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

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American Society of Plastic Surgeons In-Service Examination



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for the

In-Service Examination



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Section 1: Comprehensive

1. A 59-year-old woman is scheduled to undergo blepharoplasty. She has a history of postoperative nausea and vomiting. Administration of which of the following anesthetic agents is most appropriate for this patient?

- A) Inhalational nitrous oxide
- B) Inhalational sevoflurane
- C) Intravenous etomidate
- D) Intravenous ketamine
- E) Intravenous propofol

The correct response is Option E.

Postoperative nausea and vomiting (PONV) is a multifactorial entity, comprising patient, surgical, and anesthetic factors. Attempts have been made to identify the risk factors. A recent study concluded that female gender, a history of motion sickness or PONV, nonsmoking status, and use of postoperative opioids were most predictive. The incidences of PONV with the presence of zero, one, two, three, or all four of these risk factors were 10%, 21%, 39%, 61%, and 79%, respectively. Some surgical procedures are associated with a higher incidence of PONV, eg, major breast procedures, strabismus surgery, laparoscopy, and laparotomy. Agents used during anesthesia, including opioids, nitrous oxide (N₂O), and volatile inhalational anesthetics, are emetogenic. Pain, anxiety, and dehydration may also increase the incidence of PONV.

Propofol is widely used in ambulatory surgery because of its favorable clinical characteristics, including rapid recovery and minimal PONV. When compared with propofol, sevoflurane is associated with a higher incidence of PONV. Etomidate has minimal cardiovascular side effects, but it has a high incidence of PONV and is not commonly used in outpatient anesthesia. Nitrous oxide has been found to increase PONV when used as a primary anesthetic agent but not when used in combination with other agents. Intravenous anesthesia with ketamine has a lower risk of pulmonary aspiration but may result in higher rates of PONV.

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2. A journal article advocating a specific recommended algorithm for the management of pressure ulcers is published. Evidence-Based Medicine (EBM) criteria are used, and Level I studies are cited to provide the rationale. Which of the following best describes a Level I EBM study?
- A) Case series of greater than 10 patients
 - B) Expert opinion by an experienced senior author
 - C) Multicenter, randomized, controlled study
 - D) Prospective cohort study
 - E) Retrospective comparative study

The correct answer is Option C.

During the 1970s, epidemiologists in Canada began to recognize and explain the importance of critical appraisal of all studies in the medical literature. This concept has become known as Evidence-Based Medicine (EBM). In 2001, The Institute of Medicine called for all physicians to incorporate EBM into their practices. With formal recognition of the validity of evidence, physicians can work to eliminate bias and placebo effect and generate widely accepted standards of treatment. Under the principles of EBM, different types of evidence are assigned a level of rating (depending on type of the study) and a grade (stating whether the practice is recommended or optional). This common language provides an improved method of communication among clinicians across different specialties.

Level I studies are high quality, multicenter or single-center, randomized, controlled trials or a review of these studies. Level II studies are of lesser quality, randomized, controlled trials, or prospective cohort studies (or systematic review of these studies). Level III studies are retrospective comparative studies or case-controlled studies. Level IV studies are case series, and Level V studies are expert opinion, case reports, or evidence based on nonhuman, physiologic, bench research. Grade A or strong recommendation is given to therapeutics based on Level I evidence; grade B or recommended is given to Levels II, III, and IV; grade C is given to inconsistent Levels II, III, or IV; and grade D or optional is given to Level V studies.

In a survey of 459 articles published in the 2003 edition of *Plastic and Reconstructive Surgery*, 27 were classified as Level I or II, 33 were Level III, and 399 were Level IV or V. Although the plastic surgery literature inherently deals with innovative methods and studies, which can be difficult to quantify, it is beneficial to recognize and strive to attain the highest levels of clinical evidence in order to improve patient care.

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3. A 25-year-old woman comes to the office because she has a lump in her right armpit. She reports that the lump increases in size and becomes tender during her period. She also says that it restricts arm movement and interferes with her ability to play tennis, especially during menses. Examination shows a 4 × 4-cm, soft, mobile mass in the right axilla that is tender to palpation. There is no evidence of firmness or palpable nodules within the mass. Which of the following is the most appropriate next step in management?
- A) Excision of axillary tissue
 - B) Fine-needle aspiration
 - C) Incisional biopsy
 - D) Mammogram
 - E) Sentinel lymph node biopsy

The correct response is Option A.

Axillary accessory breast tissue should be removed surgically. It is found in 0.4% to 6% of women and may be asymptomatic, cause pain, restrict arm movement, or cause cosmetic problems or anxiety. There have been reports of malignant degeneration of this accessory breast tissue, and the current recommendations are for simple excision through an axillary incision.

Fine-needle aspiration may diagnose the presence of breast tissue, but it also may be inconclusive. A mammogram would not be helpful in confirmation of this diagnosis; however, MRI has been used to evaluate the presence of axillary breast tissue. A sentinel lymph node biopsy would not be necessary given the lack of malignancy. An incisional biopsy taking a sample of tissue is unnecessary, as the lesion should be completely excised.

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4. A 33-year-old man who sustained burns to 95% of the total body surface area five days ago is scheduled to undergo the initial stages of surgical reconstruction. In preparing this patient, which of the following is the advantage of using cultured epidermal autografts versus split-thickness skin grafts?
- A) Donor site
 - B) Durability
 - C) Elasticity
 - D) Immediate availability
 - E) Reduced expense

The correct response is Option A.

With use of cultured epidermal autografts, no donor site limitations exist. The patient's own keratinocytes are expanded in tissue culture and a small skin specimen may be cultured and expanded within two to three weeks. Unfortunately, there is no dermal matrix tissue and, therefore, the graft lacks the elastic quality of normal skin or even split-thickness skin grafts. This results in wounds that are stiff, and motion is limited in the face and around joints. Likewise, the lack of a dermis results in very slow basement membrane formation; therefore, there are frequent problems with blistering and easy shearing. The use of cultured epidermal autografts is somewhat limited by its high cost and delay in availability as the tissue is cultured.

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

5. A 34-year-old man undergoes correction of the defect shown three years after sustaining an injury to the left tip of the nose while playing football. Placement of an alar batten graft is planned. During septal graft harvest, the mucoperichondrial plane is difficult to elevate, and the cartilage is removed with an adherent perichondrial layer. Which of the following is most likely to result from the use of this graft compared with a cartilage-only graft?
- A) Extrusion
 - B) Necrosis
 - C) Ossification
 - D) Resorption
 - E) Warping

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The correct response is Option E.

Pure cartilage grafts tend to maintain shape, but grafts with an intact perichondrial layer can curl significantly and lead to unpredictable results. During septal graft harvest, care must be taken to elevate mucoperichondrial flaps in the proper plane. Likewise, auricular or costal cartilage grafts must be harvested in a subperichondrial plane. Removal of the perichondrium and softer outer cartilage layer leaves the more rigid cartilage core, which maintains shape more predictably.

Extrusion, necrosis, ossification, and resorption are not known to be affected by the presence or absence of the perichondrial layer.

The alar batten graft is a useful means of adding support to a deformed or weakened alar cartilage (see the photograph taken one month postoperatively).



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Warped cartilage has a “memory” and tends to return to its warped shape unless adequate support is provided.

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6. A 52-year-old woman undergoes reconstruction of the left breast using an ipsilateral extended latissimus dorsi myocutaneous pedicled flap. Postoperatively she develops venous congestion along the distal end of the skin paddle. Leeches are used in an attempt to relieve venous congestion. Which of the following is the most effective prophylactic antibiotic therapy?
- A) Cephalexin
 - B) Ciprofloxacin
 - C) Clindamycin
 - D) Metronidazole
 - E) Penicillin

The correct response is Option B.

Medicinal leeches (*Hirudo medicinalis*) have been used as an aid to salvage congested free flaps. The incidence of infection associated with leech therapy reported in the literature ranges from 2.4% to 20%. The severity of infections ranges from cellulitis to tissue necrosis, abscess, and septicemia. Delayed infection from colonized necrotic tissue can also occur. The organism most often responsible is *Aeromonas hydrophila*, a gram-negative anaerobe that is part of the intestinal resident flora of the leech. Resistance to penicillins and first-generation cephalosporins is not uncommon because of their production of beta-lactamase enzymes. Resistance to trimethoprim and sulfamethoxazole, tetracycline, imipenem, and even gentamicin has also been reported. Susceptibility to fluoroquinolones such as ciprofloxacin continues to be observed. Prophylactic antibiotics with a fluoroquinolone and aminoglycoside are recommended, and therapy should be continued until any open wound or necrotic tissue has completely healed.

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7. A 28-year-old man with a skull tumor underwent resection with a resultant bony defect and exposed dura mater. A reconstructive alloplastic cranioplasty was performed, which was complicated by iatrogenic burns to the dura mater, underlying brain, and surrounding soft tissue. Which of the following alloplastic materials was most likely used?
- A) High-density porous polyethylene
 - B) Methylmethacrylate
 - C) Nonceramic hydroxyapatite cement
 - D) Polytetrafluoroethylene
 - E) Silicone

The correct response is Option B.

Methylmethacrylate is an alloplastic acrylic resin that has been used in craniofacial reconstruction, forehead augmentation, chest wall reconstruction, and, when impregnated with antibiotics, for treatment of infected long bone fractures. It is fashioned by mixing a powder with a liquid monomer. The resultant paste is formed in an exothermic reaction that can achieve temperatures of 70°C. Therefore, it is mandatory that the paste be cooled with constant irrigation as it is applied and molded into the defect in order to prevent thermal injury. In animal craniofacial experiments, temperature elevations of 28°C have been recorded but with subdural temperature elevations of only 0.56°C if constant irrigation was used.

High-density porous polyethylene (Medpor) has also been used for the repair of craniofacial defects as well as in the realm of cosmetic surgery. It is prepackaged in sterile form and is available in sheets, blocks, and prefabricated shapes/implants. It does not generate exothermic reactions when contoured for use.

Nonceramic hydroxyapatite cement is based on calcium phosphate and requires mixing with water in order to form a paste before it is applied. This paste, however, is formed without an exothermic reaction. It is also resorbable and is replaced eventually with bone (though not 100% replacement many times, thereby potentially leading to a contour deformity).

Polytetrafluoroethylene (PTFE) has been used for subcutaneous augmentation (Gore-Tex), facial aesthetic surgery, vascular conduits, and even for facial implants (Proplast), although Proplast was recalled by the FDA secondary to reports of foreign body reaction and biomechanical failure. It is biologically inert and noncarcinogenic, and it also does not give off an exothermic reaction when used.

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8. Sturge-Weber syndrome is characterized by which of the following vascular anomalies?

- A) Arteriovenous malformation
- B) Capillary malformation
- C) Hemangioma
- D) Lymphatic malformation
- E) Venous malformation

The correct response is Option B.

Capillary malformations are slow-flow vascular malformations that classically were referred to as “port-wine stains.” Facial capillary malformations often occur in a dermatomal distribution. In Sturge-Weber syndrome, the capillary malformation may involve V1, V2, and/or V3 dermatomes, with ipsilateral ocular and leptomeningeal vascular anomalies.

Arteriovenous malformations are a combination of arterial and venous channels. MRI best documents the extent of involvement. The mainstay of management is embolization and surgical excision.

Hemangiomas are vascular tumors, not malformations. They grow rapidly, often within the first year of life, and regress slowly, often involuting by 5 years of age. Hemangiomas typically are observed and not treated unless they cause visual interference, auditory canal obstruction, airway blockage, or ulceration and bleeding. Treatment regimens include corticosteroids or interferon.

Lymphatic malformations are characterized as microcystic, macrocystic, or combined. Lymphatic malformations most commonly occur in the cervicofacial region, axilla/chest, mediastinum, retroperitoneum, buttock, and perineum, and were classically referred to as “cystic hygromas.” Lymphatic malformations in the floor of the mouth and tongue present as macroglossia, vesicles, and intermittent swelling. Lymphatic malformations may enlarge with infection.

Venous malformations are the most common type of vascular malformation. They are present at birth, slowly increase in size as the child grows, and are prone to thrombosis. Maffucci syndrome includes exophytic cutaneous venous malformations, bony exostoses, and enchondromas. There is also a risk for malignant transformation.

The two major categories of vascular anomalies include tumors and malformations. Vascular tumors exhibit rapid growth with endothelial proliferation followed by regression.

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Vascular malformations have a normal rate of endothelial cell turnover, are present at birth, and grow proportionately with the child.

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9. A 25-year-old man with profound hyperhidrosis is undergoing botulinum toxin type A (BOTOX Cosmetic) injection. EMLA (prilocaine-lidocaine) cream is applied to the injection site. Which of the following best represents the minimum amount of time necessary to achieve anesthesia?
- A) 5 Minutes
 - B) 15 Minutes
 - C) 30 Minutes
 - D) 60 Minutes
 - E) 90 Minutes

The correct response is Option D.

EMLA (eutectic mixture of local anesthetic) is a highly effective method of inducing topical anesthesia. A eutectic mixture consists of two substances that when mixed have a lower melting point than either substance alone. EMLA uses a combination of lidocaine and prilocaine. It has excellent penetration and produces remarkably little sensitivity reaction.

The efficacy of EMLA varies according to the relative thickness of the skin and its vascularity. The cream is applied fairly thickly (1-2 g of EMLA per 10 cm² of skin) and a dressing such as Opsite or Tegaderm is used to keep it in place. Gentle regular massage to the area can be applied for at least an hour.

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10. During which of the following phases of wound healing is the net rate of collagen synthesis greatest?

- A) Contraction
- B) Fibroblastic
- C) Hemostasis
- D) Inflammatory
- E) Remodeling

The correct response is Option B.

During the fibroblastic phase, three to five days after injury, fibroblasts migrate into the wound and lay new collagen. Type 3 collagen predominates early in normal wound healing but is later replaced by Type 1 collagen. It is during this time that the greatest rate of collagen synthesis occurs in the wound.

Contraction begins during the fibroblastic stage (proliferative) and continues well into the remodeling phase.

Hemostasis is the brief period before healing starts. This allows for vasoconstriction and clotting to be activated.

Collagen synthesis does not occur during the inflammatory phase; instead, there is activation of the inflammatory system to allow “cleansing” of the wound in preparation for healing.

During the remodeling phase (maturation), the net amount of collagen is constant as there is an equal amount of degradation and synthesis. However, the wound becomes stronger because there is cross-linking of the collagen fibers. Maximum tensile strength is achieved after approximately 12 weeks.

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11. A 2-week-old female infant is brought to the office because she has a bright red lesion on her cheek that has been rapidly increasing in size. Examination shows a 10-mm lesion on the malar eminence; there is no evidence of ulceration or bleeding. Which of the following is the most appropriate next step in management?

- A) Incisional biopsy
- B) Injection of a corticosteroid
- C) Laser therapy
- D) Oral corticosteroid therapy
- E) Observation only

The correct response is Option E.

The patient described has a hemangioma. The most appropriate management of a hemangioma on the cheek is observation. After a rapid growth phase, most of these lesions proceed to involution and disappear completely by puberty. Complications may occur such as ulceration, bleeding, or infection.

Lesions that obstruct vision or the airway may require more aggressive treatment, such as injection or oral administration of a corticosteroid. Laser therapy is not effective in the treatment of hemangiomas. Incisional biopsy is only necessary if a malignancy is suspected.

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The response options for the next two items are the same. You will be required to select one answer for each item in the set.

For each patient with dermatologic symptoms, select the most likely diagnosis (A–E).

- A) Bazex syndrome
- B) Erythroplasia of Queyrat
- C) Nevoid basal cell carcinoma syndrome
- D) Squamous cell cancer
- E) Xeroderma pigmentosum

12. A 5-year-old girl is brought to the office because of erythema, inflammation, and bullae formation on the face and neck area one day after spending a sunny day in the park with her family.
13. A 16-year-old boy comes to the office because of a three-year history of dome-shaped, tan papules on the face, neck, and trunk; erythematous pits in the palm of his hand; and swelling and pain in the molar and premolar areas.

The correct response for Item 12 is Option E and for Item 13 is Option C.

Xeroderma pigmentosum is an autosomally recessive disease with incidence of 1:1,000,000 in the United States and 1:40,000 in Japan (incidence in men and women is the same). The usual age of presentation is the first few years of life. Physical findings include acute sun sensitivity with sunburn-like reaction (erythema, inflammation, and bullae formation), pigmented macules, telangiectasias in photodistribution, dry, scaly, and atrophic skin, and multifold increased risk for BCC, squamous cell carcinoma, and malignant melanoma. Treatment includes sun avoidance, sunscreen, dermatologic cancer screening every three months, surgery, cryotherapy, topical treatment with 5-FU and imiquimod.

Nevoid basal cell carcinoma (Gorlin) syndrome is an autosomal dominant disease with a 1/60,000 incidence (incidence in men and women is the same). The usual age of presentation is birth or childhood. Physical findings include dome-shaped tan papules on face, neck, and trunk (basal cell carcinoma [BCC]); erythematous pits in the palm of the hand or plantar aspect of the feet; and swelling and pain in molar and premolar areas (odontogenic keratocysts), colobomas, hypertelorism, and fibrosarcomas. Differential diagnoses include Bazex syndrome, melanocytic

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nevi, and xeroderma pigmentosum. Diagnosis is usually made by clinical findings and supported by biopsy and skeletal surgery. Treatment includes surgical excision, application of topical 5-fluorouracil (5-FU) and imiquimod, and frequent cutaneous examinations. Patients should avoid radiotherapy, radiographs, and sun as these can induce the formation of new BCCs.

Bazex syndrome is another autosomally dominant inherited disorder. It is characterized by multiple BCCs of the face, follicular atrophoderma of the extremities, localized or generalized hypohidrosis, and hypotrichosis. Physical findings are classically unlike those of Gorlin syndrome and usually do not include pits in the hands and feet and molar pain.

Erythroplasia of Queyrat arises from the squamous epithelial cells of the glans penis. It is synonymous with Bowen disease of the glans penis, is seen mostly in uncircumcised men, and represents an in situ form of squamous cell carcinoma. Progression to invasive carcinoma may occur after a variable period of time.

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14. A 62-year-old man is scheduled to undergo repair of an abdominal wall hernia. A preoperative photograph is shown. He has a 15-year history of chronic lung disease and receives daily corticosteroids to control his symptoms. Supplementation with which of the following is most likely to decrease impairment of wound healing in this patient?
- A) Vitamin A
 - B) Vitamin B₁ (thiamine)
 - C) Vitamin B₂ (riboflavin)
 - D) Vitamin B₆ (pyridoxine)
 - E) Vitamin C

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The correct response is Option A.

Animal studies have shown that impairment of wound healing caused by use of corticosteroids can be reversed by the oral administration of vitamin A (retinoic acid), 15,000 IU daily for seven days. Patients with true deficiencies of vitamin B₆ (pyridoxine), vitamin B₁ (thiamine), or vitamin B₂ (riboflavin) may have wound healing problems and benefit from supplementation. Vitamin C deficiency (scurvy) results in inability to cross-link collagen fibers and decreased wound tensile strength, which may be reversed by vitamin C supplementation.

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15. A 29-year-old woman who is positive for the *BRCA1* gene underwent bilateral mastectomies and immediate reconstruction with placement of tissue expanders. After completion of the second session of tissue expansion, she has severe pain in the chest wall. There is no evidence of hematoma or infection. Which of the following is the most appropriate next step in management?
- A) Administer pain medication
 - B) Apply a warm compress to the breasts
 - C) Plan for return to the operating room
 - D) Reassure the patient
 - E) Withdraw fluid from the tissue expander

The correct response is Option E.

Physical signs and symptoms should be closely monitored during tissue expansion. Pain and rapidly blanching skin under tension are evidence of excessive expansion at that setting. The patient's pain immediately after expansion (or even in a slightly delayed manner) is indicative of ischemic tissue with poor oxygen tension. Neural tissue has been shown to have the lowest tolerance to ischemia, hence in part explaining the pain. The most appropriate step in management is to withdraw enough fluid to relieve pain. This amount can be dramatically small at times; a few milliliters can correct the problem.

Other measures to relieve pain, such as administering pain medication and applying warm compresses, can be attempted after withdrawing fluid, if necessary. Adding more fluid is inappropriate. There is no need at this stage to return to the operating room.

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16. A 47-year-old man has deep partial-thickness burns of the neck, trunk, and abdominal wall involving 55% of the total body surface area. Which of the following is the most effective immediate method to deliver nutrition to this patient?
- A) Ad lib oral intake with high-calorie protein shakes
 - B) Enteral nutrition through gastrostomy tube
 - C) Enteral nutrition through nasogastric tube
 - D) Parenteral nutrition through central venous catheter
 - E) Parenteral nutrition through peripheral intravenous injection

The correct response is Option C.

Providing nutrition early in the management of a burn victim is critical to a successful outcome. Since the gastrointestinal tract is typically intact in a burn victim, enteral feeding is the route of choice. In massive burn patients, care must be taken to recognize gastric and/or intestinal ileus, which may complicate and inhibit the advancement of enteral feeds. Nevertheless, burn victims rarely require parenteral nutrition on a long-term basis.

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The response options for the next two items are the same. You will be required to select one answer for each item in the set.

For each patient with excessive abdominal tissue, select the most appropriate surgical procedure (A–E).

- A) Abdominoplasty
- B) Abdominoplasty and liposuction
- C) Circumferential lower body lift (hemi-body lift)
- D) Liposuction
- E) Panniculectomy

17. A 49-year-old woman who underwent gastric bypass surgery. She has lost 100 lb, going from a body mass index (BMI) of 45 kg/m^2 to 28 kg/m^2 , and now has excess anterior abdominal and buttock tissue.
18. A 55-year-old man with a BMI of 40 kg/m^2 , who has had episodes of severe intertrigo and skin infections from overhanging skin and fat of the anterior abdomen. He has smoked one half of a pack of cigarettes daily for five years.

The correct response for Item 17 is Option C and for Item 18 is Option E.

For the massive weight-loss patient, only a circumferential lower body lift adequately addresses excessive tissue of both the anterior and posterior trunk.

For the patient with skin infections, a panniculectomy will address the excessive abdominal pannus, which is producing the symptoms described. In a patient with a history of smoking, there is an increased risk of wound-healing complications and skin necrosis. Other surgical options that involve undermining tissues and raising skin flaps will further jeopardize the vascularity and healing of the overlying skin. Liposuction would address the excess adipose tissue but not the excess skin. A straight panniculectomy without undermining will minimize the risk of wound complications in a patient with a history of smoking. Patients who smoke should be counseled on the importance of smoking cessation at least four weeks before and after elective surgery.

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19. A 68-year-old man has recurrent squamous cell carcinoma of the floor of the mouth. He underwent radiation therapy one month ago. A wide local resection is performed with a marginal mandibulectomy. Which of the following is the most appropriate reconstructive option?

- A) Dorsal tongue flap
- B) Local mucosal flap
- C) Osteocutaneous fibular free flap
- D) Radial forearm free flap
- E) Split-thickness skin graft

The correct response is Option D.

A radial forearm free flap is the most appropriate reconstructive option for the patient described.

A dorsal tongue flap would be difficult to inset in the floor of the mouth and would create additional tethering.

A large defect of the floor of the mouth with a marginal mandibulectomy would be difficult to close with a local flap in a patient who has undergone radiation.

An osteocutaneous fibular free flap is inappropriate because there is no segmental mandibular defect with a marginal mandibulectomy.

A split-thickness skin graft would be inappropriate to place on exposed bone.

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20. A 67-year-old man undergoes three-vessel coronary artery bypass grafting using the left and right internal mammary vessels and a saphenous vein graft. He develops mediastinitis postoperatively and requires wide operative debridement with a resultant chest defect. Reconstruction with which of the following flaps is most likely to result in flap necrosis?

- A) Latissimus dorsi
- B) Omentum
- C) Pectoralis major
- D) Rectus abdominis
- E) Serratus anterior

The correct response is Option D.

The rectus abdominis muscle has several sources of blood supply, including the superior and inferior epigastrics and intercostal vessels. For the purpose of chest wall reconstruction, the rectus muscle is pedicled upon its superior blood supply, the superior epigastric vessels, which itself is a continuation of the internal mammary vessels. Since the internal mammaries have been used on both sides for the purpose of coronary artery bypass grafting, the blood supply to the rectus has been compromised. Although it is possible to raise the rectus muscle on only the eighth intercostal blood vessel, this method is less reliable and less likely to be sufficient to sustain the entire rectus muscle, making it prone to flap necrosis.

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21. A 50-year-old man has a 1.2-cm defect of the left nasal tip (shown) immediately after undergoing Mohs micrographic surgery for basal cell carcinoma. Reconstruction with a bilobed flap is planned. For this procedure, which of the following is the maximum angle of transposition recommended for the flap?
- A) 30 Degrees
 - B) 60 Degrees
 - C) 100 Degrees
 - D) 120 Degrees
 - E) 180 Degrees

The correct response is Option C.

The bilobed flap is an important “workhorse” technique for nasal tip defects less than 2 cm in diameter. Contour deformities or poorly placed incisions result when flaps are designed with

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over-rotation of the lobes. A proper design, known as the Zitelli modification, should limit the total rotation about the pivot point to 90 to 100 degrees (45 to 50 degrees per lobe), with the smaller second flap placed in the loose skin of the nasal dorsum or sidewall. A triangular excision is needed between the pivot point and the defect to avoid dog-ear formation. Wide undermining in the submuscular plane is performed on all sides of the flap to decrease tension while preserving perfusion. A proper design and technique should result in restored nasal tip contour with minimal deformity.

Over-rotation of the flaps with more than 50 degrees per flap or 100 degrees in total will result in excess pull on the flap and donor site, causing tissue deformity and possible flap strangulation. Large dog ears and tight scars become the norm. A defect that requires only 60 degrees of rotation, or 30 degrees per lobe, would be better served by a single flap transposition, such as a single-lobe banner flap or a rhomboid flap.

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22. An 11-year-old girl has full-thickness dermal necrosis in the infusion zone of an antebrachial intravenous catheter which was used for treatment of a metastatic lower extremity sarcoma. Localized swelling was noted five days earlier after approximately 100 mL of the medication extravasated into the subcutaneous tissues. Total parenteral nutrition and intravenous doxorubicin had been administered as well as intravenous cefazolin and vancomycin. CT of the leg with intravenous contrast medium had also been performed in the past week. Which of the following is the most likely causative agent of the dermal necrosis from extravasation injury?
- A) Cefazolin
 - B) Doxorubicin hydrochloride
 - C) Radiographic contrast medium
 - D) Total parenteral nutrition
 - E) Vancomycin

The correct response is Option B.

Extravasation injuries are potentially dangerous occurrences that necessitate careful clinical follow-up and early treatment to avoid late catastrophic sequelae. Cytotoxic and hyperosmolar agents may result in local tissue necrosis, and high-volume injuries may cause compartment syndrome and limb ischemia. Though such injuries can occur in any patient, higher risk groups include children and the elderly, intensive care and chronically ill patients.

While any of the agents listed could be harmful in sufficient volume, doxorubicin hydrochloride (Adriamycin) is the one agent that should raise particular alarm. Adriamycin is associated with severe soft-tissue necrosis and warrants close follow-up for early surgical debridement, if needed. Dilution of the agent with saline or hyaluronidase may be helpful. Other early interventions, which are standard to all extravasation injuries, include splinting, elevation, local dressings, and close serial examination.

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23. A 48-year-old woman underwent delayed right breast reconstruction with a DIEP flap in which the internal mammary vessels were used as the recipient vessels. One day after surgery, the skin paddle of the free flap appears congested and Doppler examination of the perforator shows diminished arterial signal. Emergent operative exploration shows that the venous pedicle is thrombosed. Local infusion of which of the following agents is most effective in reestablishing circulation?
- A) Dextran
 - B) Heparin
 - C) Lidocaine
 - D) Milrinone
 - E) Tissue plasminogen activator

The correct response is Option E.

Tissue plasminogen activator (TPA) catalyzes the conversion of plasminogen to plasmin. Unlike the other previously used thrombolytic agents, urokinase and streptokinase, TPA is more specific because its efficacy is enhanced by the presence of fibrin. In theory, this results in fewer bleeding complications than the less specific thrombolytic agents, which are no longer available in many hospital pharmacies.

Most large free flap series report that venous thrombosis is more commonly encountered than arterial compromise. Free flap monitoring is the most important aspect of free flap care with a low threshold for reexploration critical to the success of free flap salvage. Once thrombosis of a vascular pedicle is observed and the anastomosis taken down, thrombectomy followed by thrombolysis can often result in flap salvage.

Intravenous dextran and heparin have been used for platelet inhibition and anticoagulation to improve free flap patency rates. Heparin irrigation locally is used to prepare vessels for anastomosis. Lidocaine and papaverine are used locally to vasodilate vessels. Milrinone is a systemic vasodilator but has not been shown to improve free flap patency.

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24. An 80-year-old woman has been receiving papain-urea ointment for management of a pressure necrosis wound over the lateral aspect of the right calf. A 4 × 10-cm-diameter zone of black, dry, insensate eschar is noted on the right calf. A 1-cm zone of mild erythema and slight liquefaction of the eschar edges are noted. No tenderness to palpation is noted. Pedal pulses are present. Which of the following is the main disadvantage of using a papain-urea ointment in this patient?
- A) Elevation of compartment pressures
 - B) Inadequate debridement
 - C) Painful dressing changes
 - D) Renal toxicity
 - E) Resistant organism infection

The correct response is Option B.

The patient described has a full-thickness dermal injury with ensuing liquefactive necrosis that requires sharp debridement to healthy tissue. Enzymatic ointments are not sufficient for this level of necrotic tissue burden. Papain is a potent digestant of nonviable protein material but does not affect healthy tissues. Urea increases the digestive potency of papain. Collagenases are another class of commonly used enzymatic debridement agents.

The patient described has no clinical evidence of compartment syndrome, and enzymatic debridement would not elevate compartment pressures. Presence of a life- or limb-threatening condition, including compartment syndrome, fasciitis, deep space infection, or ischemia, would necessitate surgical intervention rather than continued care with local dressings.

In some patients, these ointments can cause burning and they may be diluted with a hydrogel to reduce pain. Dressings containing silver ions inactivate papain and they should not be used together. Although burning is a drawback, the main disadvantage in the scenario described is the inability of these agents to treat large areas with a significant amount of necrosis. These are slow-acting agents that allow separation of superficial eschar over days to weeks. They are useful in smaller wounds in patients who may not easily tolerate or who are logistically unable to undergo surgical debridement.

Renal toxicity has not been identified with papain-urea.

Although the patient described is at risk of colonization by resistant organisms, infection is not a contraindication of enzymatic debridement.

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25. A 20-year-old college student is being evaluated because of painful blistering of his toes the morning after he walked two miles in snowy weather, wearing sandals and no socks. Which of the following best describes the primary beneficial effect of ibuprofen for this patient?

- A) Control of edema
- B) Control of pain
- C) Decreased secondary tissue damage
- D) Prevention of antiplatelet aggregation
- E) Speeding of demarcation

The correct response is Option C.

Thromboxane A₂ is a powerful mediator of the inflammatory process responsible for secondary tissue damage in frostbite injuries. Ibuprofen blocks the cyclooxygenase cascade that results in the production of thromboxane A₂. The negative effect of blockade of the cyclooxygenase is decreased production of prostaglandin I₂ and E₂, which are responsible for vasodilatation and antiplatelet aggregation. Although pain control is a beneficial result of the use of ibuprofen, many patients suffering from frostbite injuries require narcotic pain medications. Demarcation cannot be speeded by the use of ibuprofen and may require up to six months before amputation should be undertaken.

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26. A 25-year-old woman is brought to the emergency department after sustaining an avulsion of the ring finger of the left hand. The avulsed part was transported to the hospital in a plastic bag. The patient is employed as a concert pianist and her livelihood depends on successful replantation. Which of the following is the most appropriate treatment to improve survival of the finger and optimize the clinical outcome?
- A) Acute bone grafting
 - B) Coverage of the exposed tendons with a groin flap
 - C) Delayed tendon reconstruction
 - D) Neural repair with at least eight interrupted 10-0 nylon sutures
 - E) Resection of the injured vessels and vein grafting

The correct response is Option E.

Ring avulsion injury remains one of the most challenging replantation problems because of the large zone of injury of the soft tissues. As a result, the regional vessels are significantly damaged due to the stretch avulsion, and as such, need to be resected widely and replaced with vein grafts.

Amputated parts should be transported dry in a saline-iced slurry and protected by a plastic bag. Bone grafting should be reserved for a failed union, in the subacute or late setting, while tendon repair should be performed at the time of replantation. A neural repair with more than four sutures is not necessary and may contribute to neuroma formation.

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

27. A 52-year-old woman (shown) is evaluated six years after bilateral mastectomies and radiation therapy for cancer of the left breast because of a new, small open area near the left axillary fold which she first noted three weeks ago. She has been compliant with postoperative oncologic surveillance. Temperature is 98.9°F (37.2°C), pulse is 80 bpm, respirations are 16/min, and blood pressure is 140/75 mmHg. Physical examination shows a 2 × 2-cm open ulcer on the left chest wall with exposed rib. Which of the following is the most likely cause of the ulcer?

- A) Abscess
- B) Loss of skin integrity from intertriginous shearing forces
- C) Lymphedema drainage tract
- D) Osteoradionecrosis of the underlying ribs
- E) Recurrent breast cancer

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The correct response is Option D.

The effects of ionizing radiation are permanent and may present either acutely or in delayed fashion, even years after the original radiation insult. The mechanism of injury from this radiation is through free radical production which, in turn, directly damages the DNA. In the acute period, the effects of radiation may manifest themselves as erythema and edema of the skin, vasodilation with endothelial edema, and lymphatic obliteration. This eventually leads to capillary thrombosis and subsequent inadequate tissue oxygenation. Over time, nonhealing ulcers can spontaneously develop, sometimes years later.

Abscesses usually would present initially with pain, erythema, and localized fluctuance and are often with associated fever and/or malaise.

Intertriginous shearing would most often present as superficial epidermal loss with possible superinfection with yeast due to moisture.

Lymphedema can be a chronic condition after mastectomy and axillary node dissection and is usually manifested as generalized edema of the ipsilateral upper extremity. Sinus tract formation is rare.

Although recurrent cancer is always a concern in patients with a personal history of cancer, proper, regular, and thorough surveillance can often detect recurrences early, especially in compliant patients. Most recurrences occur within the first five years.

A postoperative photograph is shown.



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

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28. A 55-year-old man comes to the emergency department because of acute onset of pain, swelling, and erythema of the right groin, lower abdominal wall, and right scrotum. He has type 1 diabetes mellitus which is controlled with insulin. He has smoked one pack of cigarettes daily for the past 30 years. He weighs 145 kg (320 lb); BMI is 35 kg/m². Temperature is 38.3°C (101°F), pulse is 136 bpm, and blood pressure is 90/40 mmHg. In addition to admission to the hospital and administration of pain medication, which of the following is the most appropriate sequence in management?
- A) Intravenous antibiotics, hyperbaric oxygen, intravenous hydration
 - B) Intravenous hydration, immediate surgical debridement, right orchiectomy
 - C) Intravenous hydration, intravenous broad-spectrum antibiotics, CT of abdomen
 - D) Intravenous hydration, intravenous broad-spectrum antibiotics, immediate surgical debridement
 - E) Observation, intravenous antibiotics

The correct response is Option D.

The most likely diagnosis is Fournier disease. Diabetes mellitus, alcoholism, heavy smoking, leukemia, and AIDS can predispose to this condition. Common sources of infection include urogenital disease, trauma, or recent manipulation (iatrogenic trauma, ie, endoscopic procedures).

Key steps in treatment include early diagnosis, intravenous hydration, and broad-spectrum antibiotics (anaerobic coverage for *Clostridium perfringens* should continue as it is difficult to culture this). Immediate surgical debridement along fascial planes is of utmost importance. Orchiectomy is rarely needed, as testicles have their own blood supply and are protected by external spermatic fascia. Mortality rate is quoted to be 7% to 75%, with the higher rate in patients with diabetes, alcoholism, and in cases of delayed diagnosis.

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29. Which of the following additional findings in the patient shown is indicative of the most life-threatening syndrome?

- A) Hydrocephalus
- B) Large or multiple axial nevi
- C) Posterior midline nevi
- D) "Satellite" nevi
- E) Underdevelopment of a limb

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The correct response is Option A.

This patient has congenital melanocytic nevi (CMN), which are birthmarks that are present at birth or become apparent within the first year of life. They are found in 1% to 2% of the general population. In addition to being cosmetically disfiguring, CMN are one of several known risk factors for development of melanoma.

While the majority of malignant melanomas arise from melanocytes in previously normal skin or within acquired and often atypical (dysplastic) melanocytic nevi, few would dispute the contention that melanomas may arise in CMN. The incidence of such malignant transformation, however, remains a highly controversial topic in cutaneous oncology. It has been estimated that large CMN carry a 4.5% to 10% lifetime risk of melanoma or other neural crest malignancies. While this risk appears to be distributed over the lifetime of the patient, recent studies suggest that it is greatest in early childhood, between birth and 10 years of age, with 50% of the malignancies developing by 5 years of age, and 70% by 10 years of age. Interestingly, 50% of the melanomas that develop occur within the nevi, but the other 50% occur within the central nervous system (CNS) or within normal skin. Despite this significant increase in risk, it should be noted that giant CMN-associated melanomas still account for less than 3% of all pediatric melanomas.

Large CMN may also be associated with symptomatic or asymptomatic systemic abnormalities. Whereas melanocytes in CMN are generally limited to the mid to upper dermis, a subset of giant CMN exhibit melanocytes in the lower third of the dermis, within the subcutaneous fat, and occasionally as deep as the fascia and skeletal muscles possibly causing ipsilateral limb underdevelopment. Large axial CMN have been associated with the syndrome of neurocutaneous melanosis (NCM).

