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- Log in to the website.
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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.

Please note that choosing to enter your responses through the online answer sheet will limit your ability to view answers and solutions interactively as you complete items.

American Society of Plastic Surgeons In-Service Examination



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

Material released March 2012.

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

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HONOR CODE STATEMENT

for the

In-Service Examination



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By taking this examination, I acknowledge that I have read this honor code statement and agree to abide by the terms stated therein.

Section 1: Comprehensive

1. A 12-year-old boy is brought to the emergency department with a soft-tissue injury to the left knee after falling while playing football. Which of the following types of cells is most likely to appear first at the wound site?
- A) Fibroblast
 - B) Lymphocyte
 - C) Macrophage
 - D) Neutrophil
 - E) Platelet

The correct response is Option E.

The process of wound healing occurs as a sequence of overlapping processes. The appearance of cell types in an acute wound occurs in the following order: platelets, neutrophils, macrophages, lymphocytes, and fibroblasts, during the inflammatory phase.

Tissue injury causes injured vessels to constrict rapidly, with primary hemostasis being a platelet-mediated process. Platelets trapped in the clot contain growth factors that initiate the coagulation and wound-healing cascade.

The ensuing phases of wound healing consist of inflammation, collagen synthesis, angiogenesis, epithelialization, and remodeling.

During the inflammatory phase, after platelet aggregation and degranulation, chemoattractants, activation factors, and vasoconstrictors are released. An efflux of neutrophils occurs at the wound site to primarily sterilize the wound. Within 2 to 3 days, the inflammatory cell population shifts to monocytes that differentiate into macrophages, which orchestrate the repair process. Collagen synthesis occurs as circulating bone marrow-derived cells migrate into the wound and develop a fibroblastic cell function. These cells and local, activated fibroblasts synthesize and secrete the replacement collagen scar. Fibroblasts become the predominant cell type by 3 to 5 days in clean, noninfected wounds. As fibroplasia progresses, granulation tissue forms as a consequence of neoangiogenesis and the directed growth of vascular endothelial cells stimulated by platelet and activated macrophage and fibroblast products. Wound reepithelialization occurs as keratinocytes at the wound margins migrate and proliferate once epidermal continuity is reestablished. Remodeling of the

resultant scar is a dynamic process that occurs slowly over months to years. Collagen deposition and degradation occur to yield a mature scar; however, maximum tensile strength of a wound reaches only approximately 80% of noninjured skin.

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2. A 35-year-old woman comes to the office with her boyfriend for consultation regarding augmentation mammoplasty. She currently wears a size 34B brassiere and is considering having her brassiere size increased to a D cup. She says she is happy with the way she looks in clothes, but the boyfriend indicates he would like to see a little more cleavage when she is in a swimsuit. History includes liposuction of her lateral thighs 6 months ago by a local dermatologist; she was satisfied with the result. She has also had injection of botulinum toxin type A to the glabella 3 times in the last year. Which of the following is the best reason to refuse performing the procedure for this patient?
- A) The patient may be being pushed into surgery
 - B) The patient may be a “surgiholic”
 - C) The patient may have body dysmorphic disorder
 - D) The patient may have a personality disorder
 - E) The patient may have unrealistic expectations

The correct response is Option A.

Most aesthetic surgeons and mental health professionals agree that patients who exhibit even mild signs of psychiatric problems are not good candidates for aesthetic surgery. Many patients present without obvious signs of problems and are unfortunately discovered when postoperative problems arise. However, there are certain groups of patients with easily identifiable characteristics that constitute a red flag: those who are pushed into surgery by others, those with whom you are incompatible, the “surgiholic” with a long past surgical history, those facing marital or familial disapproval, those with body dysmorphic disorder, the overly demanding patient, and those with unrealistic expectations.

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3. A healthy 8-year-old girl is brought to the office because of a 15-cm congenital nevus of the buttock and thigh. Which of the following is the most appropriate recommendation to the parents for management?
- A) Alexandrite laser treatment
 - B) Punch biopsy
 - C) Serial excision starting at age 21 years
 - D) Tissue expansion and excision
 - E) Observation for 3 to 6 months

The correct response is Option D.

While the overall lifetime risk of congenital nevocytic lesions is estimated in the 5 to 12% range, giant nevi tend to transform earlier. Some studies suggest that 50% of the malignancies that do develop in large nevi do so by age 3 years, and 70% occur by puberty. Giant nevi are classified as lesions over 20 cm in adults, or lesions in children that are estimated to reach 20 cm by full growth (9 cm on the head, 6 cm on the body). Patients with giant congenital nevi are estimated to have a 51% increased risk of developing melanoma. Another study showed a 5-year malignant melanoma transformation rate of 5.1%.

Given this propensity for malignant transformation, many authors advocate early aggressive treatment of giant nevi, starting at age 6 months. Serial excision, skin grafting, cultured epidermal autografts, and dermal regeneration templates (Integra) have all been described as treatments. In older patients, rotation and free flaps can be incorporated as needed.

Alexandrite lasers have not been advocated for nevi. Studies of ruby and carbon dioxide lasers have mixed results, some showing adequate lesion destruction and cosmesis, others with high rates of hypertrophic scarring.

Observation may be appropriate for smaller congenital nevi, though in this patient, at this age, the melanoma risk is sufficient to warrant intervention. Over 3 to 6 months, one would not expect clinically significant changes. Indeed, many would have urged earlier treatment. Waiting until age 21 years would also be inadvisable.

Punch biopsy is useful for surveillance of smaller lesions, though it may not be representative of a large lesion, and could possibly yield false-negative results.

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4. A 42-year-old man is brought to the emergency department after sustaining a traumatic, sharp amputation of the penis at the level of the proximal shaft during a domestic abuse incident. Repair of which of the following structures is necessary to obtain successful replantation of the penis?

- A) Cavernous artery
- B) Circumflex artery
- C) Deep dorsal artery
- D) Pudendal artery
- E) Subtunical venous plexus

The correct response is Option C.

Before the advent of microsurgical techniques, the procedure to replant a penis was rudimentary – surgeons would simply suture the approximate corporal bodies and the overlying tunica. Although successful occasionally, this technique was prone to partial necrosis of the glans or shaft and was associated with sexual and erectile dysfunction. The use of microsurgical techniques has allowed surgeons to repair transected structures more precisely and achieve significantly improved results. A review of the current published literature on penile replantations finds that, in addition to repair of the urethra, the three neurovascular structures that are repaired consistently are the dorsal nerves, dorsal veins, and the deep dorsal artery. Generally, a suprapubic catheter is placed to divert urinary flow for 2 to 3 weeks while the urethral repair heals.

The cavernous artery is buried within the substance of the corpus cavernosum and is technically difficult to repair.

The circumflex artery runs circumferentially through collateral circulation and would not be repaired normally.

The pudendal artery is a branch of the internal iliac vessels and is located much more proximally in the pelvis. It gives rise to the inferior rectal artery, perineal artery, posterior scrotal artery, and the deep dorsal artery.

The subtunical venous plexus is extremely small and would be technically difficult to repair.

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5. Which of the following is included in the principles of informed consent regarding augmentation mammoplasty?
- A) Alternatives to the procedure
 - B) Appropriate safeguards to protect the privacy of personal health information
 - C) Costs of the procedure
 - D) Photographic release
 - E) Requirement for arbitration

The correct response is Option A.

