of negative pressure wound therapy for such a large wound may be helpful as a temporary measure, but as a method of definitive wound closure would result in healing by secondary intention, scarring, and prolonged wound care. A full-thickness skin graft is not appropriate because of the large size of the defect and the amount of skin graft that would be required. A full-thickness graft would result in a major defect in another part of the body that would require primary closure. A local fasciocutaneous flap for such a large defect would require significant mobilization of tissue, and similarly, would result in a large donor site defect that would require grafting. A free flap is not necessary when there is viable soft tissue in the wound base. There is no exposed bone, tendon, nerves, blood vessels, or significant dead space, which would make a stronger argument for a flap-over-skin graft. Although not provided as an option in this question, the use of biosynthetic materials or dermal matrix tissues has been reported in the literature as an intermediate step to skin grafting, but it is important to consider the necessity of these materials in effecting outcomes in light of the significant cost of using them.

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27. A 35-year-old woman undergoes abdominoplasty and inner thigh liposuction. After the procedure, burning pain radiating down the right anterior thigh is noted. Pain increases when the patient stands and walks. Injury to which of the following nerves is most likely in this patient?

- A) Genitofemoral
- B) Iliohypogastric
- C) Ilioinguinal
- D) Lateral femoral cutaneous
- E) Saphenous

The correct response is Option D.

In several studies of complications of abdominoplasty, the most common nerve injury was to the lateral femoral cutaneous nerve. Symptoms include anterior and lateral thigh burning, tingling, and/or numbness that increase with standing, walking, or hip extension.

The genitofemoral nerve supplies the proximal portion of the thigh about the femoral triangle just lateral to the skin that is innervated by the ilioinguinal nerve. Nerve injury may result from hernia repair, but injury to this nerve is rare.

The ilioinguinal nerve arises from the fusion of T12 and L1 nerve roots and pierces the transversus abdominis and internal oblique muscles. The nerve then supplies sensory branches to supply the pubic symphysis, the superior and medial aspect of the femoral triangle, and either the root of the penis and anterior scrotum in the male or the mons pubis and labia majora in the female. The nerve can be injured in abdominoplasty and other lower abdominal incisions. Symptoms include paresthesia of the skin along the inguinal ligament. The sensation may radiate to the lower abdomen. Pain may be localized to the medial groin, the labia majora or scrotum, and the inner thigh.

The iliohypogastric nerve arises primarily from L1. The distribution of the cutaneous sensation of the iliohypogastric nerve most commonly is a small region just superior to the pubis. The iliohypogastric nerve is rarely injured in isolation. Symptoms include burning pain into the inguinal and suprapubic region.

Saphenous nerve symptoms of entrapment may include a deep aching sensation in the thigh, knee pain, and paresthesia in the cutaneous distribution of the nerve in the leg and foot.

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28. An otherwise healthy 68-year-old man comes to the office because of an enlarging mass over the right ear for the past 30 years. A photograph is shown. He had no prior treatment of the mass. MRI confirms the diagnosis of arteriovenous malformation. In the past 3 months, he had bleeding from the mass requiring hospital admission and blood transfusions. Bleeding is controlled after prolonged direct pressure. Which of the following is the most appropriate management for this lesion?
- A) Corticosteroid therapy
 - B) Laser therapy
 - C) Resection
 - D) Sclerotherapy
 - E) Observation

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The correct response is Option C.

The most appropriate treatment for this lesion is radical resection, with the goal of eradicating the lesion. Although the lesion is prone to recurrence, this approach maximizes the chances for a cure. This patient has recurrent bleeding and is at risk for death due to exsanguination. Observation is not acceptable in this otherwise healthy 68-year-old. Laser therapy is futile as it will only affect superficial dermal structures, and this lesion clearly involves large vessels and deeper tissues. Corticosteroid therapy is appropriate for management of infantile hemangioma but has no role in the treatment of arteriovenous malformations. Sclerotherapy is not indicated in this patient.

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29. A 55-year-old man undergoes microsurgical replantation of an amputated ear. There is venous congestion, and leeches are applied. This patient is at risk for infection by which of the following organisms?

- A) *Actinobacillus lignieresii*
- B) *Aeromonas hydrophila*
- C) *Eikenella corrodens*
- D) *Pasteurella canis*

The correct response is Option B.

Aeromonas hydrophila is an organism present in the leech species *Hirudo medicinalis* gastrointestinal tract that can lead to an infection if used medicinally. In this patient with venous congestion and application of leeches, antibiotic prophylaxis is recommended with fluoroquinolones, tetracycline, or trimethoprim-sulfamethoxazole.

Actinobacillus lignieresii is seen in horse bites, *Pasteurella canis* in dog bites, and *Eikenella corrodens* in human bites.

In a recent review of ear reattachment methods, a variety of approaches have been used including microsurgical reattachment, burying of the part in a subcutaneous pocket, periauricular tissue flaps for coverage of the part, and direct reattachment as a composite graft. Microsurgical replantation is associated with the best aesthetic outcome even if venous anastomosis is not possible and leeching is necessary.

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30. A 32-year-old male athlete sustains a contact burn to the right foot. Serial debridement results in exposure of the medial aspect of the first metatarsophalangeal joint. A photograph is shown. Which of the following is the most appropriate option for definitive wound management?
- A) Amputation of the great toe
 - B) Bony debridement and primary closure
 - C) Coverage with a fasciocutaneous free flap
 - D) Local tissue rearrangement
 - E) Negative pressure wound therapy

The correct response is Option C.

The most appropriate option to obtain definitive wound coverage is a fasciocutaneous free flap harvested from outside the zone of injury. Amputation is not indicated when the majority of the great toe is viable. In addition, this would be highly morbid for this young athlete. Negative pressure wound therapy alone would promote healing by secondary intention, but with an exposed joint this would likely result in an unstable

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wound. Local tissue rearrangement in this area results in marked donor site morbidity. Bony debridement and primary closure may lead to a healed wound, but functional morbidity would be high in this athlete.

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31. A 65-year-old woman has a draining sinus tract at the lower chest 2 weeks after undergoing a cardiac bypass procedure. After extensive debridement, there is a large central defect requiring an omental flap for obliteration of the dead space. Which of the following arteries supplies the omental flap?

- A) Gastroduodenal
- B) Gastroepiploic
- C) Left gastric
- D) Superior epigastric
- E) Superior mesenteric

The correct response is Option B.

The blood supply to the omental flap is through the right and left gastroepiploic arteries.

Understanding the anatomy and blood supply to the omentum is crucial for success in omental flap transfer. The greater omentum is harvested from the transverse colon, as the short gastric vessels are ligated and the gastroepiploic vessels preserved. The omentum can be transposed to the chest through either an opening in the diaphragm or a fascial defect in the abdominal wall.

The left gastric vessels arise from the celiac vessels and supply the lesser curvature of the stomach. The gastroduodenal artery arises from the celiac trunk and provides blood supply to the pylorus and proximal duodenum. One of the terminal branches of the gastroduodenal artery is the right gastroepiploic artery. The superior epigastric artery supplies the rectus abdominis muscle and is not intraperitoneal. The superior mesenteric artery arises from the aorta below the celiac trunk and supplies the lower duodenum through the transverse colon; it does not carry the blood supply necessary for design of an omental flap.

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32. A 35-year-old woman with type 2 diabetes mellitus is evaluated in the emergency department because of severe pain and drainage from the right buttock 36 hours after undergoing bilateral buttock augmentation with autologous fat harvested from the thighs. Temperature is 102.0°F (38.9°C), heart rate is 105 bpm, respiratory rate is 16/min, and blood pressure is 90/60 mmHg. Physical examination of the right buttock shows brawny erythema and drainage of turbid fluid from an injection site. The patient has marked tenderness of the buttock, and the abdomen is nontender. White blood cell count is $18.5 \times 10^9/L$ and serum creatinine concentration is 1.5 mg/dL. After resuscitation, which of the following is the most appropriate next step in management?
- A) CT scan of the abdomen and pelvis
 - B) Inpatient intravenous antibiotic therapy
 - C) Outpatient oral antibiotic therapy
 - D) Surgical exploration of the wound
 - E) Ultrasonography of the buttock

The correct response is Option D.

The most appropriate next step in management is to surgically explore the wound in the operating room. The clinical picture is of a severe, rapidly progressing infection, possibly necrotizing fasciitis. A high index of suspicion and early treatment are vital for successful outcomes. Necrotizing fasciitis is a rare and rapidly progressive infection of the deeper layers of skin and subcutaneous tissues, easily spreading across the superficial fascial plane, with subsequent death of the overlying skin and severe systemic toxicity. Liposuction is the most frequently associated cosmetic surgery with this infection. Signs and symptoms are insidious, nonspecific, or virtually unnoticeable early in the course of the disease. Later, erythema, prominent edema, and induration appear, accompanied by intense or intolerable pain. The clinical picture evolves into systemic toxicity and eventually multiple organ failure. Risk factors for necrotizing fasciitis include diabetes mellitus, immunosuppression, age older than 50 years, malnutrition, and peripheral vascular disease.

There are two forms of the disease: one caused by *Streptococcus pyogenes*, and the other by mixed infections caused by a variety of microbes, including *Escherichia coli*, *Proteus*, *Serratia*, and *Staphylococcus aureus*. The progressive necrosis of the tissues typically involves the superficial fascia and the subcutaneous layer. The extent

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of the gangrene at the fascial layer is typically more severe and greater than at the skin level. This insidious infection is virtually unnoticeable and nonspecific in the first 24 to 48 hours; however, in the following days, an extensive, hardened area appears, which is often dark colored in the center. Intense pain and skin necrosis follow at the level of the infection. Metabolic changes occur, ending with respiratory distress, oliguria, acidosis, increased creatine kinase activity, increased troponin concentrations, and toxic syndrome. Diagnosis and treatment consists of surgical exploration and debridement that reveal necrotic, edematous subcutaneous fat. Bacteriologic analysis of exudate, cultures, and histologic evaluation complete the diagnosis.

Early diagnosis is imperative to avoid a fatal outcome. Because necrotizing fasciitis is a progressive, rapid infection, a staged “second-look” operation and, if necessary, additional debridement should be performed. The mortality rates are high and range from 20 to 70%, but decrease to 4.2% after immediate surgical intervention.

Though antibiotic therapy is an integral part of the treatment, surgical exploration is key. CT scans and ultrasonography will not change the treatment plan and are therefore not the appropriate next step in management.

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33. A 55-year-old woman who is wheelchair-bound has a stage IV ischial pressure ulcer. She has a history of systemic lupus erythematosus and multiple sclerosis. Medications include prednisone and gabapentin. BMI is 21 kg/m² and has been stable for the past year. White blood cell count is $10.5 \times 10^9/L$, hematocrit is 30%, and serum albumin concentration is 3.6 mg/dL. After debridement of nonviable tissue, wound care is instituted. Supplementation with which of the following is most likely to promote wound healing?
- A) Echinacea
 - B) Ferrous gluconate
 - C) Glutamine
 - D) Lipid emulsion
 - E) Vitamin A

The correct response is Option E.

Vitamin A is essential because it promotes epithelialization in collagen synthesis for wound healing, and supplementation is advocated in patients on chronic corticosteroid immunosuppressive medications such as prednisone. A 20,000-IU daily dosage can be useful for wound healing in immunosuppressed or irradiated patients and appears to reverse the wound healing–suppressive effects of the medication.

Patients with chronic wounds frequently have some form of malnutrition that can impede the wound-healing process. In this case, the patient has a serum albumin concentration within the reference ranges, and a stable BMI, signifying adequate protein. In protein-deprived patients, supplementing amino acids that serve as the building blocks of protein synthesis is vital. L-arginine, in particular, has been shown to augment wound healing and collagen production. One study in elderly human subjects found that daily supplementation of 30 g of arginine aspartate for 14 days resulted in markedly enhanced collagen production and total protein.

Ferrous gluconate is a useful supplement in iron deficiency anemia. This patient has borderline anemia, though not of a severity likely to be the central impediment to wound healing. Echinacea is a common herbal supplement used as an immunostimulant but has also been shown to have immunosuppressive effects. Lipid emulsion would be useful in a severely malnourished patient, though in this case, the

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patient's BMI is stable in the normal range. Of note, omega-3 fatty acids appear to inhibit the quality of collagen strength, and avoiding this common supplement during healing may be advisable.

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34. A 73-year-old man is evaluated for a non-healing wound on the medial aspect of the calf. The wound has been present for 8 months, and he has undergone several months of serial debridements and moist wound care without improvement. A photograph is shown. Ten years ago, he was diagnosed with squamous cell carcinoma of the medial calf skin, and the condition was managed solely with radiation therapy. Which of the following is the most appropriate next step in management?
- A) Hyperbaric oxygen therapy
 - B) Negative pressure wound therapy
 - C) Wound biopsy and culture
 - D) Wound debridement and skin graft
 - E) Continued observation and wound care

The correct response is Option C.

Based on the clinical scenario described, wound biopsy and culture is the most appropriate management option. Despite wound debridement and moist wound care, the wound has not improved and is in the region of a previous malignancy. Wound biopsy would allow the diagnosis of recurrent malignancy and aid in the

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determination of further surgical intervention. Wound culture would allow the diagnosis of soft-tissue infection contributing to the wound's persistence.

Although wound debridement would be beneficial in this case, application of a skin graft in the face of possible recurrent malignancy and probable marked radiation injury would be associated with increased risk of delayed wound healing and may delay management of recurrent malignancy. If the wound was attributed only to radiation therapy, a better strategy would be to excise the irradiated soft tissues and cover the whole defect with a well-vascularized flap.

Hyperbaric oxygen therapy has been shown to be beneficial for the management of radiation soft-tissue injury. This therapeutic modality should only be instituted after a complete evaluation of the patient's wound, which would include soft-tissue biopsy because the patient previously had a malignancy in the region.

Complete evaluation of the wound would include pertinent history and physical examination, evaluation of the patient's nutritional status, examination of extremity vascular inflow and outflow, diagnosis and treatment of wound infection, and optimization of wound characteristics.

The patient has already undergone debridement and wound care for several months; therefore, continued observation and wound care would be an inadequate management option.

It is inappropriate to perform negative pressure wound therapy in an irradiated wound without diagnosis by tissue biopsy.

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35. A 50-year-old woman has wound breakdown in the lumbosacral region after spinal instrumentation, as shown in the photograph on the left. The superior aspect is closed with local paraspinal muscle advancement. The lower aspect is closed with a musculocutaneous V-Y advancement flap, as shown in the photograph on the right. Which of the following Mathes/Nahai classifications is most appropriate for this flap?

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

The correct response is Option C.

The Mathes and Nahai classification system is useful for predicting clinical applicability of various muscle and musculocutaneous flaps. With proper knowledge of the location and variation of muscle blood supply, the surgeon can safely determine the extent of muscle transposition during surgery. Five patterns of muscle circulation have been described. These patterns are based on the following relationships between the muscle and its vascular pedicle:

The regional source of the vascular pedicle(s) entering the muscle
Pedicle size

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Number of vascular pedicles
Location of the pedicle in relation to muscle origin and insertion
The angiographic patterns of intramuscular vessels

The gluteal V-Y advancement flap used in the clinical scenario described is a Mathes/Nahai Type III flap. Type III muscle flaps demonstrate two large, independent vascular pedicles arising from separate regional arteries. Other Type III muscles include the rectus abdominis and serratus anterior. Angiographic studies have shown equal filling of the intramuscular vascular system with either pedicle injection. Type III muscle flaps can be based on either pedicle and can be split to preserve muscle function. In this particular ambulatory patient, only the superior half of the gluteal muscle (based on the superior gluteal artery) was used in order to preserve lower gluteal function.

Type I muscles have a single dominant pedicle. Examples include the gastrocnemius, rectus femoris, and tensor fascia lata flaps.

Type II muscle flaps demonstrate one or more large vascular pedicles near the muscle origin and several small pedicles entering the muscle belly distally. Commonly used muscle flaps in this group include the gracilis, soleus, and trapezius. The minor pedicles are typically divided to allow maximal muscle transposition. Division of the minor pedicles typically has little effect on muscle flap survival, but poorly planned musculocutaneous flaps may suffer distal skin ischemia if not planned appropriately. This vascular pattern is the most common pattern observed in anatomical studies of human cadaveric muscle.

Type IV muscles demonstrate segmental vascularization along the entire length of the muscle. The sartorius and tibialis anterior muscles are the most clinically relevant muscles that display this type of pattern. The segmental nature of the blood supply severely limits the ability to transpose these muscles and therefore the utility is limited.

Type V muscles display one dominant vascular pedicle near the muscle origin and multiple segmental pedicles near the muscle insertion. The latissimus and pectoralis major muscles demonstrate this vascular pattern. Angiographic studies demonstrate that the intramuscular vasculature can be supplied by either the dominant or segmental pedicles. As a result, the flaps can be elevated on either vascular system.

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36. A 47-year-old woman is referred by orthopedic surgery for evaluation and discussion of soft-tissue reconstruction at the time of nonvascularized allograft reconstruction of recurrent Achilles tendon rupture. The patient has a history of congenital clubfoot and multiple previous Achilles tendon repairs. Physical examination shows atrophied skin and multiple longitudinal scars along both the medial and lateral distal posterior calf. Which of the following is the most appropriate management?
- A) Cross-leg fasciocutaneous flap
 - B) Fasciocutaneous free flap
 - C) Reverse sural artery flap
 - D) Soleus muscle flap
 - E) Tissue expansion

The correct response is Option B.

On the basis of the scenario described, fasciocutaneous free flap is the most appropriate management option.

The soleus muscle flap is appropriate for defects of the middle third of the leg but lacks adequate reach for soft-tissue coverage of the distal third of the leg.

Tissue expansion has been described for soft-tissue reconstruction of congenital talipes equinovarus but is usually reserved for children and in the setting of primary correction. When comparing tissue expansion in the limb versus non-limb sites, the incidence of complications associated with tissue expansion is significantly higher in the limb. Because a nonvascularized allograft is to be used, and the patient has a contracted and scarred soft-tissue envelope, tissue expansion would be associated with higher risk of expansion failure and complications when compared with free tissue transfer soft-tissue reconstruction.

Cross-leg flaps are rarely used because of the availability of free tissue transfer. This flap is more appropriate in children than elderly patients, in whom stiffness is a factor.

A reverse sural artery flap is not appropriate given the patient's multiple past surgeries and local scars.

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37. A 29-year-old man comes to the office because of scarring 12 weeks after he sustained extensive chemical burns to 30% of the total body surface area. Examination shows thick hypertrophic scarring of the upper extremities and anterior torso. Which of the following is the most appropriate management?

- A) Injection of a corticosteroid
- B) Scar band revision
- C) Serial casting
- D) Topical application of vitamin E
- E) Use of pressure garments

The correct response is Option E.

Compression decreases blood flow to active scars, leading to decreased production of collagen fibers. This results in a balance of collagen synthesis and lysis that produces a flatter, softer, less vascularized scar. Clinically, burn scar hypertrophy is managed by use of pressure garments and inserts that must be worn almost 24 hours per day. They should be initiated as soon as all burn wounds have closed enough to tolerate wear and continued until the burn scar has matured. Initially, the pressure applied is low (15 to 17 mmHg). Then, as the scar progresses in maturation, custom-made pressure garments that provide 24 to 28 mmHg of pressure may be fabricated for the patient.

The prompt institution of splinting techniques after the acute phase of burn injury can limit the development of long-term deformities. Splinting can combat edema, protect exposed structures and balance soft-tissue lengths to prevent contracture formation and compensate for functional deficits. Later, during the remodeling phase, serial casting can be a great adjunct to a therapeutic exercise program to restore normal range of motion. Surgical lengthening and scar band revision are options that are evaluated if hypertrophic scarring and contractures still develop after appropriate rehabilitation and management.

Although the depth and distribution of the injury factor into the development of scars, the patient's own genetic predisposition also plays a role in scar formation and maturation.

Injection of a corticosteroid can improve hypertrophic scars, but its use is limited to

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small, focused areas. Metabolic effects can be considerable. Due to the extent of scarring in this patient, corticosteroids are not an appropriate option.

Although other topically applied therapies, such as creams containing vitamin E, have been widely used with the intent to improve wound healing, there is not substantial evidence to support regular use. Thirty-three percent delayed hypersensitivity reaction can be seen with topical vitamin E.

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38. A 54-year-old woman has onset of ventricular fibrillation and severe hypotension 5 minutes after 30 mL bupivacaine 0.5% is administered to the ankle for postoperative pain control during reconstruction of the foot. After initiation of cardiopulmonary resuscitation, intravenous administration of which of the following is the most appropriate management?
- A) Atropine
 - B) Dantrolene
 - C) Flumazenil
 - D) Lipid emulsion
 - E) Metoprolol

The correct response is Option D.

The most appropriate management of acute bupivacaine toxicity is a bolus and infusion of 20% lipid emulsion. Every facility where local anesthetic is used in large doses should have a lipid rescue kit clearly labeled and available should the need arise. Although lipid rescue mechanism of action is not completely understood, it may be that the added lipid in the bloodstream acts as a “sink,” allowing for the removal of lipophilic toxins from affected tissues. Major local anesthetic toxicity can have such symptoms as sudden loss of consciousness, tonic-clonic seizures, hypertension followed by progressive hypotension, tachycardia, ventricular fibrillation, bradycardia, asystole, and cardiac arrest. Arrhythmias may be refractory to treatment, and resuscitation may be prolonged, sometimes requiring more than 1 hour.

In the event of a local anesthetic toxicity event, airway management, seizure suppression, and, if needed, cardiopulmonary resuscitation should be performed. Alert the nearest facility having cardiopulmonary bypass capability and administer 20% lipid emulsion (values in parentheses are for 70 kg) as follows:

- Bolus 1.5 mL/kg intravenously over 1 minute (~100 mL)
- Continuous infusion 0.25 mL/kg/min (~500 mL over 30 minutes)
- Repeat bolus every 5 minutes for persistent cardiovascular collapse
- Double infusion rate if blood pressure returns but remains decreased
- Continue infusion for a minimum of 30 minutes

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Although beta-adrenergic blockers may be useful in treating the excitatory cardiovascular phase of local anesthetic toxicity, the potential to progress to more advanced phases with myocardial depression and collapse preclude their routine use. In addition to lipid emulsion, the treatment for local anesthetic-induced cardiac toxicity is generally supportive, and may include amrinone, closed-chest cardiac massage, and cardiopulmonary bypass.

Flumazenil is used to reverse the effects of benzodiazepine toxicity.

Dantrolene is administered in the acute treatment of malignant hyperthermia.

Atropine and dopamine are administered as part of the Advanced Cardiac Life Support protocol for bradycardia or asystole and would not be used in the scenario described

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39. A 33-year-old African American woman has a large recurrent keloid of the left earlobe. Reexcision with postoperative radiation therapy is planned. Which of the following is the most likely long-term complication of this therapeutic plan?

- A) Altered pigmentation
- B) Desquamation
- C) Itching
- D) Skin cancer
- E) Telangiectasia

The correct response is Option A.

The patient described has a recurrent keloid after previous excision. Surgery alone has recurrence rates of over 50%, and combination therapies including injection of a corticosteroid, pressure earrings, and surgery can have marked recurrence rates.

For recurrent keloids, post-excision radiation therapy, usually given in one to three fractions, has efficacy rates between 6 and 98%. The most common long-term complications of radiation therapy include hypo- or hyperpigmentation (62%) and telangiectasias (27%). Skin desquamation is an acute reaction to radiation therapy and occurs in 24% of patients. Secondary malignancies after radiation therapy for keloids are very rare. Itching from keloids is usually improved with treatment.

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40. A 24-year-old man is brought to the emergency department after being ejected from a vehicle at high speed. Physical examination shows massive oronasal bleeding and an unstable maxilla. He is hemodynamically unstable, and other sources of marked bleeding have been excluded. Endotracheal intubation is performed. Which of the following is the most appropriate next step in management?
- A) Establishment of mandibulo-maxillary fixation
 - B) Nasendoscopy with bipolar coagulation
 - C) Operative ligation of the external carotid arteries
 - D) Placement of anterior and posterior nasal packing
 - E) Transcatheter embolization

The correct response is Option D.

After establishing an airway, the best first step to controlling massive oronasal hemorrhage is nasal packing. This can be quickly accomplished by inflating Foley catheters in the posterior choanae, followed by anterior packing with either a nasal tampon or ribbon gauze. Nasal packing has been shown to control bleeding in 29% of such patients and decrease it in another 44% of patients.

Establishment of mandibulo-maxillary fixation (MMF) may also control oronasal hemorrhage. However, achieving MMF in the emergency department is often limited by the availability of fixation devices and is complicated by the presence of an endotracheal tube.

Emergent transcatheter arterial embolization, when available, is highly effective in identifying and controlling oronasal hemorrhage when packing has failed to do so. The internal maxillary and superficial temporal arteries are most often responsible for such bleeding.

Operative ligation of the external carotid arteries is rarely effective to control oronasal hemorrhage due to rich collateral blood flow in the head and neck.

The utility of nasendoscopy is limited in the presence of marked bleeding as visualization is poor and the bleeding vessel may not be readily visible.

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41. A 48-year-old woman had delayed microsurgical breast reconstruction. Two hours after surgery, the patient has swelling of the breast and increased drain output. On examination at the bedside, the flap appears purple with capillary refill time of 1 second. Heart rate is 70 bpm, blood pressure is 110/60 mmHg, and most recent hematocrit is 28%. An arterial signal is identified in the skin paddle with a handheld Doppler. Which of the following is the most appropriate next step in management?
- A) Application of nitroglycerin paste
 - B) Operative reexploration
 - C) Pinprick of the flap
 - D) Placement of leeches
 - E) Streptokinase therapy

The correct response is Option B.

The patient described has venous insufficiency after microsurgery and the next step in management is emergent reexploration in the operating room.

Multiple studies confirm that earlier reexploration improves flap salvage rates. The rate of reexploration ranges from 6 to 14%; in these cases, the flap salvage rate ranges from 36 to 94%. Time of return to the operating room is associated with flap salvage. The majority of microvascular complications occur in the first 48 hours, and the majority of these complications are due to venous thrombosis. Common presenting signs include a purple or blue skin discoloration, brisk capillary refill, edema, oozing, or hematoma.

Release of sutures and pinprick of a flap and application of nitroglycerin paste can improve venous congestion in pedicled flaps, but do not obviate the need for reexploration in a microsurgical flap. Placement of leeches is a salvage option and often used when intraoperative maneuvers are unsuccessful. Streptokinase has been described for use in cases where a clot is found within the vascular system, but this should be reserved for use during reexploration, not before.

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42. A 55-year-old woman is evaluated for a biopsy-proven squamous cell carcinoma of the right preauricular area measuring 2.1 cm in diameter. She is otherwise healthy. Which of the following is the most appropriate next step in management?

- A) Electrodesiccation of the lesion
- B) Excision of the lesion with frozen sections
- C) Excision with a 2-mm margin
- D) Excision with a 4-mm margin
- E) Topical application of 5% fluorouracil

The correct response is Option B.

Successful local treatment of squamous cell carcinoma of the skin depends significantly on whether the tumors are at high or low risk for the complications of recurrence and metastasis. The external ear, lips, nose, and scalp appear to be high-risk locations for squamous cell carcinoma of the skin.

Squamous cell carcinomas of the skin larger than 2 cm are twice as likely to recur locally and three times as likely to metastasize than tumors that are less than 2 cm in diameter.

Frozen intraoperative examination of specimen edges can be used to judge thoroughness of excision before closure. Frozen sections of margins are recommended for high-risk squamous cell carcinoma and basal cell carcinoma in high-risk areas, lesions more than 2 cm, and any morpheaform basal cell carcinoma.

Electrodesiccation has excellent cure rates in small, low-risk squamous cell carcinoma of the skin.

Topical application of 5% fluorouracil has a role in the treatment of diffuse actinic keratoses of the face.

Surgical excision is subdivided into excision with standard margins, excision with frozen-section margin evaluation, and Mohs micrographic surgery. For low-risk non-melanoma skin cancers extending into the dermis only, excision with standard margins (4 mm for basal cell carcinoma) is the usual treatment. Adequate margins of 4 mm for low-risk squamous cell carcinoma and 6 mm for high-risk squamous cell

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carcinoma have been demonstrated by direct tumor extension from the clinical margin but are not necessarily an estimate of cure rate.

Squamous cell carcinomas are slower to invade deeper tissue than are cutaneous malignant melanomas.

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43. Which of the following thickens when a tissue expander is placed and inflated?

- A) Dermis
- B) Epidermis
- C) Fat
- D) Muscle

The correct response is Option B.

Data have shown that there are predictable changes that occur to the layers of the skin and soft tissue in response to tissue expansion. Of all the layers listed, only the epidermis displays an increased thickness as a result of tissue expansion. Specifically, the epidermis becomes thicker through a process of hyperkeratosis. There is also narrowing of intercellular spaces and an increase in mitotic activity. The dermis actually thins up to 50% with fragmentation of the elastin fibers and flattening of dermal papillae. Sweat glands and hair follicles drift farther apart. Muscle decreases in both thickness and mass, although its function remains unchanged. Fat thins with some permanent loss of total fat mass. In cases of aggressive expansion, fat necrosis and fibrosis may also occur.

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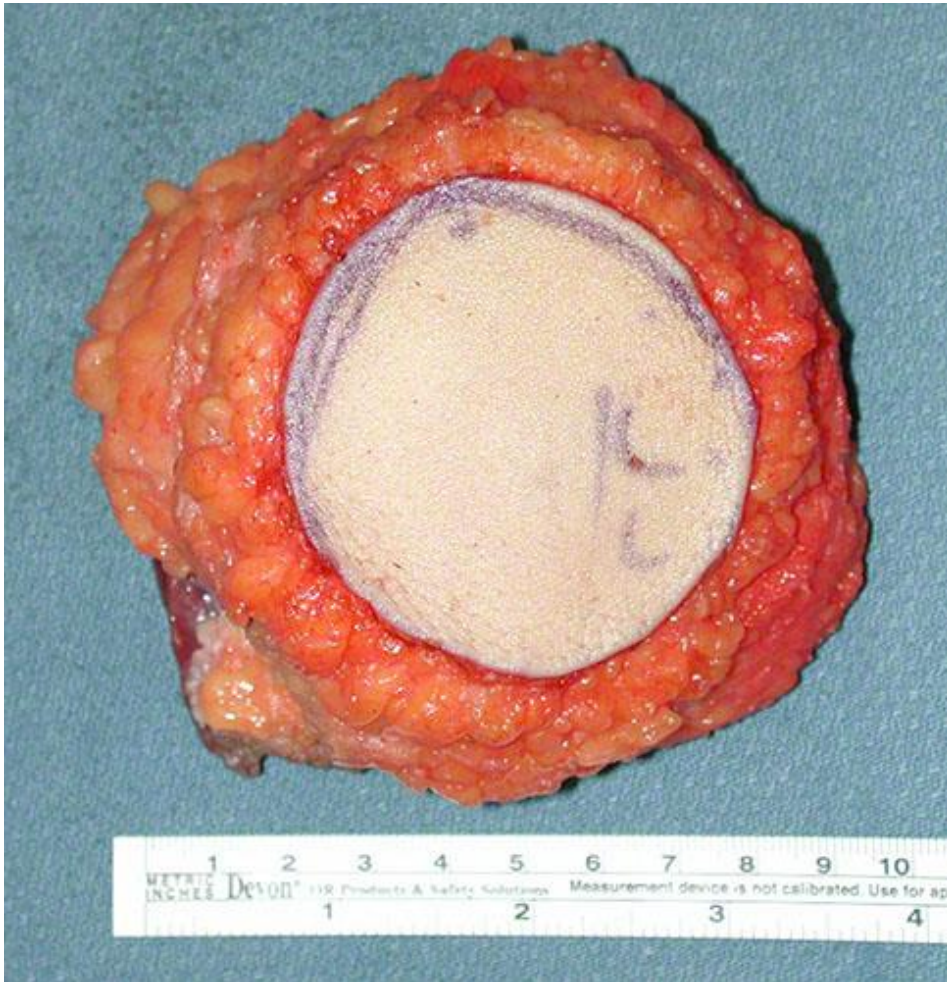


(Please note that this pictorial appears in color in the online examination)

44. A 29-year-old woman comes to the office because of a firm, mildly tender, well-circumscribed mass of the abdomen. A photograph is shown. The mass has been slowly increasing in size for the past 6 months. CT scan shows a mass that occupies the left musculofascial abdominal wall, including the rectus, external, and internal oblique muscles, and penetrates through the anterior rectus sheath. Which of the following is the most appropriate management?
- A) Neoadjuvant chemotherapy
 - B) Radiation therapy
 - C) Wide local excision, bilateral component separation, adjuvant chemotherapy
 - D) Wide local excision, mesh placement, radiation therapy
 - E) Wide local excision, right component separation, mesh reinforcement

The correct response is Option E.

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

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

If midline fascia can be reapproximated, it should be, as primary fascial closure is associated with the lowest hernia recurrence rates. Reinforcement with mesh

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has been prospectively demonstrated to reduce recurrence rates even further, especially in defects over 4 cm. If midline fascial reapproximation is not possible, reduction in the size of the defect is crucial to decrease recurrence rates. This is done by component separation. However, in this case, only a right component separation is possible, given that the tumor has invaded the left rectus muscle and obliques, precluding their use for myofascial advancement. If the obliques had been spared, a component separation could still have been attempted even if there were violation of the rectus. The most durable reconstruction would be achieved if midline fascial reapproximation were possible with mesh reinforcement. Second best would be reduction in the size of the defect with a right component separation and placement of mesh as a bridging underlay.

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

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45. An otherwise healthy 38-year-old woman undergoes prophylactic bilateral mastectomy and immediate reconstruction with deep inferior epigastric artery perforator (DIEP) free flaps. Intraoperatively, the left DIEP flap appears congested before the conclusion of the case. The left deep inferior epigastric artery and vein (DIEA and DIEV) were anastomosed to the proximal internal mammary vessels. The vascular pedicle is evaluated and each anastomosis appears patent and not kinked; however, the venous congestion persists. Which of the following is the most appropriate management?
- A) Anastomose the superficial inferior epigastric vein to an internal mammary vessel perforator
 - B) Convert to left prosthetic reconstruction
 - C) Infuse tissue plasminogen activator (tPA) to the DIEA
 - D) Initiate leech therapy
 - E) Revise the DIEV anastomosis to the retrograde internal mammary vessel limb

The correct response is Option A.