NCM connotes the association of a large axial CMN with the CNS involvement. CNS manifestations may present as hydrocephalus, seizures, focal deficits, or partial paresis. The majority of those children with NCM who manifest such problems do so before 2 years of age. When neurologic symptoms are present, the prognosis is grave. At least two thirds of those who present with or develop symptomatic CNS disease succumb to the disease process, either because of inexorable “benign” proliferation of melanocytes in the leptomeninges and brain or as a result of malignant degeneration. Symptomatic hydrocephalus may necessitate the placement of a ventriculoperitoneal or ventriculojugular shunt. Unfortunately, following malignant transformation in the CNS, such shunts afford the malignant melanocytes ready access to the systemic circulation, leading to a rapid demise.

To identify which patients with CMN may have CNS involvement, a number of risk factors have been identified. These include the presence of large or multiple axial CMN or both, nevi on the posterior midline, and the presence of multiple satellite nevi. MRI with gadolinium contrast has

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proved to be a particularly sensitive method for detecting the presence of CNS involvement by melanocytes in such patients. MRI can detect occult neurologic involvement even in infants who are clinically normal. In addition to meningeal involvement, lesions in the cerebrum, cerebellum, spinal cord, and elsewhere have been detected. The ultimate significance of such radiologically evident lesions in clinically asymptomatic children remains to be determined. The risk of developing NCM must also be a factor in any treatment decision, as the prognosis for children with symptomatic NCM is extremely poor. Since the majority of patients with NCM will succumb to the CNS involvement and not from the nevi themselves, it may be determined that the risk of surgical removal of giant CMN in these patients outweighs the benefits.

In certain children at high risk for the development of NCM (eg, those with large CMN in a posterior axial location in the presence of satellite nevi), and especially in those children with radiologic evidence of CNS involvement, a delay in surgical treatment of the large CMN until 2 years of age (the median age for presentation of neurologic symptoms) might be considered. The prognosis for children with symptomatic CNS involvement is so poor that most are unlikely to survive long enough to succumb to the “relatively” low risk of cutaneous melanoma.

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30. A 45-year-old man is scheduled to undergo abdominal wall reconstruction to repair a central defect resulting from abdominal compartment syndrome. Removal of a temporary colostomy placed two years ago and an autologous repair using a component separation technique are planned. Which of the following techniques is LEAST likely to preserve innervation of the rectus muscles in this patient?
- A) Endoscopic release of the external oblique aponeurosis
 - B) Laparoscopic division of the transversalis muscle
 - C) Periumbilical perforator sparing components release
 - D) Use of an anterior sheath fascial turnover flap
 - E) Use of a rectus muscle medial turnover flap

The correct response is Option E.

The original description of component separation technique of the abdominal wall by Ramirez includes the following maneuvers: elevation of the skin and subcutaneous fat off of the sheath and oblique fascia, division of the external oblique aponeurosis with elevation of the external oblique laterally, and selective scoring of the posterior rectus sheath. Important modifications to this technique, which can provide up to 10 cm of advancement per side, include preservation of the periumbilical perforators, endoscopic release of the external oblique, laparoscopic release of the transversalis only, and anterior sheath fascial flap to provide additional midline reach. Harvesting the rectus muscle as a turnover flap will provide additional vascularized tissue medially, but this maneuver divides the intercostal nerves that travel between the internal oblique and transversalis muscle, providing motor supply to the rectus. The denervated muscle loses its previous advantage as an innervated, functional flap.

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31. A 28-year-old man comes to the office because he has had a recurrent growth on his chin for the past two years. A photograph of the lesion is shown. After excision of the lesion, which of the following modalities is most appropriate?
- A) Injection of 5-fluorouracil
 - B) Injection of triamcinolone
 - C) Pressure therapy
 - D) Radiation therapy
 - E) Topical retinoic acid

Please note: Question 31 has been deleted from the examination.

The correct response is Option D.

Keloid scars are associated with an extremely high recurrence rate. Surgical excision alone is associated with a recurrence rate of up to 80%. Radiation therapy has emerged as an effective method to prevent keloid scarring. External beam irradiation has been shown to decrease recurrence rates to 12%–27%, but it may be associated with pigmentary changes. Methods investigated to improve success in treatment of these lesions include intralesional injection of

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corticosteroids, interferon, retinoic acid, and 5-fluorouracil. Even with these interventions, the rate of recurrence is approximately 50%. Pressure therapy has been found to be helpful in decreasing keloid recurrence but requires ongoing treatment for three to ten months, which may not be acceptable.

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32. A 45-year-old woman with Fitzpatrick type III skin comes to the office for a chemical peel to improve the appearance of sun-damaged facial skin. Initial treatment with tretinoin was unsuccessful. Examination shows fine rhytides over the cheek and perioral region. She has a history of perioral herpetic lesions. Which of the following is an advantage of using a trichloroacetic acid peel rather than a phenol peel in this patient?
- A) Consistent penetration into the upper reticular dermis
 - B) Deeper penetration into the dermis
 - C) Increased effectiveness in reducing coarse facial rhytides
 - D) Less risk for outbreak of herpetic lesions
 - E) Less risk for pigmentary changes

The correct response is Option E.

A phenol peel causes more hypopigmentation than a trichloroacetic acid (TCA) peel. This is more likely to occur in patients with darker skin or in patients who have been exposed to the sun after undergoing a phenol peel. First-line treatment for rhytides is tretinoin, hydroquinone, or glycolic acids. Treatment for refractory cases is a medium-depth TCA peel.

Phenol peels provide a controlled, predictable chemical injury with consistent penetration to the upper reticular dermis. A deep TCA peel has only one half the degree of penetration into the dermis when compared to a phenol peel. Because of this lack of penetration, even deep TCA peels do not have as profound an effect on coarse facial rhytides. The depth of the phenol peel is associated with a significant bleaching action and hypopigmentation.

Patients who have a history of perioral herpetic lesions require pretreatment with acyclovir before any chemical peel procedure. In the absence of pretreatment, a patient with a history of perioral herpetic lesions has a 50% chance of developing an outbreak. Even when pretreated with acyclovir, a patient with a history of herpetic lesions has an 8% chance of developing an outbreak; however, a patient with no history of perioral herpetic lesions who does not receive pretreatment with acyclovir has a 6.6% chance of developing an outbreak. The current recommendation is for all patients to receive pretreatment. Fortunately, the presence of a herpetic outbreak after a chemical peel, if treated promptly, will rarely leave residual scarring.

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33. A 35-year-old man is undergoing repair of a pressure sore on the left ischium using the musculocutaneous flap shown in the photograph. Which of the following is the Mathes and Nahai classification of this flap?

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

The correct response is Option C.

The gluteal musculocutaneous flap is a Type III flap, meaning it has two dominant pedicles (the superior and inferior gluteal arteries). These arteries are separated by the piriformis muscle and are sourced to the internal iliac system.

A Type I flap has a single dominant pedicle (ie, tensor fascia lata). A Type II flap has dominant and minor pedicle(s) (ie, gracilis). A Type IV flap has multiple segmental pedicles (ie, sartorius). A Type V flap has a dominant pedicle and secondary segmental pedicles (ie, latissimus).

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34. A 55-year-old woman has a temperature of 37.8°C (100.1°F) and an oxygen saturation of 96% the morning after undergoing mastectomy and immediate breast reconstruction with a unipedicled TRAM flap. She reports having pain in her abdomen and chest. Pulse is 101 bpm and regular, blood pressure is 138/80 mmHg, and urine output during the past eight hours has averaged 50 mL/hr. The TRAM flap skin island is well perfused, and there are ecchymoses of the surrounding mastectomy flap. Which of the following is the most appropriate next step in management?
- A) Anticoagulation with low-molecular-weight heparin
 - B) Increased analgesia and incentive spirometry
 - C) Pan culture and broad antibiotic coverage
 - D) Spiral CT of the chest
 - E) Wound exploration for hematoma

The correct response is Option B.

The leading cause of early postoperative fever is atelectasis, typically from decreased respiratory expansion from incisional pain. With chest wall surgery and abdominal fascial suturing, the TRAM flap may have decreased respiratory function without adequate analgesia and incentive spirometry.

Pulmonary embolism must always be considered as an option, and adequate prophylactic measures must be taken, including compression devices for the lower extremities and early postoperative ambulation. Subcutaneous heparin may be used for chemoprophylaxis as well. Because of the bleeding risk, full anticoagulation with standard or low-molecular-weight heparin should be reserved for confirmed or very high suspicion of pulmonary embolism.

Pan cultures are not appropriate for early postoperative fevers because of a low yield of positive tests. Perioperative gram-positive antibiotic coverage is appropriate; although broadening the antibiotic coverage when new-onset infection is not likely, it may result in breeding bacterial resistance and promoting *C. difficile* colitis. Fevers within the first 72 hours of clean surgery are rarely from infections unless there has been visceral injury.

A spiral CT is the test of choice for early diagnosis of pulmonary embolism and should be used in the event that the patient fails to improve rapidly with conservative measures or develops additional symptoms, such as chest pain, further desaturation, or signs of lower extremity deep vein thrombosis.

This patient does not show signs of hematoma and operative exploration is not indicated.

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35. A 48-year-old man is brought to the emergency department 40 minutes after he sustained full-thickness burns over 54% of the total body surface area. Weight is 156 lb (70 kg). According to the Parkland formula, which of the following is the most appropriate volume of fluid resuscitation for this patient during the first eight hours?

- A) 945 mL
- B) 1890 mL
- C) 3780 mL
- D) 7560 mL
- E) 15,120 mL

The correct response is Option D.

Acute burn injury is characterized by inflammation and impaired microvascular integrity with resulting capillary leak. Therefore, large amounts of fluid are required to maintain tissue perfusion during this period and prevent burn shock. Many formulas have been delineated for acute burn resuscitation to quantify the amount of fluid needed. The Parkland formula, commonly used in the United States, is 4 mL of lactated Ringer solution per kilogram per percentage burn given over the first 24 hours. One half is given in the first eight hours and the second half over the ensuing 16 hours. The total body surface area (TBSA) of burn can be approximated using the rule of nines. The body is divided into regions whose surface areas are multiples of nine: head, 9%; each arm, 9%; torso, 36%; each leg, 18%. In this case, the patient's burn is 54% TBSA. The Parkland formula is $4 \text{ mL} \times 70 \text{ kg} \times 54 = 15,120 \text{ mL}$. Half of this (7560 mL) is given over the first eight hours.

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36. A 56-year-old woman develops a necrotizing infection of the abdominal wall (shown). Appropriate antibiotics are started and devitalized tissue is debrided. Which of the following interventions is most likely to decrease mortality?

- A) High-dose corticosteroids
- B) Hyperbaric oxygen treatment
- C) Intravenous gamma globulin
- D) Topical papain-urea ointment
- E) Vacuum-assisted closure device

The correct response is Option B.

Necrotizing soft-tissue infections are rapidly progressive, polymicrobial infections that require prompt diagnosis, debridement of devitalized tissue, and administration of appropriate antibiotics. Some studies have shown that mortality rates in necrotizing infections can be reduced with the addition of hyperbaric oxygen treatment. High-dose corticosteroids, intravenous gamma globulin, and topical papain-urea ointment have not been shown to increase survival rates of necrotizing soft-tissue infections.

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37. A 48-year-old woman undergoes successful bilateral reduction mammoplasty. At her one-month follow-up visit in March, she reported no problems and was very pleased with the result. She returns in December, complaining of unequal breast size, keloid scarring, and loss of sensation in the left nipple. There is no documented chart note in the electronic medical record from her March visit. Which of the following is the most appropriate way to enter a chart note in the patient's medical record?
- A) Dated for March, emphasizing the patient's satisfaction with the procedure
 - B) Dated for March, and handwritten instead of the electronic record
 - C) Dated for March, only if the visit details are remembered clearly
 - D) Dated for December, with no mention of the omitted note from March
 - E) Dated for December, with reference to the inadvertently omitted note from March

The correct response is Option E.

A chart note dated December (the date of the current visit) should be entered that documents the inadvertent omission of the March note. Any findings can be reported as clear recollections from that visit.

Documentation in a timely fashion is an important part of maintaining an accurate medical record. From both quality of care and liability protection perspectives, a clear, legible, accurate, and timely medical record is beneficial to the patient and physician alike. When a visit is not recorded inadvertently, this occurrence should be noted and dated when this addendum is entered. Entering a chart note dated in the past is a falsification of the medical record. In the case of a patient with a complaint or lawsuit, improper documentation can be used as evidence of misconduct by the physician and may sway a case outcome regardless of appropriateness and quality of the initial patient care.

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38. A 50-year-old man who is scheduled to undergo Mohs micrographic surgery for basal cell carcinoma on the nose and cheek comes to the office for consultation regarding options for simultaneous excision and reconstruction. The patient does not want to undergo two separate procedures. Physical examination shows a 1.5-cm lesion at the junction of the right nasal ala and cheek. The lesion is reddish white and flat with indistinct margins. Which of the following is the primary reason to urge this patient to proceed with the Mohs micrographic surgery?
- A) Multiple aesthetic subunits are involved
 - B) Patient is male younger than 55 years of age
 - C) Tumor diameter is greater than 1 cm
 - D) Tumor margins are clinically indistinct

The correct response is Option D.

When the tumor has no distinct margins, it is difficult to plan adequate margins for direct resection. Mohs micrographic surgery for basal cell carcinoma can maximize preservation of uninvolved skin by selectively identifying the areas of residual tumor. Mohs micrographic surgery is advantageous in high-risk lesions such as morpheaform carcinoma, recurrent tumors, lesions with indistinct margins, and lesions in cosmetic or functionally sensitive areas.

Factors such as tumor size, number of aesthetic subunits involved, patient age, and gender are not of primary importance when deciding between Mohs micrographic surgery and direct excision.

Surgical excision with 4- to 10-mm margins is appropriate for most routine basal cell lesions. However, Mohs micrographic surgery has the highest cure rate of all surgical treatments because the tumor is microscopically delineated until it is completely removed. While other treatment methods for recurrent basal cell carcinoma have failure rates of about 50%, cure rates have been reported at 96% when treated by Mohs micrographic surgery. Intraoperative frozen sections are useful during surgical excision of high-risk lesions but may have a higher false-negative rate than Mohs micrographic surgery.

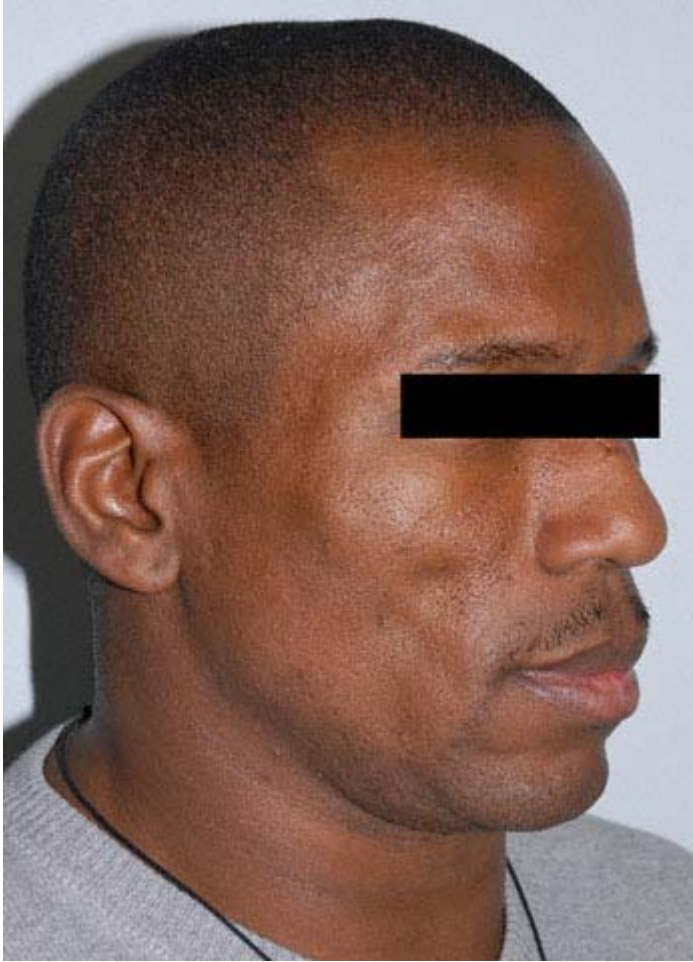
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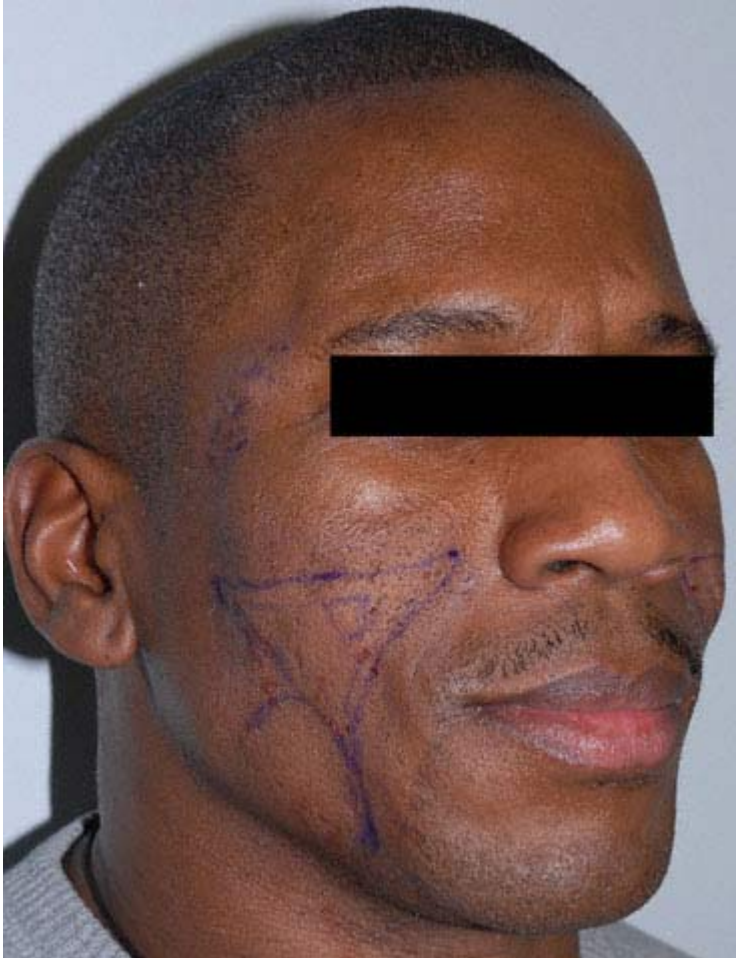
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39. A 42-year-old man who is HIV positive comes to the office for management of facial lipoatrophy. A photograph is shown. Injection of which of the following is the most appropriate treatment?
- A) Bovine collagen
 - B) Human collagen
 - C) Hyaluronic acid
 - D) Liquid silicone
 - E) Poly-L-lactic acid

The correct response is Option E.

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Lipoatrophy from HIV-associated lipodystrophy can be treated with numerous soft-tissue fillers, but only poly-L-lactic acid (Sculptra) is currently approved by the United States Food and Drug Administration (FDA). Sculptra typically is injected subcutaneously in the cheek, submuscularly in the orbital region, and subperiosteally as a “depot” in the temples (see the photograph below). Patients require multiple injections every four to six weeks for several months, but the results may last for over two years.



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

Bovine and human collagens are not FDA-approved for HIV lipoatrophy and have a much shorter half-life than Sculptra. Hyaluronic acid is not an effective long-term treatment for facial lipoatrophy. Liquid silicone is only FDA-approved for ophthalmic indications.

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40. A 25-year-old man is brought to the emergency department after sustaining injuries during a motorcycle collision. He is alert, cooperative, and vital signs are stable. Examination shows a large skin avulsion with deep lacerations of the left chest and back. Radiograph of the chest shows fractures of multiple ribs; no other abnormalities are noted. During irrigation of the chest wounds, his breathing becomes labored and oxygen saturation and blood pressure decrease precipitously. After stabilizing the airway, which of the following is the most appropriate next step in management?
- A) Administration of a vasopressor
 - B) Diagnostic peritoneal lavage
 - C) Needle decompression
 - D) Placement of central and arterial catheters
 - E) Repeat radiograph of the chest

The correct response is Option C.

The most likely diagnosis for a precipitous drop in oxygenation and blood pressure in the setting of a large open wound of the chest is tension pneumothorax. Needle decompression with a large-bore intravenous catheter is performed in the second intercostal space in the midclavicular line. This procedure is followed by tube thoracostomy for stable decompression of the thoracic cavity, thereby allowing lung inflation.

The diagnosis of tension pneumothorax is confirmed by a rush of air escaping the chest on needle decompression. In tension pneumothorax, the negative pressure caused by inspiration draws air through the wound, and the injured tissue acts as a one-way valve. This pressure accumulation in the chest causes collapse of the lungs and impedes cardiovascular filling.

Administration of vasopressors would not be a first-line means of increasing blood pressure in this patient. Decompression of the compressed atria and thoracic vessels along with fluid and blood replacement are the first resuscitative measures required. Vasopressors may play a role for hypotension after appropriate fluid resuscitation fails to normalize pressure.

Diagnostic peritoneal lavage is an emergency department technique for rapid diagnosis of occult abdominal injury. While the patient described is at risk for intra-abdominal trauma, the rapid oxygen desaturation and large chest injuries suggest a thoracic source of injury.

Line placement is needed for ongoing monitoring and care of the critically injured patient described but would not be the initial procedure. Large-bore peripheral intravenous catheters for rapid fluid infusion would be optimal for the early treatment phase of the trauma patient.

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A repeat radiograph of the chest may be helpful in establishing a diagnosis, although in the unstable patient with suspected tension pneumothorax, emergent decompression is required. The patient would not likely survive the time interval from ordering a radiograph until the results were made available.

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41. A 61-year-old obese woman comes to the office for follow-up examination because she has a nonhealing 3-cm-diameter ulcer on the sole of the right foot. Medical history includes hypertension and type 2 diabetes mellitus. A bioengineered skin substitute consisting of a cultured dermal-epidermal matrix (Apligraf) was applied one week ago. The patient has been compliant with a strict non-weight-bearing status of the foot. Current physical examination shows minimal adherence of the graft. Which of the following is the most appropriate next step in management?
- A) Application of hydrogel and gauze dressings
 - B) Application of a new biosynthetic graft matrix
 - C) Coverage with a sural fasciocutaneous flap
 - D) Full-thickness skin grafting
 - E) Surgical debridement to fascia

The correct response is Option B.

Biosynthetic skin products, particularly Apligraf, have been shown to be effective in treatment of chronic diabetic foot ulcers when used judiciously and appropriately. The largest multicenter, randomized trial of foot ulcer care showed a healing rate of 56% with biosynthetic grafting versus 38% with saline gauze treatment after 12 weeks. Both treatment groups underwent aggressive, sharp debridement and off-loading techniques. The group receiving biosynthetic grafts underwent treatment weekly for a maximum of five grafts. The fibroblasts and keratinocytes in the matrix secrete growth factors and stimulate wound healing and ingrowth of the surrounding tissues. One drawback of biosynthetic skin substitutes is the high cost. If complete wound healing can be achieved, then cost of care is lower over the long term. A single application of a dermal matrix product is not likely to be sufficient in the treatment of a chronic wound. Abandoning the course of treatment at one week would increase the cost of care without the potential to realize the benefit.

Flap coverage would be better suited for covering exposed bone or tendon or for treatment of a wound that has failed more conservative treatments.

Full-thickness grafts are less likely to take than split-thickness grafts in the area of poor wound healing described in this scenario. A split-thickness graft can be used initially instead of biosynthetic grafting and could still be used in the event of failure to heal after a proper treatment course. The advantage of using the biosynthetic instead of autologous grafting is the ability to place the graft in an office setting without anesthesia if the wound bed has been debrided adequately.

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Application of moist gauze dressings without completion of a proper treatment course with the graft matrix is likely to result in continuation of this chronic wound.

Debridement of the granulation bed would remove a healthy base for grafting. Debridement would be indicated for presence of necrosis, eschar, or fibrosis—none of which are present in the adequately debrided wound described.

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42. A 23-year-old man is brought to the emergency department one hour after sustaining a snake bite to the lower right leg while hiking. The description of the snake is consistent with that of a copperhead. The patient does not recall his immunization status. Vital signs are stable. Physical examination shows mild edema around the bite. No neurologic deficits are noted. Coagulation and routine laboratory studies are ordered. Intravenous fluids are started. Which of the following is the most appropriate next step in management?
- A) Administration of equine antivenin
 - B) Administration of tetanus toxoid
 - C) Debridement of the wound and initiation of suction therapy
 - D) Elevation and application of a tourniquet
 - E) Prophylactic fasciotomy

The correct response is Option B.

The most appropriate next step in management is to update this patient's tetanus status and observe closely for signs and symptoms of envenomation. The area of involvement should be outlined with a marking pen and the patient observed closely for progression of local tissue injury, clinical evidence of coagulopathy, and hemodynamic instability.

In the United States, 99% of snake bites are caused by the Crotalidae (pit viper) family of snakes, which includes rattlesnakes, copperheads, and cottonmouths. Rattlesnake bites deliver the most potent venom and are responsible for the majority of fatalities from snake bites; however, 10% to 50% of snake bites have been reported as dry bites.

Acute first aid interventions include avoiding excessive activity of the affected site, immobilization in a neutral position, and expeditious transportation to a hospital.

Antivenin is not recommended for dry bites (ie, no clinical evidence of envenomation) or if envenomation appears to be mild. Anaphylaxis and serum sickness are potential significant complications of equine antivenin. The general indication for antivenin administration is progressive venom injury. This is defined as worsening local injury (eg, swelling, pain, or ecchymosis), the onset of clinical coagulopathy, or the development of systemic effects including hypotension or changes in mental status. The patient should be monitored closely because the clinical presentation can change rapidly. Antivenin therapy should be instituted if signs or symptoms of envenomation develop or progress.

Debridement of the bite site and suction therapy have not been shown to be beneficial in reducing the effects of envenomation and can cause additional necrosis to the tissue under the

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suction cup. Arterial tourniquets are contraindicated because they may worsen tissue ischemia and necrosis.

Fasciotomy should be performed only for clinical signs and symptoms of compartment syndrome. Compartment syndrome and infection from extremity bites are extremely rare.

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43. A 57-year-old man with type 2 diabetes mellitus comes to the emergency department because of redness and swelling of the dorsum of his right hand five hours after being bitten by an insect. Intravenous first-generation cephalosporin is started. Three hours later, the area of redness has extended to his shoulder and chest; temperature is 103.8°F (39.9°C), pulse is 110 bpm, and blood pressure is 100/55 mmHg. Which of the following is the most appropriate management?
- A) Blood cultures and empiric addition of antifungal antibiotics
 - B) Elevation and ice compression to his extremity
 - C) Fasciotomy of compartments
 - D) Increase in dosage of intravenous antibiotics
 - E) Operative incision, drainage, and debridement of affected tissues

The correct response is Option E.

The patient described has signs and symptoms of a rapidly progressive and advancing soft-tissue infection, which is characteristic of necrotizing fasciitis. The treatment of choice is prompt operative debridement and excision of infected soft tissues and fascia. Necrotizing fasciitis is commonly polymicrobial; Group A hemolytic streptococcus and *Staphylococcus aureus* are the most common offending agents, although other aerobic and anaerobic bacteria are frequently involved. The infection travels along fascial planes and induces local hypoxia and profound overlying soft-tissue necrosis. Patients with necrotizing fasciitis often require repeat debridements early in the course of treatment to limit the spread of infection.

Obtaining blood cultures, adding antifungal antibiotics, elevation, and ice compression do not directly address the surgical emergency of necrotizing fasciitis and would potentially delay treatment.

Increasing the dosage of intravenous antibiotics would have little effect on the progression of necrotizing fasciitis.

Fasciotomy of compartments is useful for a case of compartment syndrome, but not necrotizing fasciitis.

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44. A 42-year-old man develops a dehiscence of the abdominal incision six weeks after undergoing a lower body lift. Medical history includes a 100-lb (45-kg) weight loss during the past three years. Which of the following is the most likely cause of the wound-healing problem?

- A) Hematoma
- B) Patient movement
- C) Seroma
- D) Skin necrosis
- E) Wound infection

The correct response is Option C.

Body lift procedures after massive weight loss have a complication rate of approximately 50%. The most common complication is wound dehiscence, which occurs in greater than 30% of patients. Wound dehiscence can be characterized as either early (in the immediate postoperative period) or late. Early wound dehiscence may be caused by patient movement, while late wound dehiscence is often due to underlying seroma. Although infection and skin necrosis can occur in the postoperative period and result in wound dehiscence, seroma is much more common.

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45. A 70-year-old man has a mildly tender, clean, 6-cm wound to the lower leg that occurred spontaneously seven months ago. Physical examination of the ankle shows a brown-red discoloration and edema of the surrounding tissue. Which of the following is the most appropriate initial management of the wound?

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

The correct response is Option D.

The patient described has signs and symptoms of a venous stasis ulcer, a common cause of chronic lower leg wounds. Venous valve incompetence leads to chronic venous hypertension, capillary hydrostatic pressure elevation, and leakage of fluid and proteins to the extracellular space. Oxygen transport to the tissues is impaired, causing localized cellular necrosis and ulceration.

The hallmark of treatment is compression of the edematous limb to reduce the severe interstitial edema. By decreasing the tissue pressure, oxygen delivery is enhanced and wound healing mechanisms may be gradually restored. The open wound is best treated with an absorptive and occlusive dressing such as Unna wrap. Care must be taken to avoid overcompression and arterial compromise. Unna boots can be changed weekly or more frequently as needed. After reepithelialization has occurred, compression stocking or elastic bandage wraps are essential to prevent occurrence. Compression therapy is also a cost-effective treatment. Venous insufficiency affects up to 5% of the population; more than 500,000 patients in the United States suffer from ulceration. The economic costs from treatment and lost productivity are enormous.

Hyperbaric oxygen therapy and vacuum-assisted compression dressings may augment healing or help prepare the wound for grafting, but they are not the first line of treatment in uncomplicated ulcers. Recurrent ulceration rates are high, therefore unnecessary grafting should be avoided. Silver sulfadiazine and other topical antimicrobials may help reduce surface bacterial loads but do little to promote healing in the presence of venous hypertension. Debridement is reserved for necrotic wounds.

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

46. A 62-year-old woman comes to the office for consultation regarding problems with her left eye (shown) 6 months after sustaining a 25% total body surface area (TBSA) burn that involved the face and neck. She reports that the upper eyelid turns outward, that she cannot close the eye completely, and that the eye tears excessively. These symptoms have persisted despite skin grafting several months ago by another surgeon. Physical examination confirms ectropion of the upper eyelid, lagophthalmos, and epiphora of the left eye. Which of the following is the most appropriate next step in management?
- A) Insertion of a gold weight
 - B) Paramedian forehead flap
 - C) Permanent lateral tarsorrhaphy
 - D) Reverse tarsoconjunctival flap
 - E) Skin grafting

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The correct response is Option E.

Patients with significant burns to the periocular area commonly have ectropion with corneal exposure, even after primary attempts at skin grafting. It is clear that damaged contracted skin has left this patient “skin short,” thereby preventing complete closure of the eyelid. The optimal method of eyelid reconstruction in this patient is a release of the burn scar contracture with placement of nonburned, thin, pliable skin to the area in order to bring tissue to the area, thereby correcting the underlying problem. Although multiple options for reconstruction exist, the most reasonable would involve regrafting the upper eyelid. While the literature “dogma” has been to graft the upper eyelid with split grafts and the lower eyelid with full-thickness grafts, this has not been definitely proven one way or the other by the available data. However, repeat grafting (either with thin or full-thickness grafts) to correct this problem has been used successfully to achieve good outcomes.

A gold weight is used for the paralytic eyelid after facial nerve injury.

A permanent lateral tarsorrhaphy can be performed but will narrow the ocular aperture and can be irritating to the patient.

Forehead flaps have been described to reconstruct eyelids, especially large full-thickness defects. Their biggest downside, however, is the thickness of the tissue transferred, which certainly does not reapproximate the thickness of the native upper eyelid. It also involves a two-stage procedure. The patient described has suffered burns to her face and neck, including the forehead, which renders this method of reconstruction suboptimal.

A reverse tarsoconjunctival flap can be used to reconstruct upper eyelids; however, it is generally used when the lower eyelid is not involved in the injury. It also has the disadvantages of requiring two operations, occluding the visual axis, and can only be performed with a minimum of lower eyelid tarsus, as only 2 to 3 mm is available for transfer. This patient’s upper eyelid requires more tissue than what this technique can deliver.

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47. A 25-year-old woman is undergoing bilateral augmentation mammoplasty. During the procedure, the patient becomes tachycardic, with a sudden rise in end-tidal carbon dioxide, a decrease in oxygen saturation, and elevated temperature. Which of the following is the most appropriate sequence of management?
- A) Administer a beta blocker, volume resuscitate, and finish surgery
 - B) Administer therapeutic dose of heparin intravenously and start a heparin drip; rush patient to angiography suite
 - C) Open the incision, remove both prostheses, and administer high-dose antibiotics
 - D) Place bilateral chest tubes and order a chest radiograph
 - E) Stop inhalational agents, hyperventilate with 100% oxygen, and administer dantrolene

The correct response is Option E.

Malignant hyperthermia is an inherited myopathy characterized by a hypermetabolic state when the patient is exposed to an appropriate triggering agent, such as all inhalational agents or depolarizing muscle relaxants (ie, succinylcholine). Initial presentation is usually an unexplained tachycardia, followed by an increase in end-tidal carbon dioxide, decrease in oxygen saturation, dysrhythmia, and muscle rigidity. Hyperthermia occurs but can be a late finding.

The most appropriate management involves calling for assistance, stopping all triggering agents, hyperventilating with 100% oxygen, administering dantrolene, stopping all surgery, volume resuscitating, and correcting hyperkalemia.

Removal of prostheses and administration of antibiotics are not appropriate because this is not a toxic shock syndrome. Bilateral pneumothoraces are unlikely, although they should be ruled out. Pulmonary embolism is unlikely in the young patient described during a fairly short operation (very low risk).

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48. A 4-month-old female infant is brought to the office because of redness and irritation of her navel, along with occasional drainage of a small amount of fluid. Examination of the umbilicus shows a pinpoint epithelialized tract. Which of the following is the most likely diagnosis?

- A) Omphalitis
- B) Umbilical granuloma
- C) Umbilical hernia
- D) Urachal cyst
- E) Urachal sinus

The correct response is Option E.

The most likely diagnosis for the patient described is an urachal sinus, which is derived from a persistently patent urachus with a sinus that drains to the umbilicus. Intermittent drainage is often the result of infections from this sinus tract. Surgical excision is recommended to avoid future infections and potential malignant degeneration.

Omphalitis is an infection of the umbilical stump that presents as cellulitis. It is rare in industrialized countries but can be a common cause of neonatal mortality in developing areas. The source of infection is polymicrobial.

An umbilical hernia usually presents as a mass at the umbilicus with no drainage. An umbilical granuloma or pyogenic granuloma is a benign inflammatory reaction to a healing umbilicus. This bright red, friable lesion does not have a sinus tract or drainage of fluid.

An urachal cyst is a fluid-filled structure that is also a remnant of a patent urachus; however, the two ends (umbilicus and bladder) are obliterated. They are rarely symptomatic in early childhood; however, in adolescence they can present as an abdominal mass and cause pain. These cysts can also develop infections as well.

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49. The 12-year-old girl shown is brought to the emergency department after being bitten in the face by a neighbor's dog. Her mother has brought the avulsed piece of skin wrapped in gauze. Which of the following is the most appropriate method for coverage of the wound?
- A) Application of wet-to-dry dressings
 - B) Placement of a vacuum-assisted closure device
 - C) Replacement of the avulsed piece of skin
 - D) Use of cross-lip Abbe flap
 - E) Use of a nasolabial flap

The correct response is Option C.

Lip reconstruction requires skin cover that is thin, supple, and matching; oral lining that is thin, supple, and sensate; resemblance of a vermillion that is supple, sensate, and appropriately colored; a deep labial sulcus for competence; commissure definition that provides expressive

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function; adequate stomal diameter for speech, eating, oral hygiene, or denture insertion; and an oral sphincter that is competent to contain both food during eating and saliva at rest.

Upper lip reconstruction is guided by the need to provide a central philtrum and two lateral elements. In the scenario described, the patient has an intact philtrum and left lateral element. She is brought to the emergency department with a subtotal right upper lip vermillion, skin, oral mucosa, and partial muscle loss. All of these elements are in the avulsed segment; therefore, this would be the best possible replacement of the missing tissue since the principle of plastic surgical reconstruction calls for replacing tissue with like tissue. Postoperative photographs are shown.



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

Secondary closure by either vacuum-assisted closure or dressing change will lead to contracture and distortion. Because the lips have no bony, cartilaginous, or fibrous infrastructure, wound contraction can cause permanent retraction of the free margin of the lip. The Abbe flap is best used for defects of the philtral column. The nasolabial flap is bulky and lacks innervation.

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50. During consultation with a patient who wants to undergo laser resurfacing, it is NOT necessary for the plastic surgeon to discuss which of the following pieces of information with the patient regarding informed consent?

- A) Feasible alternatives to laser resurfacing
- B) The most likely outcomes of the procedure
- C) The patient's expectations of the procedure
- D) Rare, nonserious potential complications
- E) Who is performing the procedure

The correct response is Option D.

Informed consent is the principle behind modern medical and surgical practice. A physician has the duty to disclose information that is material in determining what the reasonable patient would want to know to consent to the proposed treatment. This does not necessarily have to be all-inclusive.