Alternatives to the procedure are part of an informed consent that also includes benefits and consequences. Although it may be argued that there are not many reasonable alternatives, there is always the option to decline cosmetic surgery. Likewise, both saline and silicone gel prostheses are options regardless of the preferences of the surgeon. Other items of informed consent include the nature of the surgery or treatment; indications for the procedure; expected benefits, consequences, and side effects of the procedure; potential risks and adverse outcomes, along with their probability and severity; alternatives to the procedure being considered; the benefits, risks, and consequences of the stated alternatives; and outcome anticipated.

Appropriate safeguards to protect the privacy of personal health information are required by the Health Insurance Portability and Accountability Act (HIPAA), not by informed consent. Discussing costs of the procedure, as well as the costs of revisions, is a part of good practice and may avoid litigation and dissatisfied patients; however, it is not required as part of informed consent. A photographic release is an important part of patient care in plastic surgery and serves as useful documentation, but it is not part of informed consent. Requirement for arbitration might be helpful to avoid litigation but is not part of informed consent and is not beneficial in states that feel physicians have a better understanding of medical matters.

The six elements of valid informed consent include diagnosis or suspected diagnosis; the nature and purpose of the proposed treatment or procedure and its anticipated benefit; the risks, complications, or side effects associated with the proposed treatment or procedure; the probability of success based on the patient's condition; reasonable, available alternatives; and the possible consequences to the patient if the recommendations are not followed.

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6. A 21-month-old male infant is scheduled to undergo reconstruction of a 12-cm² cranial defect after a cranial vault reshaping procedure. Which of the following materials is most appropriate for cranioplasty in this patient?
- A) Bone dust
 - B) Hydroxyapatite
 - C) Particulate bone
 - D) Split calvarium
 - E) Split rib

The correct response is Option C.

Although alloplastic materials and bone substitutes have been used to reconstruct the pediatric cranium, autogenous bone is the best option. Unlike synthetic materials, autogenous grafts undergo rapid osseointegration because they are osteogenic, osteoinductive, and osteoconductive. Once healed, the grafted site has the same properties as native bone: strength, growth potential, stability, and resistance to infection.

Compared with other sources of autogenous graft, calvarial bone is the preferred donor site for cranioplasty, especially in pediatric patients, because it is in the operative field, volume retention and strength of the graft are excellent, and harvest causes no additional discomfort. Extracranial sources of autologous bone (rib or iliac crest) provide little volume in toddlers, have a higher resorptive rate than cranial bone, and are associated with greater donor-site morbidity.

Bone dust is the powder-like bone that results from using a high-speed burr. Bone dust is ineffective and resorbs when used for cranioplasty, possibly because of its smaller particle size and/or thermal injury during harvesting. Autogenous bone, the standard material used for cranial reconstruction, is of limited supply in young children. Calvarial bone is difficult to split until a diploic space has formed, usually after 4 years of age, and some authors do not recommend in situ harvest before 9 years of age. Cranial particulate bone grafting, however, can be harvested at any age, and studies have demonstrated that it is as effective as split calvarial bone graft for closure of cranial defects. Particulate cranial graft consists of tiny pieces of bone harvested with a low-speed, hand-driven bit and brace. It has shown in animal models as well as clinical studies to effectively heal full-thickness cranial defects.

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7. An otherwise healthy 25-year-old chef comes to the office 2 hours after sustaining scald burns when she accidentally spilled a large pot of soup. She says she washed the area immediately and dressed the burns with silver sulfadiazine. She is alert and her condition is stable. Physical examination shows partial-thickness burns on the lower abdomen, perineum, external genitalia, and anterior thighs involving approximately 15% of the total body surface area. Which of the following is the most appropriate next step in management?
- A) Administration of oral antibiotics
 - B) Outpatient care with silver sulfadiazine
 - C) Parkland formula fluid resuscitation
 - D) Referral to the inpatient burn center
 - E) Split-thickness autografting

The correct response is Option D.

The patient described with a partial-thickness burn greater than 10% of the total body surface area (TBSA) and a burn to the perineum meets the criteria for referral to the burn center. Other criteria for burn center referral, as advised by the American Burn Association, include burns that involve the face, hands, feet, genitalia, perineum, or major joints in both young or old patients (younger than age 5 years or older than age 60 years); third-degree burns in any age group; inhalation injury; electrical and lightning burns; chemical burns (especially hydrofluoric acid burns); and any patients with preexisting medical or social conditions that could adversely affect outcomes. Also, children admitted to a hospital without pediatric specialty care should be transferred, if possible.

Studies suggest that outcomes of complex burns improve at high-volume care centers. Most types of small burns can be managed well as outpatient cases, especially by motivated, healthy patients. Others may be eligible for home care to help with dressings if needed. High-volume fluid resuscitations, such as the Parkland formula, are employed for burns greater than 20% TBSA, as the inflammatory response mechanisms that necessitate high-volume resuscitations rarely occur with burns under 20% TBSA. Usually, oral fluids and/or modest intravenous supplementation are sufficient. Autografting should be reserved for deep or function-impeding burns that fail to respond to initial optimal burn wound care.

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

8. A 24-year-old right-hand-dominant male construction worker is evaluated because of a right dorsal thumb abscess that is treated with debridement and administration of antibiotics. A photograph of the residual defect is shown. Which of the following is the most appropriate method for reconstruction in this patient?
- A) Coverage with a muscle flap
 - B) Coverage with a skin flap
 - C) Full-thickness skin grafting
 - D) Negative pressure wound therapy
 - E) Split-thickness skin grafting

The correct response is Option B.



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

The residual defect includes exposed extensor tendon without paratenon. This fact, combined with the need for flexion at the interphalangeal joint and avoidance of contracture, as well as the likely need for future tenolysis, makes a skin flap the most appropriate option for reconstruction. In the scenario described, a first dorsal metacarpal artery pedicled skin flap is used to reconstruct the thumb defect with the need for back grafting of the donor site. This provides the best combination of low donor-site morbidity, the ability to provide stable soft-tissue coverage over exposed tendon without paratenon, and the competitive advantage of being relatively easy to re-elevate for subsequent procedures, if needed.

A muscle flap could be used to reconstruct the defect but would not be optimal due to the increased donor site morbidity from muscle sacrifice, as well as the increased difficulty in re-elevation versus a skin flap over tendon.

Healing by secondary intention, with or without topical negative pressure wound therapy, will certainly result in extensive contracture as well as an increased time to heal. This will impact the patient's outcome both in terms of his ability to return to work as a construction worker as well as limitations on his functional range of motion.

Skin grafting, whether split- or full-thickness, is not a reliable option in this patient because of the exposed tendon without paratenon. It is important to note that this is a classic contraindication to skin grafting and therefore leads to a flap-based reconstruction.

Furthermore, skin grafts would lead to increased contraction versus flaps and would be difficult to re-elevate for subsequent procedures.

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9. A 32-year-old woman comes to the office for consultation regarding gender reassignment surgery. She is in a stable relationship with a supportive partner and has the support of her family. She is interested in mastectomy, hysterectomy, salpingo-oophorectomy, and phalloplasty. Referral to which of the following is the most appropriate next step in management?

- A) Breast surgeon for mastectomy
- B) Endocrinologist for hormonal manipulation
- C) Gynecologist for hysterectomy and salpingo-oophorectomy
- D) Psychiatrist for evaluation
- E) Urologist to assist with phalloplasty

The correct response is Option D.