Venous drainage of the lower abdominal skin and subcutaneous tissue occurs primarily through the superficial venous system and secondarily through the deep venous system, with perforating veins interconnecting the two systems. These communicating veins have been identified on computed tomography angiography in approximately 90% of abdominal walls in vivo. The majority of the remaining 10% of patients likely have communicating veins that are too small to visualize or are absent. In these cases of anatomical superficial venous system dominance, venous drainage is dependent on the superficial venous system. A recently published 2012 article by Sbitany et al. demonstrated that the incidence of intraoperative venous congestion secondary to persistent superficial venous system dominance was 0.9% in 1201 muscle-sparing transverse rectus abdominis musculocutaneous and deep inferior epigastric artery perforator free flaps. A free flap that becomes congested after reperfusion in the operating room should be assessed immediately for possible etiologies including twisting, kinking, tension, or vasospasm of the vascular pedicle. If a technical problem is ruled out and the venous anastomosis remains patent, obligatory enhancement of venous drainage with the superficial venous system is necessary to salvage the free flap rather than revision of the original anastomosis. Various methods include an anastomosis of the superficial inferior epigastric vein

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(SIEV) to the DIEV system or any chest wall vein, including the retrograde limb of the internal mammary vessel, the branch of the internal mammary vessel, or the thoracodorsal system. This requires preemptive planning and sparing of the superficial epigastric vein or SIEV during the dissection of the flap. A vein graft can be utilized if additional length is necessary. Another option is to substitute the DIEV anastomosis with the SIEV.

Tissue plasminogen activator (tPA) would not be indicated in this scenario, as it is used as a thrombolytic and there is no evidence of vascular thrombosis. Revising the DIEV anastomosis would be moot because it is patent and the deep system is being drained. Leech therapy is useful for venous congestion, but primarily as an adjunct after potential surgical etiologies have been addressed. Sacrificing the free flap without first attempting salvage is not warranted, and using a prosthetic would be possible only if prior patient consent were obtained.

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46. A 67-year-old man with a large lentigo maligna on the left cheek comes to the office for closure after undergoing excision. Which of the following steps is most appropriate for the surgeon prior to performing a cervical-facial rotation flap?
- A) Await permanent pathology results
 - B) Confirm negative margins by Mohs micrographic surgery
 - C) Evaluate the margins clinically with a Wood lamp
 - D) Perform confocal microscopy
 - E) Refer the patient for sentinel node biopsy

The correct response is Option A.

Lentigo maligna is a slow-growing lesion with a substantial radial growth pattern before progressing to invasion in most cases. These lesions often occur in the head and neck region of older patients with a history of sun exposure. Clinical occurrence is variable, but many appear as irregular, sometimes extensive, pigmented patches on the face. Staging of these lesions follows the American Joint Committee on Cancer guidelines, and prognosis is based on depth of invasion. Need for sentinel node biopsy is based on staging and is independent of resection size.

Wide local excision of the lesion is the current standard of care, but the surgical margin for successful excision remains controversial. Alternative techniques have been investigated to improve the 8 to 20% recurrence rates associated with standard excision with 5-mm margins. Mohs micrographic surgery shows promise in the treatment of this disease, but there remains difficulty in interpretation of melanocyte proliferation on frozen section, leading to the proposal of modifications of the procedure, including sending the final Mohs margins for rush permanent section evaluation for verification of clear margins, the so-called “slow Mohs.”

Clinical evaluation of margins with Wood lamp may be useful in evaluating the clinical extent of the lesion but is not adequate for determination of surgical margins. Confocal microscopy is a new technique that allows examination of melanocytes without biopsy. This modality may be useful in diagnosis of lentigo maligna, but availability is currently limited and requires training in interpretation of images.

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47. A 60-year-old woman with breast cancer undergoes a transverse rectus abdominis musculocutaneous flap breast reconstruction after mastectomy. She has no allergies. Weight is 200 lb (91 kg). Estimated blood loss is 200 mL. Duration of the operation is 3 hours and 50 minutes. Administration of cefazolin before skin incision is planned as prophylaxis against surgical site infection. Which of the following is the most appropriate dosage and timing of this injection?

	Dose	Timing	Redosing
A)	1 g	5 minutes prior	after 150 mL of blood loss
B)	1 g	15 minutes prior	no
C)	1 g	40 minutes prior	no
D)	2 g	15 minutes prior	no
E)	2 g	40 minutes prior	no

The correct response is Option E.

There has been a renewed interest in perioperative antibiotics in recent years toward more appropriate use to decrease surgical site infection (SSI) while decreasing the incidence of resistant bacteria.

Current recommendations are to administer a single perioperative dose of antibiotics against common skin flora (gram positive), usually using a first-generation cephalosporin. However, the following recommendations may be underappreciated:

Cefazolin intravenous: 1 g if <80 kg; 2 g if >80 kg
Alternatives: clindamycin 600 to 900 mg intravenously; vancomycin 1 to 1.5 g intravenously

In this case, the patient weighs 200 lb (91 kg), so 2 g of cefazolin is the recommended dosage.

Additionally, an important factor is the timing of the administration of the perioperative

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antibiotics in order to achieve proper skin levels before incision. In one study by Classen et al., published in the *New England Journal of Medicine* in 1992, the optimal time was between 2 hours before the operation and skin incision, as greater than 2 hours before and any time after skin incision led to marked increases in the relative risk of SSIs. A follow-up by Weber et al. in 2008 narrowed the most appropriate window to between 30 and 59 minutes before skin incision.

Finally, there is the issue of redosing. Current recommendations are to redose if there is excessive blood loss (>1500 mL) or if there are long procedures where one exceeds the half-life of the antibiotic used.

In the clinical scenario described, the most appropriate choice is 2 g of cefazolin, because the patient's weight is above 80 kg, administered between 30 to 59 minutes before skin incision. Redosing on the basis of blood loss is unnecessary, although one could consider redosing at approximately 4 hours on the basis of half-life.

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48. A 47-year-old man with complete T12 paraplegia presents with a 5 × 5 × 4-cm stage IV sacral pressure ulcer. Physical examination shows the wound is clean with granulation tissue. Coverage with a local tissue flap is planned. In designing the flap, careful consideration must be made regarding which of the following?
- A) Avoiding incisions near the anus to minimize bacterial contamination
 - B) Confining scar to a cosmetically acceptable location
 - C) Designing incisions allowing for future re-advancement
 - D) Localizing individual perforators
 - E) Preserving sensory innervation

The correct response is Option C.

A systematic review of the literature was performed by Sameem et al., to determine the relative efficacy of musculocutaneous versus fasciocutaneous versus perforator flaps in the treatment of pressure ulcers. In their analysis, they concluded that all flaps had a significant recurrence and complication rate; however, there was no difference between the types of flaps used. Their paper did not specifically address the issue of how patients' conditions were subsequently managed when they did develop a recurrence. This is important, because a key surgical strategy is to consider the need for subsequent surgical procedures; in fact, perhaps more critical than the composition of the flap and the nature of its blood supply is the design of the flap and where the incisions are planned. A fundamental principle in surgical management of pressure ulcers is being able to provide healthy vascularized tissue into the wound bed and to completely obliterate dead space. Furthermore, the flap should be designed such that if a recurrence develops, the patient continues to have surgical options available, such as re-advancement or re-rotation of the prior flap(s).

Preservation of sensory innervation is important for patients who still have sensation in this area. However, in patients who are completely paraplegic, there is a lack of adequate sensory innervation and a lack of the ability to ambulate, which is what ultimately leads to the development of pressure ulcers.

Confining the scar to a cosmetically acceptable location is not a major priority in managing pressure ulcers. The cosmetic appearance of scars in this area is relatively unimportant in light of the presence of an open wound.

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Localizing individual perforators is not necessary when large rotation or advancement flaps are designed. In those situations, a broad blood supply is maintained, and multiple perforators are typically kept intact and do not require individual localization or dissection. However, it is important when a single perforator flap is being designed. Perforator flaps when used as pedicle flaps may be more prone to venous congestion and slightly higher complication rates due to the delicate dissection and isolation of the sole blood supply, which in turn is more prone to mechanical twisting and kinking. Perforator flaps ideally preserve the muscular function of the donor site, which may not be important in a patient who is paraplegic.

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49. A 55-year-old woman with a BMI of 32 kg/m² comes to the office with advanced hidradenitis suppurativa of the groin, lower abdomen, and upper thigh. Which of the following treatments is most likely to have the greatest likelihood of success in this patient?

- A) Antibiotics and excision
- B) Antibiotics and percutaneous drainage
- C) Clindamycin irrigation
- D) Intralesional injection of a corticosteroid
- E) Sclerotherapy

The correct response is Option A.

Percutaneous drainage of hidradenitis suppurativa pustule and fistula tracts, although a plausible short-term fix to address the immediate symptoms, does little to ensure long-term resolution of this very difficult clinical entity with marked impact on quality of life. Addition of topical antibiotic washes or oral antibiotics to percutaneous drainage had no significant effect on long-term recurrence rates.

Hidradenitis suppurativa is a recurrent inflammatory disease of the apocrine glands. It initially develops from follicular occlusion with subsequent abscess, inflammation, fistulas, sinus tracts, and scarring. The sites most commonly affected are the intertrigonal regions such as the axilla, groin, and genital/anal region; although, it can also affect the breasts, hips, and thighs. Women are affected three times as often as men.

Initial treatment involves local wound care and antibiotic therapy. For advanced disease, this may be followed by excision of the area of high-density apocrine glands with minimal undermining and direct closure at the site of the hidradenitis wound. At the site of inadequate resection of an area of infected glands, or if there is a recurrence, radical resection yields the best long-term result. Skin grafting and fasciocutaneous and musculocutaneous flaps have been described to cover the excisional defect. The musculocutaneous flap has been reported to be a valid option for managing infected lesions because of the abundant blood supply. Delayed secondary wound closure, with or without vacuum-assisted closure or skin substitutes, has also shown plausible outcomes.

Sclerotherapy has no role in treatment of hidradenitis suppurativa.

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50. A 67-year-old man undergoes excision of a squamous cell carcinoma from the tip of his nose. The patient's daughter, who is a physician, asks for the pathology results. Which of the following is the most appropriate response?

- A) Ask the patient's daughter to provide proof of her medical licensure
- B) Have the patient's daughter complete a medical records release form
- C) Obtain the patient's consent to release the results to his daughter
- D) Refer the patient's daughter to the pathology lab
- E) Release the pathology results to the patient's daughter

The correct response is Option C.

According to the Health Information Portability and Accountability Act (HIPAA) of 1996, it is a violation to provide personal health information about a patient without the patient's expressed consent. Consent is ideally documented in the medical record and signed by the patient. According to HIPAA, there are specific Permitted Uses and Disclosures. A physician is "permitted, but not required, to use and disclose protected health information, without an individual's authorization, for the following purposes or situations: 1) To the Individual (unless required for access or accounting of disclosures); 2) Treatment, Payment, and Health Care Operations; 3) Opportunity to Agree or Object; 4) Incident to an otherwise permitted use and disclosure; 5) Public Interest and Benefit Activities; and 6) Limited Data Set for the purposes of research, public health or health care operations. Covered entities may rely on professional ethics and best judgments in deciding which of these permissive uses and disclosures to make." Treatment is the provision, coordination, or management of health care and related services for an individual by one or more health care providers, including consultation between providers regarding a patient and referral of a patient by one provider to another.

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Section 2: Hand and Lower Extremity

51. A 29-year-old man undergoes open reduction and internal fixation of an open fracture of the proximal right tibia. There is no tissue loss, and there is little wound contamination. The wound is closed with 2-cm raised flaps. Reconstruction of the popliteal artery is required. Which of the following Gustilo fracture classifications is most likely in this patient?
- A) I
 - B) II
 - C) IIIA
 - D) IIIB
 - E) IIIC

The correct response is Option E.

Gustilo initially classified long-bone fractures into three types in order to establish a treatment algorithm. Essentially, this classification subdivided fractures according to the energy of the initial trauma that resulted in significant soft-tissue injury, periosteal stripping, and fracture comminution in the worst subtype. Debridement, antibiotics, and primary or delayed wound closure were advocated dependent on fracture severity. Type III fractures were subsequently subdivided into A, B, and C subtypes. Subtypes were stratified according to potential for complications such as infection, osteomyelitis, non-union, and amputation rates. Type IIIC had open fracture with arterial injury requiring repair (the case in this patient, even though there appears to be adequate soft-tissue coverage).

Although fracture fixation methods have substantially improved since the original publications of Gustilo, the ability to transport bone into segmental traumatic defects has also since developed, and free flaps have extended our ability to cover large wounds. This classification system has stood the test of time and still forms the basis of prognosticating and determining the optimum treatment algorithm.

The Gustilo grading scale:

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Type	Findings
I	Clean wound bed, simple/minimally comminuted bone injury, wound <1 cm
II	Wound contaminated, moderate comminution of bone, wound >1 cm
IIIA	Wound highly contaminated, severe comminution, wound 1 to 10 cm
IIIB	Wound highly contaminated, severe comminution, wound >10 cm
IIIC	Major vascular injury requiring repair for limb salvage

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52. A 32-year-old woman comes to the office for evaluation because of numbness of the left little finger 3 months after undergoing repair of a laceration of the left wrist sustained during an unsuccessful suicide attempt. Physical examination shows a healed laceration with a dysesthetic scar at the proximal wrist crease. A strong Tinel sign is present at the repair site. There is complete sensory loss of the little finger and no evidence of clawing. Motor function is intact. Wartenberg sign is absent. Two-point discrimination is greater than 15 mm. Which of the following is the most appropriate next step?
- A) Microdissect the neuroma and identify motor fascicles with electrostimulation
 - B) Microdissect the neuroma and sural nerve graft fascicles
 - C) Resect the neuroma and direct repair with transposition
 - D) Resect the neuroma and repair with sural nerve grafts

The correct response is Option A.

The patient described has an ulnar neuroma-in-continuity with intact motor function and no sensory regeneration. Mackinnon has described an electrostimulation technique where the proximal motor fibers are identified using nerve stimulation.

Resection of the neuroma, with or without transposition, is not appropriate because it would cause damage to intact nerve fascicles. Microdissection without nerve stimulation would also cause damage to intact fascicles.

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53. A 1-month-old male newborn is brought to the office by his parents for evaluation of complete simple syndactyly between the second and third toes of the left foot. The parents are concerned about the newborn's development and ability to achieve normal ambulation. Which of the following is the most appropriate intervention at this time?
- A) Surgical correction is optional but not necessary because there is no functional deficit
 - B) Surgical correction with a dorsal local flap and ligament reconstruction
 - C) Surgical correction with a dorsal local flap only
 - D) Surgical correction with a dorsal local flap, skin grafting, and ligament reconstruction
 - E) Surgical correction with skin grafting only

The correct response is Option A.

Syndactyly of the toes most commonly affects the second and third digits of the lower extremities. Various levels of webbing are possible, from partial to complete. In general, syndactyly is a condition that is primarily cosmetic and rarely requires treatment. If surgery is desired, it should be postponed until the child is old enough to take part in the decision-making process. Surgery is often performed to avoid emotional and psychological problems.

Surgical correction most commonly consists of a dorsal rectangular flap and simultaneous full-thickness or split-thickness skin grafts. However, some surgeons are performing syndactyly repair of both the upper and lower extremities with dorsal local flaps and allowing the skin defects to epithelialize in order to avoid donor-site morbidity of a skin graft. If there is only soft-tissue involvement, ligament reconstruction is not needed.

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

54. A 48-year-old woman comes for evaluation because of a 6-month history of an increasing mass on the right ring finger. She reports that a similar mass was removed from this location 2 years ago. Medical records show that the mass was solid and of a variegated tan-brown color. The pathology report identified foamy histiocytes and hemosiderin deposits. Physical examination today shows a firm, well-demarcated mass on the dorsal-ulnar aspect of the ring finger proximal phalanx. Skin is not adherent to the mass. A photograph is shown. This patient is at increased risk for which of the following?
- A) Compromise of blood flow to the finger
 - B) Invasion of the underlying bone
 - C) Local recurrence or extension
 - D) Metastasis to the liver
 - E) Spread to the regional lymph nodes

The correct response is Option C.

This is a giant cell tumor of the tendon sheath.

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Ganglion cysts are the most common tumor of the hand, but are cystic in character. Giant cell tumor of the tendon sheath (also called localized nodular synovitis, fibrous xanthoma, and pigmented villonodular tenosynovitis) is the second most common tumor, but it is the most common solid tumor affecting the hand. The hemosiderin deposits give the tumor its variable tan-brown appearance.

This tumor is noted to recur locally, particularly if incompletely excised. Giant cell tumors are not known to metastasize either distantly or to regional lymphatics. Whereas giant cell tumor of bone involves the bone itself, giant cell tumor of tendon sheath does not. This tumor is not known to invade or compromise the digital vessels and thus would not compromise blood flow to the digit.

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55. A 21-year-old man is brought to the emergency department 6 hours after he reportedly fell asleep on his right arm after ingesting a large amount of narcotics and alcohol. On examination, the arm is warm, swollen, and tense to palpation. Physical examination shows no sensation or movement of the fingers, wrist, or forearm. After initiating resuscitation, which of the following is the most appropriate next step in management?
- A) Angiography
 - B) Decompression fasciotomies
 - C) Discharge with follow-up
 - D) MRI
 - E) Observation and elevation

The correct response is Option B.

The patient described is presenting with the signs and symptoms consistent with compartment syndrome of the upper extremity. It is still early in the process but time is running out on being able to save muscle and function. The patient must be resuscitated and is likely intravascularly depleted. Of the options presented, the next best option would be to take the patient to the operating room for exploration and decompression of the arm, forearm, and possibly hand. While compartment pressures could be helpful, with this clinical picture, it is important to make a clinical diagnosis and move forward with treatment. Observation might be indicated if there were a delayed presentation in which there is the theoretical risk of increasing infection without restoring function. However, one should typically err on the side of decompression in the hope of saving muscle and function.

Imaging studies are not indicated for compartment syndrome.

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56. A 57-year-old right-hand–dominant woman with rheumatoid arthritis presents with 10/10 pain of the right thumb that is preventing her from painting, her primary activity. X-ray study shows rheumatoid changes in multiple joints; right thumb carpometacarpal (CMC) joint is consistent with Eaton stage 3-4 disease. On physical examination, the right thumb metacarpal base is prominent. Grind test result is positive. Which of the following is the most appropriate management to help this patient resume her normal activities?
- A) Arthrodesis of the thumb CMC joint
 - B) Pyrocarbon implant arthroplasty of the thumb CMC joint
 - C) Referral to a rheumatologist for infliximab
 - D) Regimen of splinting, rest, and ibuprofen 800 mg 3 times daily
 - E) Trapeziectomy with ligament reconstruction and tendon interposition

The correct response is Option E.

The patient described has a severe case of thumb carpometacarpal (CMC) joint arthritis keeping her from doing her activities of daily living. Given the severity of her disease, splinting, rest, and anti-inflammatory medications may temporize the problem, but will likely not provide her the degree of symptomatic improvement to allow her to return to her desired activities.

Trapeziectomy with ligament reconstruction and tendon interposition is a good option for this patient, since she clearly has advanced CMC disease and seeks function requiring minimal strength with preservation of mobility postoperatively. If she were a laborer or needed significant grip strength, this option would be less acceptable.

Infliximab (Remicade) is a reasonable option when multiple joints are significantly involved. Because this patient primarily has single joint disease, the systemic side effects of infliximab, most commonly infections and rarely malignancy, do not justify its use in this patient.

Arthrodesis would eliminate this patient's pain, but it would also limit thumb mobility, potentially negatively affecting her fine-motor work. Fusion of that joint would make opposition difficult and may alter the way she holds her paintbrush. Although FDA approved, thumb CMC silicone implants are inferior to trapeziectomy with ligament reconstruction and tendon interposition.

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Pyrocarbon implant arthroplasty is intended for patients with osteoarthritis but does not provide the soft-tissue stability required in this patient.

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57. A 16-year-old boy is brought to the office after “jamming” the right long finger of the dominant hand while playing football. Upon active extension, the patient exhibits an extension lag of 40 degrees at the proximal interphalangeal (PIP) joint, and hyperextension at the distal interphalangeal (DIP) joint. Which of the following is the most likely diagnosis?

- A) Central slip disruption
- B) Flexor digitorum profundus avulsion
- C) PIP volar plate tear
- D) Sagittal band rupture
- E) Swan neck deformity

The correct response is Option A.

This is the basis of the Elson test for central slip disruption of the extensor mechanism of the finger. When the proximal interphalangeal (PIP) joint is maximally passively flexed, the central slip is normally pulled distally, resulting in slack in the terminal tendon. Injury to the central slip eliminates this slack through the lateral band and allows extensor tension to be generated at the distal interphalangeal (DIP) joint. Thus, with central slip injury, the DIP joint can be actively extended with maximal PIP flexion.

Swan neck deformity results from terminal extensor tendon disruption and total inability to extend the DIP joint independent of PIP position. Flexor digitorum profundus (FDP) avulsion results in inability to flex the DIP joint. In the Elson test, DIP flexion is always possible. PIP volar plate injury may result in jamming of the volar plate within the PIP joint and paradoxical inability to flex (extension contracture) at the PIP joint. There will also be hyperextension PIP joint pain and laxity. Sagittal band disruption results in inability to actively extend at the metacarpophalangeal joint, but the finger can often maintain extension if passively placed in this position.

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58. A 57-year-old man comes to the office 4 weeks after undergoing a free osseocutaneous fibula flap. He says he has pain with walking. A photograph is shown. X-ray studies show 6 cm of fibular bone remains proximally and distally. Sensation of the right foot shows no abnormalities; pain is noted on plantar flexion. Which of the following is the most appropriate next step in management?
- A) Cast immobilization of the lower extremity (above the knee)
 - B) Cast immobilization of the lower extremity (below the knee)
 - C) Operative exploration and bone grafting
 - D) Operative exploration and nerve grafting
 - E) Reassurance that the pain is self-limiting

The correct response is Option E.

Vascularized bone flap is typically needed for defects >6 cm regardless of location in the body. The fibula is a common donor for vascularized bone. Understanding the postoperative course and complications is needed both in terms of discussions with the patient preoperatively and management of the patient's condition after surgery. Common sequelae of fibula harvest include pain in the leg (especially when walking). Four weeks is relatively early in the postoperative course and reassurance should be given.

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Risks of fibula harvest include damage to the peroneal nerve (increased when <6 cm of bone is left behind or when the head of the fibula is included in the harvest); destabilization of the ankle (increased when <6 cm of bone is left behind); and damage to the posterior tibial nerve.

A free-fibular flap design with hash marks left intact is shown.



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59. A 17-year-old boy is brought to the emergency department 5 hours after he sustained a stab wound to the left dorsal forearm. On physical examination, he is unable to extend the thumb and metacarpophalangeal joints. Exploration of the wound for repair of a presumed nerve injury is planned. Proper exposure of the nerve is between which of the following muscle groups?
- A) Brachialis and triceps
 - B) Brachioradialis and extensor carpi radialis longus (ECRL)
 - C) Extensor carpi radialis brevis (ECRB) and ECRL
 - D) Extensor digitorum communis and ECRB
 - E) Flexor carpi radialis and pronator teres

The correct response is Option D.

Inability to extend the thumb and metacarpophalangeal joints generally suggests an injury to the radial nerve. Wrist extension can be preserved because of the preservation of the extensor carpi radialis longus muscle innervation. In the forearm, the radial nerve can be best approached directly between the extensor digitorum communis and the extensor carpi radialis brevis muscles. The approach between the brachialis and triceps muscles can identify the radial nerve in the upper arm. The interval between the flexor carpi radialis and pronator teres approaches the median nerve.

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60. A 20-year-old man comes for evaluation 9 months after sustaining a stab wound to the left proximal upper arm. He did not seek medical attention at the time of the injury. Physical examination shows that he is unable to flex the left elbow with the forearm supinated. He is insensate to the lateral aspect of the upper arm and forearm. In addition to the ulnar nerve transfer to the biceps, which of the following nerve transfers is most appropriate to address this patient's motor deficit?
- A) Median nerve to brachialis
 - B) Musculocutaneous nerve to brachioradialis
 - C) Posterior interosseous nerve to triceps
 - D) Radial nerve to pronator teres
 - E) Ulnar nerve to flexor carpi radialis

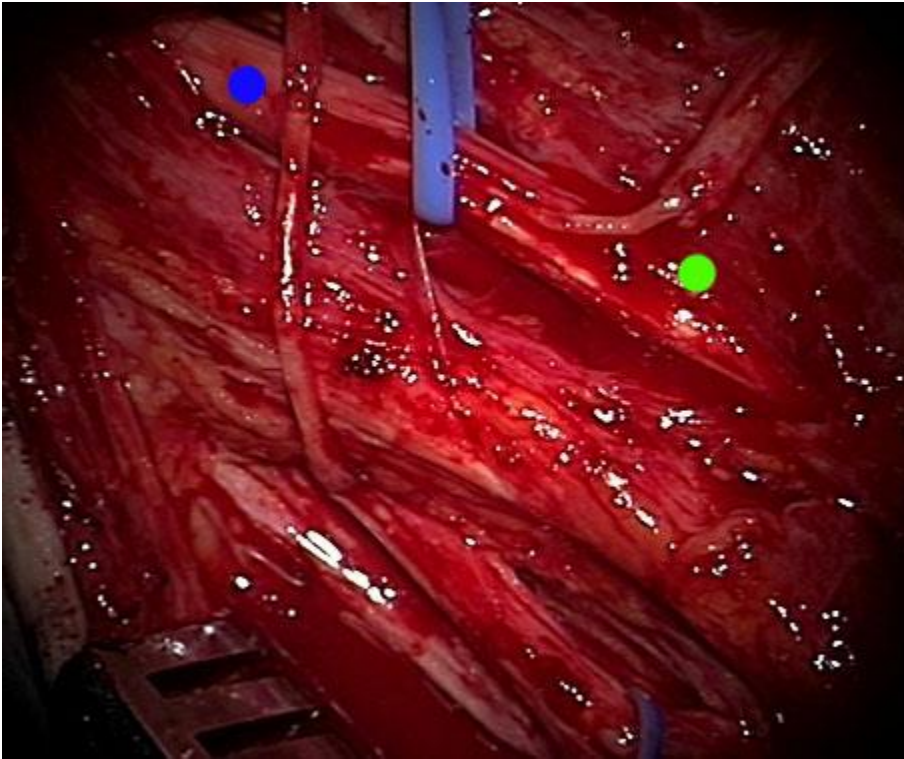
The correct response is Option A.

The patient described has sustained a laceration of the musculocutaneous nerve. With this injury, the patient would be able to flex the elbow with the forearm in a pronated position using the brachioradialis, which is innervated by the radial nerve.

Due to the proximal level and amount of time that has passed since the injury, repair with grafting of the musculocutaneous nerve may not be advisable as the axons may not reach the motor end plates of the biceps and brachialis muscles before degeneration.

Use of fascicles from the median nerve, ulnar nerve, and both nerves has been described to restore elbow flexion. Fascicles are transferred distally in the upper arm directly to the nerve branch to the brachialis and/or biceps muscle. Distal coaptation allows donor axons to reach the target muscles more rapidly, and is more appropriate for this patient whose status is nearly 1 year post injury. A fascicle from the ulnar nerve was transferred to the nerve to the biceps (blue dot) and a fascicle from the median nerve was transferred to the nerve to the brachialis (green dot).

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The musculocutaneous nerve is injured and cannot be used as a donor. The posterior interosseous nerve does not branch off the radial nerve until distal to the elbow; it would not be able to reach proximal enough to coapt to the nerve to the brachialis or biceps. The pronator teres does not flex the elbow; the median nerve is not injured. The flexor carpi radialis does not flex the elbow; the median nerve is not injured.

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61. A 3-year-old girl is brought to the office for follow-up because she is unable to flex the interphalangeal joint of the thumb of the dominant right hand. She underwent repair of a laceration of the thenar eminence of the affected hand 8 weeks ago. Operative exploration shows a 3-cm gap of the flexor pollicis longus in Zone III. Reconstruction with a palmaris longus graft is planned. Which of the following is the most appropriate postoperative management?
- A) Complete immobilization for 4 weeks
 - B) Removable dorsal-block splint; passive and active-assist flexion
 - C) Removable dorsal-block splint; passive flexion
 - D) Removable dorsal-block splint; passive, active-assist, active flexion
 - E) No immobilization

The correct response is Option A.

Early motion protocols are standard for adult tendon repairs but are not generally suitable for very young children due to poor compliance. Children have a remarkable ability to regain motion after tendon injury, especially for repairs or grafts that are outside of Zone II. In this vignette, the reconstruction was in Zone III, and the prognosis for regaining full motion even after a month of immobilization is excellent. Moreover, it is highly unlikely that a child of this age will predictably comply with splint wear and motion restrictions for the duration of tendon healing. Thus, the risk of early rupture outweighs the risk of stiffness. There are advocates of successful early motion protocols in children with Zone II tendon repairs, but most studies have failed to demonstrate an appreciable benefit of such a practice.

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62. A 22-year-old laborer underwent four-strand and epitendinous repair of a Zone II flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) injury to the long finger of the dominant right hand 5 days ago. Early active motion therapy protocol is selected for rehabilitation, by which the injured finger is passively flexed and the wrist extended, with the patient then asked to actively maintain a flexed grasp. In contrast to the rubber band Kleinert technique, this protocol is most likely to have which of the following effects on the repaired finger?
- A) Decreased risk of tendon rupture
 - B) Greater risk of finger flexion contracture
 - C) Increased FDP and FDS excursion
 - D) More tendon adhesions
 - E) Prolonged tendon repair softening

The correct response is Option C.

Low force and moderate excursion therapy protocols continue to be the most effective protocol following flexor tendon repairs. However, increasing the applied force to the repair site during postoperative rehabilitation beyond 5 N does not accelerate accrual of repair site strength after a multistranded repair. In vivo repair, results have shown that early active mobilization may limit tendon end softening and loss of repair strength that generally occurs after the first 7 days.

The mode of rehabilitation described was popularized by Strickland and has been shown to improve outcomes of Zone II repairs, probably due to both increased absolute as well as relative tendon excursions. However, in order to reduce the potential increased repair rupture rate, at least four-strand repair is required. This increased excursion leads to fewer tendon adhesions.

Because the fingers are flexed by rubber bands, the Kleinert technique predisposes the patient to flexion contractures. A combination of the Duran passive range of motion and the Kleinert technique improves the results.

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63. A 42-year-old right-hand–dominant construction worker is evaluated for an 8-week history of pain with wrist motion. Physical examination shows swelling 4 cm proximal to the Lister tubercle. There is tenderness to palpation and crepitation over the muscle bellies of the abductor pollicis longus and extensor pollicis brevis. The remainder of the examination shows no abnormalities. Which of the following is the most likely diagnosis?
- A) Basal joint synovitis
 - B) de Quervain synovitis
 - C) Extensor pollicis longus tendinitis
 - D) Intersection syndrome
 - E) Wartenberg syndrome

The correct response is Option D.

Intersection syndrome is synovitis of the second dorsal compartment. It is located where the abductor pollicis longus and extensor pollicis brevis cross the extensor carpi radialis longus and extensor carpi radialis brevis. The syndrome often occurs in athletes with repetitive forceful extension. The swelling is located 4 to 6 cm proximal to Lister tubercle.

Basal joint arthritis and synovitis would have tenderness located at the wrist crease at the carpometacarpal joint and may have x-ray findings. de Quervain is synovitis of the first dorsal compartment, which would be located over the radial styloid and have a positive Finkelstein sign. Wartenberg syndrome is radial sensory nerve compression where the nerve exits the supinator muscle. Symptoms would be paresthesia over the radial nerve distribution and a Tinel sign. Extensor pollicis longus tendinitis is synovitis of the third dorsal compartment with vague dorsal wrist pain and tenderness, usually over the Lister tubercle with exacerbation with thumb extension.

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64. A 23-year-old man comes to the office for follow-up evaluation 14 months after sustaining a closed brachial plexus injury in a motor vehicle collision. He was initially treated at another facility with occupational therapy and observation. He has been compliant with therapy. Physical examination shows 4/5 strength in shoulder abduction, elbow flexion, elbow extension, and finger flexion. He is unable to extend the wrist or fingers but has good passive mobility of the wrist and fingers. Which of the following is the most appropriate next step to restore wrist and finger extension?
- A) Distal nerve transfer
 - B) Intraplexus nerve grafting
 - C) Pedicled latissimus muscle transfer
 - D) Tendon transfer
 - E) Continued observation

The correct response is Option D.

The most appropriate management for the patient described is tendon transfers to restore wrist, finger, and thumb extension. Following closed brachial plexus injuries, patients should receive CT scan or MR myelogram and electrodiagnostic studies at 3 to 4 weeks. This will allow enough time to see pseudomeningoceles and denervation changes. The electromyography and nerve conduction studies are generally repeated at 14 to 16 weeks to look for signs of regenerating axons, and this information is used to help determine the strategy for reconstruction. Surgery is recommended in the absence of clinical or electrical evidence of recovery.

The patient described has late symptoms, and any strategy that involves attempting to repair or reconstruct the injured nerves is not recommended. After 12 to 18 months, useful motor recovery is unlikely due to intraneural fibrosis, loss of Schwann cells, muscle atrophy, and motor end-plate degeneration. Tendon transfers may be done at any time assuming that there are suitable donor tendons (at least 4/5 strength and full excursion) and that full passive mobility is present. In this example, the patient has adequate donor tendons from the median and ulnar nerves, and full passive range of motion. Examples of tendon transfers include: palmaris longus to extensor pollicis longus, pronator teres to extensor carpi radialis brevis, and flexor carpi ulnaris to extensor digitorum communis.