For simple diagnostic tests and situations in which consent is implied by actions, a consent form is not required. For example, if the patient allows blood to be drawn, consent is implied. All patients have the fundamental right to make a decision regarding treatment, including refusal of treatment, even if the medical advisors are opposed to his/her decision. The patient does have a right to know who will be performing the treatment. For children or others who are unable to make the decision for themselves, the parent or legal guardian is legally responsible for providing the information, making the decision, and signing the consent form. However, that does not mean that the child or patient who is not considered mentally competent is always left out of the process.

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Section 2: Cosmetic

51. A 44-year-old man is scheduled to undergo extensive body contouring surgery following massive weight loss. Which of the following best represents the most appropriate minimum ambient operating room temperature?

- A) 60°F (15.6°C)
- B) 65°F (18.3°C)
- C) 70°F (21.1°C)
- D) 75°F (23.9°C)
- E) 80°F (26.7°C)

The correct response is Option C.

Long operative times and significant surface area exposure are often required in body contouring procedures following massive weight loss. These factors may contribute to decreases in core body temperature. Actively maintaining intraoperative normothermia allows patients to maintain normal coagulation function during elective plastic surgery lasting longer than two hours, potentially reducing the occurrence of bleeding-related complications.

It has been recommended that ambient room temperatures for these cases be kept no less than 70°F (21.1°C). Additionally, as much of the body as possible should be covered to reduce heat loss. Additional measures to maintain normothermia include fluid-filled warming blankets placed under the patient on the operating table, warming of intravenous fluids, head and foot stockings, and forced-air warming blankets.

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52. A 45-year-old woman is being evaluated because of discrete, red, facial capillaries that she would like to have removed. Which of the following lasers is most appropriate to ablate the vessels?

- A) KTP (532-595 nm)
- B) Q-switched ruby (694 nm)
- C) Nd:YAG (1064 nm)
- D) Er:YAG (2940 nm)
- E) Carbon dioxide (10,600 nm)

The correct response is Option A.

The 532-595 nm wavelength is the most appropriate choice, as it has the highest affinity for the vessels and can be more effective with the appropriate settings. Carbon dioxide and erbium lasers are both ablative lasers with a higher affinity for water. The 1064-nm laser can be used for hair reduction or collagen stimulation but works on the deeper layers and is more specific for darker pigmentation of vessels, such as blue. It can be used for vessel reduction in the leg; however, facial vessels are more superficial and often more red than blue in coloration. The 694-nm laser would not be the first-line laser for this treatment.

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53. A 24-year-old woman comes to the office one year after undergoing secondary augmentation mammoplasty because she reports that with manipulation she “can move each breast to the other side.” Physical examination shows that each breast prosthesis can be moved across the chest midline. Which of the following is the LEAST likely cause of this finding?

- A) Multiple procedures
- B) Preexisting chest wall deformity
- C) Prostheses with large base diameter
- D) Saline prostheses
- E) Subpectoral positioning

The correct response is Option D.

Synmastia is defined as any situation in which the breast prosthesis crosses the midline, even if it is only on one side. This relatively rare complication is at some times obvious and at other times more subtle, requiring breast manipulation to become apparent. There is no correlation with the use of either silicone- or saline-filled prostheses. The complication is more common in cases in which large prostheses with large base diameters are used, in multiple successive enlargement procedures, when there is a preexisting chest wall deformity, and with the subpectoral positioning of prostheses.

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54. A 37-year-old woman obtains a baseline postoperative mammogram six months after undergoing reduction mammoplasty. The presence of which of the following calcifications is most likely to cause the plastic surgeon to order additional evaluation?
- A) Branching
 - B) Dystrophic
 - C) Eggshell
 - D) Popcorn-like
 - E) Rod-like

The correct response is Option A.

The development of microcalcifications on mammogram images after surgery requires careful analysis. Calcifications can be grouped into three categories: malignant, indeterminate, or benign. Malignant calcifications can appear as casting (linear and branching) or pleomorphic (granular). Benign calcifications have many appearances and include popcorn-like (fibroadenoma), large rod-like (secretory), round eggshell (oil cysts), and dystrophic or coarse (fat necrosis). The development of masses, architectural distortion, and skin thickening can be seen following surgery. A complete evaluation is suggested to determine if a biopsy is necessary. Tissue biopsy is recommended for calcifications that are determined to be indeterminate or malignant.

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55. A 68-year-old woman is scheduled to undergo a bilateral blepharoplasty with unilateral repair of a levator aponeurosis dehiscence. During the dissection, the distal end of the dehisced levator muscle is reattached to the tarsal plate. Which of the following anatomic structures is most likely to be visualized deep to the repair?

- A) Capsulopalpebral fascia
- B) Conjunctiva
- C) Müller muscle
- D) Orbital septum
- E) Whitnall ligament

The correct response is Option C.

The layers of the eyelid are the conjunctiva, Müller muscle, levator muscle, orbital fat, orbital septum, retro-orbicularis oculi fat, orbicularis oculi muscle, and skin. The Müller muscle lies below the levator insertion to the superior border of the tarsus and is visualized during the levator muscle repair.

The conjunctiva is located deep to the Müller muscle and should not be visualized during the muscle reinsertion to the tarsus. The orbital septum and retro-orbicularis oculi are anterior and superior to the levator tendon. The Whitnall ligament is also superior to the levator tendon. The capsulopalpebral fascia is the extension of the lower eyelid retractors and fuses at the inferior aspect of the lower eyelid tarsus.

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56. A 35-year-old woman comes to the office for consultation regarding correction of a boxy nasal tip. Physical examination shows severe malpositioning of the alar cartilage. In addition to placement of a columellar strut and suturing, which of the following is the most appropriate next step in surgical management of the deformity?

- A) Alar rim support grafting
- B) Caudal septal resection
- C) Cephalic trim of alar cartilage
- D) Dorsal augmentation
- E) Spreader grafting

Please note: Question 56 has been deleted from the examination.

The correct response is Option A.

Alar malposition was originally defined by Sheen as cephalic displacement of the alar cartilage toward the medial canthus at the midpoint of the alar rim. Severe cases can have the appearance of a boxy nasal tip. Alar rim support grafting as described by Daniel is a reliable and reproducible technique to correct the deformity.

Transposition of the alar cartilages is technically difficult and unpredictable; excision and relocation is considered aggressive. Neither caudal septal resection, cephalic trim of the alar cartilages, dorsal augmentation, nor spreader grafting would have any significant effect on the deficient alar rim in the scenario described.

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57. A 48-year-old woman undergoes skin-sparing mastectomy followed by immediate breast reconstruction with implantation of subpectoral prostheses. Which of the following best describes the resulting effect on pectoralis torque strength in this patient?
- A) Decreased on the operated side
 - B) Decreased on the side of hand dominance
 - C) Increased on the operated side
 - D) Increased on the side of hand dominance
 - E) No effect

The correct response is Option A.

Much attention has been given to abdominal wall function and complications following autologous breast reconstruction utilizing abdominal wall tissue in the form of transverse rectus abdominis musculocutaneous (TRAM), free TRAM, muscle-sparing TRAM, and deep inferior epigastric perforator free tissue transfers.

De Haan and colleagues examined the effect of immediate subpectoral prosthetic breast reconstruction following skin-sparing mastectomy on pectoralis function by measuring bilateral isometric arm strength in patients undergoing unilateral breast reconstruction. After correcting for the effect of hand dominance, the authors found a statistically significant decrease in torque strength on the operated side by 20.1% compared to the nonoperated side. This loss represents approximately half of the torque needed by healthy subjects over 50 years of age to rise from a chair and was therefore considered substantial.

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58. A 63-year-old woman comes to the office for consultation regarding improvement of facial rhytides. A chemical peel is planned. Cardiac monitoring is required if which of the following chemical solutions is applied during the procedure?

- A) 50% Glycolic acid
- B) Jessner solution
- C) 50% Lactic acid
- D) 30% Phenol-0.8% croton oil
- E) 35% Trichloroacetic acid

The correct response is Option D.

Phenol is a protoplasmic toxin that disrupts cell walls and denatures proteins. Dermal absorption is rapid, even through intact skin. High concentrations of phenol disrupt the dermal barrier and penetrate skin effectively. Its local anesthetic action produces a relatively painless coagulum. Although a small amount of phenol undergoes conjugation with glucuronic and sulfuric acids within one to two days of exposure, most is excreted unchanged in the urine. The half-life of phenol is estimated at 3.5 hours. Although it is infrequent, cardiac dysrhythmia is considered one of the potential complications of phenol peel. These dysrhythmias can include sinus tachycardia, premature ventricular contractions, atrial fibrillation, and ventricular fibrillation. Most of these dysrhythmias occur during the application of the phenol peel; therefore, appropriate cardiac and respiratory monitoring of the patient is essential.

Cardiac arrhythmias are not a reported complication when using trichloroacetic acid, glycolic acid, or Jessner solution.

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59. A 56-year-old woman undergoes staged bilateral breast reconstruction with tissue expanders followed by insertion of silicone prostheses. She underwent mastectomy four months ago for breast cancer. She has no other history of serious illness. In addition to annual clinical examinations, which of the following is the current recommendation for monitoring the integrity of the prostheses?

- A) Baseline MRI at three years, yearly thereafter
- B) Baseline MRI at three years, every two years thereafter
- C) Baseline MRI at 10 years, yearly thereafter
- D) Baseline MRI at 10 years, every two years thereafter
- E) Baseline MRI at 10 years, every three years thereafter

The correct response is Option B.

In November 2006, The United States Food and Drug Administration (FDA) approved the use of silicone gel-filled prostheses for augmentation mammoplasty in women age 22 years or older and for breast reconstruction for women of any age, thus ending a 14-year moratorium on the use of these prostheses in the United States.

As a condition for their approval, the FDA mandated that prostheses be distributed with modified patient as well as physician labeling. According to this labeling, physicians are instructed to advise patients that silicone gel-filled prosthesis ruptures are most often silent, and MRI is the most sensitive means of detecting a rupture. Patients are instructed to have regular MRIs to screen for rupture, even if there are no apparent problems. The first MRI should be performed at three years postoperatively and then every two years thereafter. If a rupture is diagnosed by MRI, the physician is instructed to advise patients to have their prostheses removed and/or replaced.

MRI has emerged as the gold standard for detection of silicone rupture with a published sensitivity and specificity of greater than 90%. To improve accuracy, a dedicated magnetic resonance breast coil should be used when imaging patients with prostheses to obtain high-resolution images, allowing detection of subtle signs of prosthesis leakage or rupture. Eighty percent to 90% of all silicone prosthesis ruptures are intracapsular and appear as the classic linguine sign.

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60. Which of the following structures is incised during the transconjunctival approach to lower eyelid blepharoplasty?

- A) Capsulopalpebral fascia
- B) Inferior rectus sheath
- C) Lower eyelid tarsus
- D) Orbicularis oculi
- E) Orbital septum

The correct response is Option A.

The transconjunctival approach to blepharoplasty involves incision through the middle of the lower conjunctiva at the inferior aspect of the lower eyelid tarsus, which is then carried through the capsulopalpebral fascia. The primary advantage of this approach is that it avoids skin incisions and transection of the orbital septum and orbicularis muscle, resulting in a reported decrease in lower eyelid retraction.

The inferior rectus sheath, orbicularis oculi, lower eyelid tarsus, and Lockwood ligaments are not transected during a transconjunctival dissection.

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61. A neonate with a small nasal hemangioma is examined and found to have supernumerary nipples. Family history includes polythelia in the patient's mother and other maternal family members. The patient and family members are at increased risk for which of the following abnormalities?

- A) Ear anomalies
- B) Renal anomalies
- C) Situs inversus
- D) Submucous clefts
- E) Thyroglossal duct cysts

The correct response is Option B.

This patient's mother should be counseled that a strong association exists between renal disease and polythelia. Kidney abnormalities such as cysts, duplications, or unilateral renal agenesis can be found in 14% of sporadic and 32% of familial cases compared with those seen in 1% to 2% of the general population. Nineteen percent of patients with adenocarcinoma of the kidney have polythelia and 16% of patients with end-stage renal disease have polythelia. In addition, other organ systems can have abnormalities, including conduction disturbances of the heart and congenital heart and gastrointestinal and central nervous system anomalies. Due to the significant incidence of congenital and acquired disorders in patients with polythelia, patients and families should be aware of the need for complete physical examination, urinalysis, and renal ultrasonography. The presence of extra nipples in children should heighten suspicion for possible renal and other anomalies.

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62. A 32-year-old man with no drug allergies is scheduled to undergo rhinoplasty with cartilage grafting. Which of the following is the primary prophylactic antibiotic of choice for this patient?

- A) Cefazolin
- B) Levofloxacin
- C) Linezolid
- D) Trimethoprim and sulfamethoxazole
- E) Vancomycin

The correct response is Option A.

Evidence supporting the recommended use of prophylactic antibiotics in plastic surgery procedures has become available in recent years. The traditional practices of routinely administering antibiotics as well as administering antibiotics well beyond the first preoperative dose have been criticized. In addition, the routine use of broad-spectrum antibiotics has not received evidence-based support.

Currently, 1 g of cefazolin administered 30 to 60 minutes prior to incision is the primary antibiotic choice in nonallergic patients for most plastic surgery procedures. For beta-lactam allergic patients, clindamycin is recommended as the prophylactic antibiotic of choice. For long (greater than 3.5 hours) or excessively bloody procedures, the recommendation is to consider an intraoperative (second) dose of cefazolin or clindamycin, respectively, not to administer vancomycin.

Other current recommendations include avoiding the use of prophylactic antibiotics for clean procedures that do not involve prostheses. Vancomycin should be used only when absolutely indicated (high methicillin-resistant *Staphylococcus aureus* rate, one dose only). For routine cases, administering additional antibiotic doses after wound closure has no additional benefit, according to several studies. Additional measures to reduce skin and surgical site infections may include maintenance of intraoperative normothermia (greater than 96.8°F [36.0°C]), normovolemia. Supplemental oxygen administration may be beneficial as well.

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63. A 36-year-old woman is scheduled to undergo secondary rhinoplasty to correct an inverted-V deformity. Which of the following operative steps is most likely to correct this deformity?
- A) Infracturing of the frontal processes of the maxilla
 - B) Nasal bone rasping
 - C) Placement of a spreader graft
 - D) Resection of the caudal septum
 - E) Weir excisions

The correct response is Option C.

Although the inverted-V deformity is often attributed to avulsion of the upper lateral cartilages, it can also be caused by excessive removal of the transverse portion of the upper lateral cartilage during dorsal septal resection. When the transverse portion of the upper lateral cartilage is over-resected, collapse of the nasal sidewalls occurs with retraction of the upper lateral cartilage and exposure of the shape of the nasal bones in the keystone area. In the scenario described, spreader grafts fashioned from septal cartilage can be used to correct this deformity. Spreader grafts can also restore an open roof deformity after aggressive hump reduction and recreate the dorsal aesthetic lines while simultaneously maintaining patency of the internal valve. These versatile grafts can be placed unilaterally or bilaterally, visible or invisible, depending on the deformity and the desired result.

Nasal hump deformity is usually corrected with nasal bone rasping. Weir excisions are resections of the alar bases used to reduce wide or flaring nostrils. Resection of the caudal septum is used to correct the hanging columella. Osteotomy of the frontal process of the maxilla helps reduce or narrow a wide nasal bridge.

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64. A 9-year-old boy is referred for evaluation because his breasts have been enlarging during the past six months without pain. Tanner stage is 1. Height and weight are in the 50th percentile. He takes no medications, and his medical history is noncontributory. Which of the following is the most appropriate next step in establishing the diagnosis?
- A) Abdominal CT and renal ultrasonography
 - B) Karyotyping
 - C) Measurement of serum gonadotropin concentrations
 - D) Testicular examination and ultrasonography
 - E) No further testing is necessary

The correct response is Option D.

Gynecomastia, defined as benign enlargement of the male breast, can affect as many as 65% of adolescent boys. It is a condition that reflects an elevated ratio of estrogens to androgens caused by age, disease, drugs, or idiopathic factors. Gynecomastia follows a triphasic distribution seen most frequently in the neonate, in early puberty, and with advanced age as a result of normal hormonal shifts that result in a relative preponderance of estrogens over androgens. For this reason, gynecomastia in these patients is considered physiologic and rarely requires workup beyond a careful history and physical examination.

The patient described comes to the office with early breast enlargement without other signs of pubertal development. Prepubertal gynecomastia is an uncommon condition, which should prompt a thorough workup for a possible pathologic cause. This is also true for patients of any age with bilateral idiopathic disease. While hormonal screening has previously been considered the first step in evaluating a patient with idiopathic gynecomastia, recent studies have suggested that these tests are rarely cost-effective. If hormone testing does suggest an occult testicular tumor, ultrasonography will be required for confirmation. Ultrasonography is therefore a preferred screening method, as it is cheaper and more accurate than hormone assays.

While specific workups have historically been suggested depending on age at presentation, the arbitrary use of screening radiologic or laboratory tests has not been found to be cost-effective. The presence of a feminizing tumor in a patient with idiopathic gynecomastia is extremely rare, affecting fewer than 3% of patients. Moreover, breast hypertrophy is an uncommon sign of testicular neoplasms, occurring in 30% of Leydig cell tumors and less than 10% of beta HCG-producing carcinomas. Feminizing adrenal tumors are even rarer. Adrenal imaging is therefore not warranted.

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Mammogram and/or ultrasonography of the breast are reasonable choices if history and physical examination are suggestive of breast cancer. Breast cancers usually present as a hard, unilateral mass in an older patient. Karyotype testing would be warranted to rule out Klinefelter syndrome if feminizing characteristics are found on physical examination.

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65. Which of the following is most indicative of the aging male abdomen as compared with the aging female abdomen?

- A) Accumulation of fat peripherally below the iliac crest
- B) Greater skin laxity
- C) Less intra-abdominal accumulation of fat
- D) Thinner skin with tendency toward striation
- E) Wider upper rectus muscle diastasis

The correct response is Option E.

Men are more likely to have a wide upper rectus muscle diastasis, and women are more likely to have a lower rectus muscle diastasis. Men's skin tends to be thicker and less prone to laxity and striation. The accumulation of flank fat is more central in men and located more peripherally below the iliac crest in women. Men have more intra-abdominal accumulation of fat, although women can accumulate intra-abdominal fat more commonly after menopause.

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66. A 26-year-old man is referred for evaluation for nasal surgery. He is satisfied with the appearance of the nose, but he has difficulty breathing through it. A Cottle maneuver significantly improves the patient's breathing. On examination, an anterior rhinoscopy is performed using a nasal speculum. No marked anatomic abnormalities are noted. Which of the following is the most appropriate management?
- A) Placement of a columellar strut
 - B) Placement of a lateral crural strut
 - C) Placement of a spreader graft
 - D) Septoplasty
 - E) Submucous resection of inferior turbinate

The correct response is Option C.

In the patient described, the improvement in respiration with the Cottle maneuver defines the area of obstruction as the internal nasal valve. The Cottle maneuver is performed by placing lateral traction on the cheek skin. This displaces the lateral nasal wall, thus opening the internal nasal valve. A normal internal nasal valve is 10 to 15 degrees. The most appropriate management for a narrowed internal nasal valve is the placement of a spreader graft to increase this angle. An anterior rhinoscopy is the inspection of the anterior portion of the nasal cavity with or without the aid of a nasal speculum.

A lateral crural strut would be indicated in cases where the obstruction is located at the external nasal valve.

Although the junction of the septum with the upper lateral cartilage contributes to the internal nasal valve, this angle will not be affected by the performance of a septoplasty. This is because the 10-mm L-strut preserved during a septoplasty is the component of the septum involved in the internal nasal valve.

Hypertrophy of the inferior turbinate is considered by many to be the most frequent cause of nasal airway obstruction; however, it does not contribute to internal nasal valve obstruction, and thus a Cottle maneuver is not diagnostic for hypertrophied inferior turbinates. Reduction of size of turbinate after administration of oxymetazoline hydrochloride (Afrin) means that conchal bone size is not a factor in airflow, and thus a submucous resection is not indicated. Therefore, although a submucous resection of the inferior turbinate may improve respiration, it will not correct the internal nasal valve obstruction.

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67. An 18-year-old man with Klinefelter syndrome is referred to the office because of overdeveloped breasts. Diagnostic workup testing is ordered. The likelihood of breast cancer is increased if testing shows which of the following results?

- A) Decreased level of plasma follicle-stimulating hormone
- B) Decreased level of plasma luteinizing hormone
- C) High number of progesterone receptors in the mesenchymal breast tissue
- D) Increased level of plasma testosterone
- E) Low number of estrogen receptors in the mesenchymal breast tissue

The correct response is Option C.

Klinefelter syndrome is a relatively rare disorder with an incidence of approximately 1:100,000, yet it represents a very important subset of patients with gynecomastia. Approximately one half of patients with typical Klinefelter syndrome (47,XXY) and one third of those with the mosaic variety (46,XY/47,XXY) develop gynecomastia. Those exhibiting gynecomastia have elevated plasma follicle-stimulating and luteinizing hormone levels, along with decreased plasma testosterone levels, suggesting a hormonal link with gynecomastia in the Klinefelter population.

The presence of estrogen and progesterone receptors in elevated concentration in patients with Klinefelter syndrome provides a potential mechanism by which these patients develop breast neoplasms. The absence of elevated estrogen and progesterone receptors in patients with idiopathic gynecomastia might help to clarify why these patients rarely develop breast malignancies.

Gynecomastia has many identifiable causes, although most cases are idiopathic. Recent studies have shown strong evidence for the estrogen-stimulating effects of breast tissue development and support for an inhibitory androgenic effect. Decreases in the androgen-to-estrogen ratio have also been associated with development of gynecomastia. No clear etiologic classification has been suggested based solely on hormonal influences. Instead, most physicians accept an arbitrary classification based on physiologic, pathologic, pharmacologic, and idiopathic causes. Idiopathic causes (25%) are the most common.

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68. A 50-year-old woman comes to the office because she developed a vesicular rash five days after undergoing full face carbon dioxide laser resurfacing to treat sun-damaged skin and acne scars. Which of the following is the most appropriate initial step in management?

- A) Administration of an antibiotic
- B) Administration of an antimicrobial scrub
- C) Administration of an antiviral agent
- D) Administration of a corticosteroid
- E) Observation

The correct response is Option C.

The patient described has most likely suffered from an outbreak of herpes simplex virus (HSV), which may occur with any resurfacing procedure, including laser, peels, and dermabrasion. Oral antiherpetic medication, such as acyclovir, valacyclovir, or famciclovir, should be prescribed prophylactically for all patients receiving resurfacing treatment, to start two days prior to the treatment and continuing for 7 to 10 days while the patient heals. HSV infection has a three- to five-day incubation period from the time of the procedure to the onset of clinical infection. If outbreak occurs—and this rarely happens while taking antiviral prophylaxis—treatment dosing of antiviral medication must be administered.

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69. A 51-year-old woman has loss of vision in her left eye immediately after autogenous fat injections to the face and nasojugal regions performed under local anesthesia with 2 mL of 1% lidocaine with 1:100,000 epinephrine. The procedure was performed using small boluses of fat, which were injected slowly into the tear trough. Physical examination shows loss of vision in the left eye. Which of the following occurrences is the most likely cause of this complication?
- A) Fat embolism
 - B) Glaucoma
 - C) Lidocaine toxicity
 - D) Retrobulbar hematoma
 - E) Vasovagal response

The correct response is Option A.

Blindness and strokes have occurred as a result of the injection of soft-tissue fillers in almost every part of the face: glabella, forehead creases, temple, nose, cheeks, nasolabial folds, and lower lip. The injection of large boluses of soft-tissue fillers in the face and the use of needles or cannulas that can easily perforate an arterial wall should be avoided. Fat injections into the face lead to an acute local increase in pressure in highly vascularized tissue. Fragments of fatty tissue reach ocular and cerebral arteries by reversed flow through branches of the carotid arteries after they are introduced into facial vessels. The manifestation of fat embolism appears either immediately after the fat injection or after a latency period. To minimize the risk of such a major complication, fat injections should be performed slowly, with the lowest possible force. Fat injections into pretraumatized soft tissue, for example, after rhytidectomy, should be avoided because of the increased risk of intravasation of fat particles.

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70. A 6-year-old boy is undergoing the first stage of total auricular reconstruction for correction of microtia. A finely detailed rib cartilage construct is carved. Which of the following aspects of this patient's postoperative care should be most effective in safely promoting adherence of the new cartilage construct to the skin cover?

- A) Application of cold compresses
- B) Application of pressure dressings
- C) Closed suction drainage
- D) Conforming splinting
- E) Open drainage incisions

The correct response is Option C.

Attentive postoperative management is imperative in total auricular reconstruction. Skin coaptation to the carved cartilage construct is best provided by continuous closed suction drainage for the first five postoperative days. The reported complication rate is less than 1%.

The quantity and quality of drainage can be monitored, and any potential hematoma is removed before it obscures the framework details. This can also be used to aid flap coaptation in cases in which temporoparietal or omental flap coverage is needed. Cold compresses are not effective in promoting adherence of the skin flap to the underlying framework.

Pressure dressings risk skin necrosis over the new cartilage framework and are not preferred over closed suction drainage. One author experienced a 33% skin necrosis complication rate in the first 15 cases in which bolster sutures were used to secure pressure bandages. In some techniques, carefully placed bolster sutures have been advocated to prevent hematoma, although the risk of skin necrosis remains. Additional skin incisions may adversely affect the final result and may also compromise the skin flap.

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71. A 35-year-old woman, gravida 3, para 3, comes to the office for consultation about augmentation mammoplasty with gel prostheses. During the visit, she inquires about the safety of breast-feeding after augmentation mammoplasty with silicone prostheses. She should be informed that the silicone levels in her breast milk after the augmentation will be which of the following?

- A) Similar to the levels in the milk of patients with no prostheses
- B) Higher than the levels in the milk of patients with no prostheses
- C) Similar to the levels in commercially available infant formula
- D) Higher than the levels in commercially available infant formula

The correct response is Option A.

A study by Semple and colleagues compared silicone levels in milk from lactating women with and without prostheses. Mean silicone levels in breast milk of augmented and nonaugmented women were not significantly different (55 ng/mL and 51 ng/mL, respectively). The silicon particle was used as a proxy of silicone.

Interestingly, silicone levels were significantly higher in commercially available infant formulas (4402.5 ng/mL). This study was performed in patients with second-generation gels in the 1990s; third-generation cohesive prostheses have not been tested, although they are likely to have a lower or similar level.

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72. A 60-year-old woman comes to the office for facial rejuvenation. Which of the following is the most effective method to minimize litigation?

- A) Communication
- B) Computer imaging
- C) Medical clearance
- D) Showing photographs of other patients

The correct response is Option A.

Effective communication is the most important factor for managing risk throughout the treatment period. It creates trust in the doctor by the patient and can minimize the risk of litigation. Obtaining informed consent is important, but if complications occur, it is the relationship that has been built between the doctor and the patient that will determine whether legal matters are pursued. Evaluation of photographs, either of other patients or of computer imaging of the current patient, and preoperative medical clearance can be helpful in determining whether or not to operate on a patient but are not as important as communication in managing risk.

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73. A 25-year-old man undergoes primary rhinoplasty and develops a septal hematoma. Which of the following is the most likely resulting nasal deformity?

- A) Midnasal asymmetry
- B) Pollybeak
- C) Retracted columella
- D) Saddle nose

The correct response is Option D.

All of the options are deformities following rhinoplasty. A septal hematoma may lead to a saddle nose deformity. A relatively high septal angle combined with decreased tip projection can lead to a pollybeak deformity. Columella retraction may result from over-resection of the caudal end of the septal cartilage and/or the nasal spine along with caudal rotation of the cartilaginous septum following overmobilization and/or vertical shortening. Midnasal asymmetry can result from asymmetric narrowing of the middle third, causing medialization of the lateral nasal wall.

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74. A 30-year-old man with alopecia undergoes micrografting for reconstruction of the anterior hairline. The patient should be counseled to expect which of the following hair growth timelines in grafted areas postoperatively?
- A) No growth for one month, followed by normal growth
 - B) Immediate hair loss followed by new, normal growth after one month
 - C) Immediate hair loss followed by new, normal growth after three months
 - D) Growth for one month, followed by hair loss and then new, normal growth after three months
 - E) Immediate normal growth

The correct response is Option D.

Following micrografting, the patient has hair growth for one month followed by hair loss and then normal growth after three months. Once the grafting is completed, there is an initial period of false growth lasting three to four weeks. The hair follicles then pass into the telogen phase, and this new hair growth is lost. The telogen phase lasts two to three months; following this, normal permanent growth begins at a rate of 1 cm monthly. Therefore, a total of approximately six months is required for the onset of permanent hair growth in the grafted area.

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75. A 34-year-old woman is scheduled to undergo brachioplasty following a 100-lb (45-kg) weight loss. Which of the following is the most likely unfavorable outcome of the procedure in this patient?

- A) Contour deformities
- B) Lymphedema
- C) Neuroma
- D) Seroma
- E) Unattractive scarring

The correct response is Option E.

The most common complication of brachioplasty in postbariatric body contouring is hypertrophic, widened, or unattractive scarring. This multifactorial problem is secondary to problems in geometry (tension and compression), multiple vectors, tissue mismatch, nutrition, and adequate resection. The plastic surgeon must strike a balance between resecting enough tissue to achieve excellent contour and not resecting so much that closure is prevented. Other complications include wound separation, hematoma, seroma, infection, sensory and motor nerve injury, over- or under-resection, fat necrosis, horizontal cutaneous furrows, standing cone deformities, edema (venous), lymphedema, and inappropriate scar placement.

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76. Which of the following most appropriately describes the biomechanical characteristic specifically designed to minimize gel diffusion in a third-generation silicone prosthesis?

- A) Increased cross-linking of silicone elastomer
- B) Increased molecular weight of silicone gel
- C) Internal barrier coating
- D) Texturing of prosthesis surface

The correct response is Option C.

Several generations of silicone gel breast prostheses have been manufactured since the early 1960s. Third-generation prostheses manufactured since 1986, and recently FDA-approved for cosmetic and reconstructive procedures in the United States, were specifically developed to address the more common problems associated with second-generation prostheses, including silicone bleed. While a number of biomechanical properties were altered, the modification that was specifically designed to reduce silicone bleeding was the addition of an inner barrier on the elastomer shell. This barrier changed the solubility characteristics of the shell, thus inhibiting the diffusion of silicone through it. McGhan Medical released a prosthesis that had a diphenyl silicone copolymer barrier layer between an inner and outer layer of high-performance elastomer (Intrashiel). The Dow-Corning Silastic II prosthesis had a fluorosilicone copolymer layer to restrict silicone bleed.

The design of silicone gel breast prostheses has evolved significantly since their first introduction. First-generation prostheses had thick shell walls, viscous gel, and Dacron patches. Hardness and contracture were major complaints. To address these issues, second-generation prostheses were developed (1973-1985), which had thinner walls and lower viscosity gel. The result was a softer, more natural-feeling prosthesis in the early postoperative period. Second-generation prostheses had the highest rates of rupture, bleed, and capsular contracture, and as a result, third-generation prostheses reintroduced thicker shells and more cohesive gel.

Increasing the cross-linking of the silicone elastomer strengthens and thickens the wall of the prosthesis. Texturing of the prosthesis surface was a strategy designed to decrease the rate of capsular contracture.

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77. A 36-year-old woman with a confirmed diagnosis of ductal carcinoma in situ is considering skin-sparing mastectomy and immediate reconstruction. The patient should be informed that her risk of developing recurrent ipsilateral breast cancer over the next four years is approximately which of the following?

- A) 2%
- B) 5%
- C) 10%
- D) 15%
- E) 20%

The correct response is Option A.

Several studies support skin-sparing mastectomy as an oncologically safe technique, based on the absence of breast ductal epithelium at the margin of the native skin flaps. A recurrence rate of less than 2% at 45 months is quoted in a study by Slavin and colleagues.

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78. A 55-year-old woman has numbness at the frontoparietal scalp following a rhytidectomy and endoscopic brow lift. The numbness is most likely the result of injury to which of the following nerves?

- A) Auriculotemporal
- B) Frontal branch of the facial nerve
- C) Supraorbital
- D) Supratrochlear
- E) Zygomaticotemporal

The correct response is Option C.

The supraorbital nerve has two divisions. The superficial division supplies sensation to the central forehead and hairline. The deep division supplies sensation to the central frontoparietal scalp. The supratrochlear nerve supplies sensation to the nasal radix and part of the central forehead. Both of these nerves are at risk of injury during resection of the corrugator muscles.

The auriculotemporal nerve and zygomaticotemporal nerve supply sensation to the temporal scalp. The frontal branch of the facial nerve is a motor nerve and does not have any sensory function.

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79. A 26-year-old woman who underwent augmentation mammoplasty six months ago comes to the office because she has numbness of the right nipple. The most likely cause is injury to which of the following intercostal nerves?

- A) Second
- B) Third
- C) Fourth
- D) Fifth
- E) Sixth

The correct response is Option C.

According to Courtiss and Goldwyn, the fourth intercostal nerve is the most important nipple innervator.

The anterior cutaneous branches of the second through sixth intercostal nerves provide the medial innervation. The anterior rami of the lateral cutaneous branches of the third through sixth intercostal nerves provide the lateral innervation.

It has been demonstrated that the lateral cutaneous branches of the third through fifth intercostal nerves and the anterior cutaneous branches of the second through fifth intercostal nerves all contribute to nipple supply. The lateral cutaneous branch of the fourth intercostal nerve has been traced into the nipple and found to have two branches. The deep branch passes inferolaterally on the pectoralis major fascia before coursing up into the areola, whereas the superficial branch passes up through the superficial parenchyma.

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80. A 35-year-old woman is scheduled to undergo repair of a tear trough deformity using injections of hyaluronic acid. To minimize the risk for potential complications, which of the following is the most appropriate recommended level of infiltration of this filler?
- A) Superficial dermis
 - B) Deep dermis
 - C) Subcutaneous
 - D) Intramuscular
 - E) Periosteum

The correct response is Option E.

Many options are available to manage a tear trough deformity. The advantage of using injections of filler material is that this method avoids the downtime of surgical options such as prostheses and pedicled fat. Injections of fat are an option but can have unpredictable outcomes. Injections of hyaluronic acids have the advantage of little downtime, low risk, and, for the most part, self-limiting complications. When injecting hyaluronic acids for tear trough correction, the filler should be injected at the level of the periosteum. Injection at this site limits the risk of palpability and surface irregularity associated with injections at more superficial levels, such as the superficial and deep dermis, subdermal, or suborbicularis oculi fat. It also potentially improves the longevity of the filler because it is placed at a level where the tissue is immobile, thus negating the effect of animation to break down the product.

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81. A 35-year-old woman is scheduled to undergo liposuction in an office-based setting. Height is 5 ft 10 in (178 cm) and weight is 185 lb (84 kg). According to the American Society of Plastic Surgeons Committee on Patient Safety, the recommended maximum total volume of aspirate should be limited to which of the following amounts?

- A) 4000 mL
- B) 5000 mL
- C) 6000 mL
- D) 7000 mL
- E) 8000 mL

The correct response is Option B.

In the “Practice Advisory on Liposuction,” the American Society of Plastic Surgeons Committee on Patient Safety defines large-volume liposuction as more than 5 L of lipoaspirate taken in one operation. Different states may have different regulations regarding liposuction aspirate volume.

Liposuction should be performed in an appropriate facility with qualified staff to monitor postoperative vital signs and urinary output. A postliposuction surgery protocol should be followed to monitor and document any signs of volume overload. These signs include:

- 1. increased blood pressure, jugular vein distension, and full bounding pulses
- 2. cough, dyspnea, lung crackles, pulmonary edema, and changes in urinary output

The physician should not combine large-volume liposuction with additional procedures because of the risk of severe complications.

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82. Which of the following is the most likely site of **ectopic** breast tissue in a patient with ectopic polymastia?

- A) Axilla
- B) Costal margin
- C) Dorsal thigh
- D) Pubis
- E) Vulva

The correct response is Option C.

Polymastic breast tissue can be categorized either as accessory or ectopic. Ectopic breast tissue is found outside the milk line at such sites as the scalp, ear, back, shoulder, epigastrium, and posterior or dorsal thigh.

Accessory polymastia occurs along the milk line. Greater than 90% of accessory breast tissue is localized to the chest region. The axilla, groin, vulva, and medial thigh may also be affected as well as regions above or below the normal breast, such as the costal margin.

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83. A 32-year-old woman with multifocal ductal carcinoma in situ in her right breast is scheduled to undergo mastectomy. There is no family history of breast cancer. Results of testing for the *BRCA* gene mutation are negative. MRI of the left breast shows no abnormalities. A discussion is held with the patient about prophylactic mastectomy on the contralateral breast. Which of the following is the principal factor in the determination of whether to perform bilateral mastectomy?
- A) Medical clearance
 - B) Need for radiation
 - C) Patient wishes
 - D) Reconstructive options
 - E) Tumor burden

The correct response is Option C.

In the scenario described, the most important consideration is the patient's choice. In several studies, patients who underwent prophylactic mastectomy at the suggestion of the physician were generally more regretful than those who underwent the procedure following a patient-initiated discussion. The lack of perioperative emotional support also affected these patients. Lack of nipple sensation and inability to breast-feed are two factors leading to patients' regret about their decision.

Factors influencing a patient's decision to choose bilateral mastectomies include *BRCA* gene status, family history, previous biopsies, dense breasts, and hard-to-read mammograms. Reconstructive options are important to explore with the patient, but ultimately the patient's wishes are most predictive of patient satisfaction in prophylactic mastectomy. Radiation and tumor burden do not affect the treatment of the contralateral breast.

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84. A 30-year-old woman has numbness of the forearm following a brachioplasty procedure to correct significant skin laxity. Which of the following nerves was most likely injured during the procedure?

- A) Axillary
- B) Intercostal brachial
- C) Medial antebrachial cutaneous
- D) Posterior interosseous
- E) Ulnar

The correct response is Option C.