The most appropriate next step in management is referral to a psychiatrist for evaluation. Gender identity disorder, formerly known as transsexualism, should ideally be managed by a multidisciplinary team. Ideal management includes psychotherapeutic, hormonal, and surgical treatments. Initial care involves a diagnostic phase in two stages. The goal of the first stage is to establish the diagnosis according to well-defined criteria and to rule out other psychiatric disorders. The second stage of the diagnostic phase is a “real-life test,” in which the patient assumes the role of the opposite sex. Ongoing supportive psychotherapy is often required. Some centers begin hormonal therapy during the “real-life test” to assist the transition and to make the test more realistic. Most centers defer hormonal therapy until 1 year following initial contact with the patient; surgery is deferred for 2 years following contact. There are no well-established protocols to guide the surgical sequence.

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10. A 50-year-old man comes to the office because of a 2-day history of worsening erythema, swelling, and tenderness of the interphalangeal (IP) joint of the thumb. He reports similar episodes in the past involving other joints but does not recall any history of trauma or skin breakage in the area. X-ray study of the thumb shows soft-tissue swelling only. No bony abnormalities are noted. Which of the following is the most appropriate first step in management?

- A) Administration of antibiotics
- B) Aspiration of joint fluid
- C) Elevation and splinting of the joint
- D) MRI of the joint
- E) Surgical washout

The correct response is Option B.

The most appropriate first step in management in the scenario described is to aspirate fluid from the joint for analysis. There are several conditions that mimic acute hand infections, and it is important to recognize them so that the appropriate treatment can be initiated. Crystalline deposition diseases, such as gout and pseudogout, tend to present with joint swelling, erythema, pain with motion, and fever, much like the signs of infection. The only way to confirm the diagnosis is to aspirate the joint and look for crystals with polarizing microscopy. Though the description of the thumb in the scenario described is consistent with possible infection, the fact that there has been no trauma or break in the skin around the joint, and the patient's history of acute arthritic episodes in other joints, raises some suspicions that this could be noninfectious. Therefore, joint aspiration to rule out other causes of acute arthritis is warranted. Administration of antibiotics and elevation and splinting should begin after the aspiration, if indicated. MRI of the joint and surgical washout are not indicated at this time.

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11. A 5-year-old girl has subcutaneous extravasation of an epinephrine infusion in the upper extremity. On examination 1 hour later, the extremity is swollen, nontender, and well perfused. Which of the following is the most appropriate next step in management?
- A) Application of a cold compress
 - B) Application of a warm compress
 - C) Elevation of the extremity
 - D) Incision and saline irrigation
 - E) Subcutaneous administration of phentolamine

The correct response is Option C.

The most appropriate next step in management is elevation of the extremity. Elevation facilitates venous return of the extravasate, reduces swelling, and minimizes the risk of skin necrosis.

The use of warm or cold compresses on the extravasation site is controversial. Heat may theoretically stimulate the evacuation of the infiltrate through vasodilation and increased blood flow. Ice may theoretically limit the inflammatory reaction, as well as the diffusion of the infiltrated substance, by causing vasoconstriction. However, warm or cold compresses may also worsen tissue damage. Heat can cause thermal injury, and ice can cause ischemia from vasoconstriction resulting in a “second hit” at the extravasation site; a partial-thickness skin injury may be converted to a full-thickness wound.

Although phentolamine, an alpha-adrenergic antagonist, has been used to treat epinephrine extravasation, the added volume of phentolamine can worsen the injury. Injection of an antidote adds more fluid to the subcutis and may increase the risk of pressure necrosis. In addition, because epinephrine causes vasoconstriction for only 60 to 90 minutes, its effects have usually worn off by the time the extravasation is noted, the patient is evaluated by a physician, the phentolamine is ordered, and the antidote is obtained from the pharmacy.

Saline flush out, or using stab incisions through which saline is flushed, may be helpful for the extravasation of chemotherapeutic agents, but it requires several incisions and would be considered only after elevation of the extremity.

References

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12. A 50-year-old woman is scheduled to undergo a cosmetic procedure in an ambulatory surgery center (ASC). The patient is concerned about her risk of dying during this procedure. This patient's postoperative risk of death from a pulmonary embolism is highest if she undergoes which of the following procedures in an ASC?

- A) Abdominoplasty
- B) Augmentation mammoplasty
- C) Rhinoplasty
- D) Rhytidectomy
- E) Suction lipectomy

The correct response is Option A.

Abdominoplasty is the procedure associated most frequently with postoperative mortality from a pulmonary embolism in an ASC.

The American Association for Accreditation of Ambulatory Surgery Facilities, Inc. (AAAASF) has collected statistics on morbidity and mortality for its accredited facilities. Mortality from office-based surgery is extremely rare. From 2001 to 2006, there were over 1 million outpatient procedures performed with 23 deaths. Pulmonary embolism was the cause in 13 of the 23 deaths. Twelve of the 13 pulmonary embolism deaths were associated with abdominoplasty alone or in conjunction with another procedure.

References

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2. Clayman MA, Seagle BM. Office surgery safety: the myths and truths behind the Florida moratoria--six years of Florida data. *Plast Reconstr Surg*. 2006 Sep;118(3):777-785.
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13. A healthy 40-year-old man comes to the office because of an injury to his finger. Examination shows a 4 × 3-cm, full-thickness defect over the proximal interphalangeal (PIP) joint of the right index finger. The joint capsule and extensor tendons are exposed. No sign of infection is noted. Coverage with an arterialized venous free flap from the forearm is planned. Which of the following is the main disadvantage of using this flap in reconstruction?

- A) Difficult flap monitoring
- B) High incidence of total flap failure
- C) Inability to transfer flap with nerve and/or tendon
- D) Limited supply of donor sites
- E) Technically demanding flap harvest

The correct response is Option A.

Arterialized venous free flaps are thin fasciocutaneous flaps that are useful in reconstructing defects of the hand. The main advantage of an arterialized venous flap is the ease of harvesting a thin flap without the need to sacrifice a major artery at the donor site. The design of venous flaps is very easy because of direct visualization of the venous plexus through the thin overlying skin. There is no limitation of the donor site because it is possible to find the venous network at any location of the body. They can be harvested as composite flaps, including nerve and tendon flaps. Despite many advantages, arterialized venous flaps are not commonly selected as the first choice for microsurgical reconstruction. Venous congestion is an expected part of the flap's postoperative course, and this makes monitoring the flap especially difficult as compared with other conventional flaps. Signs of vascular insufficiency and characteristic edema and congestion of venous flaps are difficult to differentiate. In cases of venous congestion, flap viability can be monitored only by palpating the pulse or by laser Doppler probe analysis. Though venous congestion is common, the ultimate success rate of arterialized venous flaps is similar to that of conventional flaps, with total flap loss a rare occurrence.

References

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2. Takeuchi M, Sakurai H, Sasaki K, et al. Treatment of finger avulsion injuries with innervated arterialized venous flaps. *Plast Reconstr Surg*. 2000 Sep;106(4):881-885.

3. Hýza P, Veselý J, Novák P, et al. Arterialized venous free flaps--a reconstructive alternative for large dorsal digital defects. *Acta Chir Plast.* 2008;50(2):43-50.

14. An otherwise healthy 17-year-old boy is brought to the emergency department after sustaining a laceration of the distal middle toe. On examination, the toe is bleeding. Infusion of which of the following local anesthetics is most appropriate at the wound site before repair?
- A) 0.5% Lidocaine
 - B) 1% Lidocaine
 - C) 1% Lidocaine with sodium bicarbonate
 - D) 1% Lidocaine with 1:200,000 epinephrine
 - E) 2% Lidocaine

The correct response is Option D.