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Early or subacute exploration of the injured plexus with resection and intraplexal nerve grafting can be used with ruptures or neuromas that do not conduct a nerve action potential across the lesion. In adults, grafting is reserved for C5, C6, and C7 to restore shoulder abduction, elbow flexion, elbow extension, and wrist extension. Nerve grafting for lower trunk injuries in adults is generally not successful due to the length and time required for the regenerating axon to reach the distal target muscles.

Nerve transfers have become a very useful and versatile tool for reconstruction of brachial plexus and peripheral nerve injuries. A less important distal nerve is sacrificed to replace the function of a more important nerve. Nerve transfers can be performed in preganglionic injuries and to decrease the distance to the target muscle for reinnervation. Ideally, nerve transfers are performed within 6 months of the injury. Studies have shown greater than 70% will achieve M3 function for elbow flexion and shoulder abduction. Common donor nerves include the spinal accessory, intercostals, anterior interosseous, and triceps branch.

Other options for late reconstruction include pedicled muscle transfers and neurotized functional free muscle transfers. The latissimus dorsi muscle can be used to restore elbow flexion or elbow extension but will not reach beyond the elbow. Currently, free muscle transfer is the best option to restore hand and wrist function in complete brachial plexus palsy.

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65. A 45-year-old woman is evaluated for a dorsal oblique amputation of the tip of her index finger sustained when she was cutting vegetables with a sharp knife. X-ray studies and physical examination show tuft exposure. Which of the following is the most appropriate management?

- A) Cross-finger flap
- B) Groin flap
- C) Moberg flap
- D) Split-thickness skin grafting
- E) Volar V-Y advancement flap

The correct response is Option E.

Although daily dressing changes are appropriate for fingertip injuries with one dimension measuring 1 cm or less, the exposed bone makes this less appropriate due to the increased risk of infection with prolonged bone exposure. A split-thickness skin graft would adequately cover the defect, but padding over the bone may not be sufficient and sensory recovery would not be as good as with a flap. Use of an Atasoy volar V-Y advancement flap is ideal in transverse and dorsal oblique fingertip amputations, particularly those with bone exposure where durability and padding might be a consideration. In addition, Atasoy flaps provide excellent sensation as the neurovascular supply is not interrupted. The Atasoy flap is contraindicated in volar oblique fingertip amputations, as advancement in these amputations would be inadequate. A groin flap would provide excellent durability and padding, but would be an extreme option where local flap reconstruction is available and preferred. The Moberg flap is for thumb tip injuries. The cross-finger flap is for volar defects.

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66. A 65-year-old man comes to the office because of difficulty grasping items with the left hand. He sustained a sharp amputation of the thumb in the distal third of the proximal phalanx 9 months ago. Palmar and radial abduction of the residual thumb is symmetric to the uninjured thumb. Photographs are shown. Which of the following procedures is most likely to improve hand function in this patient?
- A) Four-flap Z-plasty of the first web space
 - B) Groin flap
 - C) Heterodigital island flap augmentation of the thumb
 - D) Pollicization of the index finger
 - E) Resection of the first dorsal interosseous muscle

The correct response is Option A.

When approaching post-traumatic thumb reconstruction, two of the most important factors in determining treatment are the residual length and relative function of the remaining thumb. In this patient with a distal amputation and good active range of motion, the simplest and most beneficial procedure would be web-space deepening via a four-flap Z-plasty. Simple Z-plasty and dorsal rotational flaps can also serve to deepen the first web, but the most commonly used technique is the four-flap Z-plasty.

Groin flap can address soft-tissue deficits that this patient does not have.

Instances involving contractures of the first web space frequently require release or resection of some of the first web musculature, including the first dorsal interosseous.

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In a supple thumb with good abduction, this would not be necessary.

Pollicization of the index finger or the stump of an index finger can be useful when amputation occurs in the proximal third of the thumb. In the setting of a healthy index finger, however, amputations through the metacarpal would likely be best handled via toe-to-thumb transplantation.

Heterodigital island flaps are one method of restoring glabrous, sensate skin to the palmar surface of the thumb. Such flaps were useful primarily when trying to restore sensation to a thumb reconstructed through osteoplastic techniques. This flap would not add length to the thumb or serve to deepen the web space.

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67. In a patient with rheumatoid arthritis with painful, debilitating deformity of the left wrist and hand, which of the following is the most appropriate first step in reconstruction?
- A) Intercarpal fusion with ulnar head arthroplasty
 - B) Proximal interphalangeal joint arthrodesis with terminal extensor tendon release
 - C) Silicone metacarpophalangeal joint arthroplasty with sagittal band reconstruction
 - D) Soft-tissue reconstruction of the extensor tendon rupture with tendon transfer
 - E) Total wrist arthrodesis with ulnar head excision

The correct response is Option E.

Rheumatoid arthritis is a complex disease, and the treatment for rheumatoid hand deformities remains controversial. Over 70% of rheumatoid patients report hand and wrist dysfunction. In addition, patient concerns over the aesthetic appearance of the hand and wrist can have a significant influence on patient satisfaction following rheumatoid hand surgery. When planning surgery, one must take into account the patient's symptoms; clinical appearance, including the amount of synovitis; function; and x-ray studies.

Rheumatoid arthritis is a polyarticular disease and deformities of the proximal joints will affect the position of more distal joints. This makes timing and sequence of surgical reconstruction critical. The wrist is the most common joint affected by rheumatoid disease. The accepted strategy is to reconstruct more proximal joints first. This may provide enough stability and motion so that distal surgery is not needed. Surgical treatment of the rheumatoid wrist is usually performed to alleviate wrist pain or to treat deformities that contribute to finger deformities distally. A stable wrist is critical to a successfully reconstructed rheumatoid hand.

Synovitis is the principal pathologic feature of rheumatoid arthritis. Synovitis of the ulnar side of the wrist tends to appear first, resulting in attenuation and rupture of the extensor carpi ulnaris sheath and ligamentous stabilizers of the distal radioulnar joint (DRUJ). This leads to dorsal dislocation of the ulnar head and caput ulna syndrome. Synovitis of the volar and intercarpal ligaments leads to volar and ulnar subluxation of the carpus with supination. The intact radial wrist extensors then contribute to the

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radial deviation of the metacarpals at the carpometacarpal joint and compensatory ulnar drift at the metacarpophalangeal joint.

Treatment of rheumatoid wrist deformities involves stabilization of the carpus. In this patient, x-ray studies show pancarpal arthritis. This leaves total wrist arthrodesis as the only option presented here. If the mid-carpal joint is unaffected by disease, a limited wrist fusion may be performed such as a radiolunate arthrodesis. Treatment of the DRUJ and ulnar head is accomplished with ulnar head excision when the wrist is stabilized with a fusion. In cases of isolated DRUJ disease, the Sauvé-Kapandji procedure is recommended to prevent further ulnar subluxation of the carpus.

The other answers address pathology distal to the wrist and should not be considered primarily in patients with this degree of wrist pathology.

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68. A 32-year-old construction worker sustains an amputation of the long finger of the dominant right hand through the mid portion of the nail plate. Which of the following structures is most likely injured?

- A) Dorsal roof
- B) Germinal matrix
- C) Hyponychium
- D) Lunula
- E) Sterile matrix

The correct response is Option E.

Allen classification includes Zone 1: no bone fragment; Zone 2: injury through the sterile matrix with preservation of at least one-half of the nail bed; Zone 3: shorter nail bed remnant; Zone 4: proximal to the dorsal fold; and Zone 5: through the distal interphalangeal joint. The hyponychium is the skin distal and volar to the nail. The perionychium includes the nail, nail bed, and the surrounding skin. The paronychiae are the lateral nail folds. The eponychium is the dorsal nail fold, which is proximal to the nail fold. The sterile matrix is distal to the lunula. The germinal matrix contributes 90% of new nail growth and ends at the lunula. The extensor terminal tendon inserts 1.2 to 1.4 mm proximal to the germinal matrix.

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69. A 32-year-old right-hand–dominant woman comes to the office because of an unstable nail at the mid-nail bed of the right ring finger. The nail sometimes comes off when she puts her hand in her pocket. History includes trauma to the nail bed of the ring finger. Physical examination shows full range of motion of the finger. X-ray studies show a bone exostosis dorsally. In addition to removal of the nail plate, which of the following is the most appropriate management of nonadherence of the nail?
- A) Debridement of the distal phalanx exostosis
 - B) Debridement of exostosis and sterile matrix grafting
 - C) Nail bed ablation with split-thickness skin grafting
 - D) Reassurance that the nail will eventually regrow naturally

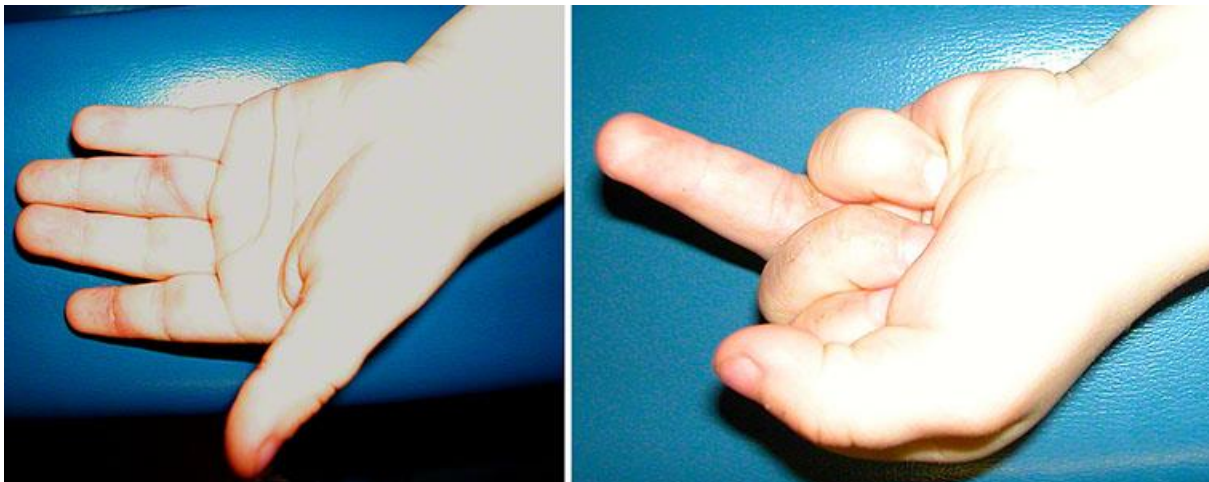
The correct response is Option B.

Nonadherence of the nail is the most common nail deformity after trauma and is usually distal to scarring in the nail bed or bone irregularities. The most common cause of nonadherence is nail bed scarring. The scar interrupts the progressive addition of nail cells from the sterile matrix to the volar nail plate, causing detachment of the nail. The nail is then unable to attach to the nail bed distally. Distal nonadherence of the nail may lead to subungual hygiene problems, an unstable nail when manipulating small objects or pain, when catching the nail on objects. Nonadherence is treated by removing the nail plate and excising the underlying scar. The area of scar resection can then be closed primarily or closed with a split-thickness sterile matrix graft if the defect is too large. Malalignment of distal phalanx fractures may cause or contribute to nonadherence. The exostosis should be removed to form a flat surface for the sterile matrix and subsequent nail adherence.

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70. A 24-year-old man with a 1-year history of poorly controlled diabetes mellitus comes to the office 3 months after sustaining a laceration of the left ring finger. Physical examination shows a thick but mobile cutaneous scar. Two-point discrimination in the fingertip is 7 mm, compared with 3 mm in other fingertips. There is no active or passive range of motion in the affected digit. Photographs are shown. Which of the following findings is most likely to preclude reconstruction in this patient?
- A) Elevated hemoglobin A_{1c}
 - B) Hypertrophy of the scar
 - C) Increased two-point discrimination
 - D) Length of time from the initial injury
 - E) Stiffness of the interphalangeal joints

The correct response is Option E.

Of the options listed, the most likely option to result in poor outcome in the setting of delayed tendon repair is stiffness of the interphalangeal joints. Hand therapy directed at achieving passive range of motion of the finger before reconstruction may make repair possible and should be attempted before proceeding with surgery.

Although poorly controlled diabetes increases the risk of perioperative infection, it would not impact the ability to perform a reconstruction. Likewise, the amount of

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time that has passed since the initial injury places the patient outside the range typically accepted for delayed primary repair, but would not directly affect a reconstruction.

Digital nerve injury requiring repair/reconstruction has been considered a relative contraindication to repair. The increased two-point discrimination in this patient suggests a prior injury with recovery similar to what might be expected with primary nerve repair. In this setting, the need for concomitant digital nerve repair is unlikely.

Although thick, the cutaneous scar is mobile, suggesting that it is not contributing to the lack of motion at the interphalangeal joints. Immature scars or wounds requiring further reconstruction would also be contraindications to reconstruction.

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71. A 60-year-old man is referred for evaluation of a flexion deformity of the left long finger. Physical examination shows a thickened cord from the mid palm to the volar proximal phalanx of the long finger. The metacarpophalangeal joint cannot be extended beyond 30 degrees. A photograph is shown. Which of the following cells is most directly responsible for the contraction of the cord shown?
- A) Macrophage
 - B) Merkel cell
 - C) Myofibroblast
 - D) Stem cell
 - E) Striated myocyte

The correct response is Option C.

Myofibroblasts act on the collagen bundles deposited by fibroblasts to cause alignment into a cord and shortening of the cord. These cells also secrete extracellular matrix components that remodel in a shorter configuration, creating durability of the contracture. More mature cords are believed to be less cellular.

Macrophages are believed to act on the extracellular matrix but do not produce contracture. Striated myocytes are in skeletal muscle and are not involved in Dupuytren disease. Merkel cells are a sensory end-organ and are not involved in Dupuytren disease.

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Stem cells including adipocyte progenitors are known to exist in Dupuytren cords. They are hypothesized to develop into cells that affect the cord. There is no evidence that these cells act on Dupuytren cords while they are still stem cells.

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72. A 23-year-old man comes for evaluation after falling from a ladder onto the left wrist. A scaphoid fracture is suspected. Initial anterior-posterior, lateral, oblique, and scaphoid-view x-ray studies show no definitive fracture. Which of the following additional imaging studies is most sensitive and specific for detecting the suspected fracture?

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

The correct response is Option D.

The imaging study that is most sensitive and specific for detecting an acute scaphoid fracture is MRI. Many authors have written about the best secondary imaging study for scaphoid fractures not evident on standard x-ray studies. MRI is the best test considering both sensitivity and specificity, followed by CT scan. The majority of the published data shows bone scan to be the most sensitive but less specific than MRI or CT scan. Ultrasonography is used for evaluation of long bone fractures but is not yet indicated for evaluation of carpal bone fractures.

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73. An otherwise healthy 36-year-old man is evaluated 2 hours after amputation of the left thumb with a machete. Examination shows a detached segment composed of the distal and proximal phalanges and exposed bone of the thumb metacarpal on the hand. No other injuries are noted. Which of the following is the most appropriate management?
- A) Coverage with a groin flap
 - B) Coverage with a reverse radial forearm flap
 - C) Coverage with a volar advancement flap
 - D) Microvascular replantation
 - E) Revision amputation

The correct response is Option D.

In the patient described, the most appropriate next step is microvascular replantation. The thumb is an important part of hand function, and thumb amputations at all levels are good indications for replantation. Length and stability of the thumb are important in forming a radial post, and the thumb takes priority in replantation. The patient is otherwise healthy, and there are no medical comorbidities or other injuries that would interfere with the replantation effort. With thumb amputation sustained at the level of the metacarpophalangeal (MCP) joint, the remaining thumb will be too short for adequate function if length is not restored. Although there may be some soft-tissue injury as a result of the saw, bone shortening may be considered to get out of the zone of injury, and vein grafts may be employed if necessary.

A groin flap can be used for soft-tissue coverage, but it requires the hand to be attached to the groin for a period of time. This can result in stiffness of the other digits, and requires a staged procedure. It would not restore length in this case. With failed replantation, it may be used for coverage, or form a component of osteoplastic thumb reconstruction.

The Moberg flap or volar advancement flap can be used for coverage of soft-tissue defects of the thumb. This is based on the neurovascular bundles of the thumb, and is used in amputations distal to the interphalangeal joint. The flap typically can cover an area up to 2 cm in size. The Moberg flap would not be available in this case, as it is contained in the detached segment.

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A reverse radial forearm flap can be used for coverage of soft-tissue defects in the hand. This does require sacrifice of a major vessel to the hand. Although this flap can be used to provide coverage for soft-tissue defects, it will not preserve length of the thumb. In the case of failed replantation with bony exposure, this flap can be employed for coverage before further thumb reconstruction.

A well-planned amputation should be considered a reconstructive procedure, and can return a patient to functional use of the hand. Goals include preservation of functional length, provision of durable coverage, preservation of sensibility, prevention of neuromas, prevention of joint contractures, minimal morbidity, early prosthetic fitting, and early return to activities of daily living. In the setting of a thumb amputation at the MCP level, the lack of a thumb will result in marked impairment of hand function. If the replantation effort fails, revision amputation may be an option, with thumb reconstruction later attempted by toe-to-thumb transfer.

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74. A 65-year-old right-hand–dominant man comes to the office because of Dupuytren contracture of the metacarpophalangeal joints of the ring and little fingers of the left hand with a 40-degree flexion deformity of the proximal interphalangeal (PIP) joint of the little finger. The PIP joint of the ring finger is not involved. He has no history of trauma. Palmar fasciectomy is performed, but no improvement of the little finger PIP joint contracture is noted intraoperatively. Which of the following is the most appropriate next step?
- A) Administration of collagenase
 - B) Excision of collateral ligaments
 - C) Percutaneous fixation of the PIP joint in forced extension
 - D) PIP joint capsulotomy
 - E) Release of the checkrein ligaments of the PIP joint

The correct response is Option E.

The decision to proceed to surgery is based on the patient's functional limitations and severity of joint contracture. A metacarpophalangeal (MCP) joint contracture of less than 30 degrees or any proximal interphalangeal (PIP) joint contracture is considered an indication for surgery. The MCP joint is rarely a problem since it can almost always be released by a simple fascial excision. If the PIP joint remains in fixed flexion, the checkrein should be examined and released. These are two ligamentous cords lying anterolaterally and running from the proximal swallowtail extensions of the volar plate to the neck of the proximal phalanx. The next structure to be released is the accessory collateral ligament running from the condyle on the head of the proximal phalanx to the lateral edges of the volar plate. Lastly, gentle manipulation may be utilized to obtain some release. Forcefully placing the joint in extension with Kirschner wire fixation is not indicated. Collagenase will not address capsular issues.

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75. A female newborn is evaluated for palsy of the right upper extremity sustained in a traction injury to the shoulder during delivery. Which of the following is the earliest age at which the absence of biceps function portends a poor prognosis for spontaneous recovery?

- A) At birth
- B) 3 months
- C) 6 months
- D) 9 months
- E) 12 months

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

The correct response is Option C.

Most experts will perform surgery on infants who are between 3 and 6 months of age. The decision to operate depends on the likelihood of spontaneous recovery of function. Many clinicians use physical examination to make this determination. At 6 months of age, if biceps function is absent, there is a poor prognosis. Some surgeons rely on early electromyography/nerve conduction studies and intervene before 6 months of age. Early treatment at 4 months shows neurologic improvement of the affected arm in more than 90% of children.

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76. An otherwise healthy 35-year-old man comes to the emergency department because of a 2-day history of swelling and pain in the index and long fingers of the right hand. He reports pain when he attempts to flex these fingers or bring them together. Physical examination shows no pain with passive extension of the fingers or during axial loading. There is pain with passive adduction of the fingers. A photograph is shown. Which of the following is the most appropriate management?
- A) Arthrotomy of the metacarpophalangeal joint of the long finger
 - B) Division of ulnar-sided Cleland ligament of the index finger
 - C) Dorsal and volar incisions in the proximal second web space
 - D) Drainage of the mid-palmar space
 - E) Release of the A1 pulley of the index and long fingers

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The correct response is Option C.

The patient described has a web space (collar-button) abscess. Pus resides dorsal to and volar to the natatory fibers of the palmar fascia with a small connection between the two spaces passing through the natatory fibers. It is drained through proximal dorsal and volar incisions in the web space. One should not incise through the apex of the web space, as this may lead to a web space contracture.



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Incisions are allowed to heal by secondary intention.

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Cleland ligament is a separate portion of the palmar fascia located within the finger dorsal to the neurovascular bundle. It is distal to the purulence in a web space abscess. Absence of pain with axial loading of the digits makes a joint space infection unlikely, so drainage of the metacarpophalangeal joint is unnecessary. Some approaches to drainage of flexor tenosynovitis involve release of the proximal sheath through the A1 pulley; the appearance in the photo (lack of fusiform swelling), and absence of pain with passive extension of the fingers, make flexor tenosynovitis unlikely in this patient. Infection of the mid-palmar space would produce more proximal pain and swelling in the palm, which is not present in this patient.

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77. A 32-year-old woman comes to the office because the toes of the right foot “drag” when she walks. She underwent vein stripping of the right leg and ligation of the lesser saphenous vein 4 weeks ago. Physical examination shows absent dorsiflexion and eversion of the ankle. Electromyography findings show:

	Muscle Group				
	Biceps femoris	Tibialis posterior	Peroneus longus	Tibialis anterior	Extensor hallucis longus
Recruitment	+	+	–	–	–

Which of the following is the most likely site of nerve injury in this patient?

- A) Common peroneal nerve at the knee
- B) Superficial peroneal nerve at the knee
- C) Sural nerve at the knee
- D) Tibial nerve at the knee
- E) Tibial nerve at the mid calf

The correct response is Option A.

The most likely site of injury would be the common peroneal nerve at the knee. Injuries to the common peroneal nerve are well documented in both traumatic (knee dislocation) and iatrogenic settings. Patients have footdrop and numbness over the first dorsal web space of the foot. History and clinical examination are the mainstays for diagnosis, but electromyography can be helpful in less-clear circumstances. The absence of recruitment of the lateral compartment muscles (peroneals) and the anterior compartment muscles (tibialis anterior, extensor hallucis longus) strongly suggest common peroneal involvement. The presence of recruitment of the biceps femoris and the tibialis posterior rules out tibial nerve involvement. An isolated superficial peroneal nerve injury would spare the anterior compartment muscles.

The sural nerve is a sensory nerve and provides no motor function.

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78. A 27-year-old woman comes to the emergency department 2 hours after sustaining a degloving avulsion injury to the right ring finger of the dominant hand. Physical examination shows complete degloving of the soft tissue of the ring finger, including both neurovascular bundles, from the level of the mid-proximal phalanx. Emergent revascularization is performed and fails. Which of the following is the most aesthetically pleasing management of this patient's condition?
- A) Debridement of nonviable soft tissue and coverage with a full-thickness skin graft
 - B) Debridement of nonviable soft tissue and coverage with a groin flap
 - C) Ray amputation of the ring finger
 - D) Resection of the necrotic digit followed by toe-to-hand transfer
 - E) Revision amputation at mid proximal phalanx with primary skin closure

The correct response is Option C.

Management of ring avulsion injuries remain controversial. Microvascular replantation is a challenging prospect in the setting of a ring avulsion injury and is often associated with the highest failure rates following replantation. This is likely secondary to the mechanism of injury that leads to destruction of the intimal layer of the supporting vasculature.

The most appropriate next step in management of the patient described is a ray amputation, which involves removal of the entire digit and most or the entire metacarpal. Completely removing the digit eliminates the segmental loss and greatly improves both function and aesthetic appearance. A well-planned amputation should be considered a reconstructive procedure and can return functional use of the hand to the patient.

Revision amputation near or at the metacarpophalangeal joint level leaves a large gap between digits and can lead to functional problems such as dropping small objects through the defect.

Skin grafting over exposed bone and tendon is unlikely to be successful.

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

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Replacing the ring finger with a toe-to-hand transfer is impractical, as the transferred digit would be significantly shorter than the adjacent digits and would ultimately impair their function. This technique is suitable for patients who have sustained amputations of the thumb or of multiple digits.

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79. A 24-year-old man is brought to the emergency department 2 hours after sustaining injuries to the left lower extremity when he was hit by a motor vehicle. Physical examination shows avulsion of the soft tissue of the posterior thigh. A fracture of the femur is stabilized by an intramedullary rod; the sciatic nerve is noted to be intact but ecchymotic at the level of the mid posterior thigh. Soft tissue is available for coverage. Which of the following is the most appropriate management?
- A) Acute resection of the ecchymotic nerve and repair with a nerve graft
 - B) Delayed resection of the ecchymotic nerve at 10 days and repair with a nerve graft
 - C) Electromyography after 3 weeks and repair with a nerve graft if fibrillations occur
 - D) Serial electrodiagnostic studies after 3 weeks and again after 3 months with repair if no improvement

The correct response is Option D.

In cases in which the nerve has undergone a significant crush component, it is important to get a sense of nerve viability and recovery. The nerve conduction study at 3 weeks largely serves as a baseline study as it rarely provides more information than physical examination other than the presence of fibrillations, which indicates at least some axonal loss. The nerve conduction study at 3 weeks is not a reliable indicator of possible nerve recovery; therefore, resection and reconstruction are not advisable at this time point. The 3-month nerve conduction study is able to pick up subtle signs of recovery that may not be evident on physical examination. If at the 3-month mark there are no signs of recovery on physical examination or nerve conduction study, repair is indicated. Acute resection of a possibly viable nerve is not indicated. If the nerve were noted to be transected at the time of initial exploratory surgery, the viability of the nerve ends would not be stable until 7 to 10 days post trauma, making this a good time for definitive repair. In the scenario described, the nerve is in continuity and viability cannot be ascertained intraoperatively at 10 days; therefore, resection and reconstruction are not indicated.

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

80. An otherwise healthy 32-year-old woman returns to the emergency department because she is unable to use her right hand 20 days after she underwent wound closure for management of a laceration to the hand. A photograph of the patient attempting to make a fist is shown. On examination, there is decreased sensation in the ulnar distribution, and the hand is warm. Which of the following tests is likely to provide the most pertinent information in developing a treatment plan for this patient's injury?
- A) CT angiography
 - B) Electromyography/nerve conduction study
 - C) Magnetic resonance angiography
 - D) Ultrasonography
 - E) No testing is necessary; physical findings are sufficient

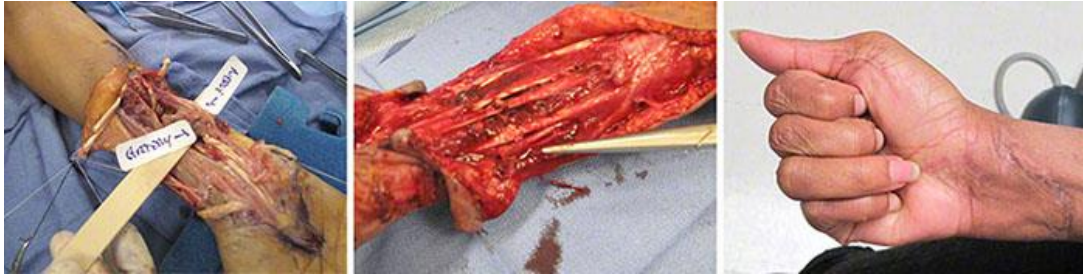
The correct response is Option E.

The patient described has a significant wrist injury until proven otherwise. Physical examination will be the most helpful in making a determination regarding what should be done next. Electromyography/nerve conduction study typically does not give actionable information until 3 weeks or more after injury. Ultrasonography may be helpful but would not give more information than one could get from a thorough physical examination and would likely be painful as the probe is pressed on the

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wound. CT angiography can be critical preoperatively if there was a concern regarding inflow. Magnetic resonance angiography would be revealing but would be expensive and unnecessary in this setting.

The patient was taken to the operating room for exploration. Intraoperative and postoperative images are shown.



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

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81. A 16-year-old boy who has asthma is brought to the emergency department 3 hours after accidentally injecting the index finger of the nondominant hand with his epinephrine auto-injector. On examination, the finger is cool, pale, and painful. Which of the following drugs works to competitively antagonize the sympathomimetic effects of epinephrine?
- A) Lidocaine
 - B) Marcaine
 - C) Nitroglycerin paste
 - D) Phentolamine
 - E) Prostacyclin

The correct response is Option D.

Epinephrine use in hand surgery is becoming more common as is the inadvertent self-injection by people who carry epinephrine injectors (EpiPens). Typically, there is little treatment needed other than supportive care. However, when concern for tissue viability is raised or there is marked pain, subcutaneous phentolamine is the drug of choice to reverse the sympathomimetic effects of epinephrine. Plain lidocaine (typically 2% or more) will cause vasodilation but by a different mechanism than the reversal of the epinephrine. Topical nitroglycerin paste has been used for reversal of vasospasm, but again, a different mechanism is used.

Marcaine is an amide anesthetic that inhibits sodium ion channels. It is not an antagonist of epinephrine.

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82. A 63-year-old man comes to the office because of pain of the right wrist and posttraumatic arthritis after a long-standing scapholunate tear that was untreated. Salvage reconstruction with proximal row carpectomy is planned. Which of the following articular surfaces should be intact in order to perform the procedure?

- A) Capitulum
- B) Lunotriquetral
- C) Radioscaphoid
- D) Scaphotrapezial
- E) Trapeziotrapezoid

The correct response is Option A.

The capitulum articulation should be intact in order to perform proximal row carpectomy.

The patient described has a chronic scapholunate tear, which if left untreated, can lead to the consequences of scapholunate advanced collapse (SLAC) wrist. With ongoing progression, degenerative wrist arthritis and pain result.

Arthritis occurs in a predictable sequence, initially at the radioscaphoid joint, followed by the scaphocapitate joint and the capitulum joint. The radiolunate joint is typically spared until advanced stages.

Proximal row carpectomy is a salvage wrist procedure that can be used in some cases of SLAC wrist. The proximal carpal bones of the wrist (scaphoid, lunate, and triquetrum) are removed, and the capitate head is allowed to rest in the lunate fossa of the radius. In order for this procedure to be successful, the capitulum joint should be free of arthritis. The patient should have preservation of cartilage on the capitate head and the lunate fossa of the radius, as this forms the new articulation of the wrist.

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83. A 21-year-old ambulatory man with spina bifida at the level of S2 is scheduled to undergo closure of a stage IV ischial decubitus ulcer. Rotational flap closure is planned. Which of the following flaps is most appropriate considering wound closure and ambulation?

- A) Gluteal thigh
- B) Gluteus muscle
- C) Hamstring
- D) Reverse latissimus dorsi
- E) Vastus lateralis

The correct response is Option A.

This patient, who has S2 paraplegia, has complete muscle function in the upper extremities, thoracic musculature, hips, and knees. Thus, detachment and relocation of hamstring muscles, the primary flexors of the knee, would greatly decrease this patient's ability to ambulate. Although the vastus lateralis is a significant knee extender, and the use of this muscle would weaken the function of the quadriceps, other quadriceps muscles (vastus intermedius, vastus medialis, and rectus femoris) can sufficiently compensate for its loss.

Reverse latissimus dorsi can be useful for lower back and sacral coverage, but it does not have sufficient reach to cover the ischium. Tensor fascia lata assists in femoral flexion and abduction, but it is a minor muscle and has little functional impact. Gluteal thigh flaps are based on the descending gluteal artery and are typically raised as fasciocutaneous flaps. Thus, it would have little effect on ambulation or lower extremity motion.

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84. A 45-year-old man comes to the office because of a 6-month history of pain in the proximal forearm. There is no history of trauma. The patient has had no numbness or tingling. Physical examination shows full normal range of motion of the extremity. Tenderness is present over the dorsal forearm, 8 cm distal to the elbow. With the elbow extended, resisted wrist extension reproduces pain. Resisted extension of the long finger with the elbow extended reproduces the pain. Which of the following is the most likely diagnosis?
- A) Anterior interosseous nerve syndrome
 - B) Intersection syndrome
 - C) Medial epicondylitis
 - D) Pronator syndrome
 - E) Radial tunnel syndrome

The correct response is Option E.

Radial tunnel syndrome is a pain syndrome where the radial nerve is compressed in the proximal forearm. Radial tunnel syndrome occurs with pain only, and there are no sensory disturbances. Often, radial tunnel syndrome can accompany lateral epicondylitis; however, the tenderness of radial tunnel syndrome is generally more distal in the forearm in the interval between the brachioradialis and extensor carpi radialis brevis muscle. Provocative testing, such as pain reproduced with resisted wrist and digital extension with the forearm extended, can occur in both lateral epicondylitis and radial tunnel syndrome. The long finger test, where pain is reproduced with resisted extension of the long finger, can help differentiate radial tunnel syndrome from lateral epicondylitis. Generally, EMG/nerve conduction studies are of limited usefulness in making the diagnosis of radial tunnel syndrome.

Medial epicondylitis, or golfer's elbow, is a tendinosis located over the medial epicondyle. Posterior interosseous nerve syndrome is a compression syndrome of the radial nerve as it divides into the posterior interosseous nerve. This syndrome generally presents with only motor findings with weakness of the extensor carpi radialis brevis, supinator, extensor carpi ulnaris, and extensor digitorum communis along with the extensor digiti quinti and indicis proprius. Anterior interosseous syndrome is a nerve compression of the median nerve which can mimic carpal tunnel syndrome. Intersection syndrome produces pain in the distal forearm.

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85. A 30-year-old woman comes to the office because of a laceration of the dorsal long finger extensor tendon. Physical examination shows extension of all fingers to zero degrees at the metacarpophalangeal joint. Which of the following structures provides extension force that explains this exam finding?

- A) Deep transverse metacarpal ligament
- B) Intact paratenon
- C) Interosseous muscles
- D) Juncturae tendinum
- E) Lumbrical muscles

The correct response is Option D.

Juncturae tendinum are tendon-like bands that connect the long, ring, and little finger extensor digitorum communis tendons. If the long finger extensor tendon is lacerated proximal to the attachment of the juncturae tendinum between the long and ring fingers, the ring finger extensor digitorum communis tendon will apply extension force to the distal long finger extensor tendon via the juncturae tendinum and produce metacarpophalangeal (MCP) extension.

Interosseous and lumbrical muscles produce flexion of the MCP joint. The deep transverse metacarpal ligament stabilized the metacarpal heads relative to each other but does not produce motion at the MCP joint. In this patient, the tendon is visible and noted to be completely lacerated; therefore, the paratenon is not intact.