The medial antebrachial cutaneous (MABC) nerve may be located within the resection area of the arm during brachioplasty, leading to regional paresthesia in the upper arm and the anterior proximal forearm. The MABC nerve exits 14 cm proximal to the medial epicondyle and tends to run in close proximity to the intramuscular septum. Patients may be treated with hand therapy and local massage, as well as medications such as gabapentin (Neurontin), if needed. Sensation often improves with the passage of time.

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85. A 45-year-old man is scheduled to undergo submucous resection septoplasty to correct left-sided nasal airway obstruction. Which of the following complications is most likely to occur if the surgeon uses a full-transfixion incision instead of a Killian (hemi-transfixion) incision?

- A) Bilateral alar notching
- B) Decreased tip projection
- C) External nasal valve collapse
- D) Middle nasal vault collapse
- E) Saddle nose deformity

The correct response is Option B.

A full-transfixion incision can lead to decreased tip projection, especially if dissected down over the anterior nasal spine. Support for the nasal tip is lost. A columellar strut can help add support.

Alar notching results from over-resection of the lower lateral cartilages.

External nasal valve collapse results from weak or narrow lower lateral cartilages and is addressed by the use of baton grafts.

Middle nasal vault collapse is prevented by the use of spreader grafts.

Saddle nose deformity is created by over-resection of the dorsal septum. At least 10 mm of dorsal septum and 10 mm of caudal septum should be preserved in a submucous resection septoplasty.

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86. A 60-year-old woman has increasing pain and swelling on the right side 10 hours after a successful subcutaneous rhytidectomy. Which of the following perioperative interventions is most likely to have prevented this complication?

- A) Administration of an antitussive
- B) Control of blood pressure
- C) Elimination of over-the-counter herbal medications
- D) Placement of a drain in the dissected area
- E) Placement of firm compressive dressing

The correct response is Option B.

Hematomas are the most common complication after rhytidectomy and vary from large collections that threaten the viability of the skin flaps, and even the airway, to small collections.

The treatment of a hematoma is evacuation. Blood pressure control is the most important preventive measure. Ranking next in importance is the avoidance of medications that interfere with the clotting mechanism, such as ginkgo, garlic, and vitamin E.

Every attempt should be made to avoid vomiting, coughing, anxiety, or pain. Drains do not prevent hematomas, but they help in an early diagnosis if the output changes character to frank blood and is increased.

Firm compressive dressing is important; however, it must not compromise the viability of the skin flaps.

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87. A 67-year-old woman comes to the office because of “sagging” of her right upper eyelid two days after receiving injections of 50 U of botulinum toxin type A (BOTOX Cosmetic) to the right forehead and bilateral lateral orbital rims for treatment of rhytides and bilateral “crow’s feet.” Examination confirms ptosis of the right eyelid and resolution of the rhytides. Inhibition of which of the following muscles most likely caused this finding in this patient?
- A) Corrugator supercilii
 - B) Frontalis
 - C) Levator palpebrae
 - D) Müller
 - E) Orbicularis oculi

The correct response is Option B.

The patient discussed most likely developed induced ptosis secondary to inhibition of the frontalis muscle on the right. Hyperactivity of the frontalis muscle and secondary deep furrow formation likely developed as a compensatory means of correcting an undiagnosed right eyelid ptosis. By blocking frontalis function, the patient was no longer able to assist in enhancing the vertical palpebral aperture, and secondary upper eyelid ptosis occurred. This is an off-label use of BOTOX Cosmetic.

Treatment of BOTOX Cosmetic-induced eyelid ptosis includes administration of alpha-adrenergic eyedrops such as Iopidine, which causes stimulation and contraction of Müller muscle, a sympathetically innervated smooth muscle that elevates the upper eyelid by approximately 2 mm. The levator palpebrae, the major elevator of the upper eyelid, is a striated muscle innervated by the oculomotor nerve (CN III), and its function is unaffected by adrenergic stimulation.

An understanding of the anatomic and functional relationship of the muscles responsible for the dynamic lines of facial expression is mandatory to avoid complications in BOTOX Cosmetic injection. The main depressors of the eyebrow are the corrugator supercilii and the procerus muscle medially, and the superolateral orbicularis oculi laterally. The main antagonist of the eyebrow depressors is the frontalis muscle. Inhibition of the brow depressors would be unlikely to result in eyebrow or eyelid ptosis.

The most common mechanism for most upper eyelid ptosis that occurs after treatment with BOTOX Cosmetic relates to the diffusion of drug through the orbital septum to the levator muscle and less commonly the Müller muscle, which usually occurs with primary treatment to the glabellar region, and therefore is unlikely in the scenario described.

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88. In a 45-year-old woman who is undergoing correction of lateral orbital fullness, which of the following is most likely to increase the risk of postoperative dryness of the eyes?

- A) Correction of brow ptosis
- B) Removal of the central preaponeurotic fat
- C) Removal of retro-orbicularis oculi (ROOF) fat
- D) Resection of the Eisler fat pocket
- E) Resection of a prolapsed lacrimal gland

The correct response is Option E.

Understanding the anatomy of the lateral upper eyelid is a key element in periorbital facial rejuvenation. Causes of lateral orbital fullness, which may contribute to an unfavorable result after upper blepharoplasty, include prominence of the superolateral orbital rim, brow ptosis, excess retro-orbicularis oculi fat, lacrimal gland ptosis, and excess periorbital fat.

Although there are generally two distinct fat compartments in the upper eyelid, there is an extensive connective tissue system encountered during upper blepharoplasty. The central preaponeurotic fat pad functions as a gliding plane between the levator and orbicularis and is separate from the medial fat pad.

The lacrimal gland should be distinguished from the lateral extension of the preaponeurotic fat pad. Lacrimal gland ptosis, if encountered, can be corrected by resuspension of the gland with sutures extending from the pseudocapsule of the gland to the periosteum at the arcus marginalis of the orbital rim. The lacrimal gland is a major contributor to tear production and resection should be avoided.

Retro-orbicularis oculi (ROOF) fat lies deep to the orbicularis oculi and superficial to the orbital septum. Removal of this fat can improve that lateral orbital contour and does not contribute to dry eyes.

The Eisler fat pocket, bordered by the lacrimal gland, orbital rim, orbital septum, and lateral canthal tendon, is an additional accessory fat pad in the lateral compartment of the upper lid and does not enter the surgical field during standard blepharoplasty.

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89. A 26-year-old woman is scheduled to undergo reduction mammoplasty. In designing the pedicles for the procedure, which of the following arteries is the predominant blood supply to the breast?

- A) Internal thoracic
- B) Lateral thoracic
- C) Supreme thoracic
- D) Thoracoacromial
- E) Thoracodorsal

The correct response is Option A.

Knowledge of the blood supply to the breast is important to the design of the pedicle to the nipple-areola complex. This knowledge can also be used when designing pedicles for the reconstruction of a breast after prior surgery, such as a lumpectomy. Perforating branches off of the internal thoracic artery (also called the internal mammary artery) are the predominant blood supply to the breast. The lateral thoracic and thoracoacromial arteries also contribute to the blood supply of the breast but to a lesser degree. The thoracodorsal artery and supreme thoracic artery do not contribute to the blood supply of the breast to any significant degree.

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90. When used for breast reconstruction, both the superior and the inferior gluteal artery perforator flaps utilize a vascular bundle that is a terminal branch of which of the following arteries?

- A) Deep circumflex iliac
- B) External iliac
- C) Femoral
- D) Internal iliac
- E) Pudendal

The correct response is Option D.

Both the superior and inferior gluteal arteries are terminal branches of the internal iliac artery. They pass out of the pelvis above and below the piriformis muscle, supplying the upper and lower halves of the muscle, respectively. As the superior gluteal artery passes the greater sciatic foramen, it divides into superficial and deep branches. The deep branch travels between the gluteus medius muscle and the iliac bone. The superficial branch goes on to supply the gluteus muscle and the overlying skin territory. The superficial branch of the gluteal artery nourishes the fat and skin in the musculocutaneous flaps in this region. These perforating vessels can be separated from the underlying muscle and fascia and form the basis for the S-GAP flap, which allows maximal preservation of the donor site muscle and other underlying structures while creating a reliable skin–soft-tissue flap. Two to three perforators are usually found arising from this vessel, with a pedicle length between 3 cm and 8 cm.

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91. Which of the following anatomic structures most effectively neutralizes trichloroacetic acid (TCA) in patients undergoing TCA peels?

- A) Epidermis
- B) Dermis
- C) Subcutaneous tissue
- D) Kidney
- E) Liver

The correct response is Option B.

In patients undergoing chemical peeling, the TCA is neutralized within the superficial dermal plexus, particularly by the protein keratin. Chemical peeling by TCA is associated with absence of systemic toxicity and adverse effects on the cardiovascular system. Therefore, these patients do not require monitoring using electrocardiogram during the procedure.

Phenol peels are absorbed in the systemic circulation to some extent. As a result, blood phenol level should be monitored. Cardiac irregularities are associated with phenol peel. Therefore, it is recommended that cardiac monitoring be performed during the procedure. Phenol is eliminated and excreted by the kidneys.

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92. A 35-year-old man has persistent numbness of the nasal tip three years after undergoing cosmetic rhinoplasty through an endonasal approach. Injury to which of the following nerves is the most likely cause of the numbness?

- A) Anterior ethmoidal
- B) Infraorbital
- C) Infratrochlear
- D) Supraorbital
- E) Supratrochlear

The correct response is Option A.

The patient described has sustained an injury to the external branch of the anterior ethmoidal nerve. This structure is particularly vulnerable to damage during endonasal rhinoplasty procedures. The nerve emanates from between the nasal bone and the lateral nasal cartilage, supplying sensation to the skin at the distal nasal dorsum and tip.

The infraorbital nerve supplies sensory enervation to the lower lateral half of the nose and columellar skin, while the infratrochlear nerve supplies the cephalic portion of the nasal sidewalls and the skin overlying the radix. The supraorbital nerve also enervates the skin of the radix, while the supratrochlear nerve supplies sensation to the forehead skin.

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93. Which of the following pharmacologic agents has NOT been implicated as a cause of gynecomastia?

- A) *Cannabis sativa*
- B) Chlorpromazine
- C) Isoniazid
- D) Metformin
- E) Spironolactone

The correct response is Option D.

Metformin is an oral hypoglycemic used in the treatment of type 2 diabetes mellitus. Metformin must be discontinued two days prior to surgery to avoid untreatable lactic acidosis and death. It has not been reported to have gynecomastia as a side effect. Therapy with estrogen or androgen can produce gynecomastia. Estradiol is a metabolic product of testosterone and this fact might explain this phenomenon. Carcinoma of the prostate is treated with stilbestrol, an estrogen that causes gynecomastia. Other pharmacologic agents that may cause gynecomastia include antiandrogens, chorionic gonadotropin, spironolactone, reserpine, phenothiazines, methyldopa, meprobamate, ergotamine, diazepam, hydantoin, hydroxyzine, marijuana (*Cannabis sativa*), digitalis, isoniazid, and anabolic steroids.

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94. A 29-year-old woman underwent a successful augmentation mammoplasty one year ago. Photographs had been taken immediately postoperatively with the patient's written permission. Three months later at a follow-up visit, the plastic surgeon spoke to her about using the photographs in advertising, and she agreed that he could use them. The surgeon documented the discussion and her agreement in her chart. Now the plastic surgeon is ready to launch a new Web site and the webmaster needs a photograph gallery. The plastic surgeon has made several attempts to contact the patient via written letters but has been unsuccessful. Because of pressure to submit the photographs for the Web site, the surgeon submits her pictures without discussing their use with her again. Which of the following best describes the surgeon's liability if the patient sues because the photographs were used?
- A) Liable because she has identifiable tattoos
 - B) Liable because written consent was not obtained specifically for advertising
 - C) Not liable because he attempted to contact the patient by mail
 - D) Not liable because verbal consent was noted in the patient's chart
 - E) Not liable because written consent was obtained to take the photographs

The correct response is Option B.

It is advisable to go the extra step when it comes to using photographs of patients, whether in the office for education of others, or in advertising of any sort. Even if the patient cannot be identified (eg, the face is not in the photograph), written consent must be obtained. The American Society of Plastic Surgeons has a sample photograph consent form available.

References

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95. A 57-year-old woman is scheduled to undergo a medial thigh lift. Anchoring of the soft tissue of the medial thigh to the Colles fascia is planned. The Colles fascia is continuous with which of the following structures?
- A) Anococcygeal raphe
 - B) Anterior rectus sheath
 - C) Deep layer of the deep perineal fascia
 - D) Posterior urogenital diaphragm
 - E) Scarpa's fascia of the abdominal wall

The correct response is Option E.

Colles fascia was first described in 1811 as a fascial layer that helps to define the perineal-thigh crease. It is described as the deep layer of the superficial perineal fascia (not the deep perineal fascia) and lies deep to the subcutaneous fat of the perineum. Anteriorly, it is continuous with Scarpa's fascia of the abdominal wall. It is distinct, unrelated, and not continuous with the anterior rectus sheath. Posteriorly, Colles fascia fuses with the posterior border of the urogenital diaphragm. It does not occur posterior to this structure. The Colles fascia is high in elastin content, giving it a yellow hue which distinguishes it from nearby white muscular fascia.

Lockwood initially described the fascial anchoring technique to be employed at medial crescentic thigh lift at which the inferior thigh flap is anchored to this fascial layer with subdermal sutures to reduce the risk of inferior scar migration, labial spreading, and recurrent thigh ptosis.

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96. A 42-year-old man has Clark Level III melanoma with a Breslow thickness of 1.5 mm in the concha of the right ear. Physical examination shows no other palpable masses. In addition to wide excision of the lesion, which of the following is the most appropriate step in management?
- A) Infraclavicular lymph node dissection
 - B) Posterior neck dissection
 - C) Sentinel lymph node biopsy
 - D) Superficial parotidectomy
 - E) Total parotidectomy with radical neck dissection

The correct response is Option C.

The lymphatic drainage of the external ear is generally believed to follow its embryologic development. In general, the external auditory canal and the superior portions of the ear drain into the mastoid region and the superior cervical chain of lymph nodes. The concha and meatus are traditionally considered to drain into the parotid and/or the infraclavicular lymph nodes. However, recent studies with lymphoscintigraphy and sentinel lymph node mapping have demonstrated that lymphatic drainage can be unpredictable.

Sentinel lymph node biopsy, which also serves to stage the extent of disease, is the most appropriate management after wide excision of the lesion. It is the most specific means of identifying regional lymph node spread. The sentinel node may be located in the parotid gland, the infraclavicular node, or some other part of the cervical chain of lymph nodes.

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97. A 15-year-old girl is brought to the office for consultation regarding correction of breast asymmetry. Physical examination shows asymmetry of breast size and shape. The right breast is 90% smaller than the left breast. The right pectoralis major muscle is normal. The right nipple is present but smaller than the left nipple. Which of the following is the most likely diagnosis?

- A) Amastia
- B) Amazia
- C) Athelia
- D) Jeune syndrome
- E) Poland syndrome

The correct response is Option B.

Poland syndrome is characterized by unilateral hypoplasia or absence of the breast associated with deformities of the chest wall and ipsilateral hypoplastic or absent pectoralis major muscle.

Amazia is characterized by absence of the glandular tissue only, while athelia is the absence of the nipple alone. Amazia can result from surgical removal of the breast bud, radiation, or congenital absence. In Jeune syndrome, the patient typically has a narrow immobile thorax, polychondrodystrophy, and renal disease. Amastia is the absence of both breast and nipple.

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98. A 59-year-old woman comes to the office because she is unhappy with the long-term results of carbon dioxide laser resurfacing performed three years earlier to treat rhytides on the upper lip. Which of the following is the most likely complication that is causing her dissatisfaction?

- A) Hyperpigmentation
- B) Hypertrophic scarring
- C) Hypopigmentation
- D) Persistent erythema
- E) Telangiectasia

The correct response is Option C.

Carbon dioxide laser resurfacing is a highly effective treatment of rhytides of the upper lip that will last for a long time (more than six years) with low rates of recurrence. The success of carbon dioxide laser skin resurfacing is generally attributed to long-term neocollagenesis and neoelastogenesis. The main drawback is a high rate of hypopigmentation, which is very distressing to patients. Although persistent erythema and hyperpigmentation can be troublesome in the first year after treatment, neither is typically seen as long-term sequelae of the procedure. Hypertrophic scarring is a possible complication of treatment; however, it is not reported as a common long-term complication of the procedure in several large series of studies.

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99. A 36-year-old woman comes to the office for consultation regarding “sagging” breasts 10 years after undergoing bilateral augmentation mammoplasty with subglandular placement of saline prostheses. Physical examination shows Grade 2 ptosis and an axillary scar. A mastopexy with capsulotomy and replacement of prostheses is planned. Which of the following pedicles is LEAST likely to preserve the blood supply to the nipple-areola complex?
- A) Inferior
 - B) Medial
 - C) Superior
 - D) Superolateral
 - E) Superomedial

The correct response is Option A.

Secondary mastopexy in the augmented patient can be particularly hazardous. In addition to scars from prior surgery, the soft-tissue envelope surrounding the prosthesis frequently becomes attenuated. Tebbetts observed that the “consequences of excessively large breast implants include ptosis, tissue stretching, tissue thinning, inadequate soft-tissue cover, [and] ...subcutaneous tissue atrophy.” Gravity causes most soft-tissue thinning and atrophy to eventually occur in the inferior pole of the augmented breast. Therefore, in secondary mastopexy augmentation procedures, blood supply to the nipple-areola complex should generally rely on a medial, superior, superomedial, or superolateral pedicle.

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100. A 40-year-old woman is scheduled to undergo surgical correction of bilateral upper eyelid dermatochalasis and mild blepharoptosis. A Fasanella-Servat procedure is planned. Which of the following is the most likely disadvantage of performing this procedure instead of a levator aponeurosis reinsertion?

- A) Dry eyes
- B) Eyelid asymmetry
- C) Incomplete correction of eyelid ptosis
- D) No removal of excess eyelid fold skin
- E) Overcorrection of eyelid position

The correct response is Option D.

Both the Fasanella-Servat procedure and the levator aponeurosis reinsertion can accomplish good surgical results and are accurate methods for the correction of mild to moderate ptosis. However, one of the major disadvantages of the Fasanella-Servat procedure is that it does not address excess skin of the eyelid fold.

Dry eyes, incomplete correction, overcorrection, and eyelid asymmetry are possible complications of both procedures.

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Section 3: Craniomaxillofacial



101. A 41-year-old man was punched in the eye two days ago and now has numbness in his cheek and double vision. Physical examination shows paresthesias in the V_2 distribution, edema of the eyelids, and proptosis. Diplopia occurs at 40 degrees of upward gaze, but there are no definite signs of entrapment. A coronal CT is shown. Which of the following is the absolute indication for repair of the orbital floor fracture in this patient?

- A) Diplopia on upward gaze
- B) Extent of orbital floor loss
- C) Medial maxillary sinus wall fracture
- D) Medial orbital wall fracture
- E) Paresthesia between the lower eyelid and upper lip

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The correct response is Option B.

The absolute indication for repair of the orbital floor fracture in the patient described is the CT finding of loss of greater than 50% of the orbital floor. Without repair, this patient is prone to enophthalmos and long-term diplopia.

Diplopia, without evidence of entrapment, is not an absolute indication for operative repair of orbital floor fractures, especially when not within 20 to 30 degrees of primary gaze. Diplopia in extreme gazes is not particularly dysfunctional; therefore, it is only a relative indication for surgery. Definite entrapment noted on examination would be an indication for surgery, but it was not demonstrated in the patient described. Note on the CT the round shape (relative to the left side) of the inferior rectus muscle in coronal section. This shape is indicative of edema in the muscle, which is the likely cause of the diplopia in extreme upward gaze.

Concomitant medial maxillary sinus wall fracture is not an indication for operative repair of the orbital floor. Further, the patient described does not demonstrate such a fracture on the CT.

A fracture of the medial orbital wall is not present on the CT image. When present, a fracture of the medial orbital wall may make enophthalmos more likely. Enophthalmos would be an indication for surgery but also was not demonstrated.

Numbness between the lower eyelid and upper lip indicates injury to the infraorbital nerve, which is present in nearly all orbital floor fractures. It is usually a neurapraxic injury, which improves to some degree with time. It is not improved by surgery, and therefore this finding is not an indication for surgery.

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102. A 66-year-old man is being evaluated because of a four-month history of a painful sore in his mouth. Physical examination shows a 3-cm ulcerative lesion of the right buccal mucosa, and a 2.5-cm node in Zone II of the right neck. Biopsy of specimens from the lesions shows squamous cell carcinoma. No distant metastases are noted. Which of the following is the most accurate TNM staging of this tumor?
- A) T1 N1 M0
 - B) T2 N1 M0
 - C) T1 N2a M0
 - D) T2 N2a M0
 - E) T3 N2a M0

The correct response is Option B.

Tumors of the oral cavity and oropharynx are staged according to the TNM (tumor, node, metastasis) system. A tumor with dimensions greater than 2 cm but less than or equal to 4 cm would be staged as T2. A single, 2.5-cm, mobile node would stage this tumor as N1.

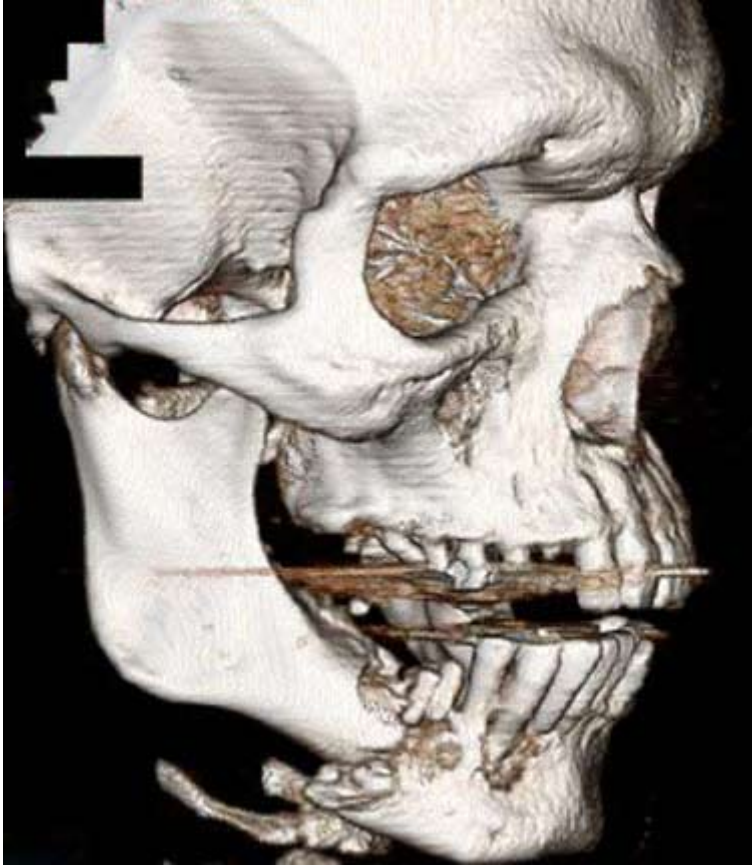
Oral Cavity and Oropharynx:

- T1 Tumor ≤ 2 cm
 - T2 Tumor > 2 but < 4 cm
 - T3 Tumor > 4 cm
 - T4 Tumor invades adjacent structures, such as cortical bone, tongue, skin, or soft tissue of the neck
-
- N1 One ipsilateral node: < 3 cm
 - N2a One ipsilateral node: > 3 but ≤ 6 cm
 - N2b Multiple ipsilateral nodes: ≤ 6 cm
 - N2c Bilateral contralateral nodes: ≤ 6 cm
 - N3 Any nodes > 6 cm

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

103. A 40-year-old woman is referred for treatment after being found to have an idiopathic fracture on panoramic radiograph (Panorex), performed because of severe pain following a dental procedure. She has been treated for osteopenia related to multiple myeloma. A CT is shown. On evaluation, the patient has chronic pain and exposed intraoral bone. Which of the following is the most likely diagnosis?

- A) Bisphosphonate-related osteonecrosis
- B) Breast cancer metastasis
- C) Infectious osteomyelitis
- D) Myeloma-induced changes to the mandible
- E) Old unhealed fracture from trauma

The correct response is Option A.

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Bisphosphonate-related osteonecrosis (BRON) is an increasingly reported diagnosis for patients being treated with bisphosphonates for bone loss from Paget disease, osteoporosis, and bone-related cancer. Bisphosphonates are clinically important for the treatment of hypercalcemia of malignancy and can reduce cancer-induced bone pain. The two bisphosphonates approved by the FDA for use in patients with cancer involving bone are pamidronate and zoledronic acid. Because of the high frequency of skeletal involvement in advanced cancers, bisphosphonates are routinely prescribed in the practice of medical oncology, and the incidence in these patients for BRON ranges between 1% and 10%. Because of the common use of these drugs in multiple myeloma, there have been many case reports of patients with BRON. Other diseases with a similar presentation include intraoral conditions including periodontal disease, gingivitis, or mucositis; temporomandibular joint disease; sinusitis; periapical pathology caused by a carious infection; osteoradionecrosis; neuralgia-inducing cavitation osteonecrosis; odontogenic infections leading to osteomyelitis; herpes zoster infection–associated osteonecrosis; benign sequestration of the lingual plate; or HIV-associated necrotizing ulcerative periodontitis.

For established pathology, there is little need for diagnostic imaging techniques because the presence of exposed bone and associated symptoms such as pain, swelling, paresthesia, suppuration, and soft-tissue ulceration can be detected without them. However, early identification of BRON, although more challenging, is potentially important for patient care and prevention of disease. A Panorex or CT combined with clinical history, examination, and biopsy are adequate.

Recommendations for patients with established BRON include oral antimicrobial rinses, such as 0.12% chlorhexidine digluconate. Systemic antibiotic therapy may be prescribed if there is evidence of infection. Establishing and maintaining an “infection-free” oral environment is especially important for patients with multiple myeloma who are being considered for stem cell transplantation. Surgical treatment should be conservative or delayed. Removal of sharp bone edges is recommended to prevent trauma to adjacent soft tissues. Loose segments of bony sequestra should be removed without exposing uninvolved bone. Segmental jaw resection may be required for symptomatic patients with large segments of necrotic bone or pathologic fracture, and with this, the potential need for vascularized tissue. No published data have established that stopping bisphosphonates will promote resolution of BRON. Although some have advocated hyperbaric oxygen therapy, the efficacy of this approach has not been established.

There have been many case reports of breast cancer metastatic to the mandible; it must be considered in any woman with severe changes to this bone. Multiple myeloma is most frequently seen in vertebrae and secondarily in long bones. Its presence in the jaw is extremely rare, and when it is seen, it is usually in the mandibular angle and ramus.

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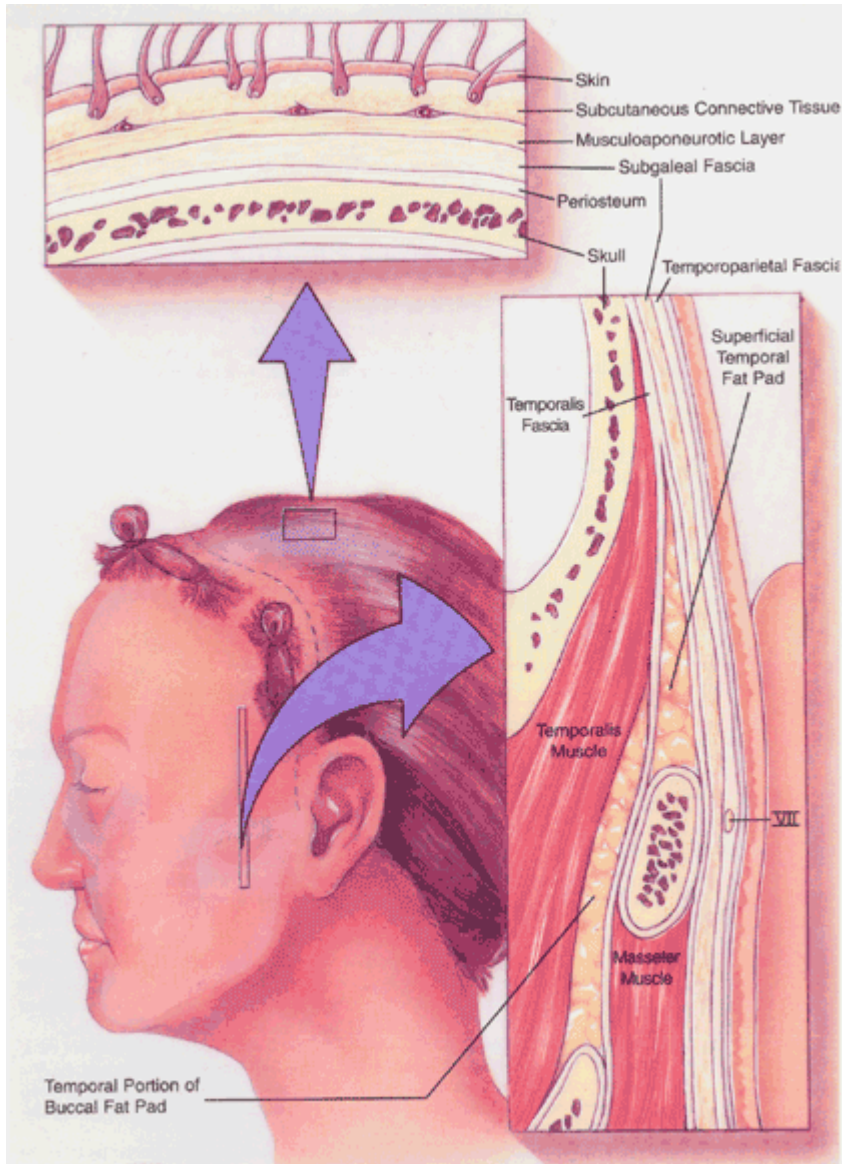
104. In the temporal region, the frontal branch of the facial nerve is located within which of the following layers?

- A) Subcutaneous tissue
- B) Superficial temporal fascia
- C) Superficial layer of the deep temporal fascia
- D) Superficial temporal fat pad
- E) Deep layer of the deep temporal fascia

The correct response is Option B.

As depicted in the image shown, the temporal or frontal branch of the facial nerve is found within the superficial temporal or temporoparietal fascia. In the temporal region, the facial nerve can be injured with a coronal approach. The layers from superficial to deep in this region include: (1) skin, (2) subcutaneous tissue, (3) superficial temporal fascia also known as the temporoparietal fascia, (4) superficial layer of the deep temporal fascia, (5) superficial temporal fat pad, (6) deep layer of the deep temporal fascia, (7) temporalis muscle.

When the coronal flap is raised, as soon as the yellow superficial temporal fat pad is seen beneath the superficial layer of the deep temporal fascia, the superficial layer of the deep temporal fascia must be incised and included with the coronal flap to protect the frontal branch, which is in the superficial temporal fascia (temporoparietal fascia), one layer superficial to this.



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

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105. A 62-year-old woman has biopsy-proven basal cell carcinoma of the left cheek. A 3-cm-diameter lesion is excised with a margin of normal tissue, leaving a circular defect measuring 4 cm in diameter. The surgical defect is reconstructed with a large cheek rotation flap measuring 25 cm², which is inset in layers using deep sutures and cutaneous sutures. Which of the following is the most appropriate CPT code for the repair?
- A) 12052 – Layered closure of wound of face 2.6 cm to 5.0 cm
 - B) 12056 – Layered closure of wound of face 20.1 cm to 30.0 cm
 - C) 14040 – Adjacent tissue transfer cheek defect 10 cm² or less
 - D) 14041 – Adjacent tissue transfer cheek defect 10.1 cm² to 20 cm²
 - E) 14300 – Adjacent tissue transfer more than 30 cm², any area

The correct response is Option E.

An important clarification in the use of the adjacent tissue transfer codes (14XXX) appears in CPT 2004. The term “defect” is now clearly defined: “For purposes of code selection, the term ‘defect’ includes the primary and secondary defects. The primary defect resulting from the excision and the secondary defect resulting from flap design to perform the reconstruction are measured together to determine the code.”

In the procedure described, the basal cell carcinoma was excised with a circular defect of 4 cm in diameter. A 4.0-cm diameter circular defect measures 13 cm² (area of the circle = πr^2). The secondary defect with flap elevation measures 25 cm². The code is selected by the total defect size, primary + secondary, which in this case equals 13 cm² + 25 cm² = 38 cm². Therefore, code 14300 is appropriate.

The adjacent tissue transfer codes include the lesion excision, so do not report lesion excision in addition to the flap code 14300.

Reporting this code as a simple layered closure would be inappropriate as a cheek rotation (adjacent tissue transfer) is necessary to close the defect.

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106. The optic nerve passes through which of the following bones of the orbit?

- A) Ethmoid
- B) Frontal
- C) Lacrimal
- D) Maxilla
- E) Sphenoid

The correct response is Option E.

Seven bones make up the orbit: the frontal bone, maxilla, zygoma, ethmoid, lacrimal, greater and lesser wings of the sphenoid, and the palatine bone. The frontal, maxilla, zygoma, and ethmoid bones constitute the strong outer rim of the orbit and protect the more delicate bones in the interior orbit. The lesser wing of the sphenoid forms the posterior aspect of the roof of the orbit and transmits the optic nerve and ophthalmic artery through the optic canal. The greater wing of the sphenoid contains the superior orbital fissure, which transmits the lacrimal nerve, frontal nerve, trochlear nerve, superior and inferior branches of the oculomotor nerve, the nasociliary nerve, and the abducens nerve.

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107. Which of the following findings does NOT support a clinical diagnosis of posterior deformational plagiocephaly?

- A) Anteriorly displaced ipsilateral ear
- B) Horizontal and level skull base
- C) Ipsilateral mastoid bulging
- D) Ipsilateral occipital flattening
- E) Parallelogram-shaped head

The correct response is Option C.

Posterior deformational plagiocephaly, resulting from a persistent head position during sleep, occurs frequently, is different from craniosynostosis, and is treated with either successful repositioning in sleep or cranial molding helmet therapy. Clinically, posterior deformational plagiocephaly presents with ipsilateral occipital head flattening, ipsilateral forehead displacement, ipsilateral ear forward displacement, and an overall parallelogram-shaped head when viewed from the top-down position. The skull base is horizontal, level, and unaffected in posterior deformational plagiocephaly.

Unilateral lambdoid craniosynostosis also presents with ipsilateral occipital flattening. Because the lambdoid suture is fused, compensatory growth, parallel to the fused suture, results in contralateral parietal bossing and ipsilateral mastoid bulging resulting in a canted skull base. This produces an overall trapezoid head shape when viewed from the top-down position.

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108. A 32-year-old man comes to the emergency department because he has had jaw pain and difficulty closing his mouth after he was punched in the face 30 minutes ago. A panoramic radiograph (Panorex) of the lower face is shown. Which of the following clinical findings is consistent with this fracture pattern?

- A) Anterior crossbite
- B) Fracture of tooth No. 31
- C) Maxillary occlusal cant
- D) Paresthesia of right upper lip
- E) Posterior open bite on the left

The correct response is Option E.

A right mandibular angle fracture is shown. Foreshortening of the height on the right from the fracture and powerful influence of the masseter will likely result in posterior open bite on the contralateral side.

Anterior crossbite occurs in maxillary hypoplasia and prognathism conditions and is not a result of the fracture in the patient described.

Tooth No. 32 is fractured in the Panorex shown. Standard numbering of the dentition of the maxillary dental arch from right to left is No. 1 to No. 16. The mandibular dental arch from left to right is No. 17 through No. 32.

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Maxillary occlusal cant occurs congenitally or with maxillary fracture.

Paresthesias of the upper lip are not associated with mandibular fracture through the inferior alveolar nerve. This fracture would be consistent with paresthesia of the right lower lip.

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109. A 30-year-old man is evaluated one week after the sudden onset of inability to move the left side of his face. He has a recent history of a viral upper respiratory illness but is otherwise healthy and takes no medications. Physical examination shows unilateral facial paralysis. Which of the following is the most appropriate next step in management?

- A) Electromyography
- B) MRI
- C) Nerve excitability test
- D) Schirmer test
- E) Observation

The correct response is Option E.

Following viral illness, Bell palsy is by far the most common form of unilateral facial paralysis. A period of three weeks should be allowed for observation before an extensive work up is initiated. Electromyography characterizes muscle activity but requires an interval of 14 to 21 days following paralysis before accurate results are possible. This is most useful in determining late prognosis in complete nerve paralysis. MRI is highly accurate in identifying mass lesions of other defects along neural pathways. In association with recent viral illness, this young, healthy individual is unlikely to demonstrate neoplasia relative to his risk for Bell palsy. Nerve excitability testing measures the membrane polarization, ion channel function, and paranodal/internodal condition of peripheral nerves. This technique is helpful in characterizing a wide variety of neuromuscular disorders, including multifocal motor neuropathy, conduction block in carpal tunnel syndrome, and diabetic neuropathy. Still, an observation period of three weeks is appropriate before testing is requested. Schirmer test uses paper strips inserted into the eye for several minutes to measure the production of tears. More than 10 mm of moisture on the filter paper in five minutes is a normal test result.

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110. A 20-year-old man is undergoing open reduction and internal fixation of a naso-orbital-ethmoid fracture. Reconstruction of the medial canthal attachments using a transnasal approach is required. Which of the following best describes the correct placement of drill holes with respect to the posterior lacrimal crest during transnasal wiring?

- A) Anteroinferior
- B) Anterosuperior
- C) Posteroinferior
- D) Posterosuperior

The correct response is Option D.

When treating a severe naso-orbital-ethmoid fracture and reconstructing the medial canthal attachments, overcorrection is indicated because telecanthus is a common postoperative sequela. When performing transnasal wiring of the medial canthus, a coronal incision is often required. Identification of the lacrimal apparatus and the anterior and posterior lacrimal crests is performed. The drill holes for the transnasal wires attached to the medial canthal ligaments are placed 1 to 2 mm above and behind the lacrimal fossa or posterior and superior to the posterior lacrimal crest. Clinical confirmation of slight overcorrection is warranted because relapse is common, and telecanthus is a likely postoperative occurrence despite attempts at overcorrection.