The most appropriate local anesthetic to infuse at the wound site before repair is 1% lidocaine with 1:200,000 epinephrine. The addition of epinephrine to the local anesthetic increases the safety of the lidocaine and facilitates the laceration repair. Epinephrine slows the absorption of the local anesthetic, which allows lower doses to be used. Epinephrine also increases the duration of action of lidocaine, which provides longer pain relief. Vasoconstriction from the epinephrine reduces bleeding at the site of the injury, which shortens the operative time, lowers the risk of iatrogenic injury, and facilitates the repair.

Epinephrine is not contraindicated in the fingers or toes. The vasoconstrictive effects of epinephrine only last for 60 to 90 minutes; much longer ischemia times are necessary to cause skin necrosis. For example, amputated digits may be successfully replanted after 33 hours of warm ischemia time.

Although epinephrine diluted to a concentration of 1:1,000,000 (which is commonly used in tumescent solution for liposuction) will cause vasoconstriction, its onset is prolonged and its duration of action is shortened compared with epinephrine 1:200,000.

Lidocaine or bupivacaine without epinephrine does not reduce bleeding at the site of injury, which increases the difficulty of the repair. In addition, without epinephrine, lower doses of local anesthetic must be used, and the patient has a shorter duration of pain relief.

References

1. Chiu HY, Chen MT. Revascularization of digits after thirty-three hours of warm ischemia time: a case report. *J Hand Surg Am.* 1984 Jan;9A(1):63-67.

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

15. An otherwise healthy 17-year-old boy is brought to the office because of a 3-month history of a bleeding, 8 × 4-mm, red lesion of the left temple that has enlarged rapidly. A photograph is shown. Which of the following is the most likely diagnosis?
- A) Congenital hemangioma
 - B) Infantile hemangioma
 - C) Kaposiform hemangioendothelioma
 - D) Pyogenic granuloma
 - E) Venous malformation

The correct response is Option D.

The most likely diagnosis is pyogenic granuloma. Pyogenic granuloma usually appears in childhood as a rapidly growing, red lesion. Lesions are commonly small (less than 1 cm) and complicated by bleeding. Definitive treatment is excision.

Congenital hemangioma is fully grown at birth. There are two types: rapidly involuting congenital hemangioma (RICH) and noninvoluting congenital hemangioma (NICH). RICH rapidly involutes postnatally and is usually fully regressed by age 12 months. Treatment is rarely necessary. NICH does not undergo involution; it remains the same size over the course of the patient's lifetime. NICH is rarely problematic, but may be resected if it causes a significant deformity.

Infantile hemangioma is usually noted 2 weeks after birth and enlarges rapidly over the first few months of life; bleeding is rare. By age 1 year, the tumor begins to regress. Problematic lesions are treated with intralesional corticosteroid, oral prednisolone, or resection.

Kaposiform hemangioendothelioma (KHE) is usually present at birth and does not increase in size. It is often large, superficial, and diffuse. It typically involves the trunk and extremities. Patients commonly have Kasabach-Merritt phenomenon (thrombocytopenia, bruising, bleeding). First-line treatment is vincristine.

Venous malformation is a congenital lesion that is present at birth and enlarges slowly over time. It is typically blue, and bleeding is uncommon. Treatment involves either sclerotherapy or resection.

References

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16. A 50-year-old man with a history of organ transplantation is scheduled to undergo resection of a squamous cell carcinoma of the scalp followed by reconstruction with a flap. This patient is most likely to avoid postoperative wound-healing complications if he is currently undergoing which of the following immunosuppressive therapies?

- A) Antilymphocyte antibody (basiliximab)
- B) Antimetabolite (azathioprine)
- C) Calcineurin inhibitor (cyclosporine)
- D) Glucocorticosteroid (prednisone)

The correct response is Option A.

Many immunosuppressive agents used in organ transplantation have been shown to impair wound healing. Thus, free tissue transfer or major reconstructive surgery has been associated with higher complication rates. Immunosuppressive agents can be categorized as antilymphocytes (lymphocyte immune globulin [Atgam], thymoglobulin, basiliximab), antimetabolites (azathioprine, mycophenolate mofetil), calcineurin inhibitors (cyclosporine, FK-506), and glucocorticosteroids. Only antilymphocyte therapy has been shown not to impair wound repair.

References

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2. Cohen M, Pollak R, Garcia J, et al. Reconstructive surgery for immunosuppressed organ-transplant recipients. *Plast Reconstr Surg*. 1989 Feb;83(2):291-295.

17. A 55-year-old woman is referred to the office by her oncologist because of a chronic ventral hernia. Hernia repair is planned. Before the procedure, the patient says she would also like an abdominoplasty during the same operation. She wonders if her insurance can be billed for the procedure or a similar one, such as a panniculectomy. Which of the following is the most appropriate management of this patient's request?
- A) Collect payment from the patient for the costs related to the abdominoplasty
 - B) Perform the abdominoplasty and hernia repair and bill the patient's insurance for both procedures
 - C) Refuse to take the case because it is fraudulent to perform any cosmetic procedures in conjunction with reconstruction
 - D) Schedule the procedure as a panniculectomy, perform the abdominoplasty, and bill the insurance for the panniculectomy

The correct response is Option A.

In the scenario described, it is most appropriate to explain to the patient that she will need to be billed separately for the cosmetic portion of the procedure and associated anesthesia. Insurance companies will not cover elective cosmetic procedures.

When performing both a reconstructive and cosmetic procedure, one must inform the operating staff at what point the elective cosmetic portion has begun. This will allow for the patient to be separately billed for anesthesia and operating room fees. Codes submitted for reimbursement of insurance coverage should represent only the reconstructive portion of the procedure.

It is not fraudulent to perform elective cosmetic and reconstruction procedures at the same time.

It is never acceptable to perform one procedure and bill for a second in the hope of being reimbursed.

References

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2. Freeman VG, Rathore SS, Weinfurt KP, et al. Lying for patients: physician deception of third-party payers. *Arch Intern Med*. 1999 Oct 25;159(19):2263-2270.

18. A 42-year-old woman with a history of progressive facial atrophy comes to the office because of a moderately sized soft-tissue deficit on the left side of the face. She is scheduled to undergo a single fat transfer procedure for correction. Which of the following is the most likely outcome of this procedure in this patient?

- A) Donor site seroma
- B) Facial nerve injury
- C) Fat embolism
- D) Hypertrophic scarring
- E) Inadequate correction

The correct response is Option E.

Romberg disease, or progressive facial atrophy, is a rare pathologic process characterized by an acquired, idiopathic, self-limited, unilateral atrophy of the face, variably involving skin, subcutaneous tissues, fat, muscle, and less frequently, the underlying bone structures.

Methods of restoration of facial contour and volume in these patients include synthetic implants, bone grafts, free tissue transfer, and fat grafting.

Fat injections have been used for over 20 years to correct soft-tissue deformities throughout the body. Fat grafts are often used for “touch-up” of various reconstructive procedures. This technique has been found to be helpful as an adjunct to free tissue transfer in cases of progressive facial atrophy and congenital hemifacial microsomia.