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86. A 27-year-old woman is evaluated for a traumatic wound to the left heel that she sustained when she was attacked by a shark 6 days ago. Physical examination shows a 5 × 5-cm soft-tissue defect with exposed bone. Reconstruction with a sensate flap taken from the instep region is planned. Which of the following nerves provides innervation to this flap?
- A) Calcaneal
 - B) Lateral femoral
 - C) Medial plantar
 - D) Superficial peroneal
 - E) Sural

The correct response is Option C.

The nerve supply to the medial plantar artery flap is the medial plantar nerve.

The medial plantar artery flap is a sensate flap that can be used for coverage of heel defects. The flap incorporates tissue from the medial instep of the foot in a non-weight-bearing area, and can be transposed posteriorly to allow for coverage of heel defects. This flap provides durable plantar glabrous skin that can allow for weight bearing.

The flap is based on the medial plantar artery, which arises from the posterior tibial artery. A branch of the medial plantar nerve providing sensation to the instep of the foot can be harvested with the flap, allowing for preservation of sensation in the reconstructed heel.

The medial plantar artery flap can also be raised as a sensate free flap, with anastomosis of the medial plantar nerve to a nerve at the recipient site.

The calcaneal nerve provides native sensory innervation to the heel.

The lateral femoral cutaneous nerve provides sensation to the anterolateral thigh flap.

The superficial peroneal nerve provides motor innervation to the lateral leg.

The sural nerve provides sensation to the lateral side of the foot.

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87. A 40-year-old woman is evaluated in the emergency department after she fell on her outstretched hand while playing tennis. Examination shows tenderness of the wrist. After the scaphoid, which of the following carpal bones is most likely fractured in this patient?

- A) Capitate
- B) Hamate
- C) Lunate
- D) Pisiform
- E) Triquetral

The correct response is Option E.

The triquetral is the second most commonly fractured carpal bone. Most triquetral fractures are dorsal ridge fractures that appear as avulsion fractures on lateral view wrist x-ray studies.

The most common carpal bone fracture incidences in order of frequency are scaphoid, triquetral, trapezium, lunate, and hamate.

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88. A 52-year-old man with a 10-year history of intravenous drug use is evaluated for right groin pseudoaneurysm. He has a history of right groin reconstruction with a local sartorius flap. After vascular reconstruction, he is left with an exposed vascular conduit in need of stable coverage. The local groin tissues are indurated and stiff. The rectus femoris muscle is rotated to provide coverage. Which of the following lower extremity function deficits is most likely in this patient?
- A) Inability to abduct the thigh
 - B) Inability to extend the knee
 - C) Inability to flex the ipsilateral hip
 - D) Weakened extension of the knee
 - E) No functional deficit

The correct response is Option D.

The rectus femoris muscle is the most superficial and central of the quadriceps extensor muscle group. It is a bipennate muscle that extends from the ilium to the patella and is surrounded by the vastus lateralis and vastus medialis muscles. The rectus femoris acts as an extensor of the knee, specifically powering the terminal 15 to 20 degrees of knee extension. It is also a powerful flexor of the hip. Recent studies have shown that the use of this muscle is effective for groin reconstruction. Mild, isolated deficits are observed although there is no clinical significance of this deficit.

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89. An 80-year-old woman comes for evaluation because she is unable to flex the tip of the little finger of her nondominant hand 9 months after sustaining a laceration from a knife. She did not seek treatment at the time of injury. She has no pain or any difficulty with activities of daily living. Physical examination shows a well-healed laceration over the volar aspect of the middle phalanx. Active range of motion is full in the metacarpophalangeal and proximal interphalangeal (PIP) joints; there is no flexion at the distal interphalangeal joint. Which of the following is the most appropriate management?

- A) Delayed primary flexor digitorum profundus repair
- B) Flexor digitorum superficialis transfer
- C) PIP joint arthrodesis
- D) Staged flexor tendon reconstruction with placement of a silicone rod followed by tendon grafting
- E) No intervention is indicated

The correct response is Option E.

No intervention is indicated for this patient. The principles of tendon repair and reconstruction have evolved since the first description of primary tendon repair in Zone II in 1967. Proper patient selection is essential before attempting any reconstruction to restore functional motion.

The indications for grafting or reconstructing through an intact flexor digitorum superficialis (FDS) are narrow, and sacrifice of an intact FDS is generally not recommended. Most of the functional arch of motion is maintained with the superficialis tendon, and many patients will function well with an FDS digit alone. Profundus reconstruction through an intact FDS is most often reserved for patients between 10 and 21 years old with high occupational demands for dexterity such as artists or musicians. This patient is beyond the recommended age range for an optimal outcome and is reporting no functional deficits as a result of her injury. In addition, delayed symptoms may give a clue to the patient's ability to comply with rigorous postoperative therapy.

Delayed primary repair can be attempted up to several weeks after a flexor tendon injury, and up to 6 weeks in pediatric patients. However, 9 months is well beyond the time when a primary repair would be possible.

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The FDS from an adjacent finger can be used as the proximal motor in cases of tendon graft reconstruction or tendon repair rupture. This is a consideration if the native proximal stump of the profundus is significantly damaged or scarred and has poor excursion. In this patient, reconstruction is not indicated, and nothing is mentioned regarding the proximal tendon.

A distal interphalangeal (DIP) joint arthrodesis may be indicated if the DIP joint is unstable with a well-functioning proximal interphalangeal (PIP) joint. Tenodesis of the flexor digitorum profundus stump is another option for soft-tissue DIP stabilization.

Tendon reconstruction is indicated when a delay in treatment makes primary tendon repair impossible. A healed wound with full passive range of motion, absence of significant scarring, and an intact flexor retinacular pulley system are considered prerequisites for a single-stage reconstruction. In any other situation, a two-stage reconstruction with implantation of a temporary silicone rod is indicated. This would be the reconstructive strategy of choice for this patient if the FDS tendon were also involved in the original injury.

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

90. An 18-year-old man comes to the office because he has “drooping” of the right shoulder and inability to abduct it beyond 30 degrees. He underwent exploration and vascular repair 4 months ago after sustaining a stab wound to the right side of the neck. Photographs are shown. Which of the following surgical transfer techniques is most likely to restore deltoid function in this patient?
- A) C5 to C6 nerve root
 - B) Intercostal to musculocutaneous nerve
 - C) Partial ulnar nerve to musculocutaneous nerve
 - D) Radial nerve fascicle to axillary nerve
 - E) Suprascapular to axillary nerve

The correct response is Option D.

Of the nerve transfers listed, only the transfer of a triceps branch to the axillary nerve will restore innervation to the deltoid muscle and provide shoulder abduction. Although debate remains over whether nerve graft repair (if possible) or nerve transfer provides better outcomes for shoulder abduction, both techniques are

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frequently employed in the setting of upper trunk brachial plexus injury.

The location of the injury (based on scar and mechanism) makes the injury likely distal to the nerve roots; in addition, root to root transfers are not typically part of the brachial plexus reconstruction ladder.

The suprascapular nerve is often the recipient nerve for partial transfers from cranial nerve XI (spinal accessory nerve) in order to provide shoulder stability. In this pattern of injury and based on the photos demonstrating atrophy of the supraspinatus and infraspinatus, the suprascapular nerve could not act as a donor nerve.

Intercostal nerve and partial ulnar nerve transfers to the musculocutaneous nerve are both frequently used to restore elbow flexion in the setting of upper trunk injuries.

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91. In relation to the pronator teres muscle, which of the following is the most likely location of the median nerve in the proximal third of the forearm?
- A) Between the superficial (humeral) and deep (ulnar) heads of the pronator teres muscle
 - B) Deep to the superficial (humeral) and deep (ulnar) heads of the pronator teres muscle
 - C) Superficial to the superficial (humeral) and deep (ulnar) heads of the pronator teres muscle
 - D) Through the deep (ulnar) head of the pronator teres muscle
 - E) Through the superficial (humeral) head of the pronator teres muscle

The correct response is Option A.

The course of the median nerve is relatively consistent. Just proximal to the elbow, at the medial epicondyle, there is a constant relationship of the median nerve, brachial artery, and the biceps tendon. From medial to lateral, the mnemonic, MAT, describes the relationship (Median nerve, brachial Artery, and biceps Tendon). In the cubital fossa, the nerve dives deep to the lacertus fibrosus, lying anterior to the brachialis muscle and medial to the brachial artery. The nerve enters the forearm between the superficial (humeral) and deep (ulnar) heads of the pronator teres muscle. As the nerve passes through the muscle bellies, it crosses the ulnar artery anteriorly, from medial to lateral, separated from the artery by the deep head of the pronator teres. After emerging from the pronator teres, the median nerve passes deep to an arch created by the two heads of the flexor digitorum superficialis. The nerve continues distally in the forearm between the flexor digitorum superficialis and flexor digitorum profundus. The nerve usually becomes superficial approximately 5 cm proximal to the wrist, emerging between the flexor digitorum superficialis and flexor carpi radialis, dorsal and slightly radial to the palmaris longus tendon.

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92. A 35-year-old man is brought to the emergency department 2 hours after sustaining a severe crush injury to the right distal thigh in a motor vehicle collision. Physical examination shows an open fracture of the femur; the leg and foot are pale and cool. There are no palpable popliteal, dorsalis pedis, or posterior tibialis pulses. Closed reduction does not restore perfusion. Which of the following is the most appropriate next step?
- A) Arterial repair with a polytetrafluoroethylene graft
 - B) Arterial repair with reverse saphenous vein graft
 - C) CT angiography
 - D) Intramedullary fixation of the femoral fracture
 - E) Placement of a temporary vascular shunt

The correct response is Option E.

Gustilo Type IIIC fractures involve arterial injury requiring repair irrespective of the degree of soft tissue and often represent significant limb-threatening injuries. Early recognition and management of lower extremity vascular injury is crucial to limb salvage. CT angiography is of little benefit in the presence of hard signs of vascular injury and can delay operative intervention as well as increase limb ischemia time.

The combination of vascular and orthopedic injuries requiring repair is rare, with a reported incidence as low as 1.5%. Data exist from both wartime and civilian groups evaluating the sequence of management of such injuries. The recommended algorithm suggests improved ischemia times and favorable limb salvage rates with temporary vascular repair, using shunts as the initial adjunct to restore perfusion followed by debridement and fracture fixation.

Definitive vascular repair should follow debridement and fracture fixation. Both synthetic polytetrafluoroethylene and autologous (reverse saphenous vein) interposition grafts are reported to be used in traumatic reconstruction, although autologous tissue is often preferred in the setting of gross contamination.

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93. A 45-year-old right-hand–dominant carpenter comes to the office because of pain in the right hand that worsens during exposure to the cold. Physical examination shows small, distal ulcers on the ring and little fingers. The other fingers are warm, and no abnormalities are noted. Digital brachial index (DBI) of the affected fingers is 0.55 ($N \geq 0.7$). DBI of the other fingers is within the normal range. Which of the following combinations is the most likely diagnosis and most appropriate next step in management?
- A) Cubital tunnel syndrome; surgical intervention
 - B) Hypothenar hammer syndrome; medical treatment
 - C) Hypothenar hammer syndrome; surgical intervention
 - D) Raynaud disease; medical treatment
 - E) Raynaud disease; surgical intervention

The correct response is Option C.

Hypothenar hammer syndrome (HHS), or ulnar artery occlusion at the wrist, involves reduced or no flow to the areas supplied by the ulnar artery. Typically due to arterial occlusion, angiography may show areas of stenosis and ectasis (“corkscrew” pattern). In either case, there are symptoms related to arterial insufficiency. Treatment options range from medical to surgical.

Indications for surgery include digital ulceration (a late finding) and distal brachial index (DBI) of less than 0.7. Surgery may involve simple ligation and resection or require reconstruction. Typical indications for surgical reconstruction include inadequate collateral flow or inadequate circulation. Some authors suggest that a preoperative DBI of less than 0.7 is an indication for reconstruction, although others state the DBI needs to be measured after arterial ligation/excision.

HHS may initially be approached with medical treatment, but the presence of ulceration and a DBI of less than 0.7 indicate the need for surgical intervention.

Raynaud disease is a vasospastic disorder which would give similar findings to HHS, except that it would not be limited to just the ulnar digits.

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94. A 24-year-old woman comes to the office because of severe thenar atrophy 3 years after failed repair of a low median nerve laceration. Tendon transfer to restore thumb opposition is planned. Optimal transfer would restore which of the following thumb functions?

- A) Palmar abduction, extension, supination
- B) Palmar abduction, flexion, pronation
- C) Palmar abduction, flexion, supination
- D) Radial abduction, extension, pronation
- E) Radial abduction, flexion, supination

The correct response is Option B.

Injury to the median nerve, either by laceration or compression, results in thenar atrophy and loss of thumb opposition. Tendon transfer is the only reliable technique to restore thumb function in the face of severe, long-standing atrophy. Thumb opposition is a composite movement comprised of palmar abduction, flexion, and pronation. Opposition positions the thumb for grasp, but is not synonymous with it. There are numerous tendon transfer procedures described to improve thumb opposition (e.g., palmaris longus, abductor digiti minimi, flexor digitorum superficialis), but the most effective improve each of the three components. Thumb extension, supination, and radial abduction (in the plane of the hand) are not movements involved in opposition.

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95. A 25-year-old man is brought to the emergency department after he sustained a mutilating injury to the right hand and wrist that requires soft-tissue reconstruction. Examination shows exposed tendon and bone over the dorsum of the right hand and wrist. The zone of injury extends to the level of the elbow. Allen test is abnormal. Which of the following is the most appropriate method of reconstruction?
- A) Coverage with a groin flap
 - B) Coverage with a reverse radial forearm flap
 - C) Full-thickness skin grafting
 - D) Negative pressure wound therapy
 - E) Split-thickness skin grafting

The correct response is Option A.

The patient described has a mutilating injury to the dorsum of the hand and wrist with exposed extensor tendons and metacarpals, which would not be an appropriate bed for a skin graft. Skin grafts survive initially by plasmatic imbibition and then by inosculation from the wound bed. Wounds with extensive exposure of tendons do not provide the potential for in-growth of vascularized tissue to maintain a skin graft. The radial forearm flap cannot be used in this patient because the palmar arch has been injured and the patient does not have communication between the radial and ulnar arterial system such that arterial compromise can occur if the radial artery is transected for the flap. Negative pressure wound therapy can be considered temporarily, but will not provide definitive management of this complex wound.

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96. A 29-year-old man comes to the office because of pain and the inability to flex the little finger of his dominant right hand 6 weeks after injuring it during a recreational football game. He reports that he “jammed” the finger and then pulled it back into place. He did not seek medical care at the time of the injury. He is concerned about maintaining an active lifestyle and preserving the maximum range of motion. Physical examination shows the inability to flex at the proximal interphalangeal joint. Lateral x-ray study of the finger is shown. Which of the following is the most appropriate management?

- A) Arthrodesis
- B) Dynamic external fixation
- C) Hemi-hamate arthroplasty
- D) Open reduction and internal fixation
- E) Silicone implant reconstruction

The correct response is Option C.

Proximal interphalangeal (PIP) joint fracture dislocations are common finger injuries that result in pain and loss of motion. Normal PIP joint range is 0 to 110 degrees.

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This type of injury normally results from an axial load applied to the finger in a hyperextended position. If more than 30 to 50% of the volar base of the middle phalanx breaks off, the joint will become unstable.

If identified early, the fracture can be managed with either open reduction and internal fixation or dynamic external fixation. At 6 weeks post injury, the fracture fragments would not be mobile, making dynamic external fixation unsuccessful. In addition, it is normally not possible to mobilize the fracture fragments in a manner that they can be reduced and fixated this far out from injury.

Silicone implant arthroplasty can provide pain relief and preserve limited PIP motion in low-demand patients such as those with rheumatoid or osteoarthritis. It would not be sufficiently durable to tolerate the lifestyle of this patient and does not provide as much range of motion as a hemi-hamate graft.

Arthrodesis will provide durable stability and pain relief even in a young patient. However, it sacrifices all motion at the PIP joint. As such, it should be reserved as a salvage option if motion-preserving options fail.

Since its description by Hastings in 1999, hemi-hamate arthroplasty has become a reconstruction of choice for unstable late dorsal fracture-dislocations, particularly those involving more than 50% of the articular surface. The dorsal central portion of the hamate is harvested as an osteocartilaginous graft. Due to the thicker articular cartilage of the distal hamate compared with the base of the middle phalanx, the bone surfaces may appear uneven even though the cartilage surface (and, therefore, the joint surface) is confluent.

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Volar plate arthroplasty (VPA) avoids the need for a bone graft donor site but cannot stabilize a PIP joint if more than 50% of the volar base of the middle phalanx is missing.

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97. A 56-year-old man comes to the office because of a 1-year history of deformity, pain, and decreasing range of motion in the proximal interphalangeal (PIP) joint of the right ring finger. History includes a crush injury to the right ring finger 3 years ago treated with splinting and therapy. Active range of motion of the PIP joint is 20 to 40 degrees. X-ray studies show severe joint space narrowing and osteophyte formation. Implant arthroplasty is discussed. Regardless of the type of implant chosen, which of the following is the most likely expected long-term outcome for this patient?

	Range of Motion	Pain
A)	Increased	no change
B)	Increased	improved
C)	Decreased	no change
D)	Decreased	improved
E)	No change	no change
F)	No change	improved

The correct response is Option F.

Several prospective and retrospective studies have shown that proximal interphalangeal (PIP) joint implant arthroplasty provides significant pain relief with no marked change in preoperative range of motion. This finding has been consistent for both silicone, pyrocarbon, and titanium-polyethylene.

Silicone PIP implants have been in use since the late 1960s. The silicone implant acts as a simple spacer following joint resection to allow for the formation of a fibrous capsule of scar tissue that functions as the new joint. The implants can be placed via volar or dorsal approach. PIP arthroplasty is indicated for osteoarthritis, post-traumatic arthritis, rheumatoid arthritis, and other inflammatory arthritic conditions. Complications for silicone arthroplasty are related to implant fracture or degradation; however, this does not guarantee the need for revision surgery. Revision rates for PIP silicone arthroplasty are between 11 to 13%. One long-term study showed greater than 50% of implants were fractured at 16 years. Studies all show significant pain reduction, improvement in functional scores, and good to high patient satisfaction.

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Surface replacement PIP implants have been used since the late 1990s. These implants depend on either cementing or osseointegration for stability. Pyrocarbon has an elastic modulus similar to cancellous bone. Short-term studies have shown an increase in joint range of motion that is not maintained in longer-term follow-up studies. In addition, many longer-term outcome studies have shown a significantly higher complication rate with surface replacement implants mostly related to loosening, subsidence, fracture, squeaking, and contracture formation. Reoperation rates for surface replacement implants are as high as 39%. However, studies do show a reduction in pain with good patient satisfaction for these implants as well.

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98. A 3-year-old boy sustains a crushing injury to the tip of the right index finger in a door. Physical examination shows a stellate laceration of the nail bed; eponychial fold and proximal nail bed are intact. Which of the following is the most appropriate counsel when advising the patient's parents about what they can expect with regard to fingertip injury and nail growth in their son?
- A) Nail growth will average about 0.1 mm a week
 - B) Nail regrowth will take approximately 3 months
 - C) Scarring of the sterile matrix will lead to absence of nail growth
 - D) The sterile matrix produces about 90% of nail growth

The correct response is Option B.

The perionychium includes the nail bed, nail fold, eponychium, paronychium, and hyponychium. The nail bed includes the germinal matrix proximally and the sterile matrix distally. The nail fold consists of a dorsal roof and ventral floor. The ventral floor is the germinal matrix portion of the nail bed. The germinal matrix produces about 90% of the nail. The sterile matrix adds a thin layer of cells to the undersurface of the nail, keeping the nail adherent to the nail bed. Scarring of the germinal matrix leads to absence of the nail, whereas injury to the sterile matrix leads to nail deformity. Nail growth averages about 0.1 mm/day. Nail appearance is not normal for approximately 100 days after injury. Approximately 50% of injuries are associated with a distal phalanx fracture.

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99. An otherwise healthy 35-year-old man is evaluated in the emergency department 5 hours after he sustained an amputation of the thumb and index finger. Neither digit is salvageable. Physical examination shows an amputation 1 cm proximal to the metacarpophalangeal joint of the thumb. The amputated digit cannot be replanted. To preserve grip strength, which of the following is the most appropriate method for reconstruction?
- A) Distraction osteogenesis of the thumb metacarpal
 - B) Long finger pollicization
 - C) Microvascular toe-to-thumb transfer
 - D) Use of a digital advancement (Moberg) flap
 - E) Use of a ring-to-thumb neurovascular island flap

The correct response is Option C.

In patients who have sustained an amputation of the thumb and replantation is not possible, optimum strength and function are achieved with the toe-to-thumb transfer. The great or second toe may be chosen, depending upon the preference of the patient and the surgeon. The transfer of the great toe gives a more aesthetic thumb reconstruction, but a greater deficit on the foot. Second-toe transfer yields a smaller thumb but a minimal defect on the foot. In a patient who wishes to preserve grip strength, long finger pollicization would yield a weaker grip. Long finger pollicization is not reported. Distraction osteogenesis is useful for amputations at the proximal phalanx or more distal. For proximal amputations, distraction does not allow sufficient length to achieve power grip. Ring-to-thumb neurovascular island transfer is a procedure to gain sensation to an insensate thumb and does not provide bony reconstruction. A digital advancement (Moberg) flap can provide coverage for amputations at the distal phalanx of the thumb. Bony reconstruction is not provided. An amputation at the metacarpophalangeal joint level is too proximal for a digital advancement flap to be useful.

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100. A 61-year-old woman is evaluated because of a volar soft-tissue injury of the thumb tip that she sustained while slicing chicken. Physical examination shows a 2×2.5 -cm soft-tissue defect of the pulp with exposed bone. X-ray study is negative for fracture or dislocation. Which of the following is the most appropriate management?
- A) Cross-finger flap
 - B) First dorsal metacarpal artery flap
 - C) Full-thickness skin grafting
 - D) Moberg volar advancement flap
 - E) Observation

The correct response is Option B.

The most appropriate management is coverage with a first dorsal metacarpal artery flap.

The patient described has sustained a soft-tissue defect of the digit with exposed bone. Given the size of the defect and the exposure of bone, soft-tissue coverage is warranted. The first dorsal metacarpal artery flap is an island flap of tissue based on the first dorsal metacarpal artery. This can provide sensate soft-tissue coverage to the thumb in a single stage, with inclusion of radial sensory nerve branches.

The cross-finger flap involves using dorsal skin of an adjacent finger to resurface the palmar soft-tissue defect. This will allow for coverage of the defect, but requires a two-stage procedure with immobilization of the two fingers which are sewn together, and can result in marked joint stiffness. Although use of the cross-finger flap is possible, it is more useful in younger patients where stiffness would be less of a concern.

The Moberg volar advancement flap is based on the neurovascular bundles of both ulnar and radial aspects of the digit. This is useful for reconstruction of thumb defects, but there is not sufficient mobility for use in the other digits. Typically, the Moberg flap can cover an area up to 2 cm^2 , but can result in interphalangeal joint contracture.

Observation alone is possible for defects of up to 1 cm^2 but would not be advised in

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this patient with a larger defect and bony exposure.

Skin grafting will likely be unsuccessful with bony exposure and would not restore soft-tissue padding to the area.

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Section 3: Craniomaxillofacial

101. Which of the following cephalometric landmarks is included in the Frankfort horizontal plane?

- A) Nasion
- B) Pogonion
- C) Point B
- D) Porion
- E) Sella turcica

The correct response is Option D.

The two cephalometric planes used most frequently in lateral cephalograms to describe and evaluate the cranial base are the Sella-nasion plane and the Frankfort horizontal plane. The Frankfort horizontal plane is defined by a line from the superior edge of the external auditory meatus (porion) to the inferior orbital meatus (orbitale). The SNA and SNB are angles used to describe the position of the maxilla and mandible, respectively. The SN refers to a line from the sella turcica to the nasion, while point A is on the maxilla and point B is on the mandible. The pogonion refers to the chin point.

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102. An 8-hour-old male newborn is examined in the neonatal intensive care unit for epibulbar dermoids. X-ray studies show fused cervical vertebrae. Which of the following additional features is most consistent with this diagnosis?

- A) Cleft palate
- B) Lower lip pits
- C) Microtia
- D) Syndactyly
- E) Telecanthus

The correct response is Option C.

Oculoauricular dysplasia (Goldenhar syndrome) may have many different possible manifestations, but is typically characterized by ear anomalies, epibulbar dermoids, facial and mandibular hypoplasia, and vertebral anomalies.

Cleft palate, although it may be encountered in patients with Goldenhar syndrome, is not generally regarded as a classic finding and is less common than microtia in affected patients.

Lower lip pits are a finding suggestive of van der Woude syndrome, the most common orofacial clefting syndrome, rather than Goldenhar syndrome.

Syndactyly is not generally regarded as a component of Goldenhar syndrome.

Telecanthus is not a classic finding in patients with Goldenhar syndrome.

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103. An otherwise healthy 50-year-old woman is referred 1 hour after Mohs micrographic surgery. The margins are clear. Physical examination shows a 1.4-cm full-thickness skin and soft-tissue defect of the nasal tip. Which of the following is the most appropriate method of reconstruction in this patient?

- A) Bilobed flap
- B) Split-thickness skin graft
- C) Nasolabial flap
- D) Paramedian forehead flap
- E) V-Y advancement flap

The correct response is Option A.

The most appropriate method of reconstruction for this patient with a moderate-sized full-thickness skin and soft-tissue defect is a bilobed flap. This technique will cover the defect with existing nasal skin providing the best color match and tissue thickness. Although bilobed flaps do have a fair amount of scarring, these incisions typically heal well. A split-thickness skin graft is not an ideal choice for nasal tip reconstruction, as this option is typically too thin to match the surrounding skin resulting in a depressed scar. Furthermore, the color match is usually not optimal. A forehead flap would be a useful technique for larger defects; however, this operation would require two trips to the operating room and is excessive for a moderate-sized defect such as described. The V-Y advancement flap is not a good choice for nasal tip defects, as it is difficult to reach the defect from the surrounding tissues and advancement results in marked distortion. A nasolabial flap is a good choice for defects of the ala but requires two operations for the nasal tip (flap transfer followed by sectioning and inset) and is therefore suboptimal compared with the bilobed flap.

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104. A 4-week-old male newborn is evaluated for complete left unilateral cleft of the lip and palate. Genetics workup shows *IRF6* gene mutation. Which of the following additional physical findings is most likely in this patient?

- A) Agenesis of the corpus callosum
- B) Glossoptosis
- C) Hypodontia
- D) Medialized internal carotid arteries
- E) Preauricular accessory tag

The correct response is Option C.

The mutation for van der Woude syndrome has been mapped to the interferon regulatory factor 6 (*IRF6*) gene in chromosome 1. The inheritance is autosomal dominant with variable penetrance. Other associated findings include hypodontia (as high as 86%), high arched palate, lip pits, syngnathia, and ankyloglossia. Agenesis of the corpus callosum and preauricular skin tags are not associated with van der Woude syndrome.

Glossoptosis is associated with Pierre Robin sequence. Medialized internal carotids can be seen in patients with velocardiofacial syndrome.

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105. The association between craniofacial defects and cardiac malformations in patients with velocardiofacial syndrome results from a disruption in the cellular development of which of the following?

- A) Cardiogenic mesoderm
- B) Ectodermal placodes
- C) Lateral plate mesoderm
- D) Neural crest
- E) Somites

The correct response is Option D.

Neural crest cells derive from the ectoderm layer of the developing embryo, specifically the neuroectoderm of the forebrain, midbrain, and hindbrain. The neural crest contributes significantly to the craniofacial region, and also to the conotruncal endocardial cushions that are responsible for dividing the outflow tract of the heart into separate pulmonary and aortic components. Therefore, defects in neural crest cell development will frequently result in malformations of both the craniofacial area and cardiac septum. Examples of this association are: Treacher Collins syndrome, Pierre Robin sequence, 22q11.2 deletion syndrome, and oculauriculovertebral syndrome.

The cardiogenic mesoderm derives from splanchnic (visceral) mesoderm, and contributes the precursor cells that differentiate into the endocardium and myocardium. It does not contribute to the head and neck.

Ectodermal placodes are separate from the neuroectoderm and consist of areas of thickened ectoderm that guide neural crest cells in forming the cranial sensory ganglia.

Lateral plate mesoderm is a derivative of the mesoderm layer of the embryo and contributes to the laryngeal cartilages and associated connective tissue of the head and neck.

Paraxial mesoderm produces somites that form the skull, meninges, voluntary craniofacial musculature, and dermis and connective tissue of the dorsal aspect of the head.

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106. A female newborn is evaluated after an uneventful delivery because of microtia of the left ear. The face appears otherwise symmetrical. Which of the following studies is most appropriate to obtain?

- A) CT scan to rule out tethered cord
- B) Echocardiography to rule out ventricular septal defect
- C) Extremity x-ray studies to rule out limb-length discrepancies
- D) Magnetic resonance angiography of the brain to rule out ipsilateral cerebral artery anomalies
- E) Ultrasonography of the kidney to screen for structural anomalies

The correct response is Option E.

Syndromic ear anomalies are associated with an increased risk of renal anomalies in syndromes such as brachio-oto-renal syndrome, Townes-Brocks syndrome, etc.

Cardiac abnormalities are not associated with isolated microtia, but they are associated with extended spectrum hemifacial microsomia (oculoauriculovertebral dysplasia).

Magnetic resonance angiography of the brain to rule out internal cerebral artery anomalies is indicated in children suspected of PHACE syndrome (P, posterior fossa; H, hemangioma; A, arterial anomalies; C, cardiac defects; E, eye anomalies) when clinical symptoms include a large segmental hemangioma.

Tethered cord is not associated with ear anomalies. It is a concern with myelomeningoceles and spina bifida, and with Chiari malformations.

Limb-length discrepancies are not associated with microtia.

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

107. A 28-year-old man is evaluated because of the facial deformity shown in the photograph. Three years ago, he underwent resection of an infratemporal malignancy and intraoperative alloplastic reconstruction of bony defects. Postoperatively, he underwent extensive radiation therapy. Which of the following is the most appropriate method for restoring facial volume in this patient?
- A) Custom-fabricated alloplastic implantation
 - B) Dermal fat grafting
 - C) Implantation of layered acellular dermis
 - D) Parascapular free flap reconstruction
 - E) Serial fat grafting

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The correct response is Option D.



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

The patient described has marked loss of facial soft-tissue volume related to the initial tumor resection and the adverse effects of postoperative radiation treatment. The best method for restoring soft-tissue volume is a scapular free flap. This method of reconstruction has advantages over the others listed. The free scapular flap does not rely on the damaged and scarred soft-tissue envelope for vascular support and, thus, it will retain its volume. In contrast, fat grafting, dermal fat graft, and layered acellular dermis all undergo some resorption, especially in this poorly vascularized

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recipient site. The scapular flap is of sufficient thickness to correct even a volume defect of this size. Although the other soft-tissue reconstructive options can improve contour, the volume required in this patient cannot be achieved with these modalities alone. The use of an alloplastic reconstruction alone can improve mid-facial volume, but will not address the lower third deficit. In addition, there is a moderate risk of extrusion and/or infection with this technique alone.

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108. A 65-year-old man undergoes surgery for management of a subtotal massive squamous cell carcinoma of the posterior larynx. History includes chemoradiation and subsequent bilateral selective neck dissections for persistent disease 9 months ago. An anterolateral thigh free flap is chosen for reconstruction, but the operative notes state that both external carotid systems were sacrificed. Which of the following recipient vessels is most appropriate in this patient?

- A) Facial
- B) Internal mammary
- C) Occipital
- D) Subclavian
- E) Transverse cervical

The correct response is Option E.

When performing head and neck microsurgery, a strong background in the vascular anatomy of that region is imperative. As chemotherapy regimens have become commonplace for laryngopharyngeal cancers, so have the challenges of failures which generally require surgery. These cases have much higher complication rates, including fistulas, strictures, and carotid injury, among others. This case demonstrates another complexity that is increasingly observed, the “vascular or vessel-depleted neck.” The facial and occipital arteries are branches of the external system and would not be available. The subclavian is generally not a viable option due to its size, location, and potential complications through dissection. The internal mammary system has potential, but requires dissection through the ribs and has morbidities and the potential need of vein grafts. Generally speaking, even radical neck dissections do not sacrifice the transverse cervical vessels as they are usually used as the caudal margin. A number of reports have detailed the usefulness of these vessels as recipients in cases like the one described.

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109. An 8-month-old female infant is brought to the office by her parents. Physical examination shows a wedge-shaped skull with a keel formation on the forehead, close-set eyes, and hollowness of the temporal fossa on both sides of the head. Premature cranial suture ossification at which of the following sites is the most likely cause of this patient's condition?
- A) Bicoronal
 - B) Lambdoid
 - C) Metopic
 - D) Sagittal
 - E) Unicoronal

The correct response is Option C.

Craniosynostosis refers to the premature fusion of one or more cranial sutures that make up the cranial vault and cranial base. Once this fusion occurs prematurely, the growth of the skull is altered and the development of the head takes on a characteristic morphologic shape that is determined by the fusing suture.

Trigonocephaly is classically characterized by a typically wedge-shaped skull when viewed from above; it originates from a premature stenosis of the metopic suture followed by a bilateral growth restriction of the forehead. This results in bitemporal narrowing and hypotelorism.

Plagiocephaly or unilateral coronal synostosis is characterized by the flattening of the forehead and frontoparietal region ipsilateral to the fused suture. As a result of this fusion, a compensatory bulge occurs in the opposite frontoparietal skull. The temporal fossa on the side of the fusion is convex and the ear becomes anteriorly displaced. The petrous portion of the temporal bone that contains the glenoid fossa is also displaced forward and the articulation with the mandible is displaced forward as a result. The nasal radix is also deviated toward the fused side and the tip of the nose is turned to the opposite side.

Ridging of the sagittal suture forms a narrow biparietal skull. Scaphocephaly shows compensatory growth in the frontal region or frontal bossing and/or occipital coning. There is associated enlargement of the head circumference. Sagittal synostosis remains the most frequent of the nonsyndromic craniosynostosis.