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111. A 56-year-old woman with type 1 diabetes mellitus has a six-month history of a slowly enlarging, painless mass in the mandible. She is edentulous. Physical examination shows a 4-cm mass on both the buccal and lingual portions of the alveolus with intact mucosa. A panoramic radiograph (Panorex) is shown. Biopsy confirms ameloblastoma. Which of the following is the most definitive management?
- A) Conservative segmental resection of the mandible, followed by nonvascularized iliac crest cortical bone grafting
 - B) Curettage and cancellous bone grafting
 - C) Segmental resection of the mandible with wide margins and cervical lymph node dissection, followed by vascularized free fibular bone grafting
 - D) Segmental resection of the mandible with wide margins and cervical lymph node dissection, followed by vascularized free fibular bone grafting and adjuvant radiation therapy
 - E) Segmental resection of the mandible with wide margins, followed by vascularized free fibular bone grafting

The correct response is Option E.

The history and radiographic findings in the patient described are most consistent with multicystic ameloblastoma. This odontogenic tumor commonly presents as a painless enlarging mass in the mandible or, less commonly, in the maxilla. The typical radiographic finding is a multilocular lucency with preservation of the cortex, though the cortex may be thinned. There are subcategories including peripheral (extraosseous) and central (intraosseous), which may be unicystic or multicystic, as in the radiograph shown. Extraosseous lesions may have no radiographic findings. This tumor goes beyond the boundaries seen on radiograph.

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Wide resection is necessary for multicystic lesions to prevent recurrence. The sizeable defect resulting from wide resection in the patient described would be best treated with vascularized bone graft, especially in light of her diabetes.

Curettage or conservative resection of this tumor would result in recurrence in 50% of patients. Conservative resection may have higher cure rates for unicystic lesions. The lack of mucosal ulceration or cortical bone erosion in a lesion this size point away from a malignancy; therefore, cervical lymph node dissection and adjuvant radiation therapy would not be indicated.

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112. A 5-year-old girl is brought to the emergency department immediately after falling from a swing set and hitting her chin on the cement pavement. Physical examination shows a laceration of the chin and an anterior open bite. Radiographs show bilateral subcondylar fractures with medial displacement of the right condylar neck and comminution of the left condylar head. A good dental relation is established while using anesthesia. Which of the following is the most appropriate management?
- A) Intermaxillary fixation for one to two weeks
 - B) Intermaxillary fixation for four to six weeks
 - C) Open reduction and internal fixation of the right and left fractures followed by early range of motion exercises
 - D) Open reduction and internal fixation of the right subcondylar fracture followed by intermaxillary fixation for one to two weeks
 - E) Open reduction and internal fixation of the right subcondylar fracture followed by intermaxillary fixation for four to six weeks

The correct response is Option A.

Open reduction of a fracture of the mandibular condyle is not commonly performed because the procedure may be complicated, and closed reduction is usually sufficient. However, open reduction of the condyle is indicated in the following four situations:

- Displacement into the middle cranial fossa
- Impossibility of obtaining adequate dental occlusion by closed reduction
- Lateral extracapsular displacement of the condyle
- Invasion by a foreign body (eg, a bullet from a gunshot wound)

Because the condylar head is not displaced in the patient described, open reduction and internal fixation of the right subcondylar fracture is not indicated. Intermaxillary fixation should be applied and remain in place for one to two weeks after the surgery. Subsequently, active and passive physical therapy of the mandible should be performed to work the mandible and remold the subcondylar union. This is especially important because of the comminuted intracapsular fracture on the contralateral side. Intermaxillary fixation applied for an extended period (greater than four weeks) may result in postoperative ankylosis. This is very difficult to treat. Releasing the intermaxillary fixation at two weeks may cause a delayed crossbite or anterior open bite. Both may be treated secondarily with a sagittal split osteotomy.

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113. The levator veli palatini muscle is innervated by which of the following nerves?

- A) Facial (VII)
- B) Hypoglossal (XII)
- C) Mandibular branch of the trigeminal (V)
- D) Maxillary branch of the trigeminal (V)
- E) Vagus (X)

The correct response is Option E.

The levator veli palatini (levator muscle) is a muscular sling in the posterior palate that is critical for palatal closure. Embryologically, the muscle arises from the fourth pharyngeal arch and, as a result, is innervated by the pharyngeal plexus, a derivative of the vagus (X) nerve. The two portions of the levator muscle arise from the eustachian tube and sphenoid bone while inserting into the other levator muscle in the midline of the soft palate. The function of the levator muscle is to elevate and posteriorly reposition the soft palate against the posterior nasal wall to assist in speech. This closes the velopharyngeal port while opening the eustachian tubes. The vagus also innervates several other muscles involved in normal speech development: the palatoglossus, the pharyngeal constrictors, the musculus uvulae, and the palatopharyngeus. The palatoglossus muscles form the anterior tonsillar pillars and lift the base of the tongue. The musculus uvulae originate from the palatine aponeurosis and the posterior nasal spine and insert into the uvula. With speech, these muscles will contract, causing a bulging of the soft palate and subsequent velopharyngeal closure. The uvula is lifted and bent backward.

The facial (VII) nerve innervates the muscles of facial animation, including the buccinator.

The hypoglossal (XII) nerve provides motor function to the tongue.

The trigeminal (V) nerve has three individual branches. The first branch, the ophthalmic division, is strictly a sensory branch. The second, or maxillary, division is also sensory. The third branch, the mandibular division, is the largest branch and is a mixed sensory and motor branch. Embryologically, the mandibular division arises from the first branchial (or mandibular) arch and provides motor function to the muscles arising from this arch. These muscles include the temporal, masseter, pterygoids, mylohyoid, tensor tympani, and the anterior belly of the digastric. It also innervates the tensor veli palatini. This muscle arises from the eustachian tube and medial pterygoid plate, wraps around the hamulus, and then inserts into the midline of the soft palate. During swallowing, these muscles tense the soft palate, opening the eustachian tube and allowing the tongue to move food posteriorly.

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114. A 6-month-old girl is brought to the office for evaluation of left anterior plagiocephaly. Physical examination shows posterior displacement of the ipsilateral supraorbital rim, deviation of the nasal root, and bossing of the right forehead. A three-dimensional CT is shown. Which of the following is the most appropriate management?
- A) Fronto-orbital advancement
 - B) Molding helmet therapy
 - C) Monobloc advancement
 - D) Repositioning of the child during sleep

The correct response is Option A.

The patient described has unilateral coronal synostosis. The most common presenting symptom is ipsilateral anterior forehead flattening, or plagiocephaly. This finding can be seen in patients with deformational plagiocephaly. Several anatomic features can be used to differentiate these two different etiologies of plagiocephaly.

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Synostotic plagiocephaly is caused by early fusion of the coronal suture on the affected side, or unicoronal synostosis. It is far less common than deformational plagiocephaly, which is thought to be caused by intrauterine deformational forces acting in the fetal skull.

In synostotic plagiocephaly, there is widening of the ipsilateral palpebral fissure, superior and posterior displacement of the supraorbital rim and eyebrow on the affected side, a higher ipsilateral ear, and deviation of the nasal root toward the affected side. The anterior fontanelle is displaced away from the affected side. The appropriate surgical procedure to correct synostotic plagiocephaly is a fronto-orbital advancement procedure. Resection of the left coronal suture will eliminate the abnormal suture but will not correct the other facial deformities.

In contrast, in deformational plagiocephaly, there is an ipsilateral narrowing of the palpebral fissure with a lower eyebrow, an inferiorly positioned ipsilateral ear, and a normal nasal root and anterior fontanelle. The cranial vault looks compressed from the forehead to the opposite occiput. Possible treatment options for deformational plagiocephaly include repositioning of the child during sleep and molding helmet therapy.

A monobloc advancement procedure involves repositioning of both the forehead and midface in a single operation and is not indicated to treat plagiocephaly.

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115. Patients with which of the following syndromes typically demonstrate hypernasality with speech?

- A) Crouzon
- B) Hemifacial microsomia
- C) Pfeiffer
- D) Saethre-Chotzen
- E) Velocardiofacial

The correct response is Option E.

Patients with velocardiofacial syndrome (VCF) typically demonstrate velopharyngeal insufficiency, which results in a hypernasal quality of speech. VCF is a result of a 22q11.2 deletion and has a wide spectrum of anomalies. The palate abnormality in VCF can vary from palatal weakness to a submucous or complete cleft of the palate. The characteristic facies are malar flattening, narrow palpebral fissures, small ears, vertical maxillary excess, and relative mandibular retrusion. The cardiovascular anomalies include ventricular septal defect, tetralogy of Fallot, and right-sided aortic arch. In planning surgery for velopharyngeal insufficiency, the most important finding is medial displacement of the carotid artery into the pharynx. Learning disabilities and psychiatric disorders are also seen in varying degrees in patients with VCF.

Crouzon, Pfeiffer, and Saethre-Chotzen syndromes all involve craniosynostosis, and patients do not have palatal issues resulting in velopharyngeal insufficiency. Hemifacial microsomia is the second-most common facial deformity after cleft lip and palate. There is a marked variability in presentation from mild to severe affecting one side of the face, including the ear, mandible, cranial nerve VII, and the soft tissue.

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116. A 4-year-old girl is brought to the office because her parents are concerned about an abnormality of her ear (shown). Which of the following is the most likely diagnosis?

- A) Cup ear
- B) Macrotia
- C) Microtia
- D) Prominent ear
- E) Stahl ear

The correct response is Option E.

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Stahl syndrome is a hereditary auricular deformity caused by an abnormal cartilaginous pleat, which extends from the crus antihelix to the edge of the helix, deforming the regular curvature of the ear. The prominent ear is typically comprised of (1) an increased conchoscaphal angle, (2) deepened conchal bowl, and (3) prominent lobule. Microtia refers to a spectrum of congenital external ear deformities ranging from a slightly smaller ear to almost complete absence.

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117. A patient with bilateral displaced subcondylar fractures is most likely to have which of the following occlusal patterns?

- A) Anterior crossbite
- B) Anterior open bite
- C) Posterior crossbite
- D) Posterior open bite

The correct response is Option B.

When a patient sustains a bilateral subcondylar fracture, there is the possibility of shortening of the posterior mandibular height. This shortening is secondary to telescoping of the condylar fragments and muscular pull of the boney components.

A premature occlusal contact of the posterior occlusion occurs, resulting in an anterior open bite.

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118. A 60-year-old man undergoes wide excision of a large, invasive, squamous cell carcinoma of the midline nasal skin. The excision includes the nasal bones and the proximal two thirds of the dorsal septum and medial upper lateral cartilages. All tip structures and nasal lining remain intact. A forehead flap is planned for repair of the nasal skin cover. Which of the following methods is most appropriate to reconstitute the nasal support layer for this repair?
- A) Cantilever cranial bone graft
 - B) Hinged septal flap
 - C) Hull graft of conchal cartilage
 - D) L-strut rib graft
 - E) Split free fibular flap

The correct response is Option A.

Support for the proximal dorsal aspect of the nose is best provided with cantilever cranial bone grafting, which secures a longitudinal piece of bone to the residual bony stump of the nasal radix or frontal bone with screws and sometimes a small plate. The graft may be allowed to extend as far as necessary, which in the scenario described may only be the proximal two thirds of the dorsum but in other cases may be all the way to the tip. The source of graft used for this purpose has been a matter of surgeon preference in the past (rib, iliac crest, cranium), but most agree that cranial bone harvest has several advantages, including longevity, painless donor site, and keeping donor and recipient sites in the same operative field.

A hinged septal flap is an L-shaped flap of septal cartilage/bone designed off the dorsal border of an already reduced septum, in order to reconstitute the height of the dorsal border of the nose in its distal two thirds, including support to the nasal tip. The shorter limb of the L should sit on the nasal spine. In the scenario described, the nasal tip support was intact. This flap will not properly reconstitute the radix.

The hull graft concept is a cartilage graft typically harvested from the auricular concha because of its already curved shape and commonly used to augment a previously over-resected dorsum or to add dorsal height for a saddle nose deformity. The use of this graft implies that there is some support already present and the main goal is contour filling.

The L-strut is a bone graft in the shape of a hockey stick that also relies on the need to restore nasal tip projection in addition to replacing the central dorsal framework. The proximal end rests on the nasal bones and the distal end on the nasal spine. Just like the hinged septal flap, it would create excessive bulk in the nasal tip when added to existing normal structures. It would certainly be appropriate if the distal septum and the alar cartilages were also absent.

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The free fibular flap, split or whole, is not appropriate for use in the scenario described because of the relatively short length requirement of the framework being replaced and the excellent vascularity of the recipient site, which obviates the need for a vascularized bone graft.

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119. A 55-year-old man with squamous cell carcinoma of the larynx has new fullness and increasing pain in the left side of the neck five days after salvage total laryngopharyngectomy and bilateral neck dissections. Internal Doppler monitoring shows an intact and viable tubed free flap, which was used in the reconstruction. He completed chemotherapy and radiation eight months ago. Which of the following is the most likely cause of the fullness?

- A) Chyle leak
- B) Hematoma
- C) Salivary leak
- D) Seroma

The correct response is Option C.

Salivary leaks usually occur in a delayed fashion hallmarked by fullness in the neck, erythema, increased white blood count, and sometimes fever. In addition, early signs of a leak can be seen in the patient's drains, with brown discoloration and turbid changes of the fluid output with multiple air bubbles. Later stages of the leak usually cause a wound breakdown and ultimately a true pharyngocutaneous fistula. This problem can cause (a) a delay in further postoperative treatment, eg, radiation therapy, (b) a delay in feeding the patient and create the need for total parenteral nutrition or a gastric feeding tube, and (c) an arterial blowout and fatality, especially when there is no muscle coverage over the carotid artery.

It is incumbent on all reconstructive surgeons to work with their extirpative colleagues to have a high suspicion for such a problem, especially in pharyngeal reconstruction. Early intervention, such as opening the wound (to prevent bathing of the carotid artery in saliva) and packing are the basic tenets of care. If, however, the carotid artery is exposed and in danger or postoperative radiation will be delayed beyond an oncologically safe time point, further reconstruction with a pedicled flap, usually a pectoralis major, is performed to potentially close the fistula but, more importantly, to cover the carotid artery. Many radiation oncologists will offer treatment even if there is a fistula as long as the major sources of danger have been overcome.

Hematomas and chyle leaks are usually apparent earlier than five days. A chyle leak becomes even more obvious by changes in the quantity and quality of the drainage after any initiation of feeding. Seromas can occur at any time, but in the scenario described, would be less likely and are usually seen later in the postoperative course. Although scenarios where a working internal Doppler and a dying flap could be proposed, they are very unlikely and the machine's primary importance is for monitoring buried flaps. Many times surgeons will design a "monitoring" paddle to be externalized, obviating the need for an internal Doppler.

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120. A 35-year-old man is brought to the emergency department following a motorcycle collision. Examination shows swelling and deformity of the mandible. Radiographs show a left subcondylar fracture with the proximal fragment displaced forward. Which of the following muscles is most likely involved in the displacement?

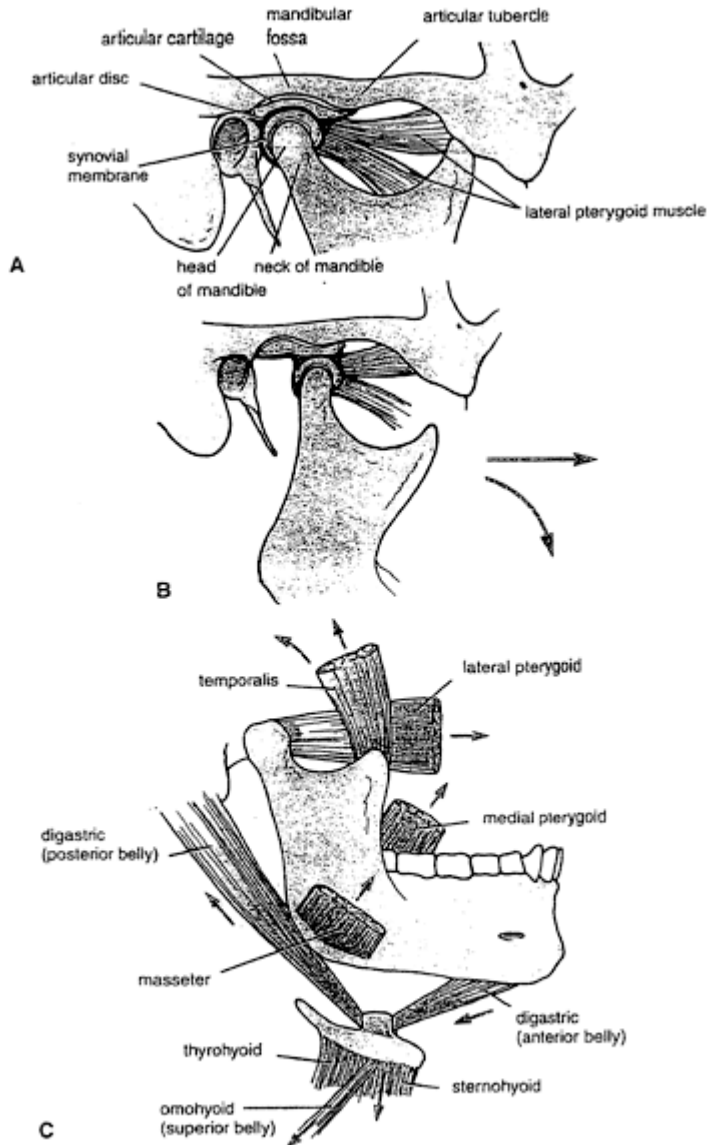
- A) Digastric
- B) Lateral pterygoid
- C) Masseter
- D) Medial pterygoid
- E) Temporalis

The correct response is Option B.

The origin of the lateral pterygoid muscle (shown below) has two components: one that attaches to the temporomandibular joint capsule and disc, and one that attaches to the fovea in the neck of the mandible. Proximally (anteriorly), the superior head attaches to the greater wing of the sphenoid bone, and the inferior head to the lateral surface of the lateral pterygoid plate. Therefore, in a subcondylar fracture, the lateral pterygoid muscle is in position to draw the proximal fragment forward.

The digastric muscle extends from the mastoid process of the temporal bone to the hyoid bone and to the anterior mandible. It depresses the mandible (inferior movement) or elevates the hyoid. The masseter, medial pterygoid, and temporalis elevate the mandible from the region of the ramus, angle, or coronoid process. The masseter originates in the zygomatic arch and inserts on the lateral surface of the ramus. The medial pterygoid originates on the lateral pterygoid plate and the tuberosity of the maxilla and attaches to the medial surface of the angle of the mandible. The temporalis muscle is fan-shaped and originates from the floor of the temporal fossa and inserts in the coronoid process and anterior border of the ramus.

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121. A 50-year-old woman is evaluated because of a two-year history of intermittent swelling and hardness of the right cheek, dry mouth, and dry eyes. Physical examination shows unilateral enlargement and firmness of the right parotid gland and xerostomia. Which of the following tests is most appropriate to confirm a diagnosis?
- A) Biopsy of a minor salivary gland of the lower lip
 - B) Fine-needle aspiration of the parotid gland
 - C) MRI of the head and neck
 - D) Serology for angiotensin-converting enzyme
 - E) Superficial parotidectomy

The correct response is Option A.

The patient described has Sjögren syndrome. This syndrome consists of xerostomia and keratoconjunctivitis sicca, resulting from lymphocyte-mediated destruction of salivary and lacrimal glands. Sjögren syndrome is caused by an autoimmune process that may be primary, or the syndrome may be a specific expression of another systemic autoimmune disease. In the secondary form, other organs may be involved, with conditions such as scleroderma, biliary cirrhosis, rhinitis, obstructive pulmonary disease, vasculitis, myositis, rheumatoid arthritis, and anemia. In the primary form, there is an increased risk of lymphoma (6% to 7%), but neither form has increased risk of salivary gland malignancies. Biopsy of the labial salivary gland remains the diagnostic method of choice for Sjögren syndrome, although sialochemical studies, scintigraphy, contrast sialography, and flow rate analysis have also been used. Serologic tests of value include rheumatoid factor, ANA, SS-A, and SS-B. Immunogenetic typing is also of value, including HLA-DR4, HLA-B8, and HLA-DR3.

Fine-needle aspiration is most valuable when it yields malignant cells in cases of salivary gland malignancy; however, it would fail to show a specific cellular pattern of focal periductal lymphocytic infiltrate and acinar degeneration as is typical in Sjögren syndrome. Furthermore, these findings are seen equally in biopsies of parotid, submandibular, and minor salivary gland tissue, with the latter being the least invasive method.

MRI and CT are of greater value in identifying neoplasms, not inflammatory conditions. The only imaging studies used in the diagnosis of Sjögren syndrome are scintigraphy, which shows major salivary gland dysfunction, and contrast sialography, which shows filling defects and punctate sialectasia. However, these findings are nonspecific.

An elevated level of angiotensin-converting enzyme is a positive serologic finding in sarcoidosis affecting the parotid gland and the eye (Heerfordt syndrome), not in Sjögren syndrome.

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Superficial parotidectomy would certainly render tissue for biopsy but is unnecessary when less invasive techniques are available. Furthermore, the treatment of Sjögren syndrome is medical, not surgical.

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122. A 45-year-old woman is evaluated because of an enlarging lump below her left ear that she first noticed five months ago. Physical examination shows asymmetrical weakness of the facial nerve. A 2-cm mass is noted just over the mandibular angle. The mass is firm and slightly tender on palpation. Which of the following is the most likely diagnosis?

- A) Adenoid cystic carcinoma
- B) Lymphoma
- C) Metastases to upper jugular lymph node
- D) Pleomorphic adenoma
- E) Warthin tumor

The correct response is Option A.

This malignancy is the second or third (depending on the study) most common in the parotid gland after mucoepidermoid carcinoma. Facial weakness combined with pain to touch of a mass anywhere in the parotid gland, which may extend well below the ear and into the buccal space, is a salivary malignancy until proven otherwise. Adenoid cystic carcinoma is well known for its neurotropism, and concomitant findings of weakness of the facial nerve and pain in the distribution on cranial nerve V are not uncommon. Adenoid cystic carcinoma is one of the most common malignancies of the submandibular and minor salivary glands. Facial nerve involvement is a significant poor prognostic indicator in any location.

Pleomorphic adenoma and Warthin tumor are benign lesions not associated with pain and weakness of the facial nerve. Likewise, lymphoma, a more rare tumor of the parotid gland, is not associated with facial nerve involvement. Lymphoma is usually associated with various collagen connective diseases, such as Sjögren syndrome. Metastatic jugular nodes, which become very large, can be locally destructive. These are usually fast growing and associated with a primary lesion with all of its related morbidity, eg, dysphagia and dysphonia.

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

123. A 42-year-old man comes to the office for consultation regarding the appearance of the right eye 10 months after sustaining a fracture of the right orbitozygomatic complex and multiple lacerations in a motor vehicle collision. He was unable to undergo treatment of the fractures because of other injuries. A photograph is shown. Which of the following is the most likely cause of the enophthalmos?

- A) Atrophy of globe fat
- B) Cicatrix of adnexal tissue
- C) Eyelid lacerations
- D) Increased orbital volume

The correct response is Option D.

Posttraumatic enophthalmos is primarily the result of increased bony orbital volume. Atrophy of globe fat and cicatrix of adnexal tissue may also contribute to enophthalmos, but minimally. Eyelid lacerations do not lead to changes in orbital volume. Clinical features of enophthalmos include narrowing of the palpebral fissure and deepening of the supratarsal fold. Enophthalmos is best assessed on submental view to evaluate globe projection. Posttraumatic enophthalmos results from displaced zygoma fractures, medial wall or floor blow-out fractures, and naso-orbito-ethmoidal fractures with disruption of the medial wall resulting in increased orbital volume.

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124. A 1-year-old boy is brought to the office for evaluation of cleft lip and palate and congenital pitting of the lower lip. Examination shows complete unilateral cleft lip and palate deformity and small sinuses in the lower lip. Which of the following is the most likely diagnosis?

- A) Pierre Robin sequence
- B) Stickler syndrome
- C) Van der Woude syndrome
- D) Velocardiofacial syndrome
- E) Waardenburg syndrome

The correct response is Option C.

The presentation of cleft lip/palate concomitant with lower lip pitting is pathognomonic for van der Woude syndrome. Present in 80% of patients with van der Woude syndrome, lower lip pits are associated with accessory salivary glands.

The Pierre Robin sequence consists of glossoptosis and micrognathia or retrognathia. Although cleft palate defects usually are associated with this sequence of findings, lower lip pitting is not.

Stickler syndrome is related to cleft lip/palate, although it is not associated with lower lip pits on physical examination.

Velocardiofacial syndrome is often associated with congenital heart disease and medial displacement of the carotid arteries but is unrelated to lower lip pits.

Although it has been reported to cause syndromic cleft lip/palate, Waardenburg syndrome is associated with a white forelock of hair and sensorineural hearing loss but not lower lip pitting.

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

125. A 3-year-old boy with hemifacial microsomia has the anomaly shown in the photograph. Which of the following is the most likely diagnosis?

- A) Goldenhar syndrome
- B) Stickler syndrome
- C) Treacher Collins syndrome
- D) Van der Woude syndrome
- E) Velocardiofacial syndrome

The correct response is Option A.

Goldenhar syndrome (oculoauriculovertebral spectrum) is a subset of hemifacial microsomia and, in addition to microsomia of the face, includes vertebral anomalies and/or epibulbar dermoids (as shown in the photograph).

Stickler syndrome, or hereditary arthro-ophthalmopathy, presents with flat facies, myopia, and spondyloepiphyseal dysplasia and is associated with clefts of the palate.

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Treacher Collins syndrome is also known as mandibulofacial dysostosis. Patients with Treacher Collins have bilateral Tessier No. 6, 7, and 8 clefts and present with mandibular deformities, lower eyelid colobomas, auricular deformities, and hypoplastic zygomas.

Patients with van der Woude syndrome present with lower lip pits, with or without cleft lip, with or without missing second premolars.

Velocardiofacial syndrome, or the 22q.11 deletion, is found in 8% to 10% of isolated clefts of the palate and is associated with heart anomalies, velopharyngeal dysfunction, and other conditions.

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126. A 43-year-old woman has periodic drainage of clear fluid from the nose three months after she sustained severe trauma to the face during a motor vehicle collision. She is concerned that the drainage may be cerebrospinal fluid. Which of the following tests of nasal secretions in this patient is most specific for leakage of cerebrospinal fluid?

- A) Determination of protein content
- B) Double halo sign
- C) Glucose dipstick
- D) Measurement of beta-2 transferrin level
- E) Measurement of potassium level

The correct response is Option D.

Measurement of the beta-2 transferrin level is the most specific test for cerebrospinal fluid (CSF) because this molecule marker is located only in the CSF and vitreous humor of the eye. Because the test is expensive, however, it must be ordered judiciously.

Other tests for CSF are less specific and reliable. Although decreased protein and potassium levels are associated with CSF leakage, these tests are not as specific for CSF. The test for double halo sign (fluid placement on a gauze pad or filter paper and observation for double halo formation) has a sensitivity of 78% but a false positive rate of 75%. Glucose dipstick testing was the first technique used to detect CSF. It is based on the principle that the glucose content of CSF exceeds that of mucus or blood.

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127. Which of the following cranial sutures is the first to undergo physiologic closure?

- A) Coronal
- B) Lambdoid
- C) Metopic
- D) Sagittal
- E) Squamosal

The correct response is Option C.

Physiologic or normal closure of the metopic suture occurs prior to any of the other sutures listed. Recent studies report a potentially even earlier closure of the metopic, at six months, than previously thought. Prior to this most recent study, the metopic was thought to close normally around 2 years of age. All of the other sutures begin closure much later with the closure progression being sagittal (22 years), coronal (24 years), lambdoid (26 years), and the squamosal (35 years).

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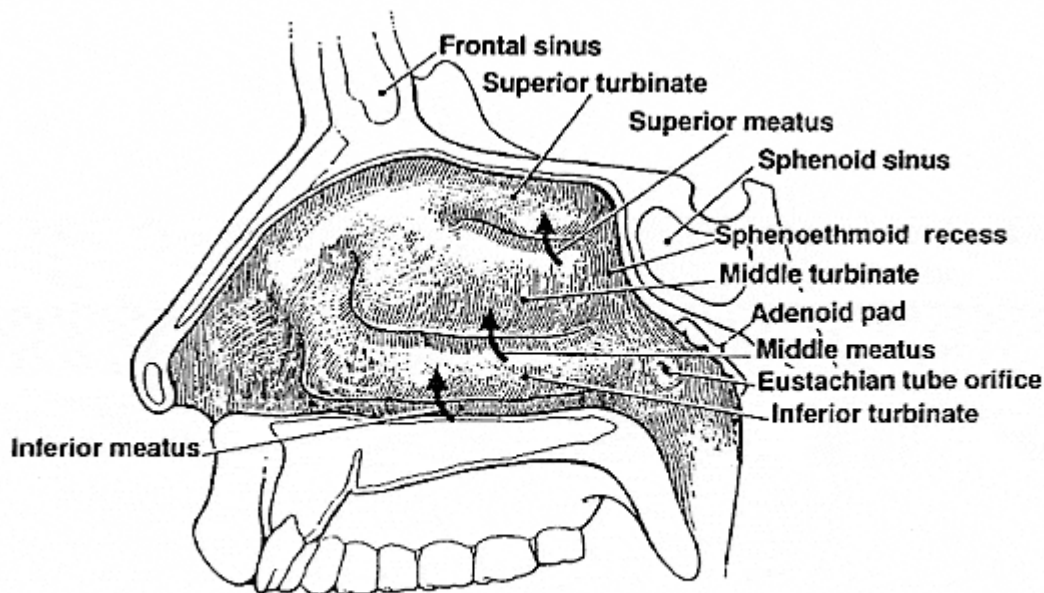
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128. The nasolacrimal duct drains into the nose at which of the following anatomic locations?

- A) Inferior concha
- B) Inferior meatus
- C) Middle concha
- D) Middle meatus
- E) Superior concha

The correct response is Option B.

The nasolacrimal duct, which maintains the drainage of the nasolacrimal system, drains into the inferior meatus just below the inferior concha (see diagram). Other structures also drain into the nose. The auditory tube opens into the nasopharynx just posterior to the inferior concha. The sphenoid sinus drains into the sphenoethmoid recess superior and posterior to the superior concha. The posterior ethmoid air cells drain into the superior meatus. The nasofrontal duct, maxillary sinus, and anterior ethmoid air cells all exit into the nose at the middle meatus.



Reproduced with permission from Pownell PH, Minoli JJ, Rohrich RJ. Diagnostic nasal endoscopy. *Plast Reconstr Surg.* 1997; 99: 1451-1458.

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129. A 3-year-old girl with mid face hypoplasia, proptosis, and malocclusion is brought to the office for consultation. Which of the following is the most likely occlusal relationship in this patient?

- A) Angle class I
- B) Angle class II, division 1
- C) Angle class II, division 2
- D) Angle class III

The correct response is Option D.

The patient described with Crouzon disease and a hypoplastic mid face has an Angle class III malocclusion. Angle class I is characterized by the alignment of the mesiobuccal cusp of the maxillary first molar with the mesiobuccal groove of the mandibular first molar. Angle class II is characterized by the alignment of the buccal groove of the lower first molar distal to the mesiobuccal cusp of the upper first molar. Angle class II division 1 is associated with flaring of the maxillary incisors and increased overjet. Angle class II division 2 is associated with lingually displaced maxillary teeth and excessive labial inclination of the maxillary central incisors. Angle class III is characterized by the alignment of the buccal groove of the lower first molar mesial (anterior) to the mesiobuccal cusp of the upper first molar.

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130. A 60-year-old man is referred to the office by his primary care physician for consultation regarding deformity of the nose caused by rhinophyma. Physical examination shows enlargement of the nasal tip, pitting and scarring of the skin, and several irregular, nodular growths. Which of the following conditions is the most likely cause of these findings?

- A) Acne vulgaris
- B) Facial dermatitis
- C) Hidradenitis suppurativa
- D) Rosacea

The correct response is Option D.

Rhinophyma is a condition involving the nose in which the nasal skin is erythematous with telangiectasias and is sometimes purple in color. In severe cases, the skin can have pits, fissures, and scarring. Sebum and bacteria can result in chronically infected skin and often an unpleasant odor. The nasal tip is preferentially enlarged, and as the nasal skin hypertrophies, the aesthetics units of the nose are distorted and obliterated. Patients may suffer from secondary nasal airway obstruction. Tumorous growths can develop late, and a severe aesthetic deformity can result. Rhinophyma is believed to be the fourth stage of evolving rosacea. It is the phase that develops after acne rosacea. Patients have a predisposition to increased facial vascularity that can result in pre-rosacea or frequent facial flushing, vascular rosacea with erythrosis and telangiectasias, followed by inflammatory rosacea or acne rosacea, and ultimately rhinophyma. Although facial flushing caused by vasoactive substances such as caffeine or alcohol may exacerbate the condition, a direct cause and effect relationship has not been found and rhinophyma is believed to be more likely a severe form of acne rosacea. Isotretinoin (Accutane) is used in the treatment of acne rosacea and is not a direct cause of rhinophyma. Similarly, ultraviolet radiation is not known to be a direct cause of rhinophyma.

Acne vulgaris is a common, chronic inflammation of the pilosebaceous units of the face and trunk.

Facial dermatitis usually occurs in the perioral region, mainly in young women. It results in discrete erythematous micropapules that can become confluent, forming inflammatory plaques. Although all conditions listed are disorders of sebaceous and apocrine glands, only rosacea is believed to lead to rhinophyma.

Hidradenitis suppurativa is a chronic, suppurative, cicatricial disease of apocrine gland-bearing skin of the axillae and urogenital region.

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131. A 4-year-old boy is brought to the office because of a lump near his right eyebrow. The lesion has been enlarging gradually since it was first noticed by his parents when he was 3 months of age. On physical examination, a 2-cm, firm, mobile mass is palpated at the lateral aspect of the right eyebrow. The lesion has distinct margins and there are no other related symptoms. Which of the following is the most appropriate initial step in management?
- A) Angiography
 - B) CT
 - C) Needle aspiration
 - D) Surgical excision
 - E) Observation only

The correct response is Option D.

The most likely diagnosis in the patient described is a dermoid cyst of the orbital region. Most orbital dermoids manifest as solitary masses with distinct palpable margins and without intracranial extension. These lesions are present in the lateral aspect of the upper orbit and usually do not have any related symptomatology. As a result, these patients do not require preoperative evaluation to exclude the possibility of intracranial involvement. Simple excision of the cyst is appropriate at the time of diagnosis.

Rarely, a dermoid cyst may present with indistinct margins. During palpation, the lesion may appear to decrease in size and proptosis may occur. These rare patients may have extension of the dermoid cyst through the lateral orbital wall. In these cases, further evaluation with CT should occur to determine the extent of intraorbital involvement and determine whether more complex surgery is needed to reconstruct the defect. Failure to do this may result in an incomplete resection of the dermoid, possibly leading to inflammation, abscess, or sinus formation.

Observation is not recommended for management of dermoid cysts. These cysts should be appropriately managed with either surgical excision or further preoperative evaluation at the time of diagnosis. Needle aspiration has not been shown to be effective for preoperative evaluation of a dermoid cyst, nor has angiography. Dermoid cysts can occur bilaterally.

In contrast, midline dermoid cysts are much more likely to demonstrate intracranial involvement, and, therefore, immediate surgical resection is not recommended. A CT of the head, including the base of the skull, is needed to rule out intracranial extension prior to removal of the lesion and to rule out other types of lesions such as glioma, encephalocele, angiofibroma, and others. Splaying of the nasal bones on CT can be seen without intracranial extension. However, patients

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with intracranial involvement will also have defects in the foramen cecum and crista galli and significant dural attachment. These findings indicate the need for craniotomy for adequate exposure and resection of the lesion.

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132. A 27-year-old man is brought to the emergency department two hours after sustaining a laceration of the left ear in a fight. Physical examination shows a 3-cm laceration that extends from the helix to the conchal bowl. A ring block is performed. The wound is cleaned and suturing is begun. The patient grimaces and withdraws during suturing of the section of the laceration that extends to the concha. The most likely cause is inadequate anesthesia of which of the following nerves?
- A) Auricular branch of the vagus (X)
 - B) Auriculotemporal
 - C) Great auricular
 - D) Lesser auricular
 - E) Lesser occipital

The correct response is Option A.

The majority of the external ear can be readily anesthetized by placing a ring of local anesthetic around the ear. The exception is the concha and the posterior auditory canal. These structures are innervated by the Arnold nerve, the auricular branch of the vagus nerve (X), which travels along the ear canal. This nerve, and therefore the concha and the posterior auditory canal, is not successfully anesthetized with a ring block of the ear. If anesthesia is needed in this area, local infiltration is required.

The sensory innervation of the external ear is as follows:

Name	Origin	Anatomic Landmark	Distribution
Great auricular	Cervical plexus (C2, C3)	Ascends from Erb Point, 6.5 cm below the level of the tragus on the midpoint of the sternocleidomastoid muscle belly Often travels slightly posterior to the external jugular vein	Lower half of the anterior and posterior surfaces of the ear
Auriculotemporal	Mandibular branch (V3) of the trigeminal nerve	Ascends with superficial temporal vessels	Tragus and the anterior superior portions of the auricle and external auditory canal
Lesser occipital	Cervical plexus (C2, C3)	Emerges higher than the great auricular nerve and travels along the posterior edge of the sternocleidomastoid	Posterior superior aspect
Auricular branch of the vagus (Arnold nerve)	Vagus nerve (X)	Travels along the ear canal	Concha and the posterior auditory canal

There is no “lesser auricular nerve”; hence, the name “great auricular” is used rather than “greater auricular.”