Although fat embolism has been rarely reported during fat transfer in the face, complication rates of fat grafting are low, especially when compared with complications of free tissue transfer for reconstruction of facial deformities, which may include donor site seroma, facial nerve injury, and hypertrophic scarring. The most common adverse outcome of fat grafting is likely to be inadequate correction with a single-stage procedure. A recent study found that no statistically significant difference was found in satisfaction rates between free flap reconstruction and serial fat grafting of soft-tissue deficits in hemifacial microsomia.

References

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19. A 56-year-old man comes to the office because of a lesion on the tip of his nose. He has a 10-year history of coronary artery disease, skin cancers, excisions of the face, and poorly controlled type 2 diabetes mellitus. He has smoked one pack of cigarettes daily for the past 30 years. Medications include 81 mg of aspirin daily. Physical examination shows a 1-cm nodule with irregular borders. Examination of a specimen obtained on biopsy shows morpheaform basal cell carcinoma. Which of the following is the most appropriate next step in management?
- A) Cryotherapy
 - B) External beam radiation therapy
 - C) Intralesional injection of 5-fluorouracil
 - D) Mohs micrographic surgery
 - E) Wide local excision

The correct response is Option D.

Morpheaform basal cell carcinoma is notorious for having “finger-like” extensions that are not always apparent on gross visual examination and can only be appreciated histologically. The morpheaform subtype of basal cell carcinomas tends to have a higher recurrence rate when simply excised. Mohs micrographic surgery is a technique that uses tangential excisions and frozen section pathology, which more accurately assess the margins of excision. Mohs micrographic surgery may also help minimize the extent of resection. Mohs micrographic surgery is particularly useful in morpheaform basal cell carcinoma, where obtaining negative surgical margins is critical to minimizing the risk of recurrence.

Cryotherapy and external beam radiation therapy are recognized treatments for basal cell carcinomas only when surgical excision is not feasible. In the patient described with no absolute contraindications to surgery, surgical management would be considered the mainstay of therapy.

5-Fluorouracil is an antineoplastic agent and can be used topically for basal cell carcinomas when surgical therapy is not an option. Intralesional injection for this purpose is infrequently performed and would be considered an off-label use of the product. It has a low cure rate.

Wide local excision in the area of the tip of the nose would be inappropriate because this would create a larger defect than may otherwise be required to obtain clear margins. Gross margins of 2 to 3 mm are generally sufficient for non-morpheaform-type basal cell carcinomas.

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2. Kirby JS, Miller CJ. Intralesional chemotherapy for nonmelanoma skin cancer: a practical review. *J Am Acad Dermatol*. 2010 Oct;63(4):689-702. Epub 2010 Jun 1.

20. A 14-year-old boy with a history of extensive burns and skin grafting as a child comes to the office because of multiple tight and uncomfortable scars. Examination shows raised, thick, and moderately contracted scars on the scalp, back, abdomen, upper arms, and thighs. Tissue expansion followed by scar excision is planned. Which of the following areas is most likely to have the highest rate of tissue expander failure in this patient?

- A) Abdomen
- B) Back
- C) Scalp
- D) Thigh
- E) Upper arm

The correct response is Option C.

In a 10-year follow-up study of 256 pediatric burn patients, 36 patients (14%) required expander removal due to extrusion, infection, or expander rupture or loss of the port. An additional 26 patients (10%) had inadequate expansion or inability to fully carry out the operative plan. The most common site of failure was the scalp, (27/36 patients implant removal, 18/26 inadequate expansion). Other studies show far higher complication rates in the lower leg and urge caution in expander reconstruction below the knee.

Tissue expansion is a highly effective technique for scar contracture release. Patients with scalp and leg expansion may be counseled about a higher failure rate or only partial correction of the deformity. In areas of increased tissue laxity and pliability, such as the abdomen, back, thigh, and upper arm, complication rates appear lower.

References

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2. Pisarski G, Mertens D, Warden G, et al. Tissue expander complications in the pediatric burn patient. *Plast Reconstr Surg*. 1998 Sep;102(4):1008-1012.

21. A 25-year-old woman is brought to the emergency department after sustaining deep partial-thickness and full-thickness burns to the face, neck, chest, back, and bilateral upper extremities in a grease fire. The patient is intubated and resuscitated, and the wounds are managed surgically. Which of the following is the most appropriate position to splint the burned areas?

- A) Elbow extended at 180 degrees
- B) Hands in intrinsic minus position
- C) Neck flexed at 45 degrees
- D) Shoulder abducted at 60 degrees
- E) Wrist flexed at 10 degrees

The correct response is Option A.

The most appropriate position to splint the different burned areas is neck in slight extension, shoulder fully abducted to about 90 degrees, elbow fully extended at 180 degrees, wrist in neutral or slightly extended, and hands in intrinsic plus position or position of function. This is done to prevent contractures that would pull these joints into positions that would lead to functional deficits.

References

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2. Kao CC, Garner WL. Acute burns. *Plast Reconstr Surg.* 2000 Jun;105(7):2482-2492.

22. A 50-year-old man undergoes wide local excision and bilateral selective cervical lymphadenectomy because of a 6-month history of invasive squamous cell carcinoma of the anterior floor of the mouth. Free tissue transfer using an anterolateral thigh free flap, including harvest of the lateral femoral cutaneous nerve, reconstructs the ventral glossectomy and floor-of-mouth defect. Which of the following is the most likely recipient nerve for functional sensory recovery of the free flap in this patient?

- A) Cervical branch of facial
- B) Great auricular
- C) Hypoglossal
- D) Inferior alveolar
- E) Lingual

The correct response is Option E.

Oral mucosal sensation is important in many stomatognathic functions. Mastication, oral hygiene, phonation, and swallowing can all influence patient quality of life. A proportionally worsening functional impact with an increasing area of anesthesia has been noted. Therefore, restoration of sensibility should be one of the important components of the functional rehabilitation of glossectomy defects.

Although spontaneous reinnervation does occur in noninnervated flaps, it takes a longer period of time to develop, and it may not restore adequate functional sensation, nor does it provide useful tactile sensation or two-point discrimination. These sensory modalities are important in a patient's ability to handle oral secretions and food boluses.

Microsurgical anastomoses of the lateral femoral cutaneous nerve is most commonly performed to the lingual nerve stump left after tumor extirpation.

The cervical branch is the lowest division of facial motor nerve and would not provide sensory recovery to the freely transferred thigh tissue.

The great auricular nerve provides sensation to the earlobe and can serve as an ideal donor for segmental nerve grafting, if required. Bioprosthetic conduits (nerve tubes) or vein grafts have also been described for this purpose.

The hypoglossal nerve is commonly identified and preserved in selective cervical lymphadenectomy, and, if divided, causes a motor paralysis of the ipsilateral tongue.

The inferior alveolar nerve is part of the trigeminal system (V3) and is not divided during a floor-of-mouth resection and/or glossectomy, unless a segmental mandibulectomy is also performed.

References

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23. A 5-year-old girl undergoes repair of a forehead laceration in the emergency department. Administration of ketamine is used for sedation. Which of the following best describes intravenous administration of ketamine when compared with intramuscular administration in this patient?

- A) Higher rate of laryngospasm
- B) Longer duration of effect
- C) Longer time to clinical onset
- D) Lower rate of vomiting

The correct response is Option D.

Ketamine is a dissociative sedative that provides analgesia, amnesia, and sedation. It is very effective, particularly in children. Patients over age 15 years have an increased risk of emergence phenomenon (hallucinations, nightmares, and agitation). Ketamine is frequently coadministered with glycopyrrolate and midazolam to decrease side effects.