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Unilateral lambdoid synostosis has ridging of the lambdoid suture, ipsilateral parieto-occipital flattening, prominence of the mastoid air cells, posterior displacement of the ear on the side of the occipital flattening, and scoliosis of the base of the skull, resulting in curvature of the cervical spine.

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110. A 22-year-old woman comes to the office for evaluation of an abnormal bite. On physical examination, she has an anterior open bite, and the upper teeth are not exposed with the lips in repose. Cephalometric analysis shows a nasion (N) to anterior nasal spine (ANS) distance of 45 mm (N 52–57 mm), an ANS to menton (Me) distance of 63 mm (N 63–68 mm), and an N-ANS:ANS-Me ratio of 1:1.4 (N 1:1.2). All other measurements are within the reference ranges. Which of the following is the most appropriate surgical procedure for correction of this patient's deformity?
- A) Le Fort I maxillary osteotomy with downward repositioning
 - B) Le Fort II osteotomy with maxillary advancement
 - C) Naso-orbito-maxillary osteotomy
 - D) Perinasal osteotomy
 - E) Sagittal split osteotomy with mandibular setback

The correct response is Option A.

Le Fort I osteotomy with downward repositioning effectively lengthens the maxilla in cases of isolated vertical maxillary hypoplasia. The maxilla is repositioned vertically in its entirety or rotated downward, depending on whether or not the hypoplasia extends to the posterior maxilla. The goal is to close the anterior open bite and to restore facial height, allowing 3 to 4 mm of upper incisor to show with lips in repose.

Perinasal osteotomy is a procedure designed to lengthen the skeletal framework of the nose. It lengthens and increases nasal projection. It is therefore a suitable procedure for patients with nasomaxillary hypoplasia and a foreshortened nose, but with normal dental occlusion and facial height. It does not correct maxillary height or change the dental relationships.

Naso-orbito-maxillary osteotomy is a step beyond perinasal osteotomy, in that it corrects both the foreshortened and retruded nasal framework and maxillary hypoplasia horizontally and vertically. The entire osteotomized segment includes the central section of the maxilla from nasion to teeth, and from one internal orbital rim to the other. It can therefore close an anterior open bite when vertical maxillary insufficiency is a component of the deformity in addition to a retruded nasomaxillary complex. However, it would most likely shift the occlusion into class

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II if there were not also a horizontal deficiency of the maxilla. Therefore, it is not an appropriate procedure for the patient in the vignette because it would alter the naso-orbital region unnecessarily, and possibly cause a new deformity or abnormal relationship in this otherwise isolated vertical maxillary deficiency. The indications for a or a naso-orbito-maxillary osteotomy would overlap those for a Le Fort II osteotomy.

Le Fort II osteotomy is indicated for nasomaxillary hypoplasia with a recessed maxilla and class III malocclusion. This is frequently noted in patients with a history of cleft lip and palate. The same discussion used for the naso-orbito-maxillary osteotomy would apply here as well.

Sagittal split osteotomy is a procedure that modifies the mandible, permitting setback or advancement of the mandibular dentition when the cause of the malocclusion is mandibular hypoplasia or overdevelopment. It has no effect on the maxilla.

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111. A 47-year-old man is referred for examination of a composite defect of the mandible that extends from the right mandibular angle to the left mandibular angle. Which of the following flaps is most appropriate for reconstruction in this patient?

- A) Fibula
- B) Pectoralis
- C) Radial forearm
- D) Rectus
- E) Scapula

The correct response is Option A.

The fibula flap is the most appropriate option in this case because a long section of bone requiring multiple osteotomies is needed. The fibula flap can provide 18 to 20 cm of bone and has both an endosteal and periosteal blood supply enabling shaping of the bone with multiple osteotomies. In addition, a skin paddle can be harvested with the flap to reconstruct the floor of mouth defect. The scapula and radial forearm flaps also provide bone and soft tissues; however, these flaps will not provide a long enough bone segment and cannot be reliably osteotomized in multiple locations. The rectus and pectoralis flaps are soft-tissue flaps, and their use in this case would result in marked deformity because the anterior arch has been resected.

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112. A 30-year-old woman comes to the office for evaluation of an asymmetric smile. Two months ago, she underwent primary neuroorrhaphy of a facial nerve laceration 2 cm lateral to the oral commissure. Physical examination shows no elevation of the upper lip with smiling on the side of the injury. Which of the following is the most appropriate management?

- A) Cross-facial nerve grafting
- B) Facial sling suspension
- C) Free muscle transfer
- D) Injection of botulinum toxin type A
- E) Observation

The correct response is Option E.

The injury period is short enough that the potential for the initial neuroorrhaphy to work is still likely. Clinical Tinel sign would be helpful to assess this further. Injection of botulinum toxin type A at this point would confuse the picture because it would prevent clinical monitoring of nerve recovery. If the patient does not recover nerve function within the next 6 months, then she is still a candidate for facial reanimation because the injury is not long-standing. A static procedure is not indicated unless the patient has a long-standing injury or is not a candidate for facial reanimation.

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

113. A male newborn is evaluated because of the scalp anomaly shown in the photograph. Which of the following is the most appropriate initial management of the affected area?
- A) Application of a skin substitute
 - B) Local wound care with antibiotic ointment
 - C) Primary closure
 - D) Skin grafting
 - E) Tissue expansion

The correct response is Option B.

This child has aplasia cutis congenita, or cutis aplasia, of the scalp. First described in 1767 by Cordon, cutis aplasia is the congenital absence of all skin layers including the epidermis, dermis, and subcutaneous fat. This process most commonly affects only focal areas of tissue but involvement can be extensive. The majority of cases

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involve the scalp, but this process can occur in any cutaneous area of the body. Cutis aplasia can occur in isolation or as part of a syndrome, the most common being Adams-Oliver syndrome. Cutis aplasia of the scalp can range from small areas of involvement that often heal in utero and appear at birth as a “congenital scar” to massive defects that are devoid of scalp and cranium. Most small- or intermediate-sized full-thickness defects heal quickly (as in the patient described) if kept moist and the resultant scar can be excised secondarily. Bone healing is often complete in small lesions, and residual defects can be reconstructed when the child is older if needed. Large areas are more problematic and extensive scalp defects that threaten dural integrity may require early operative intervention. Cutis aplasia involving large areas of the scalp has a reported mortality ranging from 20 to 55%, typically as a result of sagittal sinus hemorrhage or associated congenital defects. In such cases, coverage of the dura can be life-saving. Described methods of soft-tissue coverage include skin graft, cultured allograft, acellular dermis, and immediate or delayed reconstruction with a flap. Tissue expansion of the scalp in a newborn presents many challenges and is not recommended.

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114. A 55-year-old man is referred because of a 1-year history of ear and throat pain. Physical examination shows a 1-cm exophytic tumor of the anterior tonsillar pillar within the oropharynx. Biopsy of the tumor shows squamous cell carcinoma. Which of the following cervical lymphatic levels is most likely to be first involved in this patient?
- A) I
 - B) II
 - C) III
 - D) IV
 - E) V

The correct response is Option B.

The anterior tonsillar pillar (palatoglossal arch) and tonsil are the most common site for primary neoplasms of the oropharynx. A 1-cm tumor (T1) at this location has a 71% incidence of cervical lymph node metastases. Oropharyngeal tumors arising at the base of the tongue have a similar incidence of lymphatic metastases, whereas oropharyngeal wall and soft palate T1 tumors only metastasize in 8 to 25% of cases. The most direct path of lymphatic drainage from the oropharynx is to level II (jugulodigastric) lymph nodes, which can be examined clinically. From level II the progression is sequential to levels III, IV, and V. It is rare to encounter a “skipped” level. The other less frequent lymphatic drainage pathways detectable only on imaging studies are to retropharyngeal and parapharyngeal nodes. Midline tumors can drain to bilateral lymphatic systems.

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115. A 70-year-old man is evaluated following tumor resection. Physical examination shows a 4 × 4-cm defect of the right maxilla that includes all of the teeth posterior to the right canine (two premolars and three molars) but spares the right orbital floor. He did not undergo radiation therapy. He wishes to restore mastication, speech, and swallowing by the simplest means that will still be efficacious. Which of the following is the most appropriate method of reconstruction?
- A) Fibula osteocutaneous free flap with osseointegrated implants
 - B) Osseointegrated implant–retained prosthesis
 - C) Prosthetic obturator
 - D) Rectus abdominis musculocutaneous free flap with a conventionally retained dental prosthesis
 - E) Temporalis muscle pedicled flap

The correct response is Option C.

Palatal obturators can adequately restore missing maxillary dentition as well as prevent oronasal leakage of air, liquids, and foods. They have the advantage of being removable, which permits visualization of the maxillary cavity for tumor surveillance. Prosthetic retention can be difficult or impossible in sizable defects, particularly when there are few teeth to stabilize the prosthesis. In this patient who has sufficient remaining maxillary teeth and the majority of the alveolar arch, the prosthesis is expected to have good stability, and would be the appropriate choice in a patient who wishes to avoid further invasive procedures.

The temporalis muscle flap can be transposed into the oral cavity and can be used for closing defects of the palate. However, this flap alone would not provide replacement of the missing dentition and is still more invasive than a palatal obturator. Additionally, the temporalis muscle flap results in marked temporal hollowing at the donor site. The rectus abdominis musculocutaneous free flap can close the palatal defect and restore shape to the cheek in patients with a unilateral maxillectomy. In combination with a dental prosthesis, the rectus abdominis musculocutaneous free flap can restore the patient's appearance and function. However, the rectus abdominis musculocutaneous free flap is also an invasive procedure, and it can sometimes be challenging to inset the flap such that there is enough room in the mouth for a prosthesis. In a patient who has had a maxillectomy,

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there is generally inadequate remaining bone stock to place osseointegrated implants for prosthetic retention. The patient's existing dentition should be adequate to support a prosthesis. The fibula osteocutaneous free flap and other osteocutaneous flaps can be used to close the palatal defect to prevent nasal regurgitation. The fibula osteocutaneous free flap can also accept osseointegrated implants for dental restoration due to the good quality of bone stock associated with this flap. However, fibula free flap and osseointegrated implant reconstruction is a very long and extensive procedure and can require more than one surgery to fully restore this patient, particularly if osseointegrated implants are not placed during the same procedure as the free flap reconstruction.

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116. Which of the following cranial nerves provides parasympathetic innervation of the parotid gland?

- A) V
- B) VII
- C) VIII
- D) IX
- E) X

The correct response is Option D.

Innervation of the parotid gland comes from parasympathetic fibers that travel with the glossopharyngeal nerve (cranial nerve IX). It also receives taste sensation (afferent) from the posterior one-third of the tongue.

The maxillary nerve of cranial nerve V (V2) is a sensory nerve and receives sensation from the mid face.

Parasympathetic fibers (efferent) innervate the submandibular and sublingual glands via the chorda tympani. Afferent fibers, via the chorda tympani, send taste sensation of the anterior two-thirds of the tongue.

The vestibulocochlear nerve (cranial nerve VIII) supplies sound and equilibrium to the brain.

The auricular branch of the vagus nerve (cranial nerve X), innervates the external acoustic meatus. Stimulation of the vagus nerve can lead to reflex coughing (Arnold reflex).

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117. A 21-year-old man with type 1 diabetes mellitus comes to the emergency department because of a large necrotizing, non-purulent infection after minimal trauma to the right cheek. Radical surgical debridement of the ulcer is performed, and the tissue is sent for histologic and microbiologic evaluation. Which of the following organisms are most likely to be found on light microscopy?
- A) Chain-like collections of gram-positive bacteria
 - B) Grape-like clusters of gram-positive bacteria
 - C) Right angle nonseptate branching hyphae
 - D) Septate nonbranching hyphae and yeast forms
 - E) Tiny yeast forms with occasional unequal bud formation

The correct response is Option C.

Given the patient's history of diabetes and necrotizing non-purulent infection after minimal trauma, he is likely to have mucormycosis, a life-threatening fungal infection caused by organisms from the class *Zygomycetes*. On microscopy, tissue samples from patients with mucormycosis demonstrate right-angle nonseptate branching hyphae.

Grape-like clusters of gram-positive bacteria is not appropriate. This option describes the characteristic appearance of a staphylococcal infection. Given the patient's lack of cellulitis or purulent infection, it is an unlikely mechanism for this necrotizing ulceration.

Septate nonbranching hyphae and yeast forms is not appropriate. This option describes the characteristic appearance of a candidal infection. Given the patient's lack of marked erythema and excoriation, and location of the infection on the face, rather than in skin folds, the likelihood of *Candida* as the primary pathogen is extremely low.

Chain-like collections of gram-positive bacteria is not appropriate. This option describes the characteristic appearance of a streptococcal infection. Although streptococcal infections are common in the head and neck region, the patient's history and appearance of the lesion do not support *Streptococcus* as the causative organism.

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Tiny yeast forms with occasional unequal bud formation is not appropriate. This option describes the characteristic appearance of *Histoplasma capsulatum*, an opportunistic fungus, which may cause marked pulmonary infections in immunocompromised patients.

Often emergent debridement is required, and that decision will need to be made on Gram stain, not on final culture.

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118. A 60-year-old man is evaluated for a 6-cm ameloblastoma of the right maxilla. Reconstruction using an osteocutaneous iliac crest free flap is planned. Which of the following arteries supplies arterial blood to this flap?

- A) Deep circumflex iliac
- B) Deep inferior epigastric
- C) Descending genicular
- D) Lateral circumflex femoral
- E) Peroneal

The correct response is Option A.

The deep circumflex iliac artery is the major blood supply to the iliac crest free flap. It gives rise to periosteal branches and nutrient endosteal branches that supply the iliac crest bone posterior to the anterior superior iliac spine. It also gives rise to an ascending branch that supplies the internal oblique muscle and several musculocutaneous perforators that supply the overlying skin, allowing a myo-osseous or osteocutaneous free flap to be harvested, respectively. Use of the iliac crest osteocutaneous free flap has been described by several authors for maxillary as well as mandibular reconstruction, and the bone itself provides ample stock for accommodating osseointegrated implants for dental restoration.

The peroneal artery is the blood supply to the fibula free flap. Use of this flap is contraindicated when the peroneal artery contributes markedly to the blood supply of the distal lower extremity. The descending genicular artery is a branch of the superficial femoral artery and is the blood supply to the medial femoral condyle osseous free flap. Alternately, the medial superior genicular artery, another branch of the superficial femoral artery, can be used to supply this flap, but the pedicle is shorter. The descending branch of the lateral circumflex femoral artery is the blood supply to the anterolateral thigh free flap, which is a cutaneous perforator flap. The deep inferior epigastric artery is the blood supply to the rectus abdominis musculocutaneous free flap or the deep inferior epigastric perforator flap.

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119. Velar competence after treatment of velopharyngeal insufficiency with Furlow double-opposing Z-plasty is most strongly correlated with which of the following?

- A) Age at the time of procedure
- B) Compliance with speech therapy
- C) Patient gender
- D) Preoperative closure gap
- E) Type of cleft

The correct response is Option D.

Furlow double-opposing Z-plasty is an effective method of treating velopharyngeal insufficiency associated with submucous cleft palate or following conventional push-back palatoplasty procedures. Several studies suggest that the size of the preoperative velopharyngeal gap, as determined by preoperative nasendoscopy, is the most important determinant of velar competence after Furlow palatoplasty. Thus, patients with a smaller preoperative maximal closure gap were more likely to have a competent velopharyngeal sphincter postoperatively. The procedure has also been reported to be less effective in older children, in overt (versus submucous) clefts, and in patients with certain syndromes such as velocardiofacial syndrome. Nevertheless, these variables are not as important as the preoperative gap. The gender of the patient and compliance with speech therapy do not influence outcomes.

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120. A 2-month-old male infant is evaluated for complete unilateral cleft of the lip and palate. Development of which of the following tooth buds is most likely to be impaired in this patient?

- A) Central incisor
- B) First molar
- C) Lateral incisor
- D) Premolar
- E) Third molar

The correct response is Option C.

Cleft palates can affect tooth development, leading to a variety of dental abnormalities. In general, the upper lateral incisor tooth bud is most commonly susceptible to injury in the area of the cleft in both the deciduous and permanent teeth. Other teeth in the area of the cleft, such as the canines, may be affected as well. The premolar, molar, and central incisor tooth buds are typically too far from the cleft area to be affected.

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121. Which of the following types of head and neck tumors are most often associated with Epstein-Barr virus infection?

- A) Larynx
- B) Maxillary sinus
- C) Nasopharynx
- D) Tongue
- E) Tonsil

The correct response is Option C.

Nasopharyngeal cancers are most often associated with Epstein-Barr virus (EBV) infections and arise from the mucous epithelium of the nasopharynx and are relatively rare in the United States. However, these tumors are endemic in Africa and East Asia, accounting for as many as 18% of head and neck cancers in China. Nasopharyngeal tumors are classified as either squamous cell cancers, keratinizing undifferentiated carcinoma, or non-keratinizing undifferentiated carcinoma. EBV infection is most strongly associated with the non-keratinizing undifferentiated subtype and is thought to increase malignant transformation. Nasopharyngeal cancers are most commonly treated with chemotherapy and radiation, with surgery reserved for recurrent or unusual cancers. Reconstruction of skull base defects is most commonly performed using microsurgical transfer of soft-tissue flaps. Alcohol and tobacco are the most common risk factors for head and neck cancers in general, and laryngeal cancers in particular, with cigarette smoking increasing the lifetime risk 5- to 25-fold. Other risk factors for head and neck cancers in general include cigar smoking, environmental exposures, dietary factors (red meat, betel nuts), and human papillomavirus (HPV) infection. HPV infections are most commonly associated with oropharyngeal cancers (tongue, tonsil). Significant risk factors for maxillary sinus cancers include cigarette smoking and environmental factors such as exposure to wood dust.

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122. A 38-year-old truck driver is examined in the emergency department following a motor vehicle collision. He is sedated and intubated on a spine board. On examination, ecchymoses over the cheeks, swelling over the left jaw, and pulsation of the left globe are noted. Which of the following is the potential fracture of most concern?

- A) Mandibular body
- B) Medial maxillary buttress
- C) Nasal bone
- D) Orbital roof
- E) Zygomatic-malar complex

The correct response is Option D.

Fractures of the orbital roof that enter the middle cranial fossa may allow communication between the cavernous sinus and the carotid artery. Other findings include associated bruit and ipsilateral blindness, which would not be appreciated in the obtunded patient. The remaining fractures are important but are not as critical as a carotid-cavernous fistula.

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123. A 72-year-old man undergoes wide local excision of a squamous cell carcinoma of the lower lip. Margins are free of involvement. A photograph of the resulting defect is shown. Reconstruction using which of the following flaps is most appropriate in this patient?
- A) Estlander
 - B) Facial artery myomucosal
 - C) Karapandzic
 - D) Melolabial
 - E) Submental artery island

The correct response is Option C.

Karapandzic flaps are appropriate for reconstruction of defects involving one to two thirds of the lower lip, such as the one in this patient. The Karapandzic technique involves performing circumoral incisions and mobilizing the orbicularis oris muscle,

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while preserving its innervations and vascular supply. The main advantage of this technique is that a continuous sphincter of functional orbicularis muscle is created, helping to restore oral competence.

The Estlander flap is a full-thickness, cross-lip transposition flap designed to reconstruct lateral defects of the lower lip (one to two thirds) requiring recreation of the oral commissure.

Melolabial flaps can be used to reconstruct large full-thickness lower lip defects. However, they require grafting of the deep surface of the flap, have a less reliable random blood supply, and do not provide a functional muscular oral sphincter.

The submental artery island flap is based on the submental branch of the facial artery. A paddle of skin, subcutaneous tissue, and fascia harvested from the submental area can be used for coverage of lower face and preauricular defects, as well as inferior and lateral neck wounds. Its use for reconstruction of partial lower lip full-thickness defects has not been established.

Facial artery myomucosal flaps consist of oral mucosa, submucosa, a small amount of buccinator muscle, and a more deeply lying facial artery and venous plexus. They are ideal for reconstructing the inner, most lip mucosa because they consist of similar tissue, with the same color, texture, and moisture. They can also be used for reconstruction of the dry vermilion, although some drying-out and scabbing of the mucosa will occur. They are not indicated for large, full-thickness lower lip defects.

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

124. A 4-month-old female infant is brought to the office for evaluation. A photograph is shown. Which of the following additional abnormalities are most likely associated with this patient's condition?
- A) Glossopexy and cleft palate
 - B) Hydronephrosis of the kidneys and hearing loss
 - C) Lacrimal duct obstruction and coloboma of the eyelids
 - D) Posterior fossa abnormalities and stenotic cerebral arteries
 - E) Supernumerary teeth and duplicate maxilla

The correct response is Option E.

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The patient described has bilateral macrostomia, also known as Tessier No. 7 cleft, the most common facial cleft in the Tessier classification system. This resulted from the failure of fusion between the maxillary and mandibular processes. Repair of the macrostomia can be undertaken in the first months of life. Duplicated maxilla has been reported in as high as 39% of patients with macrostomia. It is defined as having multiple supernumerary teeth and marked overlap of the maxillary arches. Other craniofacial findings such as mild mandibular/condylar anomalies and alveolar clefting have also been reported. The anatomy can be defined by three-dimensional CT scan and panoramic x-ray study (Panorex). Therefore, it is important to continue to observe these children with dental and orthodontic workups as they grow, even after the repair of the macrostomia.

Glossoptosis and cleft palate are associated with Pierre Robin sequence. Renal anomalies may be associated with congenital anomalies of the ears, such as in branchiootorenal syndrome.

Posterior fossa abnormalities and intracranial arterial anomalies are associated with PHACE syndrome. (P, posterior fossa; H, hemangioma; A, arterial anomalies; C, cardiac defects; E, eye anomalies).

Coloboma of the eyelids and lacrimal gland anomalies are associated with Tessier No. 3 clefts (oro-nasal-ocular clefts).

Macrostomia is most commonly associated with hemifacial microsomia.

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125. A 16-year-old boy comes to the office because of a progressive 6-month history of unilateral nasal obstruction and frequent epistaxis. Anterior rhinoscopy shows a soft, smooth, purplish lobulated mass filling the left nasal cavity. An attempted office biopsy results in profuse bleeding. Which of the following is the most likely diagnosis?
- A) Dermoid cyst
 - B) Encephalocele
 - C) Hemangioma
 - D) Inverted papilloma
 - E) Nasopharyngeal angiofibroma

The correct response is Option E.

Nasopharyngeal angiofibromas, also known as juvenile nasopharyngeal angiofibromas, are benign but locally invasive vascular tumors that occur almost exclusively in adolescent males. Onset is most common in the second decade of life, and rarely occurs after age 25 years. Symptoms include unilateral or bilateral nasal obstruction, frequent epistaxis or blood-tinged nasal discharge, and conductive hearing loss from Eustachian-tube obstruction. In advanced stages, the angiofibroma can deform the nose, face, and orbits, as well as erode into the cranial cavity and put pressure on the optic chiasm, resulting in diplopia. Treatment is usually surgical with radiation and reserved for extensive cases such as those with intracranial extension. Preoperative embolization as well as hormone therapy with estrogens, may limit blood loss. Nasopharyngeal angiofibromas are highly vascular, and office biopsies should be avoided.

Inverted papilloma is a benign, locally aggressive neoplasm that arises in the nasal cavity and is associated with squamous cell carcinoma in approximately 5% of patients. The age of onset is usually between 40 and 60 years. Surgery is the primary treatment of inverted papilloma. Encephaloceles are neural tube defects that result in sac-like protrusions of the meninges (meningocele) or brain and meninges (meningoencephalocele) in various locations along the cranium, including intranasally. They tend to be bluish, soft, compressible masses that transilluminate. Biopsy may result in a cerebrospinal fluid leak. Hemangiomas are benign vascular lesions that are present at birth and characterized by a rapid growth phase around the age of 1 to 6 months followed by gradual involution over 1 to 12 years. A

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hemangioma would not be expected to first occur in adolescence. Dermoid cysts are derived from ectodermal and mesodermal tissue and may contain skin, hair follicles, sebaceous glands, and sweat glands. Dermoids are usually firm and noncompressible and most frequently occur as a slow-growing cystic mass over the dorsum of the nose, but may also be entirely intranasal. Dermoid cysts may also have a dural component and should not be biopsied until intracranial communication can be ruled out by x-ray studies. Encephaloceles, hemangiomas, and dermoid cysts are congenital nasal masses that occur in infancy rather than adolescence.

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126. Proper reduction of an isolated zygoma fracture requires reduction and realignment of which of the following?

- A) Zygomaticofrontal suture, zygomaticomaxillary buttress, and infraorbital rim
- B) Zygomaticofrontal suture, zygomaticomaxillary buttress, and orbital floor
- C) Zygomaticofrontal suture, zygomaticonasal suture, and infraorbital rim
- D) Zygomaticomaxillary buttress, infraorbital rim, and nasomaxillary buttress
- E) Zygomaticomaxillary buttress, orbital floor, and alveolus

The correct response is Option A.

A zygoma fracture involves displacement of the zygoma that articulates with the frontal bone, maxilla, and sphenoid. In order to stabilize the fracture after adequate reduction, the zygomaticofrontal, zygomaticomaxillary buttress, and infraorbital rim need to be stabilized. If there is a large ($>2\text{ cm}^2$) defect in the orbital floor after reduction, reconstruction of the orbital floor is also necessary to prevent enophthalmos.

Although the nasomaxillary buttress is one of the vertical buttresses of the face, the zygoma does not articulate with the nasal bones.

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127. A 58-year-old man undergoes total laryngopharyngectomy for recurrent squamous cell carcinoma. The pedicle to the most appropriate flap for reconstruction of the resulting total circumferential pharyngectomy defect extending from the base of the tongue to the cervical esophagus is located between which of the following muscles?

- A) Flexor carpi radialis and palmaris longus
- B) Teres minor, teres major, and long head of the triceps
- C) Teres minor, teres major, long head of the triceps, and humerus
- D) Vastus lateralis and rectus femoris
- E) Vastus medialis and rectus femoris

The correct response is Option D.

The best option for reconstruction in this patient requiring circumferential pharyngeal reconstruction is the anterolateral thigh flap. This fasciocutaneous flap is supplied by perforators from the descending branch of the lateral femoral circumflex vessels, which are a branch of the profunda femoris vessels. The descending branch runs between the vastus lateralis and rectus femoris muscles, not the vastus medialis and rectus femoris.

The radial forearm flap is based on the septum between the flexor carpi radialis and brachioradialis muscles in the arm. Although it can be used to reconstruct partial, noncircumferential pharyngectomy defects, it is not ideal for a long, circumferential defect in a previously radiated neck.

The pedicle runs between the flexor carpi radialis and brachioradialis, not the palmaris longus.

The circumflex scapular artery emerges from the triangular space in the back, which is defined by the teres minor, teres major, and the long head of the triceps. It is the pedicle to the parascapular and scapular flaps.

Option C defines the quadrangular space that transmits the axillary nerve and posterior humeral circumflex artery.

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128. Failure of fusion of which of the following results in the formation of a cleft of the lip?

- A) Frontonasal and maxillary prominences during the first 4 to 5 weeks of gestation
- B) Frontonasal and maxillary prominences during the first 9 to 11 weeks of gestation
- C) Lateral nasal and maxillary prominences during the first 2 to 4 weeks of gestation
- D) Medial nasal and maxillary prominences during the first 9 to 11 weeks of gestation
- E) Medial nasal and maxillary prominences during the first 6 to 8 weeks of gestation

The correct response is Option E.

Cleft lip and cleft palate are common birth defects that result from a variety of genetic and environmental factors. On average, they occur in 1.7 of every 1000 live-born babies.

The development of the lip and palate in utero involves a complex series of steps that involve cell migration, proliferation, and apoptosis. During the fourth week of gestational development, neural crest cells migrate to the developing craniofacial region of the embryo, where they help in the formation of the frontonasal prominence, the mandibular processes, and the maxillary prominences. Nasal placodes divide the lower portion of the frontonasal prominence into the paired medial and lateral nasal processes. During weeks 6 to 8 of gestation, fusion of the medial nasal prominences with each other and with the maxillary processes forms the upper lip and primary palate. Therefore, Option E is the most appropriate answer regarding the etiology of the baby's cleft of the lip.

Option D is not appropriate because it states that the failure of fusion occurs during weeks 9 to 11, which is too late in embryological development.

Options A and B are not appropriate because fusion of the frontonasal prominence with the maxillary prominences forms the primary palate.

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Option C describes the embryologic formation of an oblique cleft, and the time frame is not appropriate.

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129. A 23-year-old man sustains multiple fractures to the middle and upper face during a motor vehicle collision. The patient reports disturbances of smell immediately afterwards. Injury to which of the following bones is the most likely reason for this patient's anosmia?

- A) Ethmoid
- B) Frontal
- C) Nasal
- D) Sphenoid
- E) Vomer

The correct response is Option A.

The cribriform plate is the horizontal component of the ethmoid bone which supports the olfactory bulb and creates a passageway for the olfactory nerves.

The cribriform plates (right and left) have many foramina that act as passageways for olfactory nerves and are in intimate contact with the meninges. In addition to anosmia (loss of smell), injury to the cribriform plate may cause tearing of the meninges with cerebrospinal fluid leakage. The crista galli is a midline prominence of the ethmoid, immediately above the cribriform plates, which serves as a point of attachment for intracranial soft tissue. Other components of the ethmoid bone are the vertical portion and the lateral masses. The vertical portion is called the perpendicular plate, which forms part of the nasal septum. The lateral masses of the ethmoid bone contain a plate of bone called the lamina papyracea, which forms part of the medial orbital wall and the ethmoid air cells.

While anosmia and taste abnormalities can occur following a variety of facial fracture patterns, including frontal bone, naso-orbital-ethmoid, nasal, Le Fort, and zygoma, the close anatomic relationship of the ethmoid cribriform plate to the olfactory nerve makes it most likely.

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130. A 7-month-old male infant is referred because of the lesion shown in the photograph. Ophthalmologic examination shows mild astigmatism, for which he was being treated with corrective lenses. No amblyopia is noted. Which of the following is the most appropriate next step in management?
- A) Administration of propranolol 2 mg/kg/day in divided doses
 - B) Magnetic resonance angiography of the brain
 - C) Pulsed-dye laser (595 nm) therapy
 - D) Surgical resection
 - E) Observation only

The correct response is Option A.

The patient described has focal hemangioma. Medical therapy is the first line of treatment in this case when there are minimal ophthalmologic findings. There is a subset of periorbital hemangiomas for which surgical resection is indicated: well-localized hemangioma amenable to resection, greater than 2 diopters of astigmatism, visual obstruction, or nonresponsive to medical therapy. In a study by Arneja and Mulliken, the best ophthalmologic improvement occurred when the hemangioma was resected at less than age 3 months.

Laser therapy can treat discoloration only and will not decrease the bulk of the lesion.

Surgical debulking is indicated if the hemangioma does not clinically respond (softer, lightening in color, no improvement in/worsening of astigmatism).

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131. Which of the following muscles is associated with the hyoid or second branchial arch?

- A) Lateral pterygoid
- B) Levator veli palatini
- C) Posterior digastric
- D) Stylopharyngeus
- E) Thyroarytenoid

The correct response is Option C.

The first branchial arch, also known as the mandibular arch, has the trigeminal nerve (ophthalmic, maxillary, and mandibular branches) as its neurologic component. The muscles of mastication (i.e., temporalis, masseter, medial, and lateral pterygoids); mylohyoid; anterior digastric; tensor tympanic; and the tensor veli palatini are the muscle components. The cartilaginous bar gives rise to the premaxilla; maxilla, zygomatic bone; part of the temporal bone; incus; malleus; anterior malleolar ligament; and the sphenomandibular ligament. The pharyngeal pouch and groove develop the tubotympanic recess (tympanic cavity, mastoid antrum and pharyngotympanic tube, internal acoustic meatus, tympanic membrane, adenoids). The vascular element largely disappears, but gives rise to the maxillary and external carotid arteries.

The second branchial arch, also known as the hyoid arch, accounts for 95% of all branchial arch anomalies. The cranial nerve is the facial nerve. It supplies the muscles of facial expression; buccinators; stapedius; stylohyoid; posterior digastric; auricular and platysma muscles. The skeletal contributions from Reichert's cartilage include the stapes, styloid process, stylohyoid ligament, and hyoid (lesser cornu and upper part of body). The pharyngeal pouch and groove shape the crypts of the palatine tonsil and the cervical sinus. The vascular component again primarily disappears but forms the stapedia and hyoid arteries.

Third branchial cleft anomalies are rare. The glossopharyngeal nerve sends motor innervation to only the stylopharyngeus. The cartilaginous bar forms the hyoid (greater cornu and lower part of body). The pharyngeal pouch and groove give rise to the inferior parathyroids, thymus, and cervical sinus. The vascular elements contribute to the internal carotid and common carotid.

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The fourth branchial arch is supplied by the vagus nerve (superior laryngeal, inferior laryngeal). Musculature innervated includes the cricothyroid and all intrinsic muscles of the soft palate, including the levator veli palatini. The thyroid and epiglottic cartilage develop from the cartilaginous bar. The pharyngeal pouch and groove form the superior parathyroids, and the thyroid parafollicular cells. The right fourth aortic arch forms the subclavian artery, while the left fourth aortic arch forms the aortic arch.

The sixth branchial arch also is supplied by the vagus nerve (recurrent laryngeal nerve). This area supplies all intrinsic muscles of the larynx (except the cricothyroid-fourth arch). This includes the thyroarytenoid muscle, which makes up the primary mass of the vocal fold. It consists of two parts, the ventricularis and vocalis. Skeletal derivations form the cricoid, arytenoid, corniculate, and cuneiform cartilages. The right sixth aortic arch gives rise to the right pulmonary artery and the left sixth aortic arch forms the left pulmonary artery and the ductus arteriosus.

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132. A 4-year-old girl is referred by her speech therapist because she has persistent nasal air escape with phonation. She underwent isolated repair of the cleft palate in infancy. Physical examination shows a long, mobile palate. No fistula is noted. Nasendoscopy shows good coronal closure with poor lateral pharyngeal wall movement. Which of the following is the most appropriate management?
- A) Augmentation of Passavant ridge
 - B) Continued speech therapy
 - C) Implantation of a palatal lift prosthesis
 - D) Posterior pharyngeal flap
 - E) Sphincter pharyngoplasty

The correct response is Option E.