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133. Syndromic cleft palate is most commonly found in patients with which of the following syndromes?

- A) Apert
- B) Saethre-Chotzen
- C) Stickler
- D) Van der Woude

The correct response is Option C.

Stickler syndrome accounts for 25% of syndromic cleft palate cases. As the most common form of syndromic cleft palate, this syndrome is also associated with ocular and auditory defects. Apert syndrome is an autosomal dominant form of syndromic craniosynostosis. Although this syndrome is defined by uni- or bicoronal craniosynostosis and acrosyndactyly, palatal clefting is not recognized as a syndromic component. Saethre-Chotzen syndrome is an autosomal acrocephalosyndactyly characterized by coronal craniosynostosis, low hairline, proptosis, antimongoloid slanting of palpebral fissures, and nasal deviation. Cleft palate defects are not associated with this syndrome. Van der Woude syndrome, associated with lower lip pitting and cleft palate, accounts for 1% of syndromic cleft defects.

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134. A 64-year-old man has a two-year history of enlargement of the preauricular region. Physical examination shows 3-cm masses located over the parotid gland bilaterally. The masses are not tender to palpation and there is no facial nerve deficit. CT confirms bilateral lesions in the parotid glands. Which of the following is the most likely diagnosis?

- A) Adenocarcinoma
- B) Adenocystic carcinoma
- C) Mucoepidermoid carcinoma
- D) Pleomorphic adenoma
- E) Warthin tumor

The correct response is Option E.

Salivary gland tumors frequently occur within the parotid gland, and the vast majority (75%) of parotid tumors are benign.

Warthin tumor is a common neoplasm of the parotid gland, accounting for 10% of all parotid tumors. These tumors are usually painless and tend to grow very slowly, frequently over several years. They are more common in older men and are frequently bilateral. Warthin tumors are usually treated with superficial parotidectomy with only minimal margins needed. Recurrence is common.

Adenocarcinomas comprise 10% of malignant parotid gland tumors. These tumors vary according to grade and histologic appearance. They most frequently occur after the fifth decade of life and commonly involve the minor salivary glands. In the parotid gland, they manifest as fixed masses characterized by occasional pain or facial palsy.

Adenocystic carcinoma, or cylindroma, is infrequent in the parotid gland (7%) but quite common in the minor salivary glands (35%). It is a slowly growing mass, often associated with pain and facial palsy. These tumors are aggressive, with one-third to one-half of affected patients developing metastatic disease.

Mucoepidermoid carcinoma is the most common malignancy of the parotid gland. It is rarely bilateral. It may be low or high grade. Low-grade tumors are slow-growing and indolent; high-grade tumors are much more aggressive. The recurrence rate of high-grade tumors is increased, and the facial nerve is frequently affected.

Pleomorphic adenomas, or benign mixed tumors, are the most common salivary gland neoplasms, comprising about 60% of all salivary gland tumors and 80% of benign tumors.

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They occur as painless salivary masses that are firm and well circumscribed. Facial weakness is not found. Bilateral tumors are rare. This tumor is treated by resection and in rare cases (recurrence) can transform into malignant mixed tumor.

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135. An 8-year-old boy is brought to the office because of new-onset facial asymmetry that has slowly progressed over the past six months. The patient is otherwise healthy and has no other abnormalities. A current photograph is shown. Which of the following is the most likely diagnosis?

- A) Binder syndrome
- B) Craniofacial fibrous dysplasia
- C) Oculoauriculovertebral spectrum
- D) Romberg disease
- E) Treacher Collins syndrome

The correct response is Option D.

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Romberg disease (progressive hemifacial atrophy, linear scleroderma, Parry-Romberg) is a progressive atrophy of one side of the face. Patients with Romberg disease often have a pigmented streak on the forehead, progressing to the “coupe de sabre” or facial depression. There is progressive atrophy of the skin, subcutaneous tissue, and bone. Many believe that it is a subset of localized or linear scleroderma.

Patients with Binder syndrome, or nasomaxillary or premaxillary hypoplasia, have low-set and flat nasal tip, a short, retracted columella, Class III occlusion, and a columella and upper lip that is “drawn into” the floor of the nostrils.

Fibrous dysplasia is a bony dysplasia, presenting as localized bony deformity (ground glass appearance on CT scan). Fibrous dysplasia may be limited to a localized area (monostotic) or may be generalized, affecting many sites (polyostotic), and is called McCune-Albright syndrome.

Goldenhar syndrome (oculoauriculovertebral spectrum) is a subset of hemifacial microsomia and, in addition to microsomia of the face, includes vertebral anomalies and/or epibulbar dermoids.

Treacher Collins syndrome is also known as mandibulofacial dysostosis. Patients with Treacher Collins have bilateral Tessier No. 6, 7, and 8 clefts and present with mandibular deformities, lower eyelid colobomas, auricular deformities, and hypoplastic zygomas.

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136. The parents of the 3-month-old male infant shown come to the office for consultation. The parents have another child, who also has a cleft lip and palate (CL/P). Neither parent has CL/P. Which of the following best represents the likelihood that their third child will have CL/P?

- A) 2%
- B) 4%
- C) 9%
- D) 17%
- E) 50%

The correct response is Option C.

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The risk of having a child with a cleft lip and palate (CL/P) is dependent on multiple factors. Familial cases have a risk that is dependent on family history, parental involvement, and other sibling involvement. Risks can be categorized as follows:

Normal parents, one child with a CL/P: the risk for the next child is 4% (as in the scenario described).

Normal parents, two children with a CL/P: the risk for the next child is 9%.

Affected parent with a CL/P, no affected children: the risk for the next child is 4%.

Affected parent with a CL/P, one child with a CL/P: the risk for the next child is 17%.

Affected parent with a CL/P and lip pits who has van der Woude syndrome: the risk for an affected child would be 50%, as this is an autosomal dominant condition.

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137. Microtia is an auricular deformity most commonly found in patients with which of the following syndromes?

- A) Apert
- B) Binder
- C) Crouzon
- D) Pfeiffer
- E) Treacher Collins

The correct response is Option E.

Treacher Collins syndrome is characterized by bilateral abnormalities of structures within the first and second branchial arches. Treacher Collins syndrome has anomalies in structures derived from the first branchial arch, groove, and pouch. It is considered to be autosomal dominant in its inheritance with variable expressivity. Features include a convex facial profile with a retrusive lower jaw and chin, down-slant of the palpebral fissures, lower eyelid colobomas, partial absence of eyelid cilia, absent or malformed external ears, hypoplasia of the malar bones, and variable cleft palate.

Binder syndrome is characterized by nasomaxillary hypoplasia. Apert, Crouzon, and Pfeiffer syndromes are all craniosynostotic syndromes that result in mid-facial hypoplasia and a concave facial profile of varying degrees. These syndromes do not typically present with microtia.

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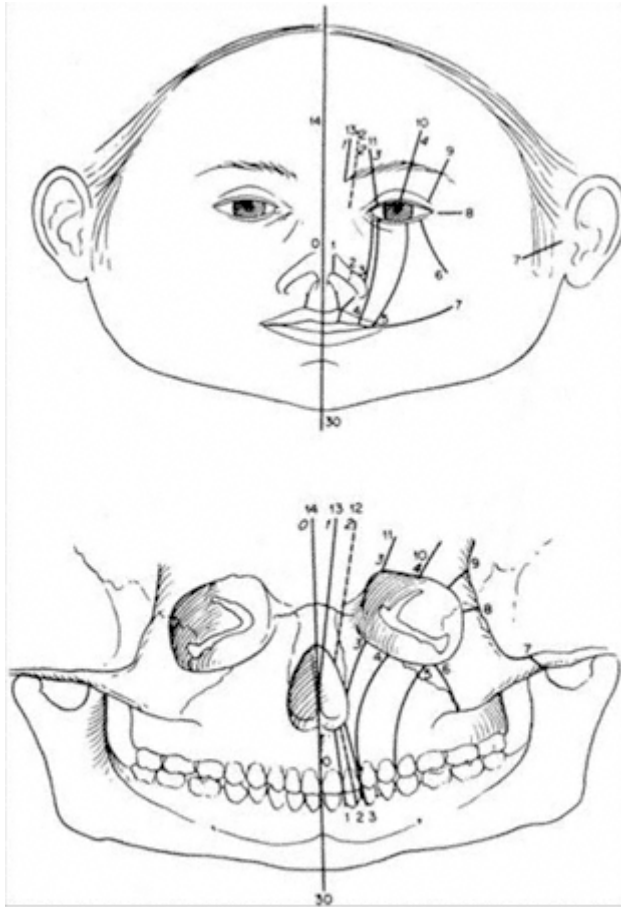
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138. A 3-year-old boy is brought to the office by his parents for consultation for macrostomia caused by a lateral facial cleft. This patient is most likely to have a bony defect that traverses which of the following locations?

- A) Mandibular bicuspid
- B) Mandibular lateral incisor
- C) Maxillary canine
- D) Maxillary lateral incisor
- E) Maxillary second molar

The correct response is Option E.

The patient described has a Tessier No. 7 facial cleft, which involves the soft tissue of the oral commissure, sideburns, and external ear (shown below). The bony involvement generally traverses the zygomatic arch and maxillary second molar.



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Tessier P, Anatomical classification of facial, cranio-facial and
latero-facial clefts, Copyright 1976, with permission from Elsevier.

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139. A 64-year-old man is evaluated for reconstruction of a defect of the lower eyelid following resection of a 1.4-cm nodular basal cell carcinoma. Examination shows an 80% full-thickness defect of the lateral lower eyelid. Which of the following is the most appropriate method of reconstruction?

- A) Cantholysis, lateral canthotomy, and primary closure
- B) Cheek advancement flap with composite graft for lining
- C) Composite graft from the ear
- D) Forehead flap with septal cartilage grafting
- E) Hughes tarsoconjunctival flap with skin grafting

The correct response is Option B.

This major (greater than 75%) defect of the lower eyelid has been categorized as a zone II defect by Spinelli and Jelks. The most appropriate method of reconstruction is the cheek advancement flap with a nasal septal cartilage and lining graft for internal lining. The cheek advancement flap can be elevated widely and rotated without tension to provide anterior coverage of the defect, while the composite graft is used for lining and support of the lower eyelid. Cantholysis, lateral canthotomy, and primary closure are most useful for defects that are less than 50%. Similarly, the Hughes tarsoconjunctival flap is best used in defects that are less than 50%, as larger flaps would result in significant deformity of the upper eyelid. Composite grafts from the ear are rarely used for lower eyelid reconstruction because the tissues are usually thicker than the lower eyelid and may be associated with partial or complete graft loss. Forehead flaps can be used for medial eyelid or canthal defects but are tertiary options in reconstruction of lateral lower eyelid defects.

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

140. A 40-year-old man is being evaluated because of lower dental show and occasional drooling since undergoing bilateral sagittal split mandibular osteotomy and genioplasty four years ago. Lip sensation is normal. A clinical photograph is shown. Which of the following is the most likely cause of these findings?
- A) Excessive downward repositioning of the genioplasty segment
 - B) Failure to reapproximate the mentalis muscle to the mandible
 - C) Injury to the buccal branch of the facial nerve
 - D) Injury to the inferior alveolar nerve
 - E) Injury to the marginal mandibular branch of the facial nerve

The correct response is Option B.

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The patient shown has ptosis of the lower lip, caused by failure to reapproximate the mentalis muscle to the mandible during genioplasty. Ptosis of the soft tissues of the chin, including the lip, and excessive lower dental show are the result. If the depth of the labial sulcus is sufficiently reduced, drooling may occur.

Provided the mentalis muscle is repaired, and no nerve injury occurs, downward repositioning of the genioplasty segment should not produce excessive lower dental show.

The mentalis muscle is innervated by the marginal mandibular branch of the facial nerve, which could sustain a neurapraxic injury during either bilateral sagittal split osteotomy or genioplasty. However, that injury would be unlikely to persist for four years.

The buccal branch of the facial nerve innervates the buccinator and orbicularis oris muscles. Loss of orbicularis oris function could lead to lip ptosis, but injury to the buccal branch of the facial nerve would be very unlikely in the situation described.

Injury to the inferior alveolar nerve can occur with either bilateral sagittal split osteotomy or genioplasty. The resulting paresthesia or anesthesia of the lower lip may lead to drooling but would not cause dysfunction in the mentalis muscle or lip ptosis.

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141. The mylohyoid muscle is innervated via which of the following nerves?

- A) Accessory
- B) Glossopharyngeal
- C) Hypoglossal
- D) Mandibular
- E) Maxillary

The correct response is Option D.

The mylohyoid muscle is a flat, triangular muscle that with its opposite forms the muscular floor of the oral cavity. It originates from the oblique line of the mandible from the mandibular symphysis to the last molar tooth and inserts along the body of the hyoid bone in median fibrous raphe from the mandibular symphysis to the hyoid bone. The mylohyoid muscle elevates the floor of the mouth during swallowing and elevates the hyoid bone, which pushes the tongue upward during swallowing or tongue protrusion. This muscle also lowers the mandible and assists in opening the mouth, mastication, sucking, and blowing.

The primary motor innervation to the mylohyoid muscle is the mylohyoid branch of the inferior alveolar nerve of cranial nerve V (mandibular nerve). This nerve is a branch of the mandibular or third division of the trigeminal nerve. The two major nerves of the third division of the trigeminal nerve are the lingual nerve and the inferior alveolar nerve. The maxillary nerve is a branch of the second division of the trigeminal nerve and provides sensation to the ipsilateral face, side of the nose, lip, and upper teeth. The hypoglossal nerve (cranial nerve XII) provides motor innervation to the tongue. This nerve supplies all intrinsic muscles and all but one extrinsic muscle of the tongue. The exception is the palatoglossus muscle, which is supplied by cranial nerve X. The spinal accessory nerve, which is cranial nerve XI, supplies motor innervation to the sternocleidomastoid and trapezius muscles. The glossopharyngeal nerve (cranial nerve IX) is a complex nerve that supplies efferent nerve innervation to the parotid gland and carries sensations to the carotid body and carotid sinus. This nerve also provides general sensation to the posterior one third of the tongue, the skin of the external ear, and the internal surface of the tympanic membrane and supplies taste for the posterior one third of the tongue.

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142. A 9-month-old female infant is scheduled to undergo repair of a cleft palate. Repair of which of the following intravelar muscles is necessary to achieve adequate postoperative velopharyngeal competence in this patient?

- A) Levator veli palatini
- B) Musculi uvula
- C) Palatoglossus
- D) Superior constrictor
- E) Tensor veli palatini

The correct response is Option A.

When repairing clefts of the palate, performing an intravelar veloplasty or reconstructing the levator veli palatini muscle within the soft palate (velum) is very important for adequate postoperative velopharyngeal competence. In the normal palate, the levator veli palatini muscle rests horizontally (coronally) within the middle third of the velum (soft palate) and functions as the motor of the velum, pulling the soft palate posteriorly and superiorly, allowing for apposition of the free edge of the velum against the posterior pharyngeal wall (velopharyngeal competence). In the cleft palate, the levator veli palatini muscle is “clefted” and courses sagittally, in an anterior-posterior direction, attached abnormally to the posterior edge of the hard palate, the tensor aponeurosis, and the superior constrictor.

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

The palatoglossus muscle is the muscle found in the anterior tonsillar pillar, arising from the soft palate and inserting into the side and dorsum of the tongues. The palatoglossus muscle elevates the posterior part of the tongue toward the palate and depresses the soft palate toward the dorsum of the tongue.

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

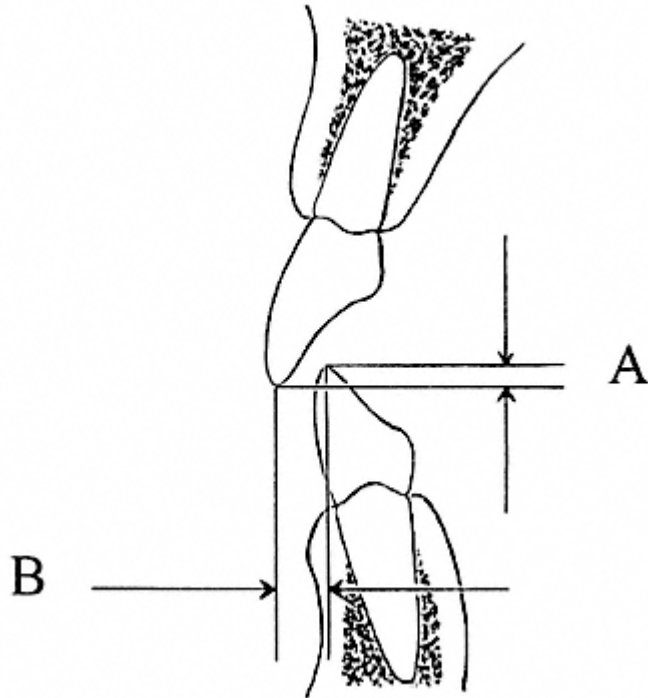
The tensor veli palatini muscle arises from the skull base, courses inferiorly and medially around the hook of the hamulus and into the palate as the tensor aponeurosis, joining the velum (soft palate) to the hard palate.

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143. Which of the following best describes the occlusal relationship indicated by the arrow labeled B in the diagram shown?

- A) Crossbite
- B) Open bite
- C) Overbite
- D) Overjet

The correct response is Option D.

Overjet is the horizontal relationship between the maxillary and mandibular incisors shown in the diagram.

Crossbite describes a reverse relationship between the maxillary and mandibular teeth, either sagittally or buccolingually.

Open bite refers to the lack of vertical overlap by the maxillary teeth over the mandibular teeth.

Overbite is the vertical overlap between the maxillary and mandibular incisors.

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144. A 38-year-old woman is referred to the office by an orthodontist for orthognathic surgery to correct facial disharmony. The following angles are noted on cephalometric analysis:

SNA	80 degrees (N 81.2)
SNB	76 degrees (N 77.3)
SN-Pogonion	70 degrees (N 80)

Which of the following is the most appropriate surgical procedure?

- A) Advancement genioplasty
- B) Le Fort I advancement and advancement genioplasty
- C) Le Fort I advancement and setback genioplasty
- D) Sagittal split mandibular advancement
- E) Sagittal split mandibular setback

The correct response is Option A.

The cephalogram is a standardized radiograph used for analyzing facial disharmony and asymmetry. Labeled landmarks help establish the relationship of the maxilla, mandible, and skull base to other facial structures. The sella (S) point marks the center of the hypophyseal fossa. The nasion (N) is the junction of the nasal and frontal bones at the most posterior point of the curve of the nose. The A point marks the innermost curvature from the maxillary anterior nasal spine to the alveolar process. The angle created by these points (sella-nasion angle, SNA) establishes the maxillary position in relation to the skull base. The B point is located at the innermost curvature from the chin to the alveolar process of the mandible. The SNA angle similarly establishes the mandibular relationship to the skull base.

The prominence of the chin is often an important consideration in orthognathic surgery. The pogonion (Pg) is the most anterior chin point. The sella-nasion-pogonion (SNPg) angle is representative of the degree of chin prominence relative to the SNB (mandible position).

Normal angle values are given in the scenario. The patient described has a relatively retrusive pogonion and a normally positioned mandible/maxilla. This would represent a class I dental relation. The pogonion is posteriorly displaced in relation to both the mandible and the maxilla.

Therefore, to establish better facial relationships, the chin prominence should be advanced via a sliding genioplasty. The mandible does not need to move.

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145. The 4-month-old boy shown has congenital midline neck and mandibular anomalies, including a mild clefting of the mandible and atrophic skin in the central anterior neck. These anomalies are a result of the incomplete fusion of which of the following paired branchial arches?

- A) First
- B) Second
- C) Third
- D) Fourth
- E) Fifth

The correct response is Option B.

Congenital midline cervical clefts are a result of a failure of fusion of the paired second branchial arches in the midline during embryogenesis. It is a rare anomaly of the anterior neck diagnosed on the basis of the clinical presentation at birth. The most commonly reported features are a cleft of reddened, thinned tissue in the midline, a protuberance of skin superiorly, a blind epithelium-lined sinus tract caudally, and a fibrous subcutaneous cord. The cord may limit neck movement. There is some degree of retrognathia and variable degrees of clefting of the lip and mandible. Other anomalies that have been found in association with midline cervical cleft are thyroglossal duct cysts and ectopic bronchogenic cysts.

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Branchial arches begin to develop in the fourth week as neural crest cells migrate into the head and neck region. By the end of the fourth week, four pairs of branchial arches are visible externally. The fifth and sixth arches are small and not yet visible on the surface of the embryo. The branchial arches are separated by prominent clefts called branchial grooves.

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146. The sural nerve is best localized at which of the following locations?

- A) 1 cm anterior to the fibular head
- B) 1 cm posterior to the lateral malleolus
- C) 1 cm anterior to the lateral malleolus
- D) 1 cm posterior to the medial malleolus
- E) 1 cm anterior to the medial malleolus

The correct response is Option B.

According to Sunderland and Ray, desirable features of cutaneous nerve grafts include (1) large fascicles with little interfascicular connective tissue, (2) separate parallel fascicles, (3) overall large diameter, (4) large-caliber axons, (5) easy accessibility, with little anatomic variation, (6) long unbranched segments, and (7) minimal sensory deficit. Because the sural nerve meets most of these criteria, it has long been the preferred donor for nerve reconstruction. This purely sensory nerve is comprised of contributions from the medial sural cutaneous nerve (branch of the tibial nerve) and the lateral sural cutaneous nerve (branch of the peroneal nerve). It has a mean diameter of 3.61 mm, which is ideal for group fascicular reconstruction; is easily harvested; and leaves minimal residual sensory deficit (the lateral foot and ankle). Up to 30 cm of nerve graft can be obtained. The distal portion of the nerve is consistently found between 1 and 1.5 cm posterior to the lateral malleolus.

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147. A 70-year-old man is scheduled to undergo wedge resection of a lesion on the lower lip. Physical examination of the lower lip shows an ulcerated, well-circumscribed 5-mm lesion 1 cm medial to the right oral commissure. Which of the following foramina is the most appropriate site for instillation of anesthetic for the procedure?

- A) Inferior alveolar
- B) Infraorbital
- C) Mental
- D) Nasopalatine
- E) Sphenopalatine

The correct response is Option C.

The most appropriate area for block infiltration is an intraoral blockade of the mental nerve. The inferior alveolar nerve travels through the mandible entering at the medial ramal border and exits at the mental nerve at the mental foramen at the level of the first and second bicuspid teeth, 1 cm below the alveolar ridge.

Blockage of the inferior alveolar nerve foramen requires injection at its entry in the posterior mandible, or within the bony canal—an area not easily accessible.

Numbness of the upper lip and nasal sidewall can be accomplished with blockade of the infraorbital nerve.

Nasal palatine anesthetic produces numbness of the external nose.

Sphenopalatine nerve blockade produces anesthesia in the internal nose and palate.

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148. A 76-year-old man is evaluated for reconstruction of a defect of the left lateral lower lip and left commissure following resection with clear margins of a 2.5-cm lesion. Examination shows a full-thickness defect of the left lateral lower lip and left commissure. Which of the following flaps is the most appropriate method of reconstruction?

- A) Estlander
- B) Gillies
- C) Karapandzic
- D) Radial forearm, with palmaris longus sling
- E) Webster-Bernard

The correct response is Option A.

This scenario involves a significant resection of the lower lateral lip including the lateral commissure. Thus, reconstruction of both the lower lip and the commissure is required. The most appropriate flap for reconstruction of this defect is the Estlander flap. The Estlander flap is an upper lip-switch flap that is used to reconstruct defects involving the commissure. Rotation of the upper lip to the lower lip provides additional tissues for reconstruction of the lower lip defect and repairs the commissure. However, rotation of the upper lip in a defect that has no commissure results in a rounded commissure and often requires additional surgery.

The Karapandzic and Gillies flaps are advancement flaps of the remaining lower lip and are most useful for central defects of the lower lip. The main difference between these options is that the branches of the facial nerve are dissected and preserved in the Karapandzic flap thereby preserving facial nerve function. The Webster-Bernard flap advances the cheek skin by removing a Burrow triangle bilaterally. Similar to the Karapandzic and Gillies flap, this option is most useful for central lip defects and does not reconstruct defects of the commissure. Finally, the radial forearm flap with palmaris longus sling is most useful for total lower lip defects.

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149. Which of the following is the most important clinical measurement when planning vertical maxillary changes?

- A) Gingival exposure with smiling
- B) Upper incisor exposure with the lips in repose
- C) Upper incisor exposure with smiling
- D) Vermilion exposure with the lips in repose

The correct response is Option B.

Upper incisor exposure with the lips relaxed is the key measurement when planning surgical vertical changes of the maxilla, aiming for a range of 3 to 5 mm. Males typically show less than females. Aging also results in a progressive decrease in upper incisor display. Normally, 100% of maxillary incisor is displayed on smile, but this relationship can be quite variable. Using relationships during smiling to determine surgical movements may result in unfavorable lip-tooth aesthetics at rest.

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150. The muscles of mastication are derived from which of the following branchial arches?

- A) First
- B) Second
- C) Third
- D) Fourth
- E) Fifth

The correct response is Option A.

The muscles of mastication (temporalis, masseter, and medial and lateral pterygoids), the mylohyoid, and anterior belly of the digastric, and the tensors veli palatini and tympani are derived from the first branchial arch.

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Arch	Nerve	Muscles	Skeletal Structures	Ligaments
First- Mandibular	Trigeminal, V2, V3	Muscles of mastication Mylohyoid and anterior belly of digastric Tensor tympani Tensor veli palatini	Malleus Incus	Anterior ligament of malleus Sphenomandibular ligament
Second- Hyoid	Facial (VII)	Muscles of facial expression Stapedius Stylohyoid Posterior belly of digastric	Stapes Styloid process Lesser cornu of hyoid Upper part of body of the hyoid bone	Stylohyoid ligament
Third	Glossopharyngeal (IX)	Stylopharyngeus	Greater cornu of hyoid Lower part of body of the hyoid bone	
Fourth and Sixth	Superior laryngeal branch of vagus (X) Recurrent laryngeal branch of vagus (X)	Cricothyroid Levator veli palatini Constrictors of pharynx Intrinsic muscles of larynx	Thyroid cartilage Cricoid cartilage Arytenoid cartilage Corniculate cartilage Cuneiform cartilage	

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Section 4: Hand



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

151. Which of the following factors is NOT associated with an increased risk of developing the condition shown in the photograph?

- A) Family history
- B) Low birth weight (less than 2500 g)
- C) Multigravida mother
- D) Prematurity (less than 37 weeks)
- E) Young maternal age (less than 25 years)

The correct response is Option A.

Amniotic band syndrome is a sporadic condition in which rupture of the amnion results in strands of tissue that ensnare the developing fetus. The factors associated with this condition

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include prematurity, low birth weight, and young multigravida mothers. This condition is sporadic and mechanical in nature. As such, it does not have a genetic basis or identifiable pattern of inheritance.

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152. A 24-year-old man comes to the office three months after sustaining a crush injury to the volar aspect of the right forearm during the rollover of a motor vehicle. Fasciotomies were performed when he awoke from a coma two days after the initial injury. Physical examination shows the digits flexed into the palm. Tenodesis effect without fixed contractures is present. A modified Henry fasciotomy scar is noted on the right forearm; skin coverage is otherwise excellent. No peripheral nerve injury is noted. Which of the following is the most appropriate surgical procedure to correct this deformity?
- A) Innervated free muscle transfer
 - B) Muscle slide
 - C) Resection of the intrinsic muscles
 - D) Tendon lengthening
 - E) Tendon transfers

The correct response is Option D.

The most appropriate surgical procedure for the correction of the deformity described is tendon lengthening. Patients with established ischemic forearm contractures are categorized by both the Holden and Tsuge classification systems. In Holden I injuries, the arterial ischemia and venous stasis begin proximal to the forearm fascial compartment. Holden II injuries are from direct trauma, and the ischemia begins at the site of the injury. The Tsuge classification defines the extent of muscle involvement as mild, moderate, or severe.

The patient described would be classified as a Holden II, mild type, because his ischemia was caused by direct trauma and his muscle involvement is limited to the deep flexors at the site of the injury. Z-plasty tendon lengthening and possible skin release and limited scarred muscle resection are sufficient.

Innervated free muscle transfers are reserved for Holden I or II, severe type, injuries. Often with nerve grafting in an attempt to establish protective distal sensation and other procedures, innervated free muscle transfers are utilized to provide both function and coverage in these patients with complete loss of muscle function after ischemic injury.

Muscle slide techniques are reserved for patients with Holden I, moderate injuries. These patients have ischemic changes affecting the entire muscle belly. Some of the muscles' contractile units should be intact. Combined with other procedures, the muscle slide permits a reduction of the distal contractures while preserving the muscle's residual contractile capabilities.

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Resection of the dorsal intrinsic muscles and part of the adductor pollicis muscle is reserved for patients with ischemic contracture of the intrinsic muscles. Intrinsic ischemic contractures may accompany any ischemic Volkmann contracture, but this will often present as the hand assuming the intrinsic-plus position following reconstruction of the extrinsic musculature. The patient described is not presenting with an intrinsic-plus deformity.

Tendon transfers are used for patients with Holden II, moderate type, injuries. Proximal muscle slides are not usually performed because detachment of these healthy muscles will potentially diminish their functional capacity. Combined with other procedures, tendon transfers are used to augment any residual existing muscle function.

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153. A 15-year-old girl is brought to the emergency department 24 hours after being bitten on the left index finger pulp pad while playing with her friend's cat. The patient received a tetanus immunization three years ago. Temperature is 37°C (98.6°F). Physical examination shows mild erythema surrounding a fluctuant area beneath a sealed puncture wound. No motor or sensory deficits are noted. Radiographs show no abnormalities. Leukocyte count is 12,800/mm³. In addition to adequate drainage of the wound, which of the following is the most appropriate next step in management?

- A) Administration of amoxicillin and clavulanate
- B) Administration of ciprofloxacin
- C) Administration of rabies toxoid
- D) Administration of tetanus immune globulin
- E) Observation

The correct response is Option A.

Cat and dog bite infections have a complex microbiologic mix, with *Pasteurella* as the most frequent isolate. Common aerobes isolated include streptococci, staphylococci, *Moraxella*, and *Neisseria*; common anaerobes include *Fusobacterium*, *Bacteroides*, *Porphyromonas*, and *Prevotella*. Patients are most often treated with a combination of a β -lactam antibiotic and a β -lactamase inhibitor, such as amoxicillin and clavulanic acid.

Alternative treatments include clindamycin plus fluoroquinolone for adults and clindamycin and trimethoprim/sulfamethoxazole for children. Ciprofloxacin does not provide adequate coverage for expected pathogens.

In general, cat bites tend to be small puncture wounds that seal almost immediately; thus, wounds should be opened sufficiently to be cleaned and allowed to drain. Dog bite wounds tend to be longitudinal lacerations that are more likely to stay open by themselves. However, canine lacerations, as compared to cat bite punctures, are more likely to result in direct structural damage to nerves, tendons, vessels, and joint structures.

Rabies is uncommon in dogs and cats in the United States. Because the cat owner is known, the vaccination record is obtainable. An animal that appears healthy and has been vaccinated should still be quarantined for 10 days to ensure it does not show signs of rabies. If the animal is found to have rabies, postexposure prophylaxis should be started as soon as possible. If the animal is a stray, the animal should be located so it can be tested for rabies. If, however, the animal cannot be located, postexposure prophylaxis is reasonable.

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Administration of tetanus immune globulin is recommended only for patients with tetanus-prone wounds who have never completed a primary immunization series. If a patient with an acute soft-tissue injury has not been immunized previously, a tetanus toxoid booster is required. The patient must complete the series. If the patient has been immunized previously, a booster dose is given if the last dose was more than five years previously (for a tetanus-prone wound) or more than 10 years previously (for a nontetanus-prone wound). Patients with a contraindication to tetanus toxoid must be managed with tetanus immune globulin alone.

Observation alone would not be appropriate for a deep puncture wound with purulent drainage and a mildly elevated leukocyte count. After adequate drainage of the wound and treatment with oral antibiotics, the patient requires follow-up to ensure the infection does not progress, possibly requiring intravenous antibiotics and further surgical drainage.

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154. A 56-year-old man with a 10-year history of pain in the wrist caused by rheumatoid arthritis comes to the office for consultation regarding surgical treatment options. Total joint replacement (arthroplasty) is a more appropriate choice than joint fusion (arthrodesis) if this patient indicates that his primary goal is which of the following?

- A) Grip strength
- B) Pain relief
- C) Proper alignment
- D) Range of motion
- E) Stability

The correct response is Option D.

Whenever a patient has a painful joint condition, various options are available for treatment. Fusion provides stability and allows pain-free function. It can restore anatomical alignment, and grip strength can be quite good. Arthroplasty also provides pain relief and corrects alignment. Generally speaking, arthroplasty does not provide the stability or strength of arthrodesis. The decision to pursue arthroplasty over arthrodesis is usually made because of the patient's desire or necessity to preserve as much range of motion as possible.

The decision of performing fusion versus arthroplasty occurs in various joints in the hand, including the basal joint, wrist joint, metacarpophalangeal, and proximal interphalangeal.

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155. A 1-year-old boy is scheduled to undergo primary surgical reconstruction of congenital talipes equinovarus. Subsequent skin shortage and wound complications are best prevented by which of the following methods?

- A) Free fasciocutaneous flap transfer
- B) Healing via second intention
- C) Preoperative tissue expansion
- D) Split-thickness skin grafting
- E) Two-stage local flap delay and transfer

The correct response is Option C.

Although the treatment of congenital talipes equinovarus (CTEV) has trended toward conservative routines of manipulation and limited surgical release (eg, Ponseti technique), surgical treatment of CTEV may be necessary in cases of delayed treatment or failure of the conservative regime. Surgical correction may be attempted via a gradual technique (Ilizarov) or as an acute correction with release of the contracted posterior and medial elements.

Many acute surgical CTEV corrections can be accomplished without skin or wound difficulties; when such difficulties are anticipated, preoperative placement of tissue expanders has proven useful in allowing primary closure of the release sites with minimal morbidity.

Second intention healing and split-thickness skin grafting may not be appropriate depending on the purposeful injury and potential exposure of tendons during the contracture release.

Adjacent tissue transfer may be compromised by altered local anatomy, and creation of a second wound around the ankle by the donor site may threaten future surgical approaches for additional correction of the deformity.

Free tissue transfer may be warranted in late correction cases with severe tissue shortage but rarely would be necessary in the setting of primary correction.

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156. A 25-year-old man comes to the emergency department six hours after sustaining an acute dorsal dislocation of the proximal interphalangeal joint of the ring finger of the dominant right hand. Following reduction, the joint is stable when flexed approximately 30 degrees but is unstable in full extension. Postreduction lateral radiographs show that approximately 20% of the volar articular surface is avulsed from the base of the middle phalanx. Which of the following is the most appropriate initial management?
- A) Extension-block splinting
 - B) Hemi-hamate arthroplasty
 - C) Repair of the torn collateral ligaments
 - D) Screw fixation of the fracture fragment
 - E) Volar plate arthroplasty

The correct response is Option A.

Acute dorsal dislocation of the proximal interphalangeal joint is a complex problem that requires various approaches to treatment depending on the percentage of articular surface disrupted and the presence of impaction. Generally, if only 20% of the volar articular surface is avulsed from the base of the middle phalanx, when the fracture is reduced, there is sufficient collateral ligament attached to both the volar lip fragment and the majority of the middle phalanx to bring the fragments into close apposition. Extension-block splinting can safely be performed up to a 30-degree angle block. If more flexion is required to reduce the fragments or maintain stability, then closed reduction and splinting is probably not adequate because unacceptable flexion contracture may result. In such cases, the wound may be opened and screw fixation of the fracture fragment may be indicated. In cases of comminution, impaction, or greater amounts of articular loss, a volar plate arthroplasty or hemi-hamate arthroplasty may be indicated. Other dynamic splinting methods of treating these injuries in certain cases are the Agee force-couple technique and the Schenck splint technique.

In summary, the maximum percentage of middle phalanx joint avulsion that is acceptable for closed reduction is approximately 30% to 40% and no more than 30 degrees of flexion can be accepted to maintain reduction.

When extension-block splinting is used, generally after approximately two weeks of splinting, the finger is gradually extended or buddy taped to an adjacent finger to start controlled extension. Prolonged flexion can result in permanent contracture.

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157. A 47-year-old woman is brought to the emergency department immediately after sustaining a laceration of the left thumb while cutting pastrami with an industrial meat slicer. Physical examination shows loss of skin and subcutaneous tissue on the volar aspect of the thumb from the metacarpophalangeal joint flexion crease to the interphalangeal joint flexion crease. The flexor tendon and digital neurovascular bundles are exposed in the wound base. Perfusion and sensation of the tip of the thumb are intact. Which of the following is the most appropriate management?

- A) Full-thickness skin grafting
- B) Reconstruction with a first dorsal metacarpal artery flap
- C) Reconstruction with a thenar flap
- D) Reconstruction with a volar advancement (Moberg) flap
- E) Split-thickness skin grafting

The correct response is Option B.

The tissue requirements are determined by the nature of the wound bed and functional requirements for the site of reconstruction. Skin grafts are inappropriate in the face of exposed tendon or tendon sheath. Advancement of the volar tissue of the thumb is useful for distal thumb defects. Dissection of the skin, subcutaneous tissue, and neurovascular bundles from the underlying tissue and flexion of the interphalangeal joint allow for distal movement of the tissue for thumb pulp pad coverage. This approach would not be useful for a volar defect at the level of the proximal phalanx. The first dorsal metacarpal artery flap could be used to provide coverage of this area of the thumb. The skin and subcutaneous tissue can be elevated from the dorsum of the index finger to the level of the middle phalanx. The first dorsal metacarpal artery is included with this tissue. If a sensory flap is desired, branches of the radial nerve within the flap can be preserved or coapted to sensory nerves at the recipient site. A thenar flap would be appropriate for providing coverage for fingertips but not this region of the thumb.