Ketamine can be administered intravenously or intramuscularly. Intravenous injection is generally safer, and has a lower rate of laryngospasm, shorter duration of clinical onset and effect, and lower rate of vomiting. It can be titrated with a continuous infusion or repeated boluses to effect.

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24. A 1-day-old female newborn is evaluated because of a 4 × 4-cm defect after undergoing dural repair of a lumbar myelomeningocele. Which of the following is the most appropriate next step in management?

- A) Negative pressure wound therapy
- B) Split-thickness skin grafting
- C) Coverage with a skin advancement flap
- D) Coverage with a local musculofascial flap
- E) Coverage with a free flap

The correct response is Option D.

The most appropriate next step in management is coverage with a local musculofascial flap. The major principle of myelomeningocele repair is to obtain a well-vascularized layer of soft-tissue coverage between the dural repair and skin repairs. The fascia overlying the paraspinous muscles can be turned over as flaps followed by paraspinous muscle advancement flaps to cover the underlying dural repair. This vascularized soft-tissue layer will minimize the risk of contact of cerebrospinal fluid with cutaneous bacteria and subsequent meningitis if either the dural repair or skin repair breaks down.

Vacuum-assisted wound therapy over a dural repair would increase the risk of cerebrospinal fluid leak, dural injury, and breakdown of the repair. A split-thickness skin graft over the dura would not adequately protect the spinal cord.

Closing the skin directly over the dural repair would place the patient at risk for meningitis in the event of a cerebrospinal fluid leak, or if wound breakdown occurred along the incision line of the widely undermined skin flaps.

The use of a free flap to cover the dural repair is unnecessary because local tissue (paraspinous muscles and fascia) is available. Harvesting the gluteal muscle(s) may cause significant donor site morbidity in a child already at risk for ambulatory problems from a neurologic deficit.

References

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25. A 53-year-old woman is evaluated in the recovery room during the first hour after microsurgical breast reconstruction with a free flap. On examination, the skin paddle appears bluish with a rapid capillary refill. There is a strong cutaneous arterial Doppler signal. Which of the following actions is most appropriate to increase the likelihood of flap salvage in this patient?

- A) Administration of systemic heparin
- B) Administration of systemic tissue plasminogen activator
- C) Application of a body warmer
- D) Application of leeches
- E) Emergent exploration

The correct response is Option E.

The patient has a venous thrombosis. The success of free tissue transfer is greater than 90% at most major microsurgical centers. Between 5 to 25% of free flaps require reexploration due to vessel compromise, as venous congestion is more common than arterial compromise. The flap salvage rate is influenced by the timing of reexploration across multiple studies. In one study, flaps that were reexplored within 5 hours had a higher flap salvage rate.

All studies point to early recognition of flap compromise as important and rapid reexploration as the most important factor to improve flap salvage. Administration of heparin, use of thrombolytics, and application of leeches will not increase the salvage rate in the scenario described. Increasing the patient's temperature also does not improve flap salvage.

References

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26. Which of the following is an example of proper Current Procedural Terminology (CPT) coding when submitting charges for procedures performed?
- A) Coding for debridement of a traumatic wound, as well as its complex closure
 - B) Coding for hernia repair in a transverse rectus abdominis musculocutaneous (TRAM) flap breast reconstruction due to use of mesh for abdominal wall repair and closure
 - C) Coding for primary closure of an anterolateral thigh free flap donor site in a lower extremity reconstruction
 - D) Coding for resection of skin cancer and coding for local small rotation flap to reconstruct
 - E) Coding for skin grafting to a radial artery free flap donor site in a head and neck reconstruction

The correct response is Option E.

Proper coding and thorough familiarity with the descriptions of the Current Procedural Terminology (CPT) is essential to avoid mistakes or involvement in insurance/payer abuse or fraud litigation.

Based on the CPT manual, skin graft closure of a radial artery free flap donor site is a separate procedure and can be billed separately.

Billing for the complex closure of a traumatic wound includes the debridement of the wound before closure.

Abdominal wall repairs are included in transverse rectus abdominis musculocutaneous (TRAM) flap cases and should not be billed separately.

Anterolateral thigh free flap donor site closure is included in the initial charge for the free flap and should not be billed separately.

Excision of skin cancer is included in local tissue rearrangement closure.

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

27. A 10-year-old boy comes to the office because of difficulty turning his head and looking up 2 years after sustaining burns in a gasoline fire involving nearly 50% of the total body surface area. Bilateral skin grafting of the distal upper extremities and proximal upper thighs was performed 2 years ago to treat deep partial-thickness burns. Current physical examination shows severe burn scar contracture on the neck (shown) and healed skin grafting of the neck and anterior trunk. After release and excision of the burn scar contracture, a 10 × 20-cm defect results. Which of the following is the most appropriate method of reconstruction to provide the most aesthetic and functional outcome?
- A) Anterolateral thigh perforator free tissue transfer to the neck
 - B) Dermal regeneration template (Integra)
 - C) Full-thickness skin graft from the inguinal region
 - D) Split-thickness skin graft from the back
 - E) Split-thickness skin graft from the posterior thigh

The correct response is Option B.

While Integra artificial skin substitute has been used traditionally in the acute management of burns, there have been many successful reports incorporating its use in general reconstructive plastic surgery. Integra is a bioengineered dermal substitute consisting of a bilayer membrane system. The dermal replacement layer is composed of a cross-linked bovine tendon collagen-glycosaminoglycan (chondroitin-6-sulfate) matrix coated on one side with a synthetic polysiloxane polymer (silicone) layer. Integra “take” mirrors skin graft “take” and follows the sequence of (1) imbibition; (2) fibroblast migration; (3) neovascularization; and (4) maturation.

As the host tissue infiltrates the dermal layer, the collagen layer is biointegrated with the wound to form a vascular neodermis capable of accepting a split-thickness skin graft following a period of 3 to 4 weeks. Proper patient selection and careful monitoring for infection or hematoma accumulation are crucial in this time period. After approximately 4 weeks, the silicone layer is removed and a thin (0.008- to 0.010-in) skin graft can be applied.

Advantages of Integra use include improved cosmesis; diminished burn scar contracture or development of hypertrophic scar; off-the-shelf availability in large quantities; increased elasticity; and the ability to use thinner skin grafts with subsequent improvement in donor site morbidity, scar, and time to heal. Other cited advantages include commensurate growth of the grafted tissue in children, potential avoidance of a microsurgical procedure, and placement over tendons with no significant reduction in tendon mobility. The disadvantages of Integra include its high cost, steep learning curve, need for at least two stages with subsequent increased time to final closure, potential for infection under the silicone layer, and lack of adnexal structures with patient complaint of skin dryness.

In the patient described, use of Integra with delayed, thin split-thickness skin grafts at 4 weeks will give the best outcome in terms of cosmesis and function. Free tissue transfer is an excellent technique for resurfacing the contracted neck following burns, but the thigh donor site has already been treated with skin grafts in the scenario described, and the aesthetic result would be suboptimal. A better choice would be the scapular or parascapular donor site, perhaps in combination with a preliminary tissue expansion of that location. Coverage with a full-thickness skin graft would diminish the risk of secondary contraction; however, harvesting enough tissue to cover the entire neck would be difficult with the inguinal region as a donor site. Coverage with a split-thickness skin graft is not an appropriate option in this location because of the risk of secondary contraction and recurrence of the neck contracture.