The patient described has velopharyngeal incompetency (VPI). The inability to adequately close the palate against the pharyngeal walls leads to nasal air escape during speech. This is most common with fricatives such as “s” and “z.” As the degree of incompetence increases, speech errors with plosive sounds become apparent, such as “d” and “p” and “b.”

At the age of 4 years, intervention to correct VPI is appropriate. Speech therapy alone is unlikely to improve hypernasal speech production. A delay in treatment can lead to the development of compensatory misarticulation and worsening speech errors that will be difficult to correct in the future.

The goals of surgery are to eliminate the symptoms of hypernasality and eliminate audible nasal emissions without causing complete obstruction of the velopharyngeal (VP) port, allowing for nasal breathing and nasal resonance. Multiple procedures have been described. Studies indicate that the success of repair depends on selecting the appropriate procedure based on the anatomy and the movement of the VP port.

Sphincter pharyngoplasty involves reduction of the lateral and posterior aspects of the VP ports while maintaining the centric opening. The palatopharyngeus muscle is incised, and a flap is constructed from the posterior tonsillar pillar. These bilateral superiorly based musculomucosal flaps are juxtaposed in the midline of the posterior pharyngeal wall. This procedure is advantageous in that it potentially recreates a functional sphincter, and the incidence of postoperative nasal obstruction is less than

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that with the pharyngeal flap.

The nasendoscopic examination demonstrates a classic palate closure pattern where the central gap is minimal, and a much larger gap occurs at the lateral ports. Thus, surgery to close the central gap, such as augmentation of Passavant ridge or a posterior pharyngeal flap, will have a lower success rate.

The prosthetic speech bulb is most useful in patients with little or no VP motion. VP movement is essential to surgical success for the VP flap procedure or sphincteroplasty. Patients with little VP movement are good candidates for prosthetic management. A VP speech prosthesis can elevate the velum (lift), fill the residual velopharyngeal gap (obturator), or both (lift-obturator).

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133. A 45-year-old woman is referred by her primary care physician because of left facial paralysis. She was hiking in the woods 2 weeks ago and pulled a tick off her leg at the end of the weekend trip. Three days ago, she had onset of a rash and fever. Since awakening this morning, she has been unable to move the left side of her face and has had painful spasms on the contralateral (right) side of her face when she tries to smile or talk. On physical examination, she is unable to move the left side of the face. Which of the following is the most appropriate management of this patient's condition?

- A) Acyclovir therapy
- B) Botulinum toxin type A injection
- C) Contralateral facial nerve grafting and free gracilis flap
- D) Corticosteroid therapy
- E) Doxycycline therapy

The correct response is Option E.

The patient described has new-onset facial paralysis brought on by Lyme disease infection. Neurologic manifestations (early disseminated infection) can show symptoms as early as a few days to a few weeks after initial bite.

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

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

Although botulinum toxin type A is efficacious in treating contralateral facial hyperkinesia, the patient is in the initial stages of Lyme disease, and treatment should be aimed at the primary disease at this time.

Corticosteroids are helpful in reducing inflammation and edema which are thought to contribute to the neurologic manifestations in Bell palsy but not for neurologic manifestations of Lyme disease (Lyme neuroborreliosis).

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134. A 12-year-old girl is brought to the office because of an enlarging mass of bone in the maxilla, precocious puberty, and café-au-lait spots. No aesthetic distortion or functional impact from the lesion is noted. She has intermittent bone pain in the upper extremities. Which of the following treatments is most appropriate in this patient?
- A) Calcitonin
 - B) Doxycycline
 - C) Pamidronate
 - D) Prednisone
 - E) Radiation therapy

The correct response is Option C.

The patient described has McCune-Albright syndrome. It is a triad of polyostotic fibrous dysplasia, precocious puberty, and café-au-lait spots. Surgical intervention is not indicated in asymptomatic lesions. The general indications for surgery are aesthetic imbalance, facial disfigurement, distortion of functional occlusion, orbital dystopia, ocular proptosis, impingement on neural foramina, impingement on the optic nerve, and intractable pain. It is debatable whether contour reduction or resection and replacement of the afflicted bone is preferable. Recent literature seems to favor the latter. Biopsy is generally not needed for diagnosis, as imaging studies are generally specific for fibrous dysplasia. Equivocal imaging may warrant biopsy to confirm the diagnosis.

In general, medical treatment has had little impact on fibrous dysplasia. Early attempts at treatment included chemotherapy, glucocorticoids, calcitonin, and radiation therapy, which were all unsuccessful.

Radiation therapy should never be used, as it clearly promotes sarcomatous degeneration of fibrous dysplasia.

Pamidronate, a bone resorption-inhibiting bisphosphonate, has been shown in multiple small studies to decrease pain associated with fibrous dysplasia and decrease bone turnover. Nonsteroidal anti-inflammatory drugs can be effective, as can narcotic analgesics in pain control. Referral to a pain specialist may be necessary.

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135. A 25-year-old man comes to the office because of jaw pain after sustaining a punch to the face 2 days ago. Maxillofacial CT scan shows a displaced comminuted fracture of the left mandibular angle. Open reduction and internal fixation is planned. Which of the following methods of fixation is considered load-bearing osteosynthesis?
- A) Champy plate (oblique ridge)
 - B) Compression plates
 - C) Lag screws
 - D) Locking reconstruction plate
 - E) Simple screws

The correct response is Option D.

Load-bearing osteosynthesis of the mandible may be accomplished with a reconstruction plate and locking screws.

There are two basic types of mandibular fracture fixation: load-bearing osteosynthesis and load-sharing osteosynthesis.

In load-bearing osteosynthesis, the plate (or external fixator) assumes all the forces of mandibular function at the fracture site. Common clinical indications include comminuted fractures, fractures with segmental defects, and those in the atrophic edentulous mandible.

In load-sharing osteosynthesis, stability at the fracture site is created by the frictional resistance between the end of the bone and the hardware used for fixation. This requires adequate bony buttressing across the fracture line. Lag screws, Champy plate (at the oblique ridge), compression plates, and simple screws are examples of load-sharing osteosynthesis, which may have different levels of force distribution between the hardware and the bone.

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136. A 10-month-old male infant with 22q11.2 deletion and preoperative basic metabolic profile within the reference range is scheduled for palatoplasty to treat a soft palate cleft. After surgery, which of the following laboratory studies is most appropriate within the first 6 hours?

- A) Fluorescent in situ hybridization
- B) Measurement of serum phosphate concentration
- C) Measurement of serum calcium concentration
- D) Measurement of serum potassium concentration
- E) Measurement of serum sodium concentration

The correct response is Option C.

Patients with 22q11.2 deletion may have cardiac abnormalities, renal issues, immune deficiencies, speech and feeding delays, mental health issues, developmental delay, cleft palate, and calcium regulation disturbances. Postoperatively, patients with 22q11.2 deletion may be at higher risk than non-deletion patients for hypocalcemia and should have postoperative calcium concentration checked in the first 6 hours postoperatively to identify and correct any abnormalities. Failure to identify postoperative hypocalcemia may lead to increased morbidity and mortality. Fluorescent in situ hybridization is a genetic test that is unnecessary in this patient who already has the diagnosis of 22q11.2 deletion. The sodium, potassium, and phosphate values are not routinely obtained early postoperatively.

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137. A 67-year-old woman comes to the office because of a 1-year history of a 2-cm basal cell carcinoma of the cheek. The lesion is excised with a 5-mm margin leaving a 3.0 × 3.0-cm defect. The wound is closed with a rhomboid flap. Which of the following is the most appropriate current procedural terminology (CPT) code for this procedure?

CPT code	Description
11100	biopsy of skin (including simple closure); single lesion
11643	excision, malignant lesion including margins face, 2.1 to 3.0 cm diameter
13132	repair, complex, cheek 2.6 to 7.5 cm
14040	adjacent tissue transfer or rearrangement cheeks defect 10 cm ² or less
14041	adjacent tissue transfer or rearrangement cheeks defect 10.1 cm ² to 30.0 cm ²

- A) 11100
- B) 11643
- C) 14041
- D) 11643 and 13132
- E) 14040 and 11643

The correct response is Option C.

The most appropriate current procedural terminology (CPT) code for this procedure is 14041, adjacent tissue transfer or rearrangement of cheek defect. In this case, the rhomboid flap is most accurately considered an adjacent tissue transfer. 11643, excision of a malignant lesion is not separately reportable with codes 14000-14302, and separate reporting would be considered unbundling.

If the lesion were excised and closed by wide undermining, only 11643 and 13132, complex closure and excision of malignant lesion, would be used. In this case, the closure consisted of more than simple undermining and thereby closure with an advancement flap is a more appropriate choice. Excision of benign or malignant lesion, excisional preparation of a wound bed, or debridement of an open fracture or open dislocation are not included in complex repair codes.

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The choices of 11643 (excision of malignant lesion) or 11100 (biopsy of skin) both under-code based on the extent of the procedure in the described scenario.

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138. A 39-year-old woman undergoes a total parotidectomy with facial nerve preservation for mucoepidermoid carcinoma of the parotid gland. The final pathology report indicates microscopic disease at the deep margin, and follow-up imaging shows no gross residual disease. No detectable nodal or other metastases are noted. Which of the following is the most appropriate next step in management?
- A) Chemotherapy
 - B) Immunotherapy
 - C) Neck dissection
 - D) Radiation therapy
 - E) Reexcision of the deep margin

The correct response is Option D.

The patient described likely has a stage III tumor (T3 N0 M0). Standard management algorithms developed by the National Comprehensive Cancer Network recommend adjuvant radiation treatment when the persistence of positive margins relates to microscopic disease and not gross disease. If there is gross disease, either by physical examination or follow-up imaging, and it is resectable, then surgical resection of the residual disease should be done initially, followed by adjuvant radiation.

Chemotherapy for major salivary gland tumors is appropriate as a first-line therapy concomitant with radiation only in cases of squamous cell carcinoma. In patients with mucoepidermoid, adenoid cystic, and adenocarcinomas, the role of chemotherapy is mainly palliative and reserved for advanced situations of recurrent or distant systemic disease. The absence of standard chemotherapy protocols for these situations attests to the degree of response that can be expected.

Immunotherapy has no significant role in the treatment of major salivary gland malignancies.

Neck dissection is indicated for malignant salivary gland tumors with clinically positive nodes detected either on physical examination or with preoperative imaging workup. This applies to parotid tumors of either the superficial or the deep lobe. Typical imaging to identify nodal disease would include CT scan or MRI or both.

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Neck dissections performed electively are rarely indicated, and only in very high-risk situations that are based on factors other than clinical and histologic features of the primary tumor. Radiation treatment is an effective treatment for negative necks with high risk of nodal disease, and is preferred over elective neck dissections.

Surgical resection of persistent disease is indicated when a previously treated parotid mass was incompletely resected, and the remaining tumor is gross and resectable, rather than just microscopic. If not resectable, then the patient should have definitive radiation treatment.

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139. A newborn in the neonatal intensive care unit is small for gestational age and has choanal atresia, cryptorchidism, a ventricular septal defect, and abnormal external ear framework. Prenatal findings included growth retardation with poor fetal movement. Which of the following additional characteristics is most likely in this newborn?

- A) Bicoronal craniosynostosis
- B) Coloboma
- C) Radial hypoplasia
- D) Syndactyly
- E) Webbing of the neck

The correct response is Option B.

The newborn described has CHARGE (coloboma of the eye, heart defects, atresia of the nasal choanae, retardation of growth and/or development, genital and/or urinary abnormalities, and ear abnormalities and deafness) syndrome. Bicoronal craniosynostosis is associated with Crouzon, Apert, and Pfeiffer syndromes, which do not include all of the other defects. Radial hypoplasia is associated with VACTERL (vertebral defects, anal atresia, cardiac defects, tracheo-esophageal fistula, renal anomalies, and limb anomalies) syndrome. Syndactyly can be seen in many conditions including Down syndrome, Apert syndrome, and Carpenter syndrome. Webbing of the neck can be commonly seen in Noonan syndrome, Klippel-Feil syndrome, and Turner syndrome.

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140. A 7-year-old girl with congenital palsy of the left facial nerve is scheduled to undergo facial reanimation using a free gracilis muscle neurotized by the motor branch to the masseter muscle. Compared with cross-facial nerve grafting from the contralateral facial nerve, use of this procedure is most likely to result in which of the following?
- A) Decreased excursion of the reanimated oral commissure
 - B) Development of a crossbite
 - C) Increased risk of long-term muscle atrophy
 - D) Need for additional surgical procedures
 - E) Unpredictable smile symmetry

The correct response is Option E.

Facial reanimation procedures using free tissue transfer have largely supplanted static procedures for pediatric facial paralysis. Although cross-facial nerve grafting (CFNG) remains an excellent option, many surgeons now prefer using the motor branch to the masseter (trigeminal nerve), since it can be done in a single stage, yields excellent muscle reinnervation, and produces muscle contraction/commissure displacement that typically exceeds that of CFNG. Although this motor branch provides innervation to the masseter, there are no reports of crossbite after its use in facial reanimation. CFNG provides relatively consistent smile symmetry and spontaneity since the stimulus for muscle contraction on both sides of the face comes from the same facial nerve source. In contrast, smile spontaneity and symmetry are much more variable when the motor masseteric branch is used and requires some cortical adjustment and/or behavioral education to develop; younger patients respond much more reliably and naturally than older patients.

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

141. A 3-year-old boy is brought to the office because of abnormal head shape since birth. Photographs are shown. The patient is developmentally appropriate and has no other medical problems. Which of the following is the most appropriate surgical procedure for correction of this deformity?
- A) Bilateral fronto-orbital advancement
 - B) Endoscopic craniotomy and helmet therapy
 - C) Monobloc distraction
 - D) Spring-mediated cranioplasty
 - E) Total vault reconstruction

The correct response is Option E.

The patient in the photograph has the classic features of sagittal suture synostosis. The primary clinical features of scaphocephaly are lengthening of the cranial vault in the anterior-posterior dimension, an anteriorly displaced cranial vertex, bullet-shaped occiput, biparietal and/or temporal narrowing and frontal bossing. All of these features are present in this patient. Because of the patient's late clinical

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presentation for treatment, the most appropriate surgical procedure would be a total cranial vault reconstruction of which there are many variations and techniques.

Because of the patient's age, he is not a candidate for either endoscopic-assisted wide strip craniotomy or spring-mediated cranioplasty. Ideal candidates for either procedure are ideally under age 6 months and 9 months, respectively, for an adequate clinical result. The results of both techniques have been shown to be comparable to traditional open remodeling procedures and are generally less invasive surgical procedures.

Although the monobloc distraction may allow the opportunity to remodel the forehead, there is no clinical indication for midface distraction in the patient described. A monobloc distraction alone will not correct the other abnormal features of scaphocephaly. It is not an indicated procedure for the correction of isolated sagittal suture synostosis.

Bilateral fronto-orbital advancement may allow the opportunity to remodel the forehead, but it will not address the other cranial vault abnormalities. There is no indication for remodeling the supraorbital bar in this case.

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142. A 45-year-old woman comes to the office because of a painful 4-cm left parotid mass. Physical examination shows weakness of the left facial muscles. CT scan of the chest shows multiple lung nodules consistent with metastases. Parotidectomy is performed, and pathologic examination of the gland shows a cribriform ("Swiss cheese") pattern of cells with perineural invasion. Which of the following is the most likely diagnosis?
- A) Adenoid cystic carcinoma
 - B) Lymphangiosarcoma
 - C) Mucoepidermoid carcinoma
 - D) Pleomorphic adenoma
 - E) Warthin tumor

The correct response is Option A.

Salivary gland tumors are relatively rare and make up about 3 to 4% of all head and neck neoplasms. The majority of salivary gland tumors (approximately 80%) originate in the parotid gland. Approximately 80% of parotid gland tumors are benign. Malignant tumors are associated with facial paralysis and pain, although they may also be asymptomatic. Malignant tumors may also metastasize to the regional lymph nodes and to distant sites.

Pleomorphic adenoma, also known as benign mixed tumor, is the most common benign tumor of the parotid gland. This tumor is histologically characterized by epithelial and connective tissue elements, with stellate and spindle cells interspersed with a mixoid background.

Warthin tumor (papillary cystadenoma lymphomatosum) is the next most common tumor of the parotid gland and is also benign. Warthin tumors predominantly occur in males and are bilateral in 10% of patients. Histologically, they are characterized by papillary cysts and mucoid fluid as well as nodules of lymphoid tissue.

Mucoepidermoid carcinoma is the most common malignancy of the parotid gland and the second most common malignancy of the submandibular and minor salivary glands. Mucoepidermoid carcinomas contain two major elements: mucus-producing cells, and epithelial cells of the epidermoid variety. Low-grade tumors are associated with a predominance of mucus-secreting cells lining cysts and intervening nests of

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well-differentiated epidermoid cells. High-grade tumors show few or no mucus-producing cells and the epidermoid cells are poorly differentiated. Intermediate-grade tumors are defined by less cyst formation than low-grade tumors with nests of epidermoid and less differentiated intermediate cells. The biologic behavior of mucoepidermoid carcinomas correlates with their histologic grade.

Adenoid cystic carcinoma is the second most common tumor of the salivary glands and the most common malignant tumor of the submandibular, sublingual, and minor salivary glands. It is slightly more common in female patients and typically affects patients between the ages of 30 and 70 years with a peak incidence of 40 to 59 years. There are three histologic subtypes: cribriform, tubular, and solid. The cribriform pattern has a classic “Swiss cheese” appearance with cells arranged in nests separated by round or oval spaces. The tubular pattern has a glandular architecture, while the solid (or basaloid) pattern has sheets of cells with little or no luminal spaces. Adenoid cystic carcinoma usually exhibits a protracted course characterized by indolent growth and a propensity for perineural invasion, reported to occur in 20 to 80% of patients. Distant metastases, most frequently to the lung, are not uncommon.

Lymphangiosarcoma is a rare vascular tumor, which may be associated with prolonged lymphedema. These tumors are more commonly found in the extremities and under light microscopy appear as vascular channels with anaplastic endothelial cells.

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143. A 6-year-old boy is brought to the emergency department because of a laceration of the hard palate. Repair of the laceration with local anesthesia for greater palatine nerve block is planned. As the anterior portion is sutured in place, the patient feels pain. Which of the following additional nerve blocks is most appropriate?

- A) Anterior superior alveolar
- B) Infraorbital
- C) Lesser palatine
- D) Middle superior alveolar
- E) Sphenopalatine

The correct response is Option E.

The sphenopalatine nerve arises from the incisive foramen and provides sensation to the anterior hard palate. Blockade of this nerve is essential for adequate blockade of the palatal mucosa for laceration repair.

The anterior superior alveolar nerve arises from the second branch of the trigeminal nerve before it exits the infraorbital foramen. The nerve supplies the maxillary anterior teeth and is part of the superior dental plexus of nerves that also includes the middle superior alveolar and the posterior superior alveolar nerves.

The infraorbital nerve provides sensation to the ipsilateral lateral nose, upper lip, and cheek.

The lesser palatine descends through the greater palatine foramen and provides innervation to the soft palate and uvula.

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144. A 4-year-old boy is brought to the office for treatment and evaluation of lid ptosis. On examination, bilateral lagophthalmos, poor levator excursion, and severe ptosis are noted. Which of the following is the most likely diagnosis?

- A) Blepharophimosis syndrome
- B) Congenital epiblepharon
- C) Congenital euryblepharon
- D) Fraser cryptophthalmos syndrome
- E) Treacher Collins syndrome

The correct response is Option A.

Blepharophimosis syndrome is the only diagnosis listed that is associated with congenital ptosis.

Blepharophimosis syndrome is associated with a tetrad of findings including ptosis, telecanthus, epicanthus inversus, and decreased horizontal lid fissure. In type I blepharophimosis, patients have epicanthus inversus and ptosis. In type II, findings include telecanthus, ptosis, ectropion of the lower lids, absent epicanthal folds, and insufficient skin in all lids. Type III is notable for telecanthus, ptosis, hypertelorism, slanting palpebral fissures, and insufficient eyelid skin. Correction involves a variety of techniques including, but not limited to, Z-plasty, transnasal wiring of the medial canthal tendon, and ptosis correction with frontalis suspension. Other abnormalities of the blepharophimosis syndrome include flattening of the nasal dorsum, hypoplasia of the superior orbital rim, as well as forehead and ear deformities.

In epiblepharon, the eyelashes are vertical as a result of excess pretarsal muscle and skin overriding the margin of the eyelid, often affecting the lower lids. This causes corneal irritation. If the condition does not resolve spontaneously in the first few years of life, correction involves shortening of the anterior lamella through excision of a horizontal piece of skin and orbicular muscle. Epiblepharon may also be caused by trauma, burns, or fractures.

Euryblepharon refers to widening of the palpebral fissure both laterally and vertically caused by a shortage of eyelid tissue. Treatment involves corneal protection and may require surgical correction with standard techniques used for ectropion repair.

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Cryptophthalmos is a failure in embryonic development of the lid fold. The eye is buried in the developing cover of the epithelium and does not differentiate normally. It may be associated with other congenital abnormalities such as syndactyly, cardiac, facial, and ear defects.

Treacher Collins syndrome is a maxillary-zygomatic cleft with a coloboma of the lower eyelid and absent eyelashes.

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145. Which of the following is the most common cause of temporomandibular joint ankylosis?

- A) Bruxism
- B) Congenital anomaly
- C) Infection
- D) Radiation
- E) Trauma

The correct response is Option E.

The most common cause of temporomandibular joint (TMJ) ankylosis is trauma. It usually occurs after untreated or inadequately treated mandibular fractures. Damage to the articular surface of the TMJ is the most common factor seen. In children, this can lead to growth disturbances ultimately requiring orthognathic surgery. Otherwise, joint replacement and repair may be indicated in adults. In the antibiotic era, infection is a rare cause. Congenital anomalies, bruxism, and radiation are less common.

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146. A 40-year-old woman comes to the office because of a 5-year history of firm, painless swelling of the upper jaw that has increased progressively in size. CT scan is performed, and the lesion is shown. Resection is performed. Pathologic examination shows odontogenic epithelial islands bordered by palisading columnar cells. No invasion into the surrounding tissues is noted. Which of the following is the most likely diagnosis?
- A) Ameloblastoma
 - B) Fibrous dysplasia
 - C) Nasopharyngeal angiofibroma
 - D) Osteosarcoma
 - E) Squamous cell carcinoma

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The correct response is Option A.

Ameloblastomas are benign, locally invasive, odontogenic tumors accounting for 1% of tumors of the jaw and 10% of odontogenic tumors. Approximately 80% occur in the mandible and 20% occur in the maxilla. The peak incidence is in the third and fourth decades but may also arise in children and adolescents. Ameloblastomas may be radiographically found to be unilocular or, more commonly, multilocular with a “soap bubble” or “honeycomb” appearance. Treatment may be with enucleation and curettage or more radical resection. In rare cases, metastatic ameloblastoma and ameloblastic carcinomas have been reported.

Fibrous dysplasia is a benign hamartomatous lesion that has a diffuse, “ground-glass” appearance on x-ray studies. It is usually treated conservatively with shaving and re-contouring of the bone. Squamous cell carcinoma is usually associated with a painful mucosal lesion. Radiographically, bony invasion may be noted in locally advanced cases. Osteosarcomas are aggressive malignancies of mesenchymal origin that exhibit osteoblastic differentiation. They are the most common primary bony cancer. Their radiographic appearance is variable and may include nonspecific destruction of the bone similar to a carcinoma, mottled ossification, similar to fibrous dysplasia, but without well-defined borders, or lamellar ossification (sheets of neo-osteogenesis). Nasopharyngeal angiofibromas are benign but locally invasive vascular tumors that occur almost exclusively in male adolescents. Their symptoms include nasal obstruction but can eventually cause facial asymmetry and eye displacement, as they grow from the region of the sphenopalatine foramen first into the nasopharynx and choanae then into the paranasal sinuses, pterygopalatine and infratemporal fossae, orbit, and even the intracranial cavity. Radiographically, they are nonencapsulated, lobular soft-tissue masses that demonstrate intense uptake of intravenous contrast due to their highly vascular nature. Extensive bony destruction is usually not a feature, but bone may be remodeled or resorbed.

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147. A 2-year-old boy who was recently adopted is brought to the office for evaluation and treatment of cleft of the lip and palate. Physical examination shows involvement of the lip, alveolus, and entire palate. A photograph is shown. He is otherwise healthy with no other congenital anomalies. Which of the following is this patient's risk of having a child with cleft of the lip?
- A) 1%
 - B) 5%
 - C) 10%
 - D) 15%
 - E) 50%

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The correct response is Option B.

The risk of having a child with a cleft of the lip and palate is multifactorial. In familial cases, the risk is dependent on the family history and sibling involvement. In this case, neither the family history nor sibling history is available, so risk calculation is dependent upon the child's personal history only. For males with an oral cleft, the prevalence of clefts in their first offspring is 4.7%, and for females it is 3.6%. If this child were to have a child with a cleft, then the risk of subsequent children to also have a cleft would be 17%. If this child also had lip pits, then the risk of having a child with a cleft would be 50% (van der Woude syndrome).

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148. A 21-year-old woman comes to the emergency department because she has had ocular pain and decreased vision since she was struck in the face with a bottle 2 hours ago. On examination in a dark room, both pupils constrict when a light is shone in the right or left sides directly. When the light is shifted from the right to the left, the pupils dilate. Which of the following is the most likely pathologic condition in this patient?
- A) Central retinal artery occlusion
 - B) Oculomotor (III) nerve injury
 - C) Preexisting cataract
 - D) Symmetrical acute glaucoma
 - E) Vitreous hemorrhage

The correct response is Option A.

A Marcus Gunn pupil is a relative afferent pupillary defect caused by a lesion of the optic nerve (between the retina and the optic chiasm) or severe retinal disease. It is observed during the swinging-flashlight test whereupon the patient's pupils constrict less (therefore appearing to dilate) when a bright light is swung in front of the unaffected eye to the affected eye. The affected eye still senses the light and produces pupillary sphincter constriction to some degree, albeit reduced. Conditions that do not cause a Marcus Gunn pupil include cataracts, vitreous hemorrhage, injury to the oculomotor nerve (cranial nerve III), or symmetrical acute glaucoma.

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149. A 23-year-old man comes to the office because of a 1-year history of painless swelling, asymmetry, and loss of interdental relationships on the right side of the jaw. Physical examination shows crowding of the right-sided first and second molars and premolar dentition. The third molar has not erupted; in its place there is a palpable firm enlargement of the mandible. Panoramic x-ray study (Panorex) shows a 3-cm radiolucent unilocular cyst. Percutaneous biopsy of the cyst shows nonkeratinizing stratified squamous epithelium. Which of the following is the most likely diagnosis in this patient?

- A) Dentigerous cyst
- B) Gingival cyst
- C) Gorlin cyst
- D) Primordial cyst
- E) Radicular cyst

The correct response is Option A.

The most appropriate answer is dentigerous cyst. This type of cyst develops in the context of an unerupted tooth, which can be seen below the cyst. The cyst is lined with benign nonkeratinizing epithelium and is caused by degeneration of the enamel reticulum of the unerupted tooth. It is the second most common type of jaw cyst. Two thirds occur in the mandible.

Gingival cysts appear most commonly on alveolar ridges of infants but can also rarely appear in adults. Their origin relates to rests of dental lamina, and, unlike dentigerous cysts, these contain keratin. Clinically, they are soft and fluctuant, and range in size between 1 and 15 mm.

Primordial cysts and odontogenic keratocysts are equivalent. They develop from rests of dental lamina and basal cell hamartomas. Therefore, unlike dentigerous cysts, these are lined with a keratinizing stratified squamous epithelium that is sometimes dysplastic. Their size range is 1 to 9 cm, and pain is a common symptom. Gorlin syndrome includes the association of multiple odontogenic keratocysts with multiple basal cell carcinomas, nasal deformity, skeletal abnormalities, calcification of the falx cerebri, and palmar or plantar pits.

Calcifying odontogenic (Gorlin) cysts are distinct from those above because they

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may be part cystic and part neoplastic. The histology shows features similar to the calcifying epithelioma of Malherbe (epithelium undergoing keratinization and calcification), and ameloblastic proliferations. Radiographically, they contain various amounts of radiopaque (calcified) material and are usually located anterior to the first molars ranging in size from 1 to 8 cm.

Radicular cysts are the most common type of jaw cysts and develop at the apex of a nonviable erupted tooth, from epithelial rests of Malassez in the periodontal ligament. As these cysts are inflammatory in nature rather than developmental, they are usually preceded by a periapical granuloma. Histology shows a fibrous shell lined with nonkeratinizing stratified squamous epithelium infiltrated with chronic inflammatory cells. Due to their painless quality, they most commonly occur as an incidental finding of routine x-ray studies of the maxilla. These cysts are radiolucent, and differ from dentigerous cysts because they are located at the apex of an erupted tooth rather than at the crown of an unerupted tooth.

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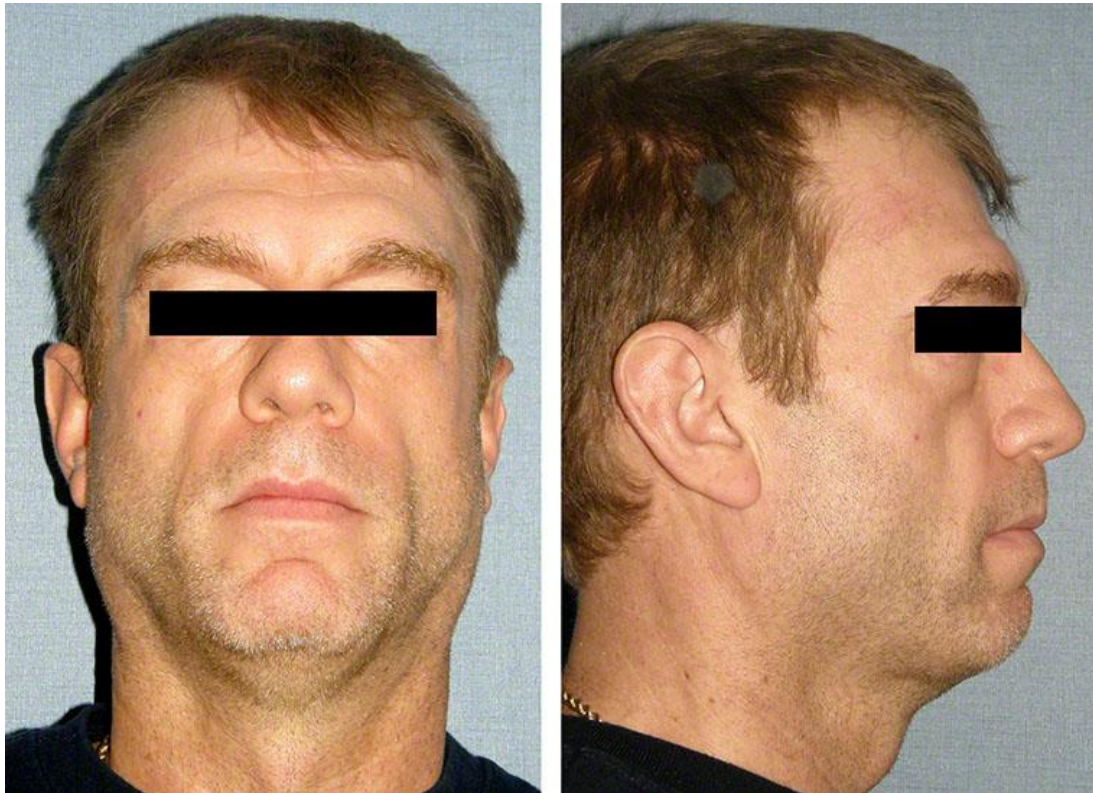
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150. Treatment with poly-L-lactic acid (Sculptra) is most likely to correct the soft-tissue facial deformity associated with which of the following conditions?

- A) Discoid lupus
- B) Progressive hemifacial atrophy
- C) Scleroderma
- D) Secondary effects of HIV treatment

The correct response is Option D.

Poly-L-lactic acid, marketed as Sculptra, has been utilized for the treatment of HIV retroviral drug-related lipoatrophy since 1999. The images shown illustrate such a patient.



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Since its initial use, the indications for utilization have broadened and include most etiologies of lipoatrophy with its second most common use for age-related changes. In patients with age-related facial changes, it has been useful for mid face rejuvenation and temporal hollowing. Similar to age-related changes is weight loss that, when mild, will also respond to poly-L-lactic acid but when severe, will require a rhytidectomy. Lipoatrophy secondary to discoid lupus has been reported to respond best to fat grafting. The least likely to respond to poly-L-lactic acid is progressive hemifacial atrophy due to the severity of the soft-tissue deformity and will usually require soft-tissue augmentation with a free flap in severe cases and fat grafting in mild cases.

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Section 4: Breast and Cosmetic

151. A 33-year-old woman with no family history of breast cancer undergoes bilateral augmentation mammoplasty with 300 mL of autologous fat per breast. Six months later, she has onset of pain in the right breast. Mammography shows linear clustered microcalcifications in the lower inner quadrant of the right breast, small lipid cysts bilaterally with scattered dystrophic rod-like calcifications in the upper outer quadrants bilaterally, and heterogeneity of the pectoral muscles. Which of the following is the most appropriate next step in management?
- A) Baseline mammography between ages 35 and 40 and yearly thereafter
 - B) Core needle biopsy of the bilateral upper outer quadrants
 - C) Core needle biopsy of the right lower inner quadrant
 - D) Repeat mammography at 6 months and 12 months
 - E) Repeat mammography in 1 year

The correct response is Option C.

Augmentation mammoplasty with autologous fat transfer has become an increasingly popular option for patients desiring modest volumetric improvement. Despite its popularity, there is still some concern regarding its safety and efficacy. ASPS offered guidelines on fat grafting for reconstructive procedures of the breast in 2009. However, caution is recommended in the setting of cosmetic procedures because the impact on radiologic changes in follow-up is still uncertain to date.