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158. A 60-year-old man comes to the office because he has had tingling and numbness on the plantar aspects of the toes of both feet for the past seven months. He says that his symptoms are more noticeable after long periods of walking or standing and are relieved by elevation of the legs. Physical examination shows weakness of flexion of the toes. Tarsal tunnel syndrome is suspected. The most likely cause of these findings is palsy of which of the following nerves?
- A) Deep peroneal nerve to flexor digitorum superficialis muscle
 - B) Interosseous nerve to quadratus plantae muscle
 - C) Medial plantar nerve to flexor digitorum brevis muscle
 - D) Superficial peroneal nerve to interossei muscles
 - E) Tibial nerve to flexor digitorum longus muscle

The correct response is Option C.

The tibial nerve bifurcates distally into the medial and lateral plantar nerves, and it is these two nerves that are impinged in the tarsal tunnel.

The flexor digitorum superficialis is in the forearm, not the leg. The flexor digitorum brevis flexes both the proximal and the middle phalanges of the toes and is innervated by the medial plantar nerve. Other intrinsic toe flexors are flexor hallucis brevis (medial plantar nerve), flexor digiti minimi brevis (lateral plantar nerve), and the interossei (lateral plantar nerve) and lumbricals (medial and lateral plantar nerves). In the most severe situation, a patient with tarsal tunnel syndrome may have “claw toes.”

Quadratus plantae is a flexor of the lateral four toes through the flexor digitorum longus but is innervated by the lateral plantar nerve. While flexor digitorum longus is a toe flexor and is also innervated by the tibial nerve, this nerve would not be involved at the tarsal tunnel.

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

159. A newborn is brought to the office because of the deformity shown in the photograph. Which of the following findings is most likely associated with this condition?

- A) Autosomal recessive inheritance
- B) High plasminogen levels
- C) Infection during the second trimester
- D) Injury to the subclavian artery
- E) Oligohydramnios

The correct response is Option E.

The patient described is brought to the office with the classic findings of skin banding and acrosyndactyly consistent with amniotic band syndrome (ABS). The incidence of ABS has been reported at 1:15,000 births with equal expression in males and females. No autosomal inheritance pattern has been identified nor has a connection been made to any infectious agent. An association with oligohydramnios may explain the increased frequency of clubfoot deformity; however, this finding is not ubiquitous. Researchers have postulated that an early transient oligohydramnios at the time of amniotic disruption is most likely causative.

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Anomalies such as calcaneovalgus, pes valgo planus, congenital hip dislocation, and congenital vertical talus can also be associated with oligohydramnios.

Vasculocutaneous catastrophe of the newborn is associated with an altered fibrinolytic system, including high plasminogen levels and antiplasmin inhibitors. Vascular injury to the subclavian artery has been a suspected cause of symbrachydactyly but not ABS.

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160. A 38-year-old man who works as a construction worker comes to the office because of pain and ulceration of the tips of the left ring and small fingers. The patient has no history of trauma, systemic disease, or hand claudication. Physical examination shows swelling and tenderness over the hypothenar eminence and small areas of ulceration on the tips of the small and ring fingers. All digits have full range of motion, good color, and capillary refill. Sensation is intact. Magnetic resonance arteriography shows an aneurysm of the ulnar artery in the palm. The small and ring fingers are perfused via the superficial palmar arch. Which of the following is the most appropriate management?
- A) Administration of nifedipine
 - B) Anticoagulation therapy
 - C) Arterial ligation
 - D) Digital sympathectomy
 - E) Intra-arterial sclerotherapy

The correct response is Option C.

The scenario described demonstrates clinical features of the hypothenar hammer syndrome or aneurysm of the ulnar artery in the palm. The perfusion of the small and ring fingers is maintained with circulation through the superficial palmar arch. Thrombus, which accumulates within the aneurysm, showers distally creating embolic infarctions of the digits. Ligation of the artery without reconstruction is acceptable given collateral blood flow to the small and ring fingers. Ligation prevents further release of emboli from the aneurysm and can reduce associated vasospasm. This may improve distal digit perfusion and help in healing of areas of ulceration. In cases where there is evidence of inadequate digit perfusion, arterial reconstruction is indicated. Injection of thrombotic agents into the ulnar artery carries the risk of thrombosis of distal arteries and digital ischemia.

The presence of the aneurysm suggests against vasospasm as the primary cause of ulceration. Therefore, digital sympathectomy and administration of antivasospastic medications, such as nifedipine, do not address the cause of the patient's problem. Anticoagulation may reduce the number of emboli but would not eliminate the aneurysm. The thrombi from the aneurysm create distal occlusion and necrosis.

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161. A 34-year-old man who works as a police officer is brought to the emergency department after sustaining a traumatic avulsion of the right heel. Examination shows a 3 × 3-cm area of exposed calcaneus on the weight-bearing aspect of the heel. Which of the following arteries and nerves supply the flap that will provide the most appropriate sensate coverage?

	Artery	Nerve
A)	Dorsalis pedis	superficial peroneal
B)	Medial plantar	medial plantar
C)	Medial sural	saphenous
D)	Posterior tibial	posterior tibial
E)	Radial	medial antebrachial cutaneous

The correct response is Option B.

Sensate flaps include an intact sensory nerve supplying the overlying skin being transferred or, as in the case of a free tissue transfer, the cutaneous nerve is preserved and reanastomosed to a recipient cutaneous nerve. Sensate flaps are useful for areas where sensation is important for the appropriate function of a reconstructed region. Sensate flaps are beneficial in resurfacing wounds located on weight-bearing areas as in pressure sores or the heel, as in the scenario described.

The most reliable sensate flap for coverage of the plantar calcaneus comes from the medial plantar flap. This flap receives its sensation from the medial plantar nerve (L4-5) and receives its blood supply from the medial plantar artery. This flap comes from the instep of the foot between the head of the first metacarpal and the midpoint of the heel. The size of the flap can be up to 12 × 6 cm. Due to its proximity to the heel and the minimal donor morbidity with loss of sensation to the instep of the foot, this flap is the most appropriate for coverage of this patient's defect.

The dorsalis pedis flap receives its blood supply from the dorsalis pedis artery. This flap can be transferred as a sensate flap using the superficial peroneal nerve. However, this flap would not reach the area needed to be covered in this patient. The dorsalis pedis flap is used most frequently for coverage of the anterior ankle and dorsal distal foot.

The medial sural artery supplies the medial gastrocnemius flap. This flap is best used for soft-tissue coverage of the upper third of the leg and the distal knee. Preservation of the saphenous nerve with the medial gastrocnemius musculocutaneous flap will provide a neurosensory flap.

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However, due to the distance from the flap, it would require a free tissue transfer and is typically not used for this type of coverage.

The proximal branches of the posterior tibial artery supply the medial soleus muscle flap. The posterior tibial nerve supplies only motor fibers to the soleus muscle and can therefore not be used as a sensate flap. This flap is best used for soft-tissue coverage of the middle third of the leg.

The radial forearm flap receives its blood supply from the radial artery and its septocutaneous perforating vessels. A neurosensory flap can be harvested based on the medial or lateral antebrachial cutaneous nerves to reconstruct the plantar surface of the foot. This would be a second choice to the medial plantar artery flap as it requires free tissue transfer.

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162. A 63-year-old man with a five-year history of rheumatoid arthritis comes to the office because he has had recurrent painful triggering of the ring and small fingers of the right hand for the past four months. He has not had numbness or tingling of the fingers. The ring and small fingers trigger and lock. A radiograph is shown. Which of the following is the most appropriate management?

- A) A1 pulley release
- B) Centralization of extensor mechanism and repair of the sagittal bands
- C) Replacement of the metacarpophalangeal (MCP) joint
- D) Tenolysis of superficialis and profundus tendons
- E) Tenosynovectomy and resection of slip of the superficialis tendon

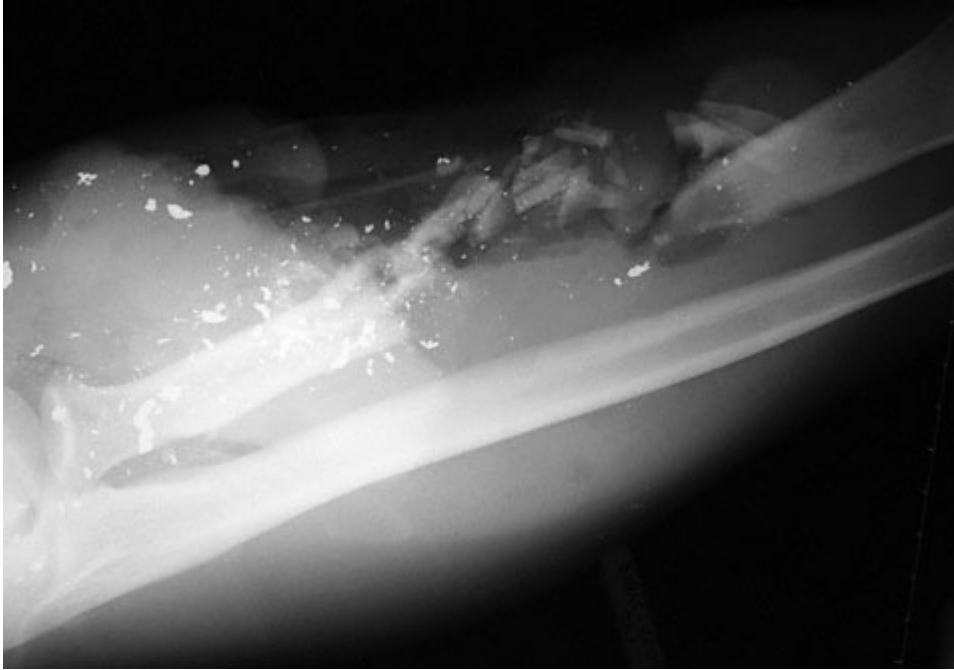
The correct response is Option E.

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The patient described has mild rheumatoid arthritis. Ulnar drift in the rheumatoid hand can be exacerbated by resection of the A1 pulley. In patients with rheumatoid arthritis, the A1 pulley should be preserved and a flexor tenosynovectomy of the fingers should be performed as well as, if necessary, a resection of one slip of the superficialis tendon. Very mild cases may also respond to corticosteroid injection. In patients with rheumatoid arthritis who have flexor tenosynovitis, the surgeon should always be cognizant of concomitant carpal tunnel syndrome, and a carpal tunnel release should also be performed if carpal tunnel symptoms are present, which is not the case in the patient described. Surgical procedures to replace the MCP joint should only be performed in cases with radiographic evidence of arthritis and pain at the MCP joints. Extensor tendon centralization and sagittal band repair are considered in cases where the subluxation of the extensor tendons results in inability to fully extend the MCP joints. Tenolysis is used to treat flexor tendon adhesions. Flexor tendon adhesions can be suspected when passive proximal interphalangeal and distal interphalangeal joint motion is greater than active joint motion.

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163. A 52-year-old man is brought to the emergency department after sustaining a gunshot wound to the right forearm. History includes well-controlled diabetes mellitus type 2, coronary artery disease, and renal insufficiency. Examination of the forearm shows viable muscle coverage and gross instability. A radiograph is shown. Following debridement and stabilization of the wound, reconstruction of the defect is planned via a vascularized free fibular transfer. In addition to clinical examination, which of the following is the most appropriate preoperative evaluation of this patient's lower extremity?

- A) Ankle brachial indices
- B) Color-flow Doppler imaging
- C) CT angiography
- D) Traditional angiography
- E) Transcutaneous partial pressure of oxygen

The correct response is Option B.

While anatomic variants in the vasculature of the leg are rare, failure to recognize these prior to sacrifice of the peroneal artery during harvest of a fibular free flap can result in disastrous ischemic complications. Variations occur more commonly in patients who have vascular insufficiency due to underlying atherosclerotic changes. In these patients, clinical examination alone is insufficient to adequately define blood flow patterns to the leg and foot.

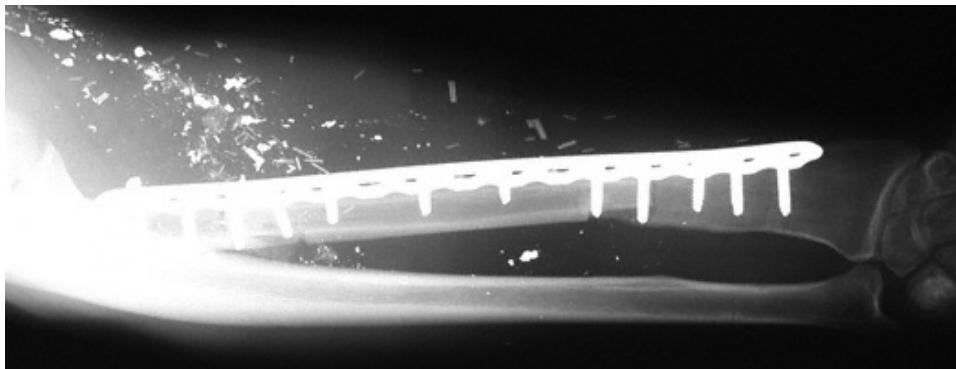
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Color-flow Doppler imaging has demonstrated excellent ability to define the presence of flow-limiting lesions in the leg. Monophasic signals in any of the three major runoff vessels strongly suggest that the limb will be at risk for ischemia following sacrifice of the peroneal artery. Comparison of the findings on color-flow Doppler with angiography demonstrates that angiography is an unnecessary addition to the initial study.

Angiography and CT angiography offer excellent road maps of the vasculature of the lower extremity, but each does involve the use of intravenous contrast. The dose of contrast used in CT angiography is significantly lower than that in traditional angiography, but neither would be justified in this patient with pre-existing renal insufficiency.

MR angiography provides a map of the vessels comparable to both angiography and CT angiography without the use of nephrotoxic contrast agents. The additional information gained by seeing the vessels preoperatively (by MRA, CT angiography, or traditional angiography) may be justified when very long segments of the bone need to be harvested or when the perfusion to the overlying skin paddle may be better defined.

Transcutaneous partial pressure of oxygen measures perfusion and does not offer any anatomic detail.



The postoperative image shown demonstrates the free fibula reconstruction of the radius.

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164. A 50-year-old woman has lymphedema of the right leg. Height is 5 ft 6 in (168 cm); weight is 250 lb (113 kg). Which of the following is the LEAST appropriate medical treatment of the lymphedema?

- A) Administration of diuretics
- B) Compression garment therapy
- C) Decompressive physical massage
- D) Intermittent pneumatic pump compression therapy
- E) Recommendation of weight loss

The correct response is Option A.

Diuretics play no role in the treatment of lymphedema. The mainstay of treatment is medical, including meticulous hygiene and regular inspection. Patients should be encouraged to lose weight, avoid even minor trauma, avoid constrictive clothing, and elevate the affected extremity. All patients should also use compression garments continuously during the day. Intermittent pneumatic pump compression therapy should be instituted on an outpatient basis and/or in the home. Benzopyrenes, including flavonoid and coumarin, have become a useful adjuvant in other countries but are currently not available for clinical use in the United States. These drugs bind to accumulated interstitial proteins, inducing macrophage phagocytosis and proteolysis. Decompressive physical massage is therapeutic.

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165. A 45-year-old woman is brought to the emergency department after sustaining fractures to the right lower extremity during a motor vehicle collision. Examination shows a 4-cm soft-tissue defect over the medial aspect of the ankle with exposed bone. Radiographs show a compound fracture of the fibula and tibia. Surgery is planned. Preoperative angiogram shows a post-traumatic occlusion of the peroneal artery. Which of the following flaps is NOT appropriate for soft-tissue coverage?
- A) Anterolateral thigh free
 - B) Free gracilis muscle
 - C) Parascapular free
 - D) Reverse soleus muscle
 - E) Sural artery

Please note: Question 165 has been deleted from the examination.

The correct response is Option E.

The sural artery flap is not appropriate for soft-tissue coverage because it obtains its major blood supply from the peroneal artery. Classically, soft-tissue defects found within the lower third of the leg are covered with free flaps as opposed to pedicled or rotational flaps. In the scenario described, either a muscle or fasciocutaneous free flap could have been used to obtain stable coverage. The reverse soleus flap, although not a free flap, is also a possible solution for smaller defects, such as the one described, located over the medial ankle region. The reversed soleus flap is supplied by a segmental perforator off the posterior tibial artery and would also have been a possible option for coverage.

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166. A 23-year-old man has pain in the left wrist after falling from a roof. Examination shows swelling of the wrist and decreased range of motion. Radiographs are shown. Which of the following ligaments is most likely to remain intact?

- A) Capitoulunate
- B) Lunotriquetral
- C) Radiolunate
- D) Radioscaphocapitate
- E) Scapholunate

The correct response is Option C.

The most likely ligament to remain intact is the radiolunate ligament.

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In routine radiographic examination of the wrist, three smooth radiographic arcs can be defined on the PA view without radial or ulnar deviation (shown). These consist of the proximal surface of the proximal carpal row, the distal surface of the proximal carpal row, and the proximal surface of the distal carpal row. Stepoff in one of these arcs may indicate an abnormal carpal relationship.



Dorsal perilunate dislocations are often associated with hyperextension and significant traumatic force. A variety of carpal ligament structures exist, both intrinsic and extrinsic in nature. These serve to link and coordinate the motion of the carpal bones, and can be disrupted in trauma. Four stages of progressive perilunate instability have been described, with a pattern of progressive injury and ligamentous disruption. Initially, as the distal carpal row is extended, there is progressive tearing of the scapholunate ligament, or scaphoid fracture. Subsequently, the distal carpal row moves dorsally, and there can be detachment of the radioscaphocapitate ligament from the radial styloid. Following this, dorsal forces extend to the lunotriquetral interval, with possible lunotriquetral ligament disruption or triquetral fracture. Finally, the capitate may exert force on the dorsal aspect of the lunate, causing it to tip volarly as it remains attached via the

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palmar radiolunate ligament (spilled teacup sign). There is no direct ligament between the lunate and the capitate.

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167. A 46-year-old man comes to the emergency department because he has pain in the index finger after falling on his outstretched right hand. He notes that the pain began immediately after the fall. Instability on isolated index to thumb key-pinch testing is noted. Radiographs show no obvious pathology. An injury to which of the following structures is most likely?

- A) First dorsal interosseous insertion
- B) Lateral band of the extensor hood
- C) Lumbrical insertion
- D) Radial collateral ligament
- E) Volar plate

The correct response is Option D.

Isolated injury to the radial collateral ligament of the index finger occurs with forced ulnar deviation at the metacarpophalangeal (MCP) joint. It can also occur in conjunction with injury to all of the structures surrounding the joint. In isolation, the findings of a complete tear of the ligament will be that of a flail joint. Attempted pinch will result in pain and ulnar deviation. These injuries are often ignored initially and progress to arthritis. Standard radiographs will not show the injury, and MRI is needed for confirmation. Isolated injury to the lumbrical will not be demonstrable on examination, while an injury to the volar plate by itself would not cause instability on key-pinch testing. Injury to the insertion tendon of the first dorsal interosseous muscle will cause a weak pinch, but the joint will not be unstable to radial pressure. Finally, the extensor mechanism does not contribute to the stability of the MCP joint.

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The response options for the next two items are the same. You will be required to select one answer for each item in the set.

For each of the following lower extremity flaps, select the dominant arterial inflow (A-E).

- A) Anterior tibial artery
- B) Peroneal artery
- C) Popliteal artery
- D) Posterior tibial artery
- E) Sural artery

168. Free fibula osseocutaneous flap

169. Proximally based soleus muscle flap

The correct response for Item 168 is Option B and for Item 169 is Option C.

The fibula osseocutaneous flap is a composite bone, fascia, and skin flap supplied by the peroneal artery.

The proximally based soleus muscle flap is supplied by branches of the popliteal artery.

A distally based soleus muscle flap is supplied by branches of the posterior tibial artery.

None of the mentioned flaps is supplied by the anterior tibial artery.

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170. A 30-year-old man who works as an ironworker is brought to the emergency department after falling 20 ft and impaling his right upper arm on a picket fence. Surgical exploration shows a complete transection of the ulnar nerve 6 in (15.2 cm) above the elbow with a 2-cm nerve gap. The median and radial nerves are intact. Which of the following procedures is most likely to result in maximal recovery of intrinsic muscle function?
- A) Anterior transposition of the ulnar nerve at the elbow followed by primary repair
 - B) Interposition nerve grafting using the lateral antebrachial cutaneous nerve
 - C) Nerve transfer of the distal anterior interosseous nerve to the deep motor branch of the ulnar nerve
 - D) Tendon transfer of the extensor digiti quinti to the extensor digitorum communis
 - E) Vascularized radial nerve grafting

The correct response is Option C.

High ulnar nerve injuries, ie, above the elbow, have routinely yielded unsatisfactory results with minimal return of intrinsic function and resultant claw hand deformity. This poor recovery of motor function of the intrinsic muscles of the hand occurs despite meticulous neuroorrhaphy technique and regardless of whether nerve graft or primary repair is performed. The principal reason for poor results is the long distance between the site of injury and the muscle motor endplates. During the many months required for the regenerating axons to traverse this gap, the target muscles are undergoing atrophy and fibrosis. The rate of nerve regeneration is approximately 1 inch per day. Motor endplates become refractory to reinnervation after about 15 to 18 months. In contrast, sensory return from high nerve injuries is usually adequate.

The key to nerve transfer is to convert a high nerve injury to a low nerve injury. In this case, the original injury is over 15 inches from the ulnar nerve innervations of the intrinsic muscles. The likelihood of any intrinsic muscle function is poor. By transferring the distal anterior interosseous nerve at the level of the pronator quadratus to the deep motor branch of the ulnar nerve, the distance that the reinnervating nerve has to travel is much shorter, thus preserving the muscle structure. The loss of pronator quadratus function is insignificant. When determining the need for nerve transfer, the time vs. distance constraints can be guided by the "Rule of 18." The Rule of 18 states: "The number of inches from the site of nerve injury to the supplied muscle added to the number of months the muscle has been denervated should be less than the number 18 in order for the primary nerve reconstruction to be attempted successfully." In other words, the nerve must be able to get to the muscle before 18 months from the initial injury.

The tendon transfer of the extensor digiti quinti to the extensor digitorum communis is inadequate to recover intrinsic function. The other options presented are all inappropriate

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because they do not address the length of time it will take the nerve to grow to the motor endplates.

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171. A 76-year-old woman with type 1 diabetes mellitus is scheduled to undergo surgical intervention for chronic ulceration of the lower extremities. Which of the following factors is NOT likely to impair wound healing in this patient?

- A) Advanced age
- B) Chronic anemia
- C) Chronic use of corticosteroids
- D) Malnutrition
- E) Poor control of diabetes

The correct response is Option B.

A number of local and systemic factors have been shown to impair wound healing. Diabetes mellitus adversely affects healing by altering circulation, attenuating inflammation, reducing tissue oxygenation, and adversely affecting glucose metabolism resulting in stress hyperglycemia. Malnutrition, including caloric, protein, vitamin, and mineral insufficiency, impairs the immune system, prevents tissue repair, and may lead to progression or recurrence of a wound. Aging is associated with reduced production of collagen and angiogenesis and a diminished response to environmental stresses. By reducing inflammation, steroids impair angiogenesis, fibrogenesis, wound contraction, reduced wound strength, and delay healing. Other factors such as infection, smoking, poor tissue oxygenation, radiation, chemotherapy, and the presence of foreign bodies or cancer within a wound are also associated with poor healing. Anemia, even to severe levels, when circulation is maintained has not been found to impair wound healing.

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172. Replantation is most likely to be contraindicated in which of the following patients who have sustained amputations of a single digit at the level of the interphalangeal joint?
- A) A 5-year-old girl with an amputation through the index finger
 - B) A 25-year-old steelworker with an amputation through the index finger
 - C) A 30-year-old musician with an amputation through the long finger
 - D) A 35-year-old attorney with an amputation through the long finger
 - E) A 40-year-old construction worker with an amputation through the thumb

The correct response is Option B.

Functional outcomes following replantation vary with the level of injury. Replantation of single digits amputated within the zone II level is relatively contraindicated due to postoperative stiffness. It is also contraindicated when rehabilitation will significantly delay the patient's return to work and the procedure offers minimal or no functional benefit. Replantation of single digits, particularly index fingers, usually does not improve hand function.

Replantation should be considered on nearly all parts in healthy children. Replantation should be considered in most cases of thumb amputation.

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173. A 65-year-old woman with long-standing rheumatoid arthritis comes to the office because she has been unable to extend the thumb and fingers of her nondominant left hand for the past eight weeks. Examination shows moderate rheumatoid arthritis with caput-ulnae syndrome, zigzag deformity of the left hand, and a boggy fullness over the extensor tendons at the wrist and around the elbow. Testing for tenodesis effect shows extension of the digits on passive flexion of the wrist. Which of the following is the most likely cause of the disability in this patient?
- A) Attritional rupture of the extensor tendons
 - B) Compression of the posterior interosseous nerve
 - C) Contracture of the ulnar-sided collateral ligaments of the metacarpophalangeal (MCP) joints
 - D) Subluxation of the extensor tendons into the gutter between the MCP joints
 - E) Tightness of the intrinsic lumbrical muscles

The correct response is Option B.

Posterior interosseous nerve (PIN) compression is a complication of rheumatoid arthritis which, together with extensor tendon rupture and metacarpophalangeal joint dislocation, should be considered in the differential diagnosis of inability to extend the fingers. The inability to extend the thumb in PIN entrapment can be a useful distinguishing clue on physical examination. Elbow joint swelling and compression of the PIN at the arcade of Frohse are the main reasons for PIN entrapment in rheumatoid arthritis. Intraarticular corticosteroid injections and surgical intervention resolve symptoms of PIN entrapment in rheumatoid arthritis.

Caput-ulnae syndrome is a dorsal dislocation of the distal ulna resulting from synovitis, ligament laxity, and extensor carpi ulnaris tendon translocation. Erosions in the prominent ulna put the extensor tendons at risk of attritional rupture.

The tenodesis effect is intact, so none of the other options is appropriate.

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

174. A 35-year-old man sustains a traumatic injury to the lower leg and undergoes closure of the wound using an anterolateral thigh free flap (shown). A cuff of muscle is harvested with the flap to fill a bone defect. Which of the following muscles can be safely harvested while using the same vascular pedicle as the flap?

- A) Adductor longus
- B) Rectus abdominis
- C) Vastus intermedius
- D) Vastus lateralis
- E) Vastus medialis

The correct response is Option D.

The anterolateral thigh flap is located over the lateral third of the thigh, between the borders of the rectus femoris and vastus lateralis muscle. Its blood supply comes from perforating branches of the lateral circumflex femoral artery and its venae comitantes. These vessels arise from the profunda femoris artery and vein. By utilizing the transverse branch of the lateral femoral circumflex artery and venae comitantes and their musculocutaneous perforators, the vastus lateralis muscle can be harvested with the anterolateral thigh flap. This muscle can be used for added bulk in the flap. The anterolateral thigh flap may also be harvested with the tensor fascia lata muscle. This flap may also be used as a functional muscle transfer.

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175. A 35-year-old man is brought to the emergency department after he sustained frostbite injuries to both hands and feet when he became lost while skiing and was exposed to subfreezing temperatures. Both hands and feet are rewarmed by immersion in circulating water for 30 minutes. Which of the following is the most appropriate diagnostic tool to establish the level of amputation in this patient?

- A) Contrast MRI
- B) Noncontrast CT
- C) Noncontrast MRI
- D) Technetium-99m bone scanning
- E) Three-view plain radiography

The correct response is Option D.

The initial management of frostbite injury is rapid rewarming by immersion of the involved areas in 40°C to 42°C circulating water for 15 to 30 minutes. The severity of the frostbite (first to fourth degree) should be noted. The wounds are dressed with loose, nonadherent dressings. Topical antibiotic ointment is applied and tetanus prophylaxis administered if indicated. Parts that are frostbitten should be splinted and elevated. The involved areas must be monitored for compartment syndrome.

Plain radiography, CT, and MRI are useful for delineating bone injuries, ligamentous injuries, and foreign material. However, the most useful tool for early prediction of the level of amputation is two-phase technetium-99m bone scanning. A retrospective study shows that an initial bone scan (as early as day 3) has excellent specificity in evaluating the severity of frostbite injury. Study data have shown a direct correlation between the demarcation zone of uptake in the phalanges and the eventual level of amputation (positive predictive value, 0.84). A second scan taken on approximately day 7 was more sensitive and informative. A strong correlation existed between positive uptake and eventual healing (negative predictive value, 0.99). This study showed that technetium-99m bone scanning, in the first few days after frostbite injury, indicates the level of amputation in severe frostbite in almost 90% of cases.

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176. A 52-year-old man comes to the emergency department because he has increasing pain and swelling of the right index finger six hours after sustaining an injury to the tip of the finger. He says he was holding a small object in his nondominant hand to paint it with a high-pressure gun when he missed the object and injected oil-based paint into the tip of the index finger. On examination of the finger, sensation is intact and capillary refill is good. Which of the following is the most appropriate initial management?
- A) Amputation of the index finger
 - B) Debridement of the index finger and serial dressing changes
 - C) Elevation of the hand, administration of antibiotics, and early mobilization
 - D) Incision and cleansing of the underlying tissue with sterile mineral oil
 - E) Observation with serial examinations

The correct response is Option B.

The patient described has a high-pressure injection injury to the index finger of his assisting hand. As with electrical injuries, the damage caused by the destructive chemicals in paint and other hydrocarbons as well as caustic cleaning solutions far exceeds the usual small and apparently innocent entrance wounds. The chemicals tend to travel down the finger and can involve the tendon sheaths with migration to the wrist, resulting in increased morbidity. The subcutaneous tissue is destroyed by either saponification or dissolution of the lipids. This situation warrants early aggressive surgical therapy. Outcome for delayed treatment is nearly uniformly poor, resulting in either amputation or permanent stiffness. The best outcomes result from emergent debridement of all involved tissue and open dressing changes. Early mobilization will assist in treatment.

Given these facts, observation for this patient is inappropriate. As his finger remains perfused and sensate, there is no need for immediate amputation. Immediate amputation is appropriate for patients who present with cool, insensate fingers. Delayed amputation may be required for finger necrosis.

Mineral oil is itself a hydrocarbon and potentially toxic and therefore not appropriate for the clinical scenario described.

The outcome for less caustic injection injury, such as water or air, is more favorable and therefore warrants less aggressive therapy. These patients can be treated with administration of antibiotics, elevation, and early mobilization with minimal or no debridement. Because the patient described had oil-based paint injected into his finger, the less aggressive therapy is not appropriate.

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177. A 45-year-old man comes to the office because he has had a two-week history of persistent pain in the small finger after bumping it against a table. Radiographs are shown. Which of the following percentages best describes the likelihood of tumor recurrence after curettage and bone grafting in this patient?

- A) 10
- B) 25
- C) 50
- D) 75
- E) 90

The correct response is Option A.

The lesion represents an enchondroma, which is the most commonly found primary bone tumor in the hand. This benign tumor is thought to develop from fragments of cartilage near the central

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physis. The tumor is most common in the proximal phalanx, followed by the metacarpals and middle phalanx. Patients often present with finger pain following minor trauma that has resulted in the development of a pathologic fracture. Radiographically, enchondromas appear as well-defined areas of central lucency in the metaphyseal or diaphyseal portion of the bone. As the enchondroma grows, it frequently results in thinning and scalloping of the bone's cortex. Stippling and punctate calcifications may be seen within the areas of lucency.

The treatment for patients presenting with a pathologic fracture within an area involved with an enchondroma usually begins with a period of immobilization to allow for fracture healing; this may then be followed by surgery, most commonly open biopsy, curettage, and bone grafting. Recurrence following curettage is infrequent but occurs in 2% to 15% of patients. Because of this, patients should have periodic radiographic screening after surgery at six months, one year, and two years after initial surgery.

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178. A 53-year-old man returns to the emergency department because he has redness, swelling, and severe pain in the left upper extremity two days after he sustained a laceration to the left hand. Current temperature is 102°F (38.9°C) and heart rate is 126/min. Current examination shows crepitus extending into the left forearm. Radiograph shows some gas in the soft tissue. Which of the following is the most likely causative organism?

- A) *Eikenella corrodens*
- B) *Pasteurella multocida*
- C) *Pseudomonas aeruginosa*
- D) *Staphylococcus epidermidis*
- E) *Streptococcus pyogenes*

The correct response is Option E.

The most likely causative organism is *Streptococcus pyogenes* (Group A Strep).

Necrotizing soft-tissue infections (necrotizing fasciitis) are rapidly progressive and potentially lethal. Symptoms usually begin with localized erythema and swelling and may mimic cellulitis in the early stages. Severe pain, crepitus, and systemic toxicity can provide clues to the diagnosis. Radiographs may show air in the soft tissues, and patients may exhibit grayish, watery discharge (dishwater pus). These infections can be caused by polymicrobial synergistic infections or may be monobacterial in nature. A recent study showed that group A streptococcus was the most common cause of monobacterial necrotizing fasciitis and that diabetes was the most commonly associated comorbidity. Early intervention and radical debridement are key to management of necrotizing fasciitis.

Eikenella corrodens is an anaerobic organism present in human oral flora and has been associated with human bite wounds.

Pasteurella multocida is a gram-negative anaerobic bacterium most commonly associated with cat bite infections.

Pseudomonas aeruginosa is a gram-negative rod that can be associated with diabetic wound infections.

Staphylococcus epidermidis is a gram-positive coccus present on the skin. It has been associated with implant infections.

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Clostridial and beta streptococcal infections are the most common causes of early-onset necrotizing infection. Diabetes mellitus is the most common morbidity.

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179. A 37-year-old woman who is a professional cellist sustains a laceration with soft-tissue loss of the tip of the long finger of the dominant right hand. The wound heals by second intention. One year later, the patient reports that the loss of soft tissue on the fingertip prevents her from working. Physical examination shows thin adherence to the underlying bone. The full length of bone is preserved, and active and passive motion is within normal limits. Sensation is decreased in the area of scarring. Reconstruction with which of the following flaps is most likely to provide the best improvement in soft-tissue bulk and sensation?
- A) Cross-finger
 - B) Groin
 - C) Kutler (lateral advancement)
 - D) Thenar
 - E) Toe pulp

The correct response is Option E.

A number of options exist for the management of soft-tissue loss from the volar aspect of the fingertip. Healing by second intention can provide a durable fingertip with acceptable sensation. Unfortunately, when there is significant soft-tissue loss, there may be insufficient padding for the fingertip. The goal of intervention is to improve the bulk of the soft tissue with sensate tissue if possible. The toe pulp flap provides the best opportunity to accomplish both of these goals. The flap is harvested from the lateral aspect of the first toe or the medial aspect of the second toe. The vascular supply of the flap is the first dorsal metatarsal artery and branches of the saphenous venous system. The flap is innervated by the deep peroneal nerve and the palmar digital nerves of the toe. These nerves can be coapted to nerves of the recipient finger. Two-point discrimination of less than 10 mm can be obtained.

Thenar and groin flaps involve staged transfer of soft tissue to the recipient digit. These flaps supply the desired soft-tissue bulk; however, they do not provide sensation to the transferred tissue. A cross-finger flap would supply a small amount of additional soft-tissue bulk. The flap is innervated through coaptation of dorsal digital nerves of the donor site to recipient digital nerves. Neither the sensation nor the amount of soft-tissue bulk would match that provided by the toe pulp flap. The Kutler flap entails advancement of tissue from the sides of the finger over the tip in V to Y fashion. Sensation and vascularity are maintained for this tissue. The amount of tissue that this technique provides would be modest compared to the other approaches.

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180. A 45-year-old woman with a six-year history of chronic lymphedema of the entire lower extremity comes to the office for consultation about surgical treatment. She says her legs always feel tired. Conservative management, including compression garment and pump compression therapy, has been unsuccessful. The size of the extremity impairs her activities of daily living. Which of the following is the most appropriate surgical management?
- A) Microvascular lympholymphatic anastomoses
 - B) Microvascular lymphovenous anastomoses
 - C) Omental transposition
 - D) Staged excision of all excess skin and subcutaneous tissue
 - E) Suction-assisted lipectomy

The correct response is Option D.

Staged excision of all excess skin and subcutaneous tissue has become the option of choice for many authors. This procedure has shown the most consistent improvement with the lowest incidence of complications. Physiologic procedures, including omental transposition, buried dermal flaps, enteromesenteric bridging, lymphangioplasty, and microvascular lympholymphatic or lymphovenous anastomoses, have not shown favorable long-term results. Suction-assisted lipectomy does not reduce the skin envelope, and the lymphedema often rapidly recurs.

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181. The American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) standards mandate that all facilities must have which of the following drugs readily available for the treatment of malignant hyperthermia?

- A) Dalteparin
- B) Dantrolene
- C) Darifenacin
- D) Dicyclomine
- E) Dobutamine

The correct response is Option B.

Dantrolene is the only clinically available drug for the specific treatment of malignant hyperthermia.

Malignant hyperthermia is a rare but potentially fatal sensitivity to volatile anesthetics and depolarizing neuromuscular blocking agents. When genetically susceptible individuals are given anesthesia with these agents, the classic findings include skeletal muscle rigidity, tachycardia, fever, cardiac arrhythmias, and metabolic and respiratory acidosis, leading to severe hypotension. Hyperthermia, the hallmark of malignant hyperthermia, is most often a late sign. The earliest signs are tachycardia and an increase in the end-expired carbon dioxide concentration.