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28. A 16-year-old girl is referred to the office because of an 8-month history of sudden and rapid enlargement of the right breast. She reports no other symptoms. Physical examination shows a large, palpable mass on the lower half of the right breast. Marked nipple-areola complex stretching, prominent dilated veins, and skin ulceration inferolateral to the mass are noted. Mammography and ultrasonography show a dense, circumscribed, homogenous 8-cm mass in the right breast. Which of the following is the most likely diagnosis?

- A) Carcinoma
- B) Cyst
- C) Giant fibroadenoma
- D) Juvenile breast hypertrophy
- E) Phyllodes tumor

The correct response is Option C.

This patient has a fibroadenoma, the most common breast neoplasm in adolescent females. Giant fibroadenomas are typically solitary, firm, nontender, and symptoms include a rapid asymmetric breast enlargement with prominent overlying veins and occasional pressure-induced skin ulceration. These lesions are larger than 5 cm and occur at or soon after the onset of puberty. These lesions are typically treated with enucleation using reduction mammoplasty techniques for optimal symmetry with the contralateral breast. Mastectomy is not indicated, and no other adjuvant therapy is necessary. Smaller fibroadenomas may be watched conservatively, with minimal risk of malignant transformation. Surgical intervention is indicated in cases of mastodynia, neck/back pain secondary to large size, difficulty with clothing due to asymmetry, and to alleviate patient concern.

Carcinoma would be unlikely in this age demographic. The differential diagnosis would additionally include cystic enlargement, breast hypertrophy, or phyllodes tumor.

Juvenile breast hypertrophy may occur as unilateral or bilateral breast enlargement. The enlargement is diffuse without evidence of a discrete mass or nodularity. Juvenile breast hypertrophy typically occurs in early puberty, rarely regresses spontaneously, and is much more severe than simple breast hypertrophy. The underlying cause is attributed to estrogen stimulation at the onset of the first menses. Treatment is reduction mammoplasty.

Phyllodes tumors are large, benign tumors that typically occur in the perimenopausal patient. They are histologically distinct from fibroadenomas, and transformation of a fibroadenoma to a phyllodes tumor is exceptionally rare.

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29. A 9-year-old girl with a unilateral cleft lip and palate undergoes alveolar bone grafting with a cancellous iliac graft. Which of the following is the most likely mechanism by which the bone graft will heal in this patient?
- A) Endochondral ossification
 - B) Osteoconduction
 - C) Osteogenesis
 - D) Osteoinduction
 - E) Progenitor cell recruitment

The correct response is Option C.

The most likely mechanism of cancellous bone graft healing is by osteogenesis. Cancellous and vascularized bone grafts heal primarily by osteogenesis. Because these grafts are rapidly revascularized, osteoblasts survive the transplantation and produce new bone at the recipient site.

Endochondral ossification is the embryologic process by which bones of the appendicular skeleton, vertebral column, and skull base are formed. The maxilla develops by membranous ossification.

Osteoconduction, or “creeping substitution,” is the mechanism by which cortical bone grafts heal (e.g., split cranial bone graft). After cortical bone is separated from its blood supply, it serves as a nonviable scaffold for the ingrowth of blood vessels and osteoprogenitor cells from the recipient site. This leads to resorption and replacement of most of the graft with new bone. The graft becomes fully osseointegrated with the recipient site.

Osteoinduction involves the stimulation of mesenchymal cells at the recipient site to differentiate into bone-producing cells. Demineralized bone and bone-morphogenic protein produce new bone by osteoinduction.

Although progenitor cells might be recruited to an area where bone grafting has occurred, they are not a primary mechanism for cancellous bone graft healing.

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30. A 25-year-old woman comes to the office because of a 1-week history of erythema and clear drainage from the right breast 6 weeks after undergoing bilateral augmentation mammoplasty. She is afebrile and her vital signs are within normal limits. The drainage from the breast is sent for cultures. Broad-spectrum antibiotics are administered, but no improvement is noted over the next 48 hours. Surgical debridement and explantation of the prostheses are performed. After 7 days, cultures grow *Mycobacterium fortuitum*. Which of the following is the most appropriate next step?
- A) Administration of ciprofloxacin and trimethoprim-sulfamethoxazole for 6 weeks
 - B) Administration of ciprofloxacin and trimethoprim-sulfamethoxazole for 6 months
 - C) Administration of isoniazid, rifampicin, and pyrazinamide for 6 weeks
 - D) Administration of isoniazid, rifampicin, and pyrazinamide for 6 months
 - E) No antibiotic therapy is needed because the infected prostheses have been removed

The correct response is Option B.

The most appropriate next step in management is to initiate a 6-month course of ciprofloxacin and trimethoprim-sulfamethoxazole (Bactrim). *Mycobacterium fortuitum* is an atypical, nontuberculous mycobacterium (NTM), and it is one of the most common causes of NTM soft-tissue infections. It occurs most commonly in the presence of foreign bodies, such as breast prostheses. The incidence of these opportunistic infections has increased over the years. NTM infections can be more indolent and manifest weeks, or even months, following surgery. They occur most commonly with erythema, swelling, and clear drainage, although purulence may be seen. Fever may be absent. On surgical exploration, exuberant granulation tissue and turbid, odorless fluid are often noted. Routine Gram stains and cultures are usually negative. Therefore, it is imperative to request acid-fast bacilli staining and mycobacterial cultures if suspicion of NTM infection is high. Removal of the prosthesis and thorough debridement of the periprosthetic space, followed by long-term (3 to 6 months) antibiotic therapy, is required to treat this infection. Culture sensitivities should guide the antibiotic regimen, but ciprofloxacin, trimethoprim-sulfamethoxazole (Bactrim), clarithromycin, and doxycycline are used commonly for treatment. Reimplantation of the prosthesis should not be considered for a period of at least 6 months.

Isoniazid, rifampicin, and pyrazinamide are standard antibiotics used to treat tuberculosis caused by *Mycobacterium tuberculosis*, not atypical mycobacteria. Although removal of the affected prosthesis is required, long-term antibiotic therapy is an essential part of the treatment.

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31. A 70-year-old man is evaluated because of chest wall incision drainage associated with leukocytosis, high fever, and blood cultures positive for *Staphylococcus aureus* 14 days after undergoing quintuple coronary artery bypass grafting using both internal mammary arteries. History includes type 2 diabetes mellitus, hypertension, hypercholesterolemia, and chronic obstructive pulmonary disease. He has smoked one pack of cigarettes daily for the past 40 years. BMI is 32 kg/m². In addition to broad-spectrum antibiotic therapy, which of the following is the most appropriate initial management of this condition?
- A) Debridement and negative pressure wound therapy
 - B) Debridement and reconstruction with a pectoralis turnover flap
 - C) Debridement and reconstruction with sternal plating
 - D) Debridement with primary rewiring and wound irrigation

The correct response is Option A.

Post-sternotomy mediastinitis is a severe complication, with an incidence ranging between 0.2 and 8%. Risk factors include advanced age, diabetes mellitus, morbid obesity, reoperation for bleeding, and use of bilateral internal mammary arteries. Deep sternal wound infections are more serious and have a higher mortality rate than superficial or sterile sternal wounds. The most common organisms are *Staphylococcus aureus* and *Staphylococcus epidermidis*, but mixed gram-positive and gram-negative infections are not uncommon. Broad-spectrum antibiotic therapy to include coverage of MRSA infection and *Pseudomonas* should be instituted. Nevertheless, debridement is the mainstay of therapy.