Fat necrosis is a nonspecific histologic finding most commonly resulting from surgery, trauma, or radiation therapy. It is common after fat transfer procedures, though often is clinically occult, and detected through follow-up mammography. The mammographic images of fat necrosis range from lipid cysts to findings that are suspected for malignancy such as clustered microcalcifications or spiculated masses. The most frequent mammographic finding in the breast parenchyma after augmentation mammoplasty with fat transfer is bilateral scattered microcalcifications followed by radiolucent oil cysts with or without microcalcification. Microcalcifications represent an evolution in the mammographic

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appearance of fat necrosis and are usually not present in early postoperative screening, but rather are a relatively late finding that is present months to years after the inciting trauma.

It is imperative that radiologists distinguish between benign and suspected microcalcifications in order to minimize the number of postoperative biopsies and frequent follow-up imaging. Although round, spherical, punctuate, and diffusely scattered calcifications are typical of benign processes, cluster, branching microcalcifications can be indicative of a malignant process and should be worked up. For this 33-year-old patient with no baseline mammography and a suspected lesion within 6 months of the procedure, routine or short-interval mammographic screening is not appropriate. A biopsy of the suspected area is required, and this patient should undergo a core needle biopsy of the clustered microcalcifications of the right breast, while the more benign-appearing calcifications within the upper outer quadrants can be observed.

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152. A 67-year-old woman comes to the office for evaluation of abscesses on her face 5 weeks after undergoing autologous fat grafting for augmentation of the cheek. Physical examination shows multiple erythematous nodules, areas of induration, and microabscesses on both cheeks. Temperature is 99.5°F (37.5°C). Liposuction donor sites show no abnormalities. A 1-week course of ciprofloxacin prescribed by the patient's family doctor failed to resolve the problem. Results of Gram stain and routine culture and sensitivity are negative. Which of the following is the most likely diagnosis?
- A) Atypical mycobacterial infection
 - B) Herpes zoster infection
 - C) MRSA infection
 - D) Mucocutaneous candidiasis
 - E) *Staphylococcus epidermidis* infection

The correct response is Option A.

Mycobacteria are ubiquitous in soil and water, and infections caused by these organisms can complicate aesthetic liposuction and autologous fat-grafting procedures. The postoperative symptoms include cellulitis, abscess formation, draining sinuses, and postoperative wound infection. Patients often do not have fever, chills, or other signs of systemic infection. While patients on immunosuppressive medications seem to be at higher risk, the problem also occurs in patients with healthy immune systems. More than 50% of patients will test negative for acid-fast bacilli, in addition to negative routine culture results. Polymerase chain reaction assay testing is now available for the most common species of nontuberculous mycobacterium, and is a useful rapid screening test for patients suspected of having this diagnosis.

Bacterial infections (MRSA) would tend to show symptoms earlier, have systemic signs, and are usually easily cultured. Herpetic infections usually present with fluid-filled vesicles earlier in the postoperative course, and often have pain as a primary complaint. There is no history of previous injectable fillers, or implants, to suggest a biofilm-related infection in this patient. Mucocutaneous candidiasis is a chronic disease of the skin, nails, and mucosal surfaces.

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153. A 62-year-old woman comes to the clinic for postsurgical assessment 2 weeks after rhytidectomy. In the right preauricular region, there is a 2 × 3-cm area of ischemic changes to the skin with a central eschar. Which of the following is the most appropriate next step in management?

- A) Debridement of the eschar
- B) Full-thickness skin grafting
- C) Local wound care
- D) Re-advancement of the flap
- E) Split-thickness skin grafting

The correct response is Option C.

Wound-healing issues and skin necrosis should initially be managed with local wound care. In many cases, the wounds will go on to heal without negative sequelae. In the remainder of the cases, a corticosteroid injection or scar revision may be all that is necessary.

Debridement of the region is not recommended because the eschar acts as a biologic dressing. Skin grafting would be indicated for a very large area of full-thickness necrosis. Re-advancement of the flap would not be indicated at this time as conservative management works well.

Furthermore, re-advancement of the flap at this time would likely place too much tension on the closure with its resulting stigmata. However, re-advancement may be indicated at the time of scar revision once the wound has healed and the skin laxity has returned.

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154. A 42-year-old woman who underwent mastectomy of the right breast 6 months ago is evaluated for delayed autologous breast reconstruction with free tissue transfer. Which of the following medications should be discontinued preoperatively if she is routinely taking it?

- A) Diltiazem
- B) Fluoxetine
- C) Metoprolol
- D) Multivitamin
- E) Tamoxifen

The correct response is Option E.

It is well known that tamoxifen can increase the risk of thromboembolic events. In a retrospective study at MD Anderson Cancer Center, it was shown that patients who received the drug close to the procedure had a significantly higher rate of complications. It is recommended that the patient stop tamoxifen at least 28 days before surgery.

Other listed medications do not have a direct effect on thrombotic complications.

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155. A 39-year-old woman is referred for abdominoplasty. She has a history of severe uterine fibroids, and her gynecologist is planning a total abdominal hysterectomy (TAH). The patient would like to have the abdominoplasty and the TAH performed at the same time. Which of the following is the most appropriate response to this patient's inquiry?
- A) Combining the surgeries can be done safely via any approach for TAH
 - B) The gynecologist may perform TAH, but the abdominoplasty flap must be raised first
 - C) The patient's risk of a thromboembolic event is decreased by having one large surgery
 - D) TAH cannot be combined with abdominoplasty

The correct response is Option A.

Performing abdominoplasty in combination with other procedures has become a much more common request from patients. Advantages to this approach would include one recovery period versus multiple (which would minimize time away from work and or family, financial advantage to the patient, and a reduced need for multiple hospitalizations and exposure to anesthesia). Several studies have proven the safety of performing abdominoplasty combined with intra-abdominal procedures such as total abdominal hysterectomy (TAH). While the safety profile of combining these surgeries has been well proven, the risk of thromboembolic events is increased due to the extended time of surgery, so that aggressive deep venous thrombus prophylaxis must be administered perioperatively such as set forth by the Plastic Surgery Task Force on Deep Venous Thrombosis Prophylaxis.

A TAH may be done via open or laparoscopic approach, depending on the gynecologist's preference or patient's chosen method. In addition, as robotically assisted gynecologic procedures have gained widespread acceptance, this approach for a TAH may also be combined with abdominoplasty surgery. Typically, if a laparoscopic or robotic method were chosen, the gynecologist would start the procedure; this way the port scars may be planned such that they can be excised within the abdominoplasty flap to be removed. Although the abdominoplasty flap may be raised off of the fascia before port placement, this usually causes the ports to be more unstable without the added support of the skin and soft tissues to properly hold them in place.

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156. A 68-year-old woman comes to the office with recurrence of laxity of the neck and lower face following an uncomplicated rhytidectomy 10 years ago. She does not smoke cigarettes. Which of the following is most likely?
- A) Associated comorbid medical conditions are now more likely to be present
 - B) More skin will typically be excised during the second rhytidectomy than the first rhytidectomy
 - C) Superficial musculoaponeurotic system (SMAS) layers scarring now precludes the re-elevation of a SMAS flap
 - D) The thickness of the skin and SMAS layers would be comparable to those seen during the first rhytidectomy
 - E) Vascular compromise of the skin flap is now more likely

The correct response is Option A.

Secondary rhytidectomy patients are typically older than primary rhytidectomy patients, and have been demonstrated to have more comorbid medical diseases. Hence, a more thorough preoperative medical evaluation is prudent for these patients. One study found that depression, necessitating the use of a selective serotonin reuptake inhibitor, was the most common comorbid disease, in one quarter of the secondary rhytidectomy patients studied. Hypertension was the second most common medical condition.

In secondary rhytidectomies, less skin is typically excised, but often, more care with tailoring and inseting the skin is required. The skin and superficial musculoaponeurotic system (SMAS) thicknesses are typically thinner than at a primary, which can make surgical elevation of SMAS flaps more difficult. Sub-SMAS scarring, however, does not preclude careful and safe re-elevation of a SMAS flap. Finally, vascular compromise of the skin is less likely in a secondary case, due to the delay phenomenon following the primary procedure.

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157. A 37-year-old man is scheduled to undergo bilateral brachioplasty to correct redundant arm skin due to massive weight loss following gastric bypass surgery. Which of the following methods is most appropriate to minimize sensory cutaneous nerve injury during this procedure?

- A) Design the longitudinal incision anterior to the bicipital groove
- B) Divide the intermuscular septum while resecting skin and fat
- C) Elevate and transpose the basilic vein before closure of the brachioplasty defect
- D) Leave at least 1 cm of fat over the brachial fascia in the proximal arm
- E) Maintain a sharp dissection plane deep to the brachial fascia

The correct response is Option D.

Among the complications that have been reported following brachioplasty are injuries to the sensory nerves that traverse the medial arm. The most likely nerve to be injured is the medial antebrachial cutaneous nerve. It perforates the antebrachial fascia at a fairly constant distance of 14 cm proximal to the medial epicondyle, putting it at a greater risk of injury than either the ulnar or median nerves, both of which lie deep to the brachial fascia. It has a variable relationship with the basilic vein, but this structure is never transposed during brachioplasty. There is a greater danger to nerve injury when the dissection is conducted deeper than the Scarpa's fascia, therefore dissection deep to the brachial fascia or harvest of the intermuscular septum is contraindicated. A layer of subcutaneous fat at least 1 cm thick should be left over the deep fascia to minimize injury to the sensory nerves in the arm. Placing the longitudinal incision slightly posterior to the bicipital groove decreases chances for injury to the nerve as well.

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158. A 43-year-old woman comes to the office for consultation regarding augmentation mammoplasty. She has a history of *BRCA1* mutation and a sister with a history of breast cancer. Which of the following is the most appropriate screening in this patient?

- A) Mammography and MRI
- B) Mammography and ultrasonography
- C) Mammography only
- D) MRI only
- E) Ultrasonography only

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

The correct response is Option A.

Among familial breast cancers, 5 to 10% are considered to be hereditary. Breast cancer susceptibility genes (*BRCA*) belong to a class of genes known as tumor suppressors. In healthy cells, *BRCA1* and *BRCA2* genes stabilize DNA and prevent uncontrolled cell growth. A woman's lifetime risk of developing breast and/or ovarian cancer is greatly increased if she inherits a mutation on *BRCA1* or *BRCA2*. *BRCA1*- and *BRCA2*-related breast cancers occur in younger women and are often associated with estrogen receptor negative tumors.

Before undergoing elective breast procedures, women older than 40 years of age should undergo screening. The American Cancer Society (ACS) recommends annual screening mammography beginning at age 40. In addition, the ACS recommends that certain women undergo screening MRI with mammography. These include women with known *BRCA1* or *BRCA2* mutation, a first-degree relative with known *BRCA* mutation, 20 to 25% lifetime risk of breast cancer as determined by risk models, history of radiation to the chest between the ages 10 and 30, or specific cancer syndromes.

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159. A 27-year-old man comes to the office for hair restoration to correct alopecia of the scalp. He sustained a burn injury to the scalp when he was a child and underwent split-thickness skin grafting to treat the burn. Micrograft hair transplantation to restore the hairline is planned. Which of the following is the most likely percentage of micrograft survival and ultimate hair growth in this patient?
- A) 10%
 - B) 25%
 - C) 50%
 - D) 85%
 - E) 95%

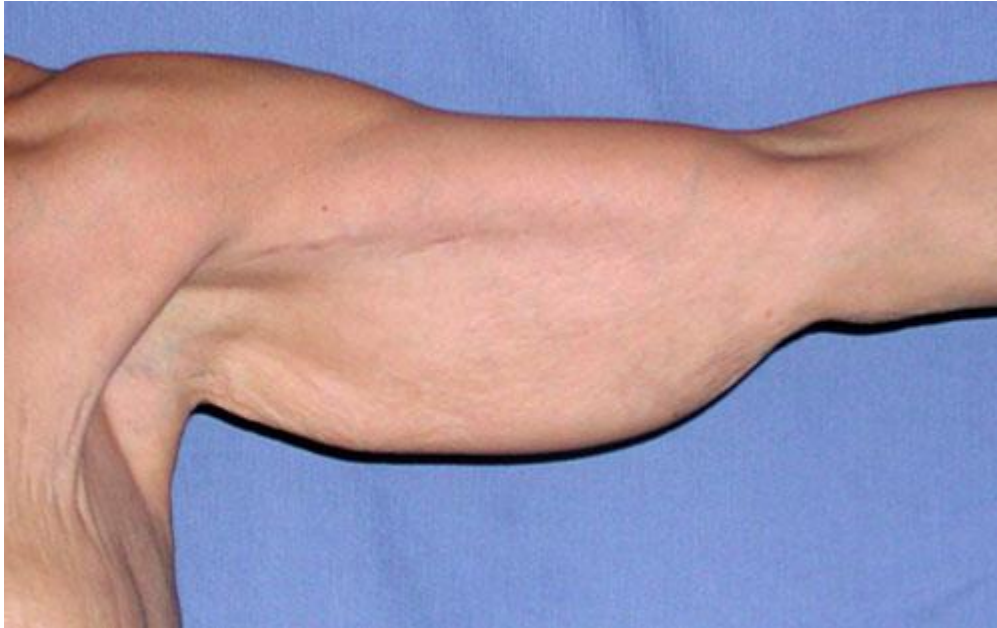
The correct response is Option D.

Because of their small size, micrografts and minigrafts appear to have a lower metabolic requirement to thrive. They tend to grow in areas of fibrosis and burn scars and over skin grafts and flaps, including split-thickness skin grafts. The rate of survival and ultimate hair growth under these circumstances appears to be approximately 85%, compared with approximately 95% on unscarred, healthy tissue. More recently, follicular unit grafts have been used in hair transplantation.

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

160. A 56-year-old woman comes to the office after gastric bypass surgery with a weight loss of 155 lb (70 kg). Weight is 143 lb (65 kg) and BMI is 24 kg/m². She desires an improved appearance of the upper arms. A photograph is shown. Which of the following is the most appropriate surgical correction of this deformity?
- A) Liposuction alone
 - B) Liposuction followed by brachioplasty
 - C) Limited medial brachioplasty
 - D) Full brachioplasty

The correct response is Option D.

The most appropriate management for this condition is brachioplasty. Surgical management of the upper arm, particularly after massive weight loss, is dependent upon the ratio of fat and skin laxity. There are several classifications, but all address this ratio. Those with a great deal of skin laxity and little fat are best treated by direct excision (brachioplasty). Those patients who have little skin laxity (and good skin tone) and marked fat may benefit from liposuction alone. Those patients in the

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middle, with skin laxity and residual upper arm fat, are likely to benefit from a combination approach, either in a single or staged fashion. In this case, the patient demonstrates considerable skin laxity and has little extra fat, so a dermatolipectomy alone will address her deformity.

A limited medial brachioplasty is useful for patients with skin laxity primarily in the proximal third of the arm and involves resection of a vertical ellipse of skin, leaving the scar in the apex of the axilla. The patient described here has skin laxity throughout the upper arm, which would not be adequately addressed with a medial brachioplasty.

Liposuction followed by brachioplasty in a staged fashion will not improve her outcome and will only serve to increase the cumulative risks of two surgeries.

Liposuction alone does not address the underlying issue of skin laxity. The patient's age and her history of obesity/massive weight loss severely decrease the ability of her skin to retract after liposuction.

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161. A 62-year-old woman is concerned that she has developed deep creases from the corner of her mouth to her chin (marionette lines). Which of the following is the most likely cause of these findings?

- A) Attenuation of mandibular ligaments
- B) Dermal thinning
- C) Mimetic muscle contraction
- D) Viscoelastic stretching
- E) Volume deflation

The correct response is Option E.

Young faces appear full because of well-supported facial fat. As one ages, deflation of facial fat occurs more visibly in areas with a high density of retaining ligaments (e.g., lateral chin and malar area). This deflation in conjunction with an intact mandibular ligament gives rise to marionette lines. Injectable fillers can minimize these lines.

The integrity of the mandibular ligaments causes the marionette lines to be more prominent as they limit the descent of facial fat. Attenuation of these ligaments would soften the marionette lines.

Viscoelastic stretching refers to the properties of skin when placed under tension (i.e., the relaxation of skin tightness following rhytidectomy).

Dermal thinning occurs throughout the face and contributes to wrinkles. Repetitive mimetic muscle contraction is thought to contribute to the depth of nasolabial folds and facial radial expansion. It may contribute to marionette lines close to the oral commissure but is not the major contributing factor.

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162. An otherwise healthy 44-year-old woman comes to the office for reduction mammoplasty consultation. She wears a size 44DD brassiere. Physical examination shows rashes underneath the breasts, shoulder grooving from brassiere straps, and shoulder pain. A reduction is planned with removal of 500 g of tissue bilaterally. The woman reveals that her sister underwent reduction mammoplasty with a much larger resection size and questions whether she will have the same relief of symptoms. Which of the following is the most appropriate response?
- A) Larger reductions are associated with less marked relief of symptoms
 - B) Larger reductions are associated with more marked relief of symptoms
 - C) Smaller reductions are associated with less marked relief of symptoms
 - D) Smaller reductions are associated with more marked relief of symptoms
 - E) Resection size is not associated with relief of symptoms

The correct response is Option E.

The ASPS has a clinical guideline summary on reduction mammoplasty, based on the available evidence. Although insurance companies often use resection weight as a criterion for coverage, resection weight is not necessarily associated with relief of symptoms; thus, predictions of relief of symptoms must be made based on the individual clinical picture. This evidence is graded B.

The risk of complications, however, does increase with resection weight (Grade B evidence). This risk of complications must be weighed against the potential for relief of symptoms with large resection weights. A distinction is made between resection weight and BMI. The ASPS guideline found only “inconclusive” data on the association between BMI and the risk of complications.

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163. A 67-year-old woman with Fitzpatrick Type I skin comes to the office because of deep rhytides and signs of photoaging. Which of the following chemical peels will penetrate to the reticular dermis?

- A) Alpha-hydroxy acid
- B) Beta-hydroxy acid
- C) Jessner solution
- D) Phenol-croton oil
- E) 20% Trichloroacetic acid

The correct response is Option D.

Croton oil is mixed with phenol to create a deeper peel. These are part of the ingredients in the Baker-Gordon and Hetter solutions. Hetter's studies demonstrated that it was the croton oil that controlled the depth of the peel. The deeper the chemical peel, the greater the risk of scarring and hyperpigmentation. Because of this increased risk of hyperpigmentation, deep chemical peels are best suited for patients that have Fitzpatrick Type I skin.

Chemical peels vary in their depth of penetration into the dermis. Superficial peels penetrate to the epidermis. Alpha-hydroxyl acids (glycolic and lactic acid) and beta-hydroxy acid peels (salicylic acid) are superficial peeling agents. Jessner solution (14 g resorcinol, 14 g salicylic acid, 14 mL of lactic acid, and 100 mL of 95% ethanol) is also a superficial peel that can be used in conjunction with a trichloroacetic acid peel to achieve a deeper and more uniform peel. Superficial peels affect the epidermis and dermal-epidermal interface. Twenty percent trichloroacetic acid is a medium-depth peel that penetrates into the papillary dermis.

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164. Which of the following is the only cosmetic indication for which onabotulinumtoxinA (Botox Cosmetic) and abobotulinumtoxinA (Dysport) have been approved by the US Food and Drug Administration?

- A) Cervical dystonia
- B) Forehead lines
- C) Glabellar lines
- D) Vertical lip creases

The correct response is Option C.

The only FDA-approved cosmetic indication for the use of onabotulinumtoxinA and abobotulinumtoxinA is to temporarily improve the appearance of moderate to severe glabellar lines. Although these products are widely used to treat other cosmetic concerns, these are all considered off-label uses. To this point, there have been no definitive adverse event reports of distant spread of botulinum toxin products when used at appropriate doses for dermatologic indications. There have been reports of adverse events in doses used for dystonia, especially in children. RimabotulinumtoxinB is only approved for treating cervical dystonia. On November 22, 2011, the FDA released a report renaming botulinum toxin type A and botulinum toxin type B to ensure their safe use (see table). Some of the reasons were to emphasize the differences in dosing and indications, and that these products are not interchangeable. The FDA recently approved application of Botox Cosmetic for smile lines related to activity of the lateral orbicularis oculi.

Summary of FDA-Approved Botulinum Toxin Products

Trade Name*	Drug Name	Drug Name	Indication
Botox	OnabotulinumtoxinA	Botulinum toxin type A	Cervical dystonia, Severe primary axillary hyperhidrosis, Strabismus, Blepharospasm
Botox Cosmetic	OnabotulinumtoxinA	Botulinum toxin type A	Temporary improvement in the appearance of moderate to severe glabellar lines

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Dysport	AbobotulinumtoxinA	Botulinum toxin type A	Cervical dystonia, Temporary improvement in the appearance of moderate to severe glabellar lines
Myobloc	RimabotulinumtoxinB	Botulinum toxin type B	Cervical dystonia

* The marketed trade names and the product formulations have not changed.

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165. A 35-year-old woman with tuberous breast deformity is scheduled to undergo augmentation/mastopexy. A smooth, round, cohesive gel implant will be used. This patient is at higher risk for which of the following complications when compared with augmentation/mastopexy performed on a patient without a tuberous breast?

- A) Capsule contracture
- B) Double bubble
- C) Hematoma
- D) Nipple-areola depigmentation
- E) Rippling

The correct response is Option B.

The classic features of a tuberous breast deformity include a constricted base with a high inframammary crease and herniation of breast parenchyma into the nipple-areola complex producing a large-diameter areola. Variable extent of micromastia is associated as well as breast asymmetry. When a patient has a high and tight inframammary crease, this crease must be released to accommodate an implant and allow correction of the deformity. If this native crease does not fully expand, then a double bubble will occur. Over time, the lower pole skin stretches in response to the implant and this double bubble often improves spontaneously. The incidence of capsule contracture, hematoma, nipple-areola depigmentation, and rippling should be similar to a patient who undergoes periareolar augmentation/mastopexy without a tuberous breast.

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166. A 38-year-old woman comes to the office because of excess fullness of the proximal posterior arm. Pinch test shows a thickness of greater than 2 cm, and skin laxity is not excessive. Liposuction is planned. Which of the following is the most likely complication of liposuction of the upper extremity?

- A) Contour irregularities
- B) Hyperpigmentation
- C) Injury to the ulnar nerve
- D) Lymphedema
- E) Seroma

The correct response is Option A.

The most common complication associated with liposuction of the arm is areas of overresection resulting in contour irregularities. Because such irregularities can be due to postoperative swelling, they should be treated conservatively for at least 6 months after surgery. Treatment may consist of fat grafting if contour abnormalities persist after 6 months. Early treatment may include lymphatic massage.

Although hyperpigmentation is possible, it is more commonly seen in the medial thigh in association with ultrasound-assisted liposuction. Seromas are rare in the upper extremity. Injury to the ulnar nerve at the elbow is possible, but it has not been reported. Care should be taken to avoid the nerve in placement of the cannula. While lymphedema is possible, if liposuction of the arm is limited to the posterior aspect, where major lymphatic channels are avoided, it can be prevented. Transient postoperative swelling is expected.

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167. A 51-year-old woman comes to the office because of unilateral swelling of the breast 1 year after subglandular silicone augmentation mammoplasty. The patient says she has not had any recent trauma, fever, or myalgia. Physical examination shows a periprosthetic fluid collection. No erythema or edema is noted. Which of the following is the most appropriate next step in management?

- A) Needle aspiration, Gram staining, and culture
- B) Oral administration of antibiotics and complete blood count
- C) Reduction of activity and use of a support brassiere
- D) Ultrasound-directed aspiration and cytology

The correct response is Option D.

The most important diagnosis that needs to be ruled out is anaplastic large T-cell lymphoma (ALCL). This is a rare (one per million) non-Hodgkin lymphoma that has been reported in women with and without breast implants. However, increasing case reports suggest an association with breast implants, although direct causation has not been established. In ALCL associated with breast implants, malignant cells infiltrate the periprosthetic capsule or the periprosthetic fluid collection. The criteria for diagnosis include malignant cytology, strong CD30 expression, and cytokeratin negativity. Therefore, ultrasound-directed aspiration and cytology is most appropriate.

Reduction of activity, wearing a support brassiere, and follow-up in 2 weeks would be appropriate for perioperative tissue edema but is not appropriate treatment for late seromas.

Needle aspiration with Gram staining and culture risks injury to the implant and would not give the cytology necessary to determine if ALCL were present.

Oral administration of antibiotics and complete blood count would not be warranted in this situation where infection is unlikely by history and physical examination.

Ultrasound-directed aspiration and drain placement alone would not give the cytology necessary to determine if ALCL were present.

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168. Which of the following is the function of secretions of the meibomian glands?

- A) Coats cornea as inner layer of tear film
- B) Lubricates eyelid skin
- C) Prevents evaporation of tear film
- D) Promotes control of infectious agents
- E) Promotes dispersion of tear film

The correct response is Option C.

Tears are a trilaminar fluid. The precorneal layer is formed by mucin-secreting goblet cells in the conjunctiva. This inner layer of the tear film covers the cornea and promotes the dispersion of the overlying aqueous layer.

The lacrimal gland secretes the middle layer. This aqueous layer is made of water and proteins. This layer promotes osmotic regulation and the control of infectious agents.

The meibomian glands produce the outer lipid layer. This oil layer helps to prevent the evaporation of the tear film. As a result, dysfunction of the meibomian glands can lead to dry eyes.

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169. Which of the following best describes the role of estrogen in breast function?

- A) Decreases cell division
- B) Decreases fibrocystic changes
- C) Facilitates ductal growth
- D) Facilitates glandular growth
- E) Facilitates periductal stromal development

The correct response is Option C.

Breast development is a complex interplay of multiple factors. Estrogen and progesterone play a significant role in breast development—not only at puberty, but also during and after pregnancy, and during and after menopause. In general, estrogen causes ductal proliferation, while progesterone causes glandular proliferations. Progesterone is similarly responsible for periductal stromal development. Estrogen increases, not decreases, cell division, and is also associated with increased, not decreased, fibrocystic changes.

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170. A 53-year-old woman comes to the office for evaluation of abdominal skin redundancy. Physical examination shows muscle laxity and lipodystrophy of the central abdomen and flank regions. Abdominoplasty and liposuction of the flank and anterior abdominal skin are planned. After this combined procedure, the patient is at greatest risk for skin necrosis of which of the following abdominal zones?
- A) I
 - B) II
 - C) III
 - D) IV

The correct response is Option A.

Abdominoplasty in combination with liposuction has been associated with a higher risk of complications. Combining both procedures has been reported to increase the risk of delayed healing, thrombotic emboli, fat emboli, skin necrosis, and fat necrosis. Increased complication rates are reported in patients with risk factors such as obesity, smoking, and diabetes mellitus. Direct undermining of the abdominal skin combined with liposuction can lead to vascular compromise of the overlying skin. The blood supply to the abdominal wall is divided into three zones: zone I, mid abdomen supplied by the deep inferior epigastric artery; zone II, lower abdomen supplied by the external iliac artery; and zone III, lateral abdomen and flanks supplied by the intercostal, subcostal, and lumbar arteries. Zone IV has not been described. Following abdominoplasty, elevation of the abdominal flap disrupts the blood supply from zones I and II, leaving the flap to be perfused by blood vessels from zone III. Liposuction with abdominoplasty of the central abdomen, zone I, is associated with the highest rate of skin necrosis. "Safe zones" include the flanks and upper lateral abdomen.

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171. When performing immediate breast reconstruction, it is important to reconstruct the lateral inframammary fold. This is because the oncologic extirpation of the breast is carried out to which of the following anatomic landmarks?

- A) Anterior edge of the latissimus dorsi muscle
- B) Anterior edge of the serratus muscle
- C) Lateral edge of the pectoralis major muscle
- D) Lateral edge of the pectoralis minor muscle
- E) Posterior edge of the serratus muscle

The correct response is Option A.

For modified radical and simple mastectomies, the landmarks of dissection are: superiorly to the clavicle, medially to the sternum, inferiorly to the inframammary fold, and laterally to the border of the latissimus dorsi muscle. The pectoralis major muscle fascia is resected with the specimen.

The recreation of the inframammary fold is important for shaping in breast reconstruction and care must be taken to evaluate and repair both the inferior and lateral components of the inframammary fold.

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172. The superficial musculoaponeurotic system invests the platysmal muscle and fuses to the external surface of which of the following?

- A) Cervical investing fascia
- B) Galea
- C) Parotid masseteric fascia
- D) Superficial temporal fascia
- E) Temporoparietal fascia

The correct response is Option C.

A subcutaneous fascia partitions the superficial subcutaneous facial fat. Anatomically, this fascia was recognized as early as 1799, when it was referred to as a cellular membrane. In 1859, Gray described the layer as the superficial subcutaneous fascia. In 1960, the usefulness of including the subcutaneous fascial layer in plicating sutures was noted. Later that decade, Tessier and Skoog, apparently working independently in France and Sweden, respectively, described the benefit of undermining and imbrication of this fascial layer in rhytidectomies. Residents from Tessier's unit then performed a number of anatomical studies to define the extent of the superficial subcutaneous fascia. Their classic anatomical study, published in 1976, described a superficial subcutaneous fascia that invested the platysma muscle and fused to the external surface of the parotid fascia. They named this fascia the superficial musculoaponeurotic system (SMAS). These findings have been corroborated by other authors, but the original study was not able to define the exact anterior extent of the SMAS. One of Tessier's residents later challenged this concept. He contended that there was no distinct parotid fascia and that the SMAS, rather than being an extension of the cervical investing fascia, was an embryologically distinct "primitive platysma." Controversy over the exact nature and extent of the SMAS persists. However, the consensus of surgical opinion seems to be that the SMAS represents the facial extension of the cervical investing fascia. As such, the SMAS envelops the platysma in the neck and cheek. Anteriorly, the SMAS becomes attenuated but terminates as the investing layer of the superficial layer of the mimetic muscles. Laterally, the SMAS fuses with the multilayer parotid capsule. Superiorly, the SMAS passes over the zygomatic arch to join the superficial temporal fascia (temporoparietalis and galea).

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173. A 28-year-old woman is scheduled to undergo vertical mastopexy. She has no history of previous breast surgery. A superior pedicle technique is planned. Which of the following is the dominant blood supply for this pedicle?

- A) Deep branches of the internal mammary artery from the fourth interspace
- B) Deep branches of the internal mammary artery from the fifth interspace
- C) Superficial branches of the internal mammary artery from the second interspace
- D) Superficial branches of the internal mammary artery from the fourth interspace
- E) Superficial branches of the lateral thoracic artery

The correct response is Option C.

The breast receives its arterial blood supply from multiple sources, and this fact is used to design multiple pedicles for the nipple-areola complex that can work reliably for both mastopexy and reduction mammaplasty procedures.

The superior pedicle receives its arterial blood supply primarily from the internal mammary branch from the second interspace. It is usually about 1 to 2 cm below the surface of the skin just medial to the breast meridian as it approaches the areola and may be localized with a handheld Doppler device during preoperative planning.

The inferior pedicle and central pedicle designs are primarily supplied by branches of the internal mammary system from the fourth interspace. Additionally, there is some accessory input from the intercostal branches at the level of the inframammary fold with the inferior pedicle design. These secondary vessels are typically interrupted in a central pedicle operation.

The medial pedicle design receives its arterial input mainly from the third superficial branch of the internal mammary artery. This vessel may be damaged by previous augmentation mammaplasty.

The lateral pedicle design receives its arterial supply from superficial branches of the lateral thoracic artery.

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174. A 53-year-old woman comes to the office for removal of multiple nevi. On injection of lidocaine, which of the following signs and symptoms is most likely to suggest lidocaine toxicity in this patient?

- A) Bronchospasm
- B) Hypertension
- C) Tachycardia
- D) Tinnitus
- E) Urticaria

The correct response is Option D.

Signs and symptoms of lidocaine toxicity include dizziness, agitation, lethargy, tinnitus, metallic taste, perioral paresthesia, slurred speech, euphoria, hypotension, and bradycardia.

Tachycardia is not a sign of lidocaine toxicity. Bradycardia is more common.

Bronchospasm and urticaria are not signs of lidocaine toxicity.

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175. An otherwise healthy 40-year-old woman comes to the office for augmentation mammoplasty. Mammography 6 months ago showed no abnormalities. Family history is negative for breast cancer. She wants to know if silicone gel implants are safe and what she should do after the procedure to monitor the implant for evidence of rupture. According to the current federal guidelines, which of the following is the most appropriate recommendation to this patient regarding surveillance?

- A) MRI 3 years after implantation and every 2 years thereafter
- B) MRI every 10 years
- C) MRI if symptoms such as chronic myalgia and fatigue develop
- D) Yearly mammograms
- E) Yearly MRI

The correct response is Option A.

Evidence-based data to confirm the validity of screening patients with silicone implants are lacking. In 2011, the FDA issued recommendations for physicians on the use of silicone gel-filled implants. Recommendations included providing copies of educational brochures, giving appropriate informed consent, maintaining medical vigilance, and reporting adverse events. It also suggested that patients undergoing augmentation mammoplasty get an MRI 3 years after implant placement and every 2 years thereafter. The purpose of these recommendations is not to replace routine cancer surveillance.

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176. A 21-year-old woman comes to the office because of a lump 2 cm below the inframammary fold. She says she has “always had it,” but it grew larger during pregnancy and has not decreased. The mass was painful during breast-feeding, and it is occasionally tender. Which of the following is the most likely diagnosis?

- A) Epidermal inclusion cyst
- B) Lipoma
- C) Polymastia
- D) Polythelia
- E) Sarcoma

The correct response is Option C.

Patients often come to plastic surgeons with subcutaneous masses. An understanding of the differential diagnosis is helpful to counsel patients. Accessory breast tissue (polymastia) along the milk line is common. This breast tissue is responsive to hormonal influence, and patients will describe cyclical pain and swelling coinciding with menses and with milk letdown. Surgical excision can be performed. Polythelia is the presence of accessory nipples. Lipomas, epidermal inclusion cysts, and sarcomas can occur as subcutaneous masses, but they do not change in character based on hormonal influence.

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177. In a patient with facial proportions within the normal ranges, which of the following measurements best approximates intercanthal distance?