With the use of dantrolene, the mortality from malignant hyperthermia decreased from 80% in 1960 to less than 10%. Dantrolene is a skeletal muscle relaxant that depresses the intrinsic mechanisms of excitation-contraction coupling. The mainstay of treatment for malignant hyperthermia includes discontinuance of the inciting anesthetic agents, rapid body cooling, and dantrolene. Rapid dantrolene preparation and infusion are critical. Therapy is started by continuous rapid intravenous push beginning at a dose of 1 mg/kg to 2.5 mg/kg and continuing until symptoms subside or the maximum cumulative dose of 10 mg/kg is reached. If symptoms reappear, the regimen may be repeated. Dantrolene is packaged in powdered form as a 20-mg vial which must be reconstituted with 60 mL of sterile water for injection (without a bacteriostatic agent). Acidic solutions such as 5% dextrose and 0.9% sodium chloride should not be used. The effective dose to reverse the crisis will vary in each individual. Pediatric dosing is the same as for adults. Care must be taken during infusion to avoid extravasation because there is a possibility for tissue necrosis because of the high pH.

Malignant hyperthermia may not occur during the first exposure to an anesthetic triggering agent, but it may develop during subsequent operations. Symptoms range from mild to life-threatening hyperthermic crisis. The only screening test for susceptibility is through muscle

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biopsy. Dantrolene should be administered preoperatively to patients prone to malignant hyperthermia; anesthetic drugs that are known to trigger malignant hyperthermia should be avoided. Medications considered safe for patients susceptible to malignant hyperthermia include both lidocaine and bupivacaine. General anesthesia can be performed with alternative anesthetic regimens including nondepolarizing paralytic agents, nitrous oxide, and opioids (eg, vecuronium, propofol [Diprivan], and fentanyl).

Dobutamine is an inotropic agent that may be used to support circulation in severe malignant hyperthermia, but it is not specific for the disease. Dicyclomine is an anticholinergic used to treat irritable bowel syndrome. Darifenacin is a muscarinic receptor antagonist used to treat overactive bladder. Dalteparin is a low-molecular-weight heparin used as deep vein thrombosis prophylaxis.

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182. A 9-year-old girl is brought to the office two years after she sustained a crush injury to the nail bed of her left ring finger. Her mother says that the nail grows but then lifts off the finger and catches onto her clothes. The patient complains that the nail looks ugly. On examination, the germinal matrix is intact but 95% of the sterile matrix is scarred. Which of the following is the most appropriate treatment?

- A) Coverage with lateral Kutler flaps
- B) Full-thickness nail bed grafting from the long finger
- C) Lateral paronychia-releasing incisions with central advancement flap
- D) Release of the sterile matrix scar and acellular dermal matrix grafting
- E) Split-thickness nail bed grafting from the great toe

The correct response is Option E.

Nail bed injuries are common occurrences. Knowledge of nail bed anatomy is essential for proper evaluation and treatment. The germinal matrix is the most proximal part of the nail bed and is hidden from view by the eponychium. The germinal matrix produces 90% of the nail plate and extends to the visible white arc of the nail known as the lunula. The sterile matrix is the distal portion of the nail bed and adds a thin layer of cells to the undersurface of the nail, which maintains nail adherence to the nail bed. In the patient described, the sterile matrix is scarred and the nail cannot adhere to the nail bed.

Reconstruction requires removal of the scarring to the sterile matrix followed by split-thickness nail bed grafting. Though harvesting of a split-thickness nail bed graft should not leave any deformity, one study found a 25% donor deformity.

In contrast to a sterile matrix defect, when using a nail bed graft for reconstruction of the germinal matrix, a full-thickness graft is needed. Also, when harvesting a full-thickness nail bed graft, donor morbidity will always occur. Therefore the donor site should be from the first or second toes or from spare parts in multidigit injuries.

Lateral Kutler flaps, which are used for soft-tissue loss of the fingertip, may be required in conjunction with nail bed reconstruction but not in this scenario.

A full-thickness graft is not an appropriate choice because it is not necessary, and an uninjured digit should not be used for a full-thickness graft donor site.

Lateral paronychia-releasing incisions with central advancement flap can be used for full-thickness germinal and sterile matrix losses up to around 4 mm, but this defect is too extensive.

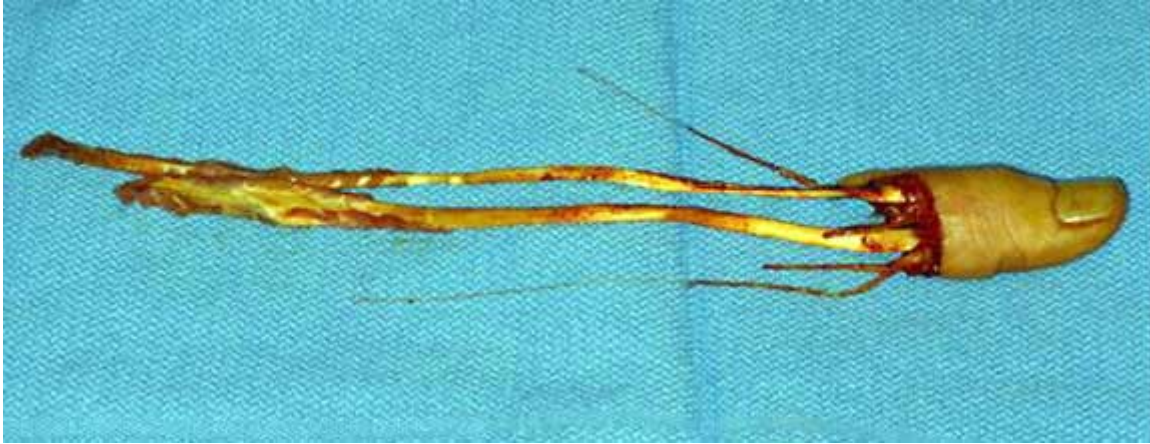
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Release of the sterile matrix scar and acellular regenerative dermal matrix grafting are more appropriate for a pincer nail deformity.

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183. A 35-year-old woman is brought to the emergency department four hours after sustaining an amputation of the right thumb when it was caught in a machine at a meatpacking plant. The amputated part (shown) was wrapped in moist saline gauze and placed on ice within 20 minutes of the injury. Which of the following factors is most likely to limit the success of replantation of the thumb?

- A) Inadequate bone stock
- B) Initial treatment of digit
- C) Mechanism of injury
- D) Possibility of infection
- E) Warm ischemia time

The correct response is Option C.

The extensor tendons and flexor tendons in the scenario described have been avulsed from the musculotendinous junction. In addition, the nerve ends extend proximally beyond the level of the soft-tissue injury; both of these findings are indicative of an avulsion-type injury. Such injury mechanisms often result in significant intimal injury within digital arteries, limiting the success of replantation. The amputated part was appropriately managed, and warm ischemia time was minimized. Digits have been successfully replanted with greater than 24 hours of cold ischemia time. Amputations at the metacarpophalangeal or interphalangeal level of the thumb may result in joint fusion; however, in this scenario, bone stock is adequate for skeletal fixation. Infection is a potential problem following any traumatic hand injury, but adequate surgical debridement and appropriate antibiotic coverage make replantation loss from infection a rare occurrence.

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184. A newborn who sustained a traction injury to the shoulder during delivery because of the use of forceps has complete palsy of the left upper extremity. Surgical intervention is indicated if there is no spontaneous biceps recovery by what age?

- A) 6 weeks
- B) 6 months
- C) 18 months
- D) 24 months
- E) 36 months

The correct response is Option B.

Most experts will perform surgery on infants who are between 3 and 6 months of age. At 3 months of age, if biceps function is absent, there is a poor prognosis. Early on, 92% will recover spontaneously. If biceps function is noted, surgery is not recommended. At 3 months of age, the child is retested by electromyography if there is no biceps function, although there is poor correlation with final results. The final evaluation is cervical myelography.

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185. A 17-year-old boy sustains a traumatic injury to the right lower extremity. Examination shows weakness of plantar flexion and loss of sensation over the plantar surface of the foot. Which of the following nerves is most likely injured?

- A) Deep peroneal
- B) Femoral
- C) Obturator
- D) Superficial peroneal
- E) Tibial

The correct response is Option E.

The most likely nerve to be injured is the tibial nerve.

The tibial nerve is a branch of the sciatic nerve. It travels through the popliteal fossa and gives off branches to the gastrocnemius, soleus, plantaris, and popliteus muscles. The tibial nerve travels in proximity to the posterior tibial artery. In the leg, it gives off branches to the flexor digitorum longus, tibialis posterior, and flexor hallucis longus. Distally in the foot, it branches to give rise to the medial and lateral plantar nerves, which provide sensation to the plantar surface of the foot. Injury to the tibial nerve results in deficits of plantar flexion, as well as anesthesia to the plantar surface of the foot. Tibial nerve disruption has been considered an indication for amputation as opposed to limb salvage in traumatic injuries of the lower extremity. However, one study suggests that limb salvage can be performed even in the face of absent plantar sensation at the time of presentation. This may indicate that absence of plantar sensation is not a reliable correlate for tibial nerve disruption.

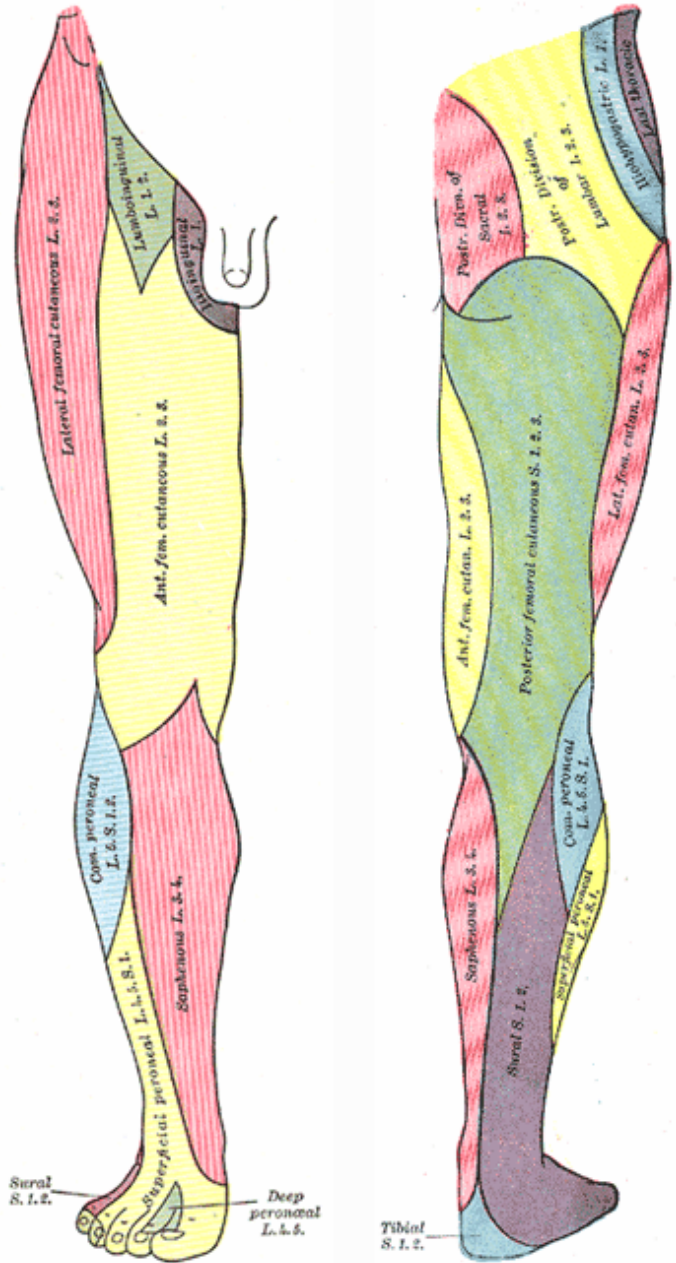
The deep peroneal nerve arises from the common peroneal nerve at the fibular neck. It travels in the anterior compartment of the leg and gives branches to the tibialis anterior, extensor hallucis longus, and extensor digitorum longus and brevis, as well as peroneus tertius. The sensory distribution is in the area of the first web space. Injury to the deep peroneal nerve causes weakness in dorsiflexion of the foot.

The femoral nerve innervates muscles of the anterior thigh, including the quadriceps group, iliacus, and sartorius. Injury to the femoral nerve results in weakness of leg extension.

The superficial peroneal nerve arises from the common peroneal nerve at the fibular neck. It supplies the lateral compartment of the leg, giving motor branches to peroneus longus and brevis, as well as sensory contribution to the lateral aspect of the leg. Injury to the superficial peroneal nerve results in anesthesia of the lateral aspect of the leg and weakness in eversion and plantar flexion of the foot.

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The obturator nerve provides innervation to the medial thigh muscles (adductor group), including adductor brevis, longus, and magnus, as well as the gracilis and obturator externus. The cutaneous branch provides sensation of the medial thigh. Injury to the obturator nerve results in weakness in thigh adduction and sensory deficits in the medial thigh.



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The images reflect the cutaneous nerve sensory territories.

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186. A 45-year-old woman is evaluated for a two-year history of a slowly enlarging soft-tissue tumor of the right volar palm at the level of the distal palmar crease and the fourth metacarpophalangeal joint. Findings on MRI are highly suggestive of a soft-tissue malignancy. Which of the following is the most appropriate management?

- A) Excisional biopsy through a Brunner incision
- B) Incisional biopsy through a longitudinal incision
- C) Needle aspiration and touch preparation of specimen
- D) Preoperative chemotherapy followed by wide local excision
- E) Wide local excision followed by radiation therapy

The correct response is Option B.

The biopsy is the most important aspect of the evaluation of any hand tumor. The biopsy must be planned properly so that it does not make adequate wide local resection more difficult or impossible. The biopsy incision must be incorporated within the definitive resection; therefore, transverse or Brunner incisions would spread the tumor away from the primary, which could increase the incidence of local recurrence or prevent limb-preserving surgery.

In the scenario described, the scar should be parallel to the metacarpal, allowing it to be easily removed within the resection margins. One study suggested that ultimate survival may be compromised when the biopsy is performed at an institution other than the one providing definitive treatment.

MRI is the imaging technique of choice for evaluating soft-tissue neoplasm. In one study of 134 palpable masses in the hand, MRI demonstrated the cause of the masses in 94% of the cases. Despite the helpful information shown by MRI, soft-tissue biopsy is still mandatory to determine a definitive treatment plan.

Needle aspiration and touch preparation is not appropriate for soft-tissue malignancy of the hand. More substantial tissue is needed to evaluate potential sarcomas. Favorable results have been reported using core needle biopsy.

Wide local excision followed by radiation therapy and preoperative chemotherapy followed by wide local excision are not appropriate because definitive tissue biopsy is needed before radical surgery and chemotherapy are undertaken.

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187. A 34-year-old woman who is a concert pianist is brought to the emergency department because of a laceration on the volar aspect of the right index finger at the mid-proximal phalanx caused by a broken vase. Operative exploration shows complete laceration of the radial digital nerve and the profundus and superficialis tendons in the flexor tendon sheath. Which of the following is the most effective management of the flexor tendon injury?
- A) Excision of the superficialis tendon; repair of the profundus tendon; early active-motion protocol
 - B) Excision of the superficialis tendon; repair of the profundus tendon; immobilization for three weeks
 - C) Repair of the profundus and superficialis tendons; early passive-motion protocol
 - D) Repair of the profundus and superficialis tendons; immobilization for three weeks

The correct response is Option C.

The most effective management is profundus and superficialis tendon repair with early passive-motion protocol. Repairing the superficialis tendon not only improves strength and function but also has been shown to increase circulation to the tendon repairs.

Many studies have shown that a direct correlation exists between the strength of the tendon repair and the number of core sutures used across the repair (strength is proportional to the number of sutures).

Many studies have shown the strength and adhesion-prevention benefits of early passive-motion protocols. Some studies have advocated early flexion active-motion protocols, but none have found the results superior to the early passive-motion protocols. One study has also shown that early passive-motion protocols do not interfere with the outcomes of primary digital nerve repairs when Zone II flexor tendon and digital nerve injuries occur simultaneously.

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188. A 19-year-old man is brought to the emergency department after sustaining a heavily contaminated, open fracture of the tibia during an all-terrain vehicle collision. The injury is classified as a Gustilo Type IIIB fracture of the tibia in the distal third of the right leg. A comminuted 4-cm segment of the tibia is debrided. A soft-tissue defect measuring 7×4 cm overlies the fracture site. Which of the following is the most appropriate initial method to stabilize the fracture?
- A) Contralateral free fibula flap with intramedullary rod stabilization
 - B) Iliac crest bone graft with plate stabilization
 - C) Ipsilateral pedicled fibula flap with intramedullary rod stabilization
 - D) Placement of an antibiotic-impregnated spacer
 - E) Placement of an external fixation device

The correct response is Option E.

The most appropriate initial step for fracture stabilization is placement of an external fixation device. The patient described will require multiple debridements for the heavy contamination, followed by a free muscle flap to provide soft-tissue coverage of the exposed tibia fracture, and a future avascular bone graft for the 4-cm segmental bone loss.

Intramedullary rod stabilization for the initial management of open fractures of the tibia has gained increasing popularity in the orthopaedic literature, but the bone fixation is converted from external fixation to an intramedullary rod within the first 10 days of injury immediately prior to muscle flap coverage.

Although reported in the literature, the use of the ipsilateral fibula has been criticized, especially in trauma cases, because of (1) the loss of the mechanical integrity of the limb, which is especially useful to maintain limb length; (2) the loss of the peroneal artery in a traumatized limb; and (3) the loss of the origins of the deep muscles, which contributes an additional 30% loss of strength in an already traumatized and weakened extremity.

A 4-cm segmental bone loss does not require vascularized bone by either a pedicled or free bone flap.

Plate stabilization of the tibia fracture described is not indicated because of the heavy contamination and the soft-tissue loss. Also, avascular bone grafts are not recommended in the initial management of open lower extremity wounds because of the risk of graft loss secondary to infection.

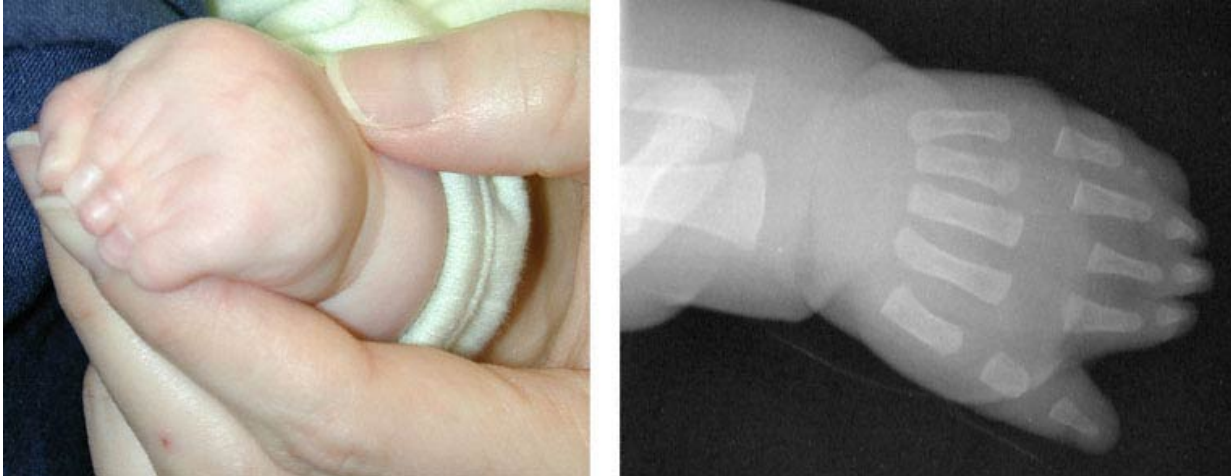
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An antibiotic-impregnated spacer could be used to help prevent infection, but it is not the initial step for fracture stabilization.

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189. A newborn child is brought to the office because of the hand deformity shown in the photograph and the radiograph. Which of the following is the most appropriate classification for this deformity?

- A) Duplication
- B) Failure of differentiation
- C) Failure of formation: longitudinal
- D) Failure of formation: transverse
- E) Overgrowth

The correct response is Option B.

Approximately one in 600 infants is born with a congenital difference of the upper limb. The American Society of Surgery of the Hand and International Federation of Societies for Surgery of the Hand developed a unified classification system to help reduce the confusion from the previous system of Greek and Latin prefixes.

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Classification of Congenital Hand Differences

Type/Description

- I Failure of formation of parts
- IA Transverse (eg, amelia, more distal amputations)
- IB Longitudinal (eg, phocomelia, radial dysplasia)
- II Failure of differentiation (separation) of parts (eg, synostosis, syndactyly, contracture, camptodactyly, trigger digits, clinodactyly)
- III Duplication (eg, polydactyly, triphalangeal thumb)
- IV Overgrowth (eg, macrodactyly)
- V Undergrowth (eg, hypoplastic thumb)
- VI Constriction band syndrome
- VII Generalized skeletal deformities (eg, dystrophic dwarfism)

The photograph shows the hand of a newborn child with a simple syndactyly, which is a conjoining of the adjacent fingers. This syndactyly would be classified as a failure of differentiation. Surgical treatment would be performed in a staged procedure, avoiding separating adjacent web spaces for fear of devascularizing a finger. Separation is usually delayed until the child is one year old; however, earlier separation may be needed to separate the small and ring finger syndactyly, if there is a significant difference in the digital length. Surgical repair of the deformity involves multiple skin flaps from the adjacent fingers, along with full-thickness skin grafting. Releases should be performed before the child is of school age.

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190. A 22-year-old woman comes to the emergency department with a severe injury to the distal phalanx of the index finger after closing the finger in a car door. Abnormal nail development will most likely result if which of the following structures of the nail bed is injured?

- A) Dorsal nail fold
- B) Hyponychium
- C) Perionychium
- D) Periosteum
- E) Sterile matrix

Please note: Question 190 has been deleted from the examination.

The correct response is Option A.

The majority of the fingernail is produced by cells of the proximal one third of the nail bed, known as the germinal matrix. This zone extends from the nail fold through the semicircular white area known as the lunula. The dorsal roof of the nail fold harbors the base of the nail in the germinal matrix. Severe injury or scarification in this zone can result in deformed or inhibited nail production. Counseling the patient about future possibility of deformity is helpful at the time of injury in order to set future expectations for healing. Careful reapproximation and reinsertion of avulsed nail in the germinal matrix zone may help prevent future deformity.

The hyponychium is the skin area underneath the distal end of the nail and is an important zone for touch and sensory discrimination. The perionychium is the skin zone lateral to the nail and is a frequent site of acute and chronic infection after nail trimming or injury.

Injury to the periosteum of the distal phalanx is common in crush injuries. With adequate drainage of hematomas under one half of the nail surface or open repair of nail beds for hematomas over one half of the nail surface, a normal nail can develop.

Overlying the dorsal periosteum is the sterile matrix of the nail bed, which is essential for promoting nail growth, advancement, and adherence. A scarred nail bed can result in poor adherence of the overlying nail. In cases of destruction of the sterile matrix, split grafts of nail bed from adjacent digits or toes have been described as a method of promoting more normal nail development.

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191. A 2-month-old infant is scheduled to undergo staged surgical release of complete syndactyly of every web space. Which of the following web spaces are most appropriately addressed during the first stage of syndactyly release?

- A) 1st and 2nd
- B) 1st and 4th
- C) 2nd and 3rd
- D) 2nd and 4th
- E) 3rd and 4th

The correct response is Option B.

Syndactyly is a condition resulting from failure of the normal separation process during five to eight weeks of gestation. It occurs in approximately one in 2000 births, either spontaneously or as part of a syndrome. Syndactyly is classified as complete or incomplete based on degree of distal to proximal webbing. It is also described as complex or simple, reflecting the presence or absence of bony involvement.

When syndactyly involves multiple digits, a plan must be developed to accomplish as much as safely possible at each operation to minimize the total number of operations. Border digit syndactyly should be addressed between four and six months to minimize tethering effects and abnormal growth. Complete syndactyly of adjacent web spaces should not be performed at the same stage due to the increased risk of vascular compromise to the digit.

In complete syndactyly, the border digits (1st and 4th web spaces) are usually released first. The 2nd and 3rd web spaces are released later in two separate operations. If there is no border digit tethering, complete release can be performed in two operations by first releasing the 1st and 3rd web spaces, followed by the 2nd and 4th web spaces.

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192. A 38-year-old man comes to the office for follow-up examination two months after undergoing open reduction and internal fixation of a fracture of the right proximal fibula. A preoperative radiograph is shown. On current physical examination, he can evert the right foot, but he is unable to dorsiflex it. This patient has most likely sustained an injury to which of the following nerves?

- A) Common peroneal
- B) Deep peroneal
- C) Sciatic
- D) Superficial peroneal
- E) Sural

The correct response is Option B.

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The patient described has sustained an injury to his deep peroneal nerve. An electromyogram should be ordered to confirm the diagnosis. The common peroneal nerve divides into two branches. The deep branch of the peroneal nerve innervates the extensor hallucis longus and the anterior tibial muscles. The superficial branch of the peroneal nerve provides motor innervation to the peroneus longus and brevis muscles. If the common peroneal nerve had been injured, eversion would not have been likely. A sural nerve injury would have a sensory component, not a motor component. The sciatic nerve injury would have more global consequences, though this pattern is theoretically possible in a Sunderland Grade VI injury. Thus, the most likely injured nerve is the deep peroneal nerve.

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193. Which of the following is NOT included in the global carpal tunnel release Current Procedural Terminology (CPT) code 64721?

- A) Exploration of the motor branch
- B) Internal neurolysis
- C) 90 Days of uncomplicated postoperative care
- D) Release of distal forearm fascia (antebrachial fascia)
- E) Synovial biopsy or limited synovectomy

The correct response is Option B.

Internal neurolysis is not included in the global code 64721, although external neurolysis is. Internal neurolysis is reported as CPT code 64727. Release of distal forearm fascia (antebrachial fascia), exploration of the motor branch, synovial biopsy or limited synovectomy, and 90 days of uncomplicated postoperative care are included in the global CPT code 64721. Also included are “incision, division of the palmar aponeurosis, division of the transverse carpal ligament, exploration of the carpal tunnel, release of the median nerve, exploration of the motor branch, release of the motor branch, epineurotomy, external neurolysis, closure of the operative wound, application of dressing, including wrist splint and anesthesia (local/wrist block) provided by the surgeon.”

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194. A 42-year-old man with type 1 diabetes mellitus comes to the office because he has had a sore on the heel of the left foot for the past 12 months. Physical examination of the foot shows a 4 × 4-cm ulcer. Pulses are difficult to palpate on the dorsalis pedis and posterior tibial arteries. No other abnormalities are noted. Noninvasive vascular studies are performed. Reconstruction with a free flap is planned. Which of the following is most likely to indicate the need for major arterial inflow reconstruction prior to reconstruction of the defect?
- A) Ankle-brachial index of less than 0.7
 - B) Biphasic arterial Doppler waveform
 - C) Delay in capillary refill of the toes of more than 3 seconds
 - D) Doppler signal loss from the dorsalis pedis artery
 - E) Great toe pressure of less than 30 mmHg

The correct response is Option E.

Thirty percent of diabetic patients have significant arterial calcifications in these arteries, which impedes blood pressure cuff compression, rendering the ankle-brachial pressure index inaccurate for ischemia. The ankle-arm index of 0.7 may thus be falsely elevated in this patient. Ordinarily, one would attempt to raise this index to at least 0.5 or 0.6 before performing soft-tissue reconstruction. Biphasic or triphasic arterial waveforms are usually consistent with sufficient vascularity for wound healing. Monophasic waveforms are associated more with extremity ischemia. However, even monophasic waveforms, as long as there is good amplitude and a narrow waveform complex, may be acceptable prior to attempting soft-tissue reconstruction.

Digital vessels are frequently spared from calcification and absolute toe pressures are a better indicator of peripheral ischemia than ankle pressures. A toe pressure of less than 30 mmHg indicates ischemia and the need to obtain an angiogram with a view to prior vascular inflow improvement (such as angioplasty, stenting, or surgical reconstruction) before proceeding to soft-tissue reconstruction. Capillary refill time is a subjective clinical evaluation that is not as accurate or objective as pressure testing. Incomplete plantar arch communication between the dorsalis pedis and posterior tibial arterial systems is not an accurate indication for ischemia.

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195. Which of the following carpal bones is the second most commonly fractured?

- A) Capitate
- B) Lunate
- C) Pisiform
- D) Scaphoid
- E) Triquetrum

The correct response is Option E.

The triquetrum is the second-most commonly fractured carpal bone. Most triquetrum fractures are dorsal ridge fractures that appear as avulsion fractures on lateral view radiographs of the wrist.

Pisiform, lunate, and capitate bones fracture less often than the triquetrum. The scaphoid is the most commonly fractured carpal bone.

Scaphoid fractures comprise 70% of all carpal fractures, with triquetral at 14%. The isolated incidence of other carpal bone fractures is 0.2% to 5%.

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196. A 35-year-old woman comes to the office for consultation because she has had rapidly progressive contractures of the thumb and index fingers of both hands and development of knuckle pads during the past nine months. She also has 1.5-cm painful nodules on the soles of both feet. Which of the following is the most likely cause of the patient's disease?

- A) Decrease in apoptotic gene expression
- B) Decrease in ratio of type III to type I collagen
- C) Deposition of antigen-antibody complexes
- D) Inheritance of an autosomal recessive trait
- E) Proliferation of myofibroblasts

The correct response is Option E.

The most likely causative event in the scenario described is proliferation of myofibroblasts. The patient described presents with Dupuytren diathesis, a phenomenon of rapidly progressing contractures in a young person. A diathesis can be recognized when there is a strong family history in a patient who is young at the time of onset and presents with bilateral disease, especially with radial-sided disease or diffuse dermal involvement. There does not seem to be a correlation between Dupuytren diathesis and patient gender. An association of ectopic disease is common. Ectopic deposits have been described on the soles of the feet (Lederhose disease), over the dorsum of the proximal interphalangeal joints (Garrod knuckle pads), and on the penis (Peyronie disease).

The three pathophysiologic phases of Dupuytren disease are the proliferative, involutional, and residual stages. The proliferative stage is characterized by an intense proliferation of myofibroblasts. The involutional stage is characterized by the alignment of the myofibroblasts along lines of tension. During the residual stage, the tissue becomes mostly acellular and devoid of myofibroblasts, and only thick bands of collagen remain. Many studies confirm an increase in the ratio of type II to type I collagen in Dupuytren disease. It is thought to be inherited as an autosomal dominant condition with incomplete penetrance.

A decrease in apoptotic gene expression is seen at the healing borders of keloids but has not been found in Dupuytren disease. The pathophysiology causing autoimmune diseases such as lupus erythematosus, scleroderma, and rheumatoid arthritis is the deposition of antigen-antibody complexes.

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197. A 55-year-old man who is employed as a police officer is brought to the emergency department after sustaining injuries to the left lower extremity during a motor vehicle collision. Physical examination shows fracture of the tibia with 2 cm of bone loss, a large amount of tissue loss, and soft-tissue contamination extending over the calf, ankle, and forefoot. Sensation is absent in the plantar surface. Which of the following factors is most likely to influence the surgeon to proceed with immediate amputation of the leg?

- A) Age of patient
- B) Amount of bone loss
- C) Contamination of soft tissue
- D) Injury to posterior tibial nerve

The correct response is Option D.

In recent publications from the Lower Extremity Assessment Project (LEAP), a multicenter prospective study to determine outcomes following lower extremity trauma, the most significant factor in a surgeon's decision to immediately amputate was the absence of plantar sensation and the severity of soft-tissue injury. While age, soft-tissue contamination, and bone loss may be significant predictors of long-term limb salvage and function, they were not as significant in impacting the surgeon's initial decision to salvage or amputate the leg.

The Gustilo grade is used to categorize the amount of soft-tissue injury and periosteal stripping.

Gustilo II Moderate soft-tissue injury and stripping

Gustilo IIIA A high-energy injury, but there is adequate soft tissue for closure despite laceration or undermining

Gustilo IIIB The presence of extensive soft-tissue injury with periosteal stripping and gross contamination

Gustilo IIIC Limb ischemia in addition to the findings in a IIIB injury

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198. A 23-year-old man is brought to the emergency department after sustaining a single gunshot wound to the right upper arm. Physical examination shows a high radial nerve palsy. Which of the following is the most appropriate first step in management of potential nerve injury?
- A) Immediate surgical exploration and primary nerve repair if nerve is lacerated
 - B) Immediate surgical exploration and repair with a nerve graft if nerve is lacerated
 - C) Immediate surgical exploration, resection of devitalized nerve, and suture tagging of nerve ends for delayed repair
 - D) Observation with electromyography six weeks after injury followed by exploration and repair if no return of function
 - E) Observation with electromyography six months after injury followed by exploration and repair if no return of function

The correct response is Option D.

In general, nerve injuries associated with open wounds should be explored and repaired early. If the nerve injury resulted from a relatively clean laceration or wound, it should be explored and repaired immediately. Crush or significant soft-tissue injury prohibits early nerve repair until the extent of devitalized tissue can be determined and the soft-tissue repair is stable.

Although gunshot wounds are technically open injuries, they should be treated as closed or blunt nerve trauma because the etiology of the trauma is predominately heat and shock. The majority of nerve dysfunction spontaneously recovers after gunshot wounds. Thus, the most logical first step in treatment is observation for at least six weeks at which time electrodiagnostic studies can be undertaken.

If there is not complete clinical return of function within six weeks, electrodiagnostic studies should be performed for baseline function and repeated at 12 weeks if clinical return of function is still not complete. If electromyography does demonstrate motor unit potentials, expectant management should be continued as full function should return. Electrodiagnostic studies should not be delayed for six months because long-term function is significantly decreased if nerve repair is delayed longer than three months.

Lack of clinical or electrical evidence of reinnervation at three months requires surgical exploration. A nerve that has been completely divided or fails to conduct intraoperatively should be managed with resection of scar tissue and repair of the nerve gap with an interpositional nerve graft. An in-contiguity lesion should undergo neurolysis of nonfunctioning nerve units and nerve grafting. The functioning units can remain intact.

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199. A 52-year-old man comes to the office because he has had a clinical diagnosis of carpal tunnel syndrome including numbness and dysesthesia of the thumb, index, and long fingers of both hands for the past four months. He says his symptoms worsen at night and when his wrist position changes while driving. Electrodiagnostic studies show delayed motor and sensory latencies and slowed conduction velocity at the wrist, indicating a conduction block of the median nerve. This block is most likely caused by localized nerve ischemia that results in which of the following?
- A) Blocking of calcium channels
 - B) Failure to maintain the resting nerve potential at -30 mV
 - C) Opening of sodium channels
 - D) Prevention of nerve membrane depolarization
 - E) Thickening of the myelin sheath

The correct response is Option D.

Local nerve ischemia prevents depolarization. A charge is maintained across the axon membrane with the interior of the axon having a charge of -90 mV. When the resting membrane potential reaches -50 mV, the membrane depolarizes. Since there is a relatively greater concentration of K^+ ions on the inside of the axon, there is a slow leak of K^+ ions, which causes the inside of the axon to become less negative. The ATP-dependent pump imports K^+ and exports Na^+ , maintaining the normal resting membrane potential at -90 mV. Maintenance of this ionic charge separation across the membrane requires energy, and the mechanism stops when the energy supply is interrupted, as with local ischemia. This is one of the mechanisms for conduction block that occurs with nerve compression. Various membrane channels consist of proteins embedded in the phospholipid membrane bilayer that allow passage of Na^+ , Ca^{2+} , and K^+ ions. With chronic nerve compression, the myelin sheath disintegrates and saltatory conduction between nodes of Ranvier ceases.

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200. A 27-year-old man has a large segmental defect of the humerus. Reconstruction using an osteocutaneous free flap from the lower leg is planned. A portion of which of the following muscles is most appropriately included with the bone to protect the pedicle and improve reliability of the skin island?

- A) Extensor digitorum longus
- B) Flexor hallucis longus
- C) Gastrocnemius
- D) Peroneus longus
- E) Tibialis posterior

The correct response is Option B.

The most appropriate muscle is the flexor hallucis longus.

The fibular free flap is a workhorse flap for reconstruction of large segmental bone defects. The vascular supply of this flap comes from the peroneal artery. A large segment of bone can be harvested, consisting of the majority of the fibula with the exception of the proximal 6 cm at the fibular head and the distal 6 cm near the ankle joint. The fibular flap can be harvested with a skin paddle on the lateral aspect of the leg, based on perforators through the lateral intermuscular septum or via the muscle. The pedicle is located adjacent to the flexor hallucis longus muscle in the deep posterior compartment of the leg. Inclusion of a cuff of the flexor hallucis longus muscle can be performed to protect the pedicle and add bulk to the reconstruction if necessary. A composite flap of fibula and the entire flexor hallucis longus muscle has been described. The lateral portion of soleus muscle can also be included in the fibula free flap if desired.

The extensor digitorum longus muscle is in the anterior compartment of the leg. The gastrocnemius muscle is in the posterior compartment of the leg and is more superficial. The peroneus longus muscle is in the lateral compartment of the leg. The tibialis posterior muscle is in the deep posterior compartment of the leg and is located along the interosseous membrane.

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Thank you for your participation.

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145	(A) (B) (C) (D) (E)
146	(A) (B) (C) (D) (E)
147	(A) (B) (C) (D) (E)
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152	(A) (B) (C) (D) (E)
153	(A) (B) (C) (D) (E)
154	(A) (B) (C) (D) (E)
155	(A) (B) (C) (D) (E)

156	(A) (B) (C) (D) (E)
157	(A) (B) (C) (D) (E)
158	(A) (B) (C) (D) (E)
159	(A) (B) (C) (D) (E)
160	(A) (B) (C) (D) (E)
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162	(A) (B) (C) (D) (E)
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164	(A) (B) (C) (D) (E)
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173	(A) (B) (C) (D) (E)
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196	(A) (B) (C) (D) (E)
197	(A) (B) (C) (D)
198	(A) (B) (C) (D) (E)
199	(A) (B) (C) (D) (E)
200	(A) (B) (C) (D) (E)

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