Adequate sternal and soft-tissue debridement is vital and can be combined with immediate sternal closure with delayed primary wound closure versus delayed closure of the entire wound with or without flaps to aid in obliterating any dead space. Many studies have demonstrated that the use of negative pressure wound therapy for wound coverage as a bridging method to final wound closure decreases the morbidity of these patients and is associated with decreased recurrent infection and treatment failure rates compared with conventional therapy, specifically primary rewiring or plating, especially for those at high risk.

Flap closure at the time of sternal debridement can be performed; however, if bilateral internal mammary arteries are used for the bypass, a pectoralis turnover flap is not an option because of loss of the internal mammary artery for the pectoralis major. Options would include coverage with the pectoralis transposition flap based on the thoracoacromial artery, an omental flap, or a rectus abdominis flap based on the intercostal artery.

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32. A 46-year-old woman scheduled to undergo abdominoplasty and lipoplasty is concerned about postoperative discomfort. A regional block during the procedure is planned for pain management to minimize the need for narcotics. The anesthetic for the regional block should be injected to which of the following tissue planes?

- A) Between the external oblique and the internal oblique
- B) Between the internal oblique and the transverse abdominis
- C) Between the skin and the external oblique
- D) Between the transverse abdominis and the transverse fascia
- E) Between the transverse fascia and the peritoneum

The correct response is Option B.

The thoracolumbar nerves that innervate the anterior abdominal wall travel as multiple mixed segmental nerves that branch and communicate widely in the transverse abdominis plane (TAP), located between the internal oblique and transverse abdominis muscles.

The TAP regional block provides abdominal wall analgesia by affecting the sensorial afferent nerves of T6 to L1 found in this plane. Local anesthetic injected into the TAP has been shown to decrease the amount of postoperative narcotic requirements in abdominal wall surgery.

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33. A 34-year-old woman is referred for evaluation because of a 9×7 -cm lateral soft-tissue deformity of the right thigh with skin thickening. She has a history of oncologic resection and external beam radiation of 50 Gy. Which of the following is the most appropriate step in management?

- A) Acellular dermis
- B) Dermal-fat grafting
- C) Full-thickness skin grafting
- D) Lipoaspirate injection

The correct response is Option D.

Radiation has deleterious effects on local vascularity, fibroblast activity, growth factor levels, and mesenchymal stem cell populations. Microscopic examination of irradiated tissue shows microvascular thrombosis and abnormal vasculature. Clinically, irradiated wounds are associated with slower epithelialization, decreased tensile strength, and higher infection and dehiscence rates. Although data are still limited, marked improvements in irradiated tissues have been reported with autologous fat injection. Lipoaspirate injected in areas of chronic radiation wounds improved the wound quality by either promoting a more vascular wound amenable to reconstruction or spontaneous closure. Adipocytes contain stem cells which improve wound vascularity.

Acellular allogeneic dermis is produced from human cadaveric allograft skin. During the skin processing, immunogenic components that include all viable cells are extracted, leaving acellular dermis and extracellular matrix intact. The entire epidermis and all of the dermal cells are removed during a freeze-drying process. The resultant matrix has undamaged collagen types IV and VII, elastin, and laminin. The acellular and porous dermal matrix allows ingrowth and colonization by host fibroblasts and endothelial cells. Acellular allogeneic dermis provides a template for fibrous ingrowth, resulting in an integrated graft that is not rejected. It can be used for almost any area as long as there is adequate blood supply to support the graft. Acellular allogeneic dermis survival in less vascular areas is unknown.

Dermal-fat grafts are usually harvested from the same areas as full-thickness skin grafts are. These include the lower abdomen, the suprapubic or periumbilical regions, the gluteal or inframammary folds, the subiliac crest, and even the forearm for hand surgery purposes. An ellipse of skin with dimensions appropriate to fill the recipient defect is outlined. The epithelium can be removed by sharp excision with a scalpel or dermabrasion. Previous radiation, excessive cicatrization, deficiency of circulation, and poor healing qualities caused by poor nutrition and systemic diseases all militate against a satisfactory result.

Skin grafts are used in a variety of clinical situations. The essential indication for the application of a skin graft is wound closure. In general, full-thickness skin grafts are applied to the regions of the face, ears, and hands. Split-thickness skin grafts are usually placed on the trunk and genitalia. Skin grafts are usually the initial treatment of choice for many open wounds that cannot be closed primarily. Grafting offers the simplest method of wound closure in the reconstructive ladder, assuming that primary closure is not possible or would lead to undue tension. Skin grafts are generally avoided in management of more complex wounds. Conditions with deep spaces and exposed bones, such as open sternal wounds, pressure sores, and open fractures, normally require the use of skin flaps or muscle flaps for stable wound coverage. Skin grafts have limited success in wounds with a compromised blood supply, such as irradiated wounds and ischemic ulcers.

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34. An otherwise healthy 38-year-old woman with a BMI of 34 kg/m^2 is scheduled to undergo suction lipectomy of the abdomen, hips, and thighs using a tumescent technique and a 5000-mL lipoaspirate. The infiltrate contains lidocaine and epinephrine. Which of the following adjustments to the planned procedure is most appropriate to decrease the risk of intraoperative complications?

- A) Decreased rate of infusion of the wetting solution
- B) Infiltration of all areas simultaneously
- C) Removal of the epinephrine from the wetting solution
- D) Substitution of bupivacaine for lidocaine
- E) Use of a superwet technique instead of tumescent

The correct response is Option E.

In the tumescent technique of infiltration of wetting solution, the tissues are infiltrated with roughly a 3:1 ratio of wetting solution to lipoaspirate. This is generally done to effect, with the tissues becoming firmer once engorged with fluid. In large-volume liposuction (greater than 4 L), it is especially important to understand the possible side effects of the constituent parts of the wetting solution, including the volume of administration, the local anesthetic, and the epinephrine.

In terms of lidocaine toxicity, there are various factors to take into consideration, including the level and rate of drug absorption, drug interactions, fluid management, prothrombogenic factors, and volume of the wetting solution and aspirate. According to the ASPS Safety Committee Advisory on Liposuction, two options are available to decrease the risk of lidocaine toxicity in large-volume liposuction cases: 1) decrease the concentration of lidocaine in the wetting solution; and 2) use smaller volumes of infiltrate by applying the superwet technique (1:1 ratio of infiltrate: lipoaspirate) rather than the tumescent technique. Furthermore, one can omit the lidocaine altogether from the infiltration solution.

The pressure and rate of infusion of the wetting solution do not affect the rate of lidocaine absorption.

Infiltration of all areas simultaneously will be counterproductive. The use of epinephrine in wetting solutions is critical because it causes vasoconstriction, which results in both improved hemostasis as well as delayed absorption of the anesthetic agent, which prolongs its effect, decreases the amount of anesthetic needed, and reduces the risk of lidocaine toxicity. Therefore, its removal from the wetting solution is not indicated. However, in large-volume liposuction cases, staged infiltration of multiple anatomical sites may provide a wider safety

margin.

The use of bupivacaine and prilocaine in wetting solutions has not been clinically studied or assessed. Bupivacaine should be used with caution if added to infiltrate solutions because of its slow elimination and reversal and its potential for severe side effects involving the cardiovascular, neurologic, and hematologic systems.

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35. Which of the following characteristics best distinguishes keloid scar tissue from hypertrophic scar tissue?

- A) Collagen