- A) Eyebrow length
- B) Nasal bone width
- C) Orbital fissure width
- D) Stomion-to-menton distance
- E) Subnasale-to-stomion distance

The correct response is Option C.

Intercanthal distance most closely approximates orbital fissure width. Normal facial values are often described as proportions rather than absolute numbers. Many texts describe normal intercanthal distance as between 30 and 35 mm, but some studies have shown intercanthal distances of up to 40 mm in healthy cohorts. Thus, using the facial features as referents can be helpful. The face is often divided into fifths for analysis of width, and the intercanthal distance represents one fifth, as does the orbital fissure width. The nasal bone width is narrower than the intercanthal distance, and the eyebrow length extends lateral to the lateral canthus, representing greater than a fifth of the facial width. Subnasale, stomion, and menton distances are most often used to calculate facial height proportions. Although there is no reason why, theoretically, a measurement of facial height could not correspond to a measurement of facial width, these values do not.

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178. A 30-year-old woman comes to the office for augmentation mammoplasty and mastopexy after a 50-lb (23-kg) weight loss. She wears a size 38B brassiere. Physical examination shows grade II ptosis and a sternal notch to nipple distance of 26 cm bilaterally. Simultaneous augmentation mammoplasty with short-T mastopexy using smooth saline-filled breast implants that will be implanted in a dual-plane configuration through an inframammary incision is planned. Which of the following factors puts this patient at highest risk for reoperation?

- A) Inframammary implant insertion route
- B) Presence of breast ptosis
- C) Use of drains
- D) Use of saline implants
- E) Use of smooth-walled implants

The correct response is Option B.

It has long been realized that combination augmentation mammoplasty operations are more difficult and have a higher revision rate than either operation alone. A recent review of 177 primary augmentation mammoplasty cases found that, of the factors listed, preexisting breast ptosis and simultaneous mastopexy were both linked to a higher rate of reoperation when possible contributing factors were statistically analyzed. Furthermore, increasing grades of breast ptosis were linked with increasingly higher reoperation rates.

Although incision site for augmentation mammoplasty has been markedly linked to the rates of capsular contracture, inframammary incisions have been shown in at least two studies to date to have the *lowest* rate of capsule formation, with periareolar and transaxillary incisions showing 5 to 10 times higher rates of capsule-related complications.

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179. Which of the following is the most appropriate method for demonstrating objective, dynamic nasal cavity patency and nasal function?

- A) Anterior rhinoscopy
- B) Cottle maneuver
- C) Nasal endoscopy
- D) Rhinomanometry
- E) Sound wave analysis

The correct response is Option D.

Subjectively, the nasal valve can be assessed using the Cottle test. Anterior rhinoscopy is an objective way to evaluate the nasal cavity; however, the examiner's assessment of how much of the nasal cavity is obstructed or patent is subjective. Nasal endoscopy, CT scan, and MRI are described as tests capable to assess the nasal cavities, helping in the diagnosis of anatomical variations associated with nasal disorders. Objectively speaking, rhinomanometry is a dynamic way to assess nasal cavity patency and nasal function; it aims at establishing nasal resistance, which is the difficulty of passing air through the nose, through the measurement of transnasal pressure and airflow. Analysis of sound waves is a static way to assess nasal patency and geometry quantifying the areas of nostril cross section all the way to the nasopharynx and nasal cavity volume between the two cross-sectional areas chosen.

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180. A healthy 30-year-old woman undergoes autologous fat grafting of the buttocks. The patient receives a dose of antibiotics before incision with sterile skin preparation and draping. Tumescant liposuction is performed. Gravity separation of the fat is performed intraoperatively, and 350 mL of fat is reinjected into each buttock. Postoperatively, the patient reports some areas of discrete tenderness, firmness, and limited erythema. Incision and drainage shows oily, cloudy fluid. Which of the following is the most likely cause of this patient's complication?
- A) Inadequate administration of antibiotics preoperatively
 - B) Inappropriate length of time for tumescent effect before aspiration
 - C) Lack of antibiotic administration postoperatively
 - D) Method of fat injection delivery
 - E) Use of gravity fat separation rather than centrifugation

The correct response is Option D.

The most likely cause of this patient's complication is inadequate attention to injection delivery of microaliquots of fat, leading to fat necrosis. Liposculpting, or liposuction and fat grafting, for buttock contour improvement is increasing in popularity and becoming a frequently performed procedure. Good results can be obtained, and patient satisfaction can be high. However, complications may also occur and should not be ignored. Proper technique is an essential component of effective liposculpting. Delivery of overly large amounts of fat into inadequate substrate can lead to inadequate revascularization and fat necrosis, described in the scenario as "tenderness, firmness, and drainage of cloudy, oily fluid." Superinfection of nonviable tissue can occur, creating "limited erythema" responsive to "a short course of oral antibiotics," but the most likely cause is not related to preoperative or postoperative antibiotics because the patient received what can be considered appropriate antibiotic therapy for a "clean," elective case. Neither the described 3:1 fat-to-fluid ratio nor the use of gravity fat separation is considered an inappropriate liposuction technique.

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181. A 65-year-old woman undergoes rhytidectomy using a high superficial musculoaponeurotic system technique. On examination 1 hour postoperatively, the patient is unable to raise her right eyebrow. No other abnormalities are noted. The patient's family is anxious, and they want to call a neurologist. Which of the following is the most appropriate course of action at this time?

- A) Administer intravenous corticosteroids
- B) Consult a neurologist
- C) Order nerve conduction studies
- D) Reexamine the patient in 24 hours
- E) Surgical reexploration

The correct response is Option D.

The high superficial musculoaponeurotic system (SMAS) technique, as described by Barton, divides the SMAS transversely at the superior-most portion of the zygomatic arch. Anatomical studies show that the procedure can be performed safely, as the frontal branch of the facial nerve runs in close proximity to the periosteum of the zygomatic arch, not within the SMAS, in the zone of SMAS transection.

The most common cause of facial nerve inactivity in this situation is related to the transient effects of local anesthesia injected during surgery. Reexamination once the effect of the local anesthesia has worn off is recommended. Intravenous corticosteroids, in a randomized controlled study, did not reduce facial edema, and would not benefit this patient. The diagnostic studies, neurology consult, and surgical reexploration are premature at this point in the patient's course, but may be helpful later if there is no evidence of return of nerve function.

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182. A 30-year-old woman comes to the office because of a 3-week history of unilateral swelling of the left breast. She underwent subglandular placement of textured silicone breast implants 4 years ago. She has had no trauma, fevers, or chills. A 1-week course of an oral antibiotic prescribed by her family physician has failed to resolve the swelling. On physical examination, the left breast is 300 to 400 mL larger than the right breast. No other abnormalities are noted. Ultrasonography report shows seroma and results are negative for hematoma or mass. Which of the following is the most likely diagnosis in this patient?
- A) Anaplastic large cell lymphoma
 - B) Double capsule phenomenon
 - C) Giant fibroadenoma of the breast
 - D) Hematoma due to capsule tear
 - E) Periprosthetic abscess

The correct response is Option B.

The combination of late-onset swelling without signs of periprosthetic infection (fever, cellulitis), no history of trauma, and a negative ultrasonography suggests late-onset seroma, as can occur with a double capsule phenomenon. Late seromas occur as a complication in about 1% of reported breast implant series. This issue seems to be more common in the setting of textured implants, particularly those implants manufactured with an aggressive texturing process. At surgery, a capsule layer is seen lining the pocket, which often contains a substantial volume of serosanguineous seroma fluid and a textured implant coated in a tight second capsule at the center of the pocket. Double capsule has been reported in both the subglandular and submuscular positions. A giant fibroadenoma of the breast would have a dominant mass, distortion of the breast shape, and would be visible on ultrasonography. Abscess would be likely to occur with fever, chills, and cellulitis of the breast. Hematoma of this size would be likely to have a history of trauma, breast pain, and external bruising. Although anaplastic large cell lymphoma is a possibility in the differential of late-onset seromas, it is a rare disorder. Seroma fluid, obtained either by ultrasound-guided aspiration or at the time of open surgery, should be sent for cytologic examination and immunohistochemistry to rule out this rare possibility.

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183. A 58-year-old woman comes to the office because of muscle weakness of the lower face after undergoing rhytidectomy. Which of the following findings is most likely to indicate an injury to the cervical branch facial nerve in this patient, rather than the marginal mandibular nerve?

- A) The patient can still purse her lips
- B) The patient has lower lip depression weakness
- C) The patient has lower lip numbness
- D) The patient has mid-facial weakness
- E) The patient has upper lip numbness

The correct response is Option A.

In a cervical branch facial nerve injury, lip depression can be weak, but the mentalis and orbicularis oris innervation remain intact, so that the patient would be able to purse her lips. Neither the cervical nor marginal mandibular nerves provide sensation to the lip. It would not be necessary to obtain a nerve conduction study in this case, because physical examination would be enough to distinguish between injuries to these nerves. The mid-face motor nerves would not be involved.

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184. A 45-year-old woman treated with axillary dissection and mastectomy for Stage II breast cancer has onset of lymphedema of the right upper extremity. Conservative management with compression garments and lymphatic massage has not led to adequate resolution. Which of the following procedures is most appropriate to address the lymphedema in this patient?

- A) Brachioplasty
- B) Charles procedure
- C) Homan procedure
- D) Liposuction
- E) Lymphatico-venous bypass

The correct response is Option D.

Liposuction has been reliably shown to improve lymphedema post-breast cancer therapy.

Lymphatico-venous bypass is a procedure that is gaining popularity, but the literature is still controversial with regard to its efficacy. The Homan and Charles procedures have become less popular due to drastically increased morbidity compared with liposuction.

Brachioplasty is a technique to address excess skin of the upper arm and will not improve lymphedema.

Resection approach, or debulking, involves surgical excision of subcutaneous tissue, which may or may not include excision of the overlying skin. Charles first described this resection method in 1912, and variations of this technique of radical excision of the subcutaneous tissue and primary or delayed skin grafting are still used today. Debulking procedures are not designed to directly address lymphatic vessel dysfunction but instead provide improved comfort by removing redundant skin and subcutaneous tissues.

Homan described and popularized subcutaneous excision beneath flaps. This may be performed in two stages on a single extremity. A medial resection may be performed first, as more tissue can be removed from the medial than from the lateral aspect of both the arm and the leg. If necessary, a lateral procedure may be performed 3

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months after the initial operation. If bilateral disease is present, the operation may be performed on both involved limbs during the initial procedure, although in cases of massive edema, the prolonged operative time and excessive blood loss mitigate against this approach.

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185. A 52-year-old woman is evaluated for breast reconstruction after modified radical mastectomy with adjuvant chemotherapy and radiation therapy 18 months ago. Her last radiation treatment was 8 months ago. BMI is 29 kg/m². Examination today shows hyperpigmentation of the right chest wall with no redundancy of the mastectomy skin flaps. Her contralateral breast is a D cup with grade III ptosis. Which of the following methods will create the best symmetry for this patient?
- A) Deep inferior epigastric perforator flap
 - B) Gel breast implant and acellular dermal matrix
 - C) Latissimus dorsi musculocutaneous flap
 - D) Tissue expander and acellular dermal matrix placement with planned staged exchange for permanent gel implant
 - E) Tissue expander placement alone with planned staged exchange for permanent gel implant

The correct response is Option A.

The deep inferior epigastric perforator flap would give the patient autologous tissue reconstruction with ample tissue for skin resurfacing and soft tissue for volume. In this radiated patient with a tight skin envelope, a tissue expander/implant, with or without acellular dermal matrix, would be difficult to create an appropriately ample skin envelope and the patient would be at higher risk for wound-healing problems and capsular contracture. The latissimus dorsi musculocutaneous flap, although an autologous tissue reconstruction, would have insufficient volume to adequately match this patient's contralateral side. It would have to be combined with an implant.

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186. A 65-year-old woman comes to the office for follow-up 6 days after undergoing bilateral upper eyelid blepharoplasty and repair of the right levator aponeurosis. Preoperatively, the patient had bilateral levator excursion of 13 mm and 4 mm of ptosis of the right eyelid. No ptosis of the left eyelid was noted. Physical examination today shows 2 mm of ptosis of the left upper eyelid. The right upper eyelid is well positioned. Which of the following is the most likely explanation for these findings?

- A) Hering law
- B) Horner syndrome
- C) Müller maneuver
- D) Todd paresis
- E) von Graefe sign

The correct response is Option A.

Hering law describes equal innervation to the eyelids in that the signal to the levator is the same despite the potential need for each eyelid to work independently. In the scenario described, the patient had obvious ptosis of the right eyelid, and the signal to raise the eyelids was strong. When the right ptosis was corrected, the signal to raise the eyelids decreased, and the more mild ptosis of the left eyelid was uncovered. To help avoid this problem, a Hering test or a patch test can be performed. The Hering test is performed by elevating the ptotic eyelid and observing whether the other eyelid becomes ptotic. A patch test is when the ptotic eyelid is covered for a period of time (usually 15 minutes) and then observed for whether the non-ptotic eye becomes ptotic. The key to both tests is to decrease the excessive signal to raise the eyelids.

Horner syndrome includes ptosis of the eyelid, constriction of the pupil, and decreased sweating due to disease in the sympathetic system. This can be due to a tumor, congenital or iatrogenic.

von Graefe sign is lagophthalmos in downgaze. This is related to Graves disease. Müller maneuver is the reverse of the Valsalva maneuver. After a forced expiration, an attempt at inspiration is made with closed mouth and nose, thereby creating negative pressure in the chest and lungs. This maneuver is used to find weakened areas of the airway.

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Todd paresis is focal weakness following a seizure. This can affect eye position.

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187. A 59-year-old woman comes to the office for evaluation of rhytidectomy for facial aging. Use of a fibrin glue during rhytidectomy is planned. Which of the following is most commonly associated with use of tissue sealants after rhytidectomy?

- A) Decreased ecchymosis
- B) Decreased period of induration
- C) Decreased scar formation
- D) Increased drainage
- E) Increased edema

The correct response is Option A.

Tissue sealants, such as fibrin tissue adhesives and platelet-rich plasma, have been utilized to affect drainage, ecchymosis, and edema following rhytidectomy. Prospective studies have demonstrated decreased rate of ecchymosis, edema, seroma, and prolonged induration. Although no major differences exist, studies have shown only a trend toward drainage reduction. Tissue sealants have not been shown to affect scar formation.

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188. A plastic surgeon flies home after taking her oral American Board of Plastic Surgeons (ABPS) examination. She is excited to finally start advertising to the public in order to grow her practice. She enlists an endorsement from one of her satisfied patients who underwent augmentation mammoplasty. The patient provides a quote and allows her photograph to be used. The plastic surgeon also wants to highlight her additional fellowship training in breast surgery. She is an American Society of Plastic Surgeons (ASPS) candidate member. Inclusion of which of the following items in her advertisement would be a breach of the ASPS Code of Ethics?

- A) ASPS logo
- B) Assertion of advanced skills in breast surgery as a result of her breast fellowship
- C) A list of her plastic surgery training programs
- D) Testimonial of the patient stating that this is the best plastic surgeon she knows

The correct response is Option A.

The plastic surgeon described is board eligible, not board certified, and a Candidate Member of the ASPS. She cannot use the logo until she is a member of the ASPS, and she must first be board-certified. She cannot assume she has passed her oral board examination until the board contacts her to let her know this. Using the ASPS logo in advertising is a breach of the ASPS Code of Ethics without board certification and full membership in the ASPS.

Claims highlighting the fact that she is a female plastic surgeon to attract female patients do not represent a breach of the Code of Ethics, nor is sharing her educational history. She has enlisted her patient's endorsement, and use of a direct quotation as a testimonial from the patient is fine if it is clearly a quote from the patient. The plastic surgeon needs to be careful, because other plastic surgeons in her area may think she is breaching the Code of Ethics with claims of superiority, as stated in Section 2IG: The member, either personally or through a partner or associate or any physician or other affiliated health care provider, uses or participates in the use of any form of public or private communication (including computer imaging and electronic communications) containing a false, fraudulent, deceptive, or misleading statement or claim.

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189. A 32-year-old man is brought to the office 24 hours after he underwent liposuction of the upper extremities, breasts, and chest. He appears disoriented and confused. Examination shows a petechial rash over the anterior trunk and axilla. Which of the following is the most likely cause?

- A) Allergic reaction to a medication
- B) Fat embolism
- C) Lidocaine toxicity
- D) Thrombotic thrombocytopenic purpura
- E) Transient ischemic attack

The correct response is Option B.

Fat embolization syndrome (FES) is clinically characterized by a triad of symptoms occurring within 24 to 72 hours following surgery or trauma: 1) alterations in mental status, 2) respiratory dysfunction, including hypoxemia or tachypnea, and 3) a petechial rash involving the anterior trunk, axillary, or head and neck regions.

Common predisposing conditions include traumatic long bone and pelvic fractures, orthopedic procedures, liposuction, and soft-tissue injuries. Non-traumatic etiologies include pancreatitis, diabetes mellitus, osteomyelitis, and alcoholic liver disease. Proposed mechanisms for fat embolism include 1) mechanical disruption—release of fat droplets from disrupted bone marrow or adipose tissue forced into torn venules in areas of trauma, or 2) biochemical—release of free fatty acids as chylomicrons induced by systemic changes from trauma or sepsis.

Diagnosis of FES is primarily clinical. Major diagnostic criteria include respiratory distress, cerebral dysfunction, and petechial rash. Minor criteria include tachycardia, tachypnea, fever, hypoxemia, thrombocytopenia, and hypocalcemia. Treatment for FES is primarily supportive. Respiratory support should focus on maintaining adequate tissue oxygenation and arterial saturation. Mechanical ventilation may be necessary. Hemodynamic and fluid resuscitation may be required. Use of corticosteroids remains controversial.

The triad of symptoms including the petechiae concentrated in the upper truncal region would be an unusual occurrence for an allergic medication reaction. Lidocaine toxicity occurs initially with perioral numbness, vertigo, and visual

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disturbances, and progresses to muscle twitching, unconsciousness, seizures, and finally to cardiorespiratory failure. Lidocaine toxicity would be earlier in onset and is not associated with a petechial rash. Although thrombotic thrombocytopenic purpura (TTP) may initially occur with petechiae, TTP is more commonly associated with headache, confusion, and digestive symptoms such as diarrhea, nausea, and abdominal pain. Transient ischemic attack may occur with temporary loss of vision, hemiparesis, confusion, or paresthesia.

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190. A 32-year-old woman comes to the office because of capsular contracture of the right breast. She underwent bilateral augmentation mammoplasty with saline implants 9 years ago. Revision surgery using simultaneous implant exchange with fat grafting is planned. Which of the following is the most likely fat retention volume over a 6-month period in this patient?

- A) 25%
- B) 45%
- C) 65%
- D) 85%

The correct response is Option C.

Previously published work using radiologic volumetric data analysis with fat grafting for cosmetic augmentation mammoplasty demonstrates volume retention over 6 months of $64 \pm 11\%$. Such loss of breast volume may be attributable to an element of apoptosis, a reduction in adipocyte volume after transplantation and survival, or a reduction in the fluid content of the grafted slurry. In reality, all three of these factors are likely to contribute to volume reduction over time.

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191. A 48-year-old woman comes to the office because of pain and tearing of the right eye 1 week after undergoing upper eyelid blepharoplasty. Fluorescein stain test result is positive for corneal erosion. On physical examination, absence of which of the following is most likely to put this patient at risk for corneal ulceration?

- A) Accommodation reflex
- B) Bell phenomenon
- C) Ocular convergence
- D) Oculocardiac bradycardia
- E) Pupillary light response

The correct response is Option B.

Transient lagophthalmos during sleep is not uncommon following blepharoplasty. During the first few weeks of recovery, it is important to protect the eyes with lubricating drops and ointment. Bell phenomenon, an upward and outer movement of the eye when the eye is closed, is a protective mechanism which keeps the cornea protected behind the upper eyelid. Bell phenomenon is absent in 10 to 15% of the population. Accommodation reflex, oculocardiac reflex, ocular convergence, and pupillary light response do not place the cornea at risk after blepharoplasty.

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192. An otherwise healthy 27-year-old man comes to the office for removal of asymptomatic enlarged breasts that have persisted unchanged since onset at age 14. He takes no medications and does not use recreational drugs. Physical examination shows symmetrical collections of rubbery, firm subareolar tissue 4.5 cm in diameter. There is scant surrounding fatty tissue and no ptosis; areolas are 28 mm in diameter. Which of the following is the most appropriate management of this patient's condition?
- A) Circumferential periareolar resection with liposuction
 - B) Mastectomy via Wise pattern incision
 - C) Observation to allow for involution
 - D) Oral hormone-blocking medication
 - E) Subareolar tissue resection via pull-through excision technique

The correct response is Option E.

Gynecomastia, enlargement of the male breast, may occur as physiologic temporary overgrowth of the adolescent breast or it may appear during adulthood as a result of numerous etiologies. It can consist of various proportions of excess subareolar fibrous breast tissue and adipose tissue in the periphery, with the extent often depending upon the habitus of the individual. Appearing at about age 14 in more than 65% of healthy boys, gynecomastia will typically resolve within 2 years of onset in otherwise healthy males. Persistence of adolescent-onset gynecomastia after age 21 is unlikely to resolve with conservative measures. Hormone blockers have no place in the management of persistent breast tissue in otherwise healthy individuals. A wide variety of surgical treatment options for resection of redundant male breast tissue have been published. These include direct excision through a number of described incisions, traditional and ultrasound-assisted liposuction, and recently, use of an arthroscopic shaver. Ultrasound-assisted liposuction may have an advantage in stimulating skin retraction for cases where mild to moderate ptosis exists when scar minimization is desired. For otherwise uncomplicated gynecomastia, excision of fragmented subareolar tissue via a limited areolar border incision with the pull-through technique is the most appropriate choice of therapy. When redundant skin exists in addition to excess male breast tissue, immediate skin resection via periareolar, transverse lenticular, omega-shaped, or Wise (inferior pedicle) incision are among the numerous methods described. Regardless of the resection method, an evolving trend favors allowing skin to retract for 6 to 9 months before determining

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whether there is a need to subject the individual to additional incisional scarring.

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193. A 32-year-old Korean man comes to the office for evaluation of a wide nose with decreased projection. He desires rhinoplasty for an improved aesthetic appearance. Compared with Caucasian nasal anatomy, which of the following is most likely in this patient?

- A) Height of the lower lateral cartilage is shorter
- B) Height of the upper lateral cartilage is longer
- C) Length of the septal cartilage is longer
- D) Length of the upper lateral cartilage is shorter
- E) Overlapping length of the upper lateral cartilage and the nasal bone is shorter

The correct response is Option A.

The cartilaginous structures of Asian noses are substantially different from those of Caucasian noses in terms of the shape, size, thickness, and relationship to other structures. The lengths of the upper and lower lateral cartilage of Asian noses are similar to those of Caucasian noses. However, the heights of the upper and lower lateral cartilage of Asian noses are shorter than those of Caucasian noses. Therefore, rhinoplasty with cephalic resection of the lower lateral cartilage in Asian noses should be approached with caution to prevent overresection. The overlapping length of upper lateral cartilage and nasal bone is similar in both Asians and Caucasians.

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194. A 45-year-old woman comes to the office because of puffiness of both lower eyelids. Physical examination shows little lower lid skin excess, but prominent eyelid fat pads. Lid tone, snap back, and distraction test results show no abnormalities. Lid-cheek junction is smooth. A retroseptal transconjunctival approach of the lower lid is planned. Regarding the operative approach, which of the following statements is most accurate?
- A) Fat pad reduction without violating the orbital septum is performed
 - B) Lower eyelid skin resurfacing with laser or chemical peel should not be performed concurrently with a retroseptal approach
 - C) The incision should be placed 1 to 2 mm below the tarsal border
 - D) The inferior oblique muscle will be noted between the central and lateral fat pad
 - E) The plane of dissection is deep to the orbicularis, but superficial to the orbital septum

The correct response is Option A.

The incision for a retroseptal approach is usually placed 4 to 5 mm below the tarsal border, or about 8 mm for the lid margin. The plan of dissection for a retroseptal approach is, by definition, deep to both the orbicularis muscle and septum. Because the fat pads are retroseptal, modification does not require entry through the septum when a retroseptal approach is used.

The preseptal approach is typically chosen for modification of the lid-cheek junction, and facilitates fat pad redistribution and access to the midface. The retroseptal approach is used for reduction of fat pads only. The inferior oblique muscle is located between the central and medial compartments of fat.

Multiple authors have shown that it is indeed safe to perform skin resurfacing with either chemical peel or laser simultaneously with a transconjunctival blepharoplasty.

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195. During fetal development, failure of the mammary pit to elevate above the skin level results in which of the following deformities?

- A) Accessory nipple
- B) Amastia
- C) Amazia
- D) Athelia
- E) Nipple inversion

The correct response is Option E.

The congenitally inverted nipple is common and occurs in 4% of infants. It results from the failure of the mesenchyme to proliferate above the level of the skin.

Amastia is absence of the entire breast. Athelia is absence of the nipple. Amazia is absence of the mammary gland with an intact nipple and areola. Polythelia, or accessory nipple, results from failure of regression along the milk line.

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196. A 35-year-old man comes to the office 4 weeks after undergoing open rhinoplasty and submucous resection of a deviated septum. He reports nasal crusting, bleeding, and a whistling sound from his nose. Which of the following is the most likely diagnosis?

- A) Exposed conchal bone
- B) Internal nasal valve collapse
- C) “L” strut fracture
- D) Septal perforation
- E) Submucous hematoma

The correct response is Option D.

Symptoms of septal perforations include crusting along the septal defect, bleeding, and whistling. The whistling sound is due to the altered airflow pattern. Perforations can be caused by trauma, cocaine snorting, and infectious or inflammatory causes. In this patient, surgical trauma is the most likely cause. Treatments for symptomatic septal perforations include flaps and grafts. Asymptomatic perforations do not require treatment.

The symptoms of internal nasal valve collapse, and submucous hematoma would be restricted airflow. “L” strut fracture or collapse would occur with an external deformity and not the symptoms described. Exposed conchal bone is caused by overresection of inferior turbinate mucosa. When performing a submucosal resection of the inferior turbinate, this would not occur with a submucous resection of the septum.

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197. A 53-year-old woman comes to the office for evaluation of breast asymmetry. Reduction of the left breast and augmentation of the right breast with implant and autologous fat transfer are planned. She is concerned about fat injection and cancer risk. Which of the following is the most appropriate response regarding mammographic changes after fat transfer?

- A) Calcifications warranting biopsy are more likely on the fat transfer side
- B) Calcifications warranting biopsy are more likely on the reduction side
- C) Masses requiring biopsy are more likely on the reduction side
- D) Scarring will be decreased on the reduction side
- E) There are no differences between mammographic findings in fat transfer and reduction

The correct response is Option C.

Fat transfer to the breast remains a controversial procedure. There are some concerns about the oncologic safety of fat transfer, and for this reason some authors do not recommend fat transfer in patients with a history of cancer. Another concern about fat transfer is the potential difficulty in screening for malignancy. Rubin, et al. compared mammographic changes after fat transfer with changes after reduction mammoplasty. In this blinded study, radiologists reviewed pre- and postoperative mammograms of patients who had undergone augmentation and fat transfer and reduction mammoplasty. In the reduction cohort, masses requiring biopsy and scarring were more common; other abnormalities, including oil cysts, benign calcifications, and calcifications requiring biopsy showed no differences between the groups.

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198. A 45-year-old man is referred for scalp reconstruction after undergoing Mohs micrographic surgery for removal of squamous cell carcinoma of the scalp. The defect measures 5×10 cm. The scalp is reconstructed with a rotation flap measuring 20×30 cm with a 5×2 -cm split-thickness skin graft on the secondary donor defect. When assigning a current procedural terminology (CPT) code for the adjacent tissue transfer, which of the following is the correct area to use?
- A) 50 cm^2
 - B) 600 cm^2
 - C) 650 cm^2
 - D) 810 cm^2
 - E) 1000 cm^2

The correct response is Option C.

Adjacent tissue transfer is one of the most common procedures performed by plastic surgeons, and accurate coding is essential for accurate reimbursement, insurance integrity, and ethical reasons.

The most appropriate method for calculating the area is to add the area of the defect to the area of the flap. The area of the defect is considered the “primary defect,” and the flap alone is considered the “secondary defect.” It is the combination of these that determines the area on which the current procedural terminology (CPT) codes are based. In this case the defect measures 5×10 cm, or 50 cm^2 . The flap itself measures 20×30 cm, or 600 cm^2 . Therefore, the total area used to assign the correct CPT code is 650 cm^2 .

The skin graft is over part of the secondary defect, which is already covered by the secondary defect measurement. However, the skin graft is an additional code that should be added to the codes for adjacent tissue transfer.

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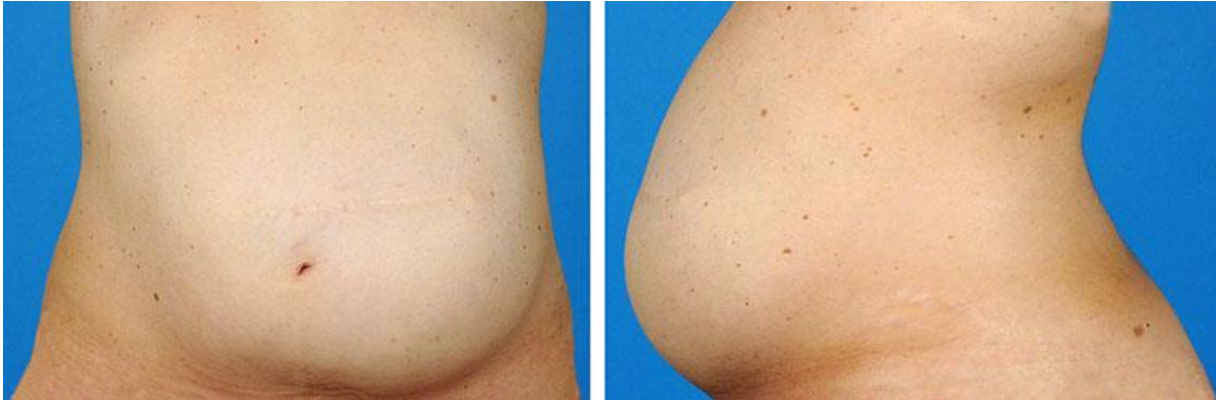
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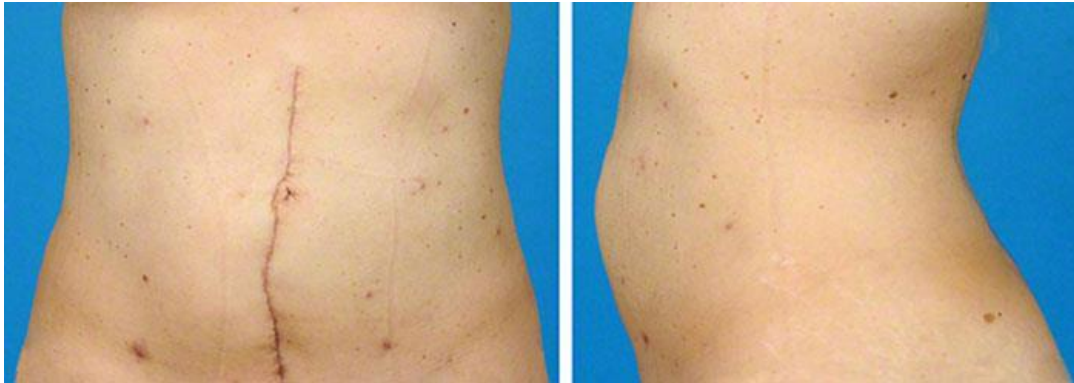
(Please note that this pictorial appears in color in the online examination)

199. A 39-year-old woman is evaluated because of an abdominal bulge after undergoing resection of a 6 × 6-cm desmoid tumor 2 years ago through a lower transverse incision. A 10 × 10-cm area of left rectus muscle and some right rectus muscle were resected, and 2 cm of normal fascia and muscle remain inferior to the costal margin and superior to the anterior superior iliac spine on the left side. The defect was initially bridged with synthetic mesh only. Which of the following is the most appropriate next step in management of this patient's condition?
- A) Anterior component separation with biologic mesh overlay
 - B) Anterior component separation with biologic mesh underlay
 - C) Biologic mesh overlay only
 - D) Retrorectus component separation with synthetic mesh underlay
 - E) Rives-Stoppa technique of mesh placement only

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

The correct response is Option D.

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Hernia repair has evolved considerably in the past decade. There are a number of different types of mesh, which can be generally classified as synthetic mesh and biologic or biodegradable mesh. Biologic or biodegradable mesh can stretch with time, and are not as durable as synthetic mesh. They are, however, indicated in contaminated wounds or hernias at high risk for contamination, such as in patients with multiple medical comorbidities. Polypropylene mesh, because of its high rate of tissue ingrowth, is recommended in many cases.

Mesh underlay has been shown to be superior to mesh overlay, and a retrorectus repair is the recommended repair of the American Hernia Society. Mesh overlay is unlikely to be sufficient to repair the defect; and the patient had a failed mesh repair. Component separation will not address the absolute tissue loss of the rectus abdominis resection. Anterior component separation has a higher risk of hernia formation than a retrorectus repair. A component separation with biologic mesh might be appropriate in a contaminated wound, but this patient does not have a contaminated wound.

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200. A male newborn is evaluated in the hospital because of prominent ears. Nonsurgical correction with auricular molding is recommended. In order to achieve optimal correction, therapy should be initiated at which of the following ages?

- A) 3 days
- B) 14 days
- C) 1 month
- D) 6 months
- E) 1 year

The correct response is Option A.

If treatment is initiated within the first few days of life, auricular molding can adequately and permanently treat some congenital ear deformities. Treatment must be initiated before 3 days of age and continue to 6 months of age. The efficacy of this mode of treatment is attributed to cartilage pliability due to high concentrations of circulating maternal estrogen in the first few days of life. Maternal estrogen concentrations are highest in the first 3 days of life and begin to decrease thereafter. In order to achieve good results with auricular molding, treatment must be initiated while maternal estrogen concentrations are increased and therefore cartilage pliability is high.

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Thank you for your participation.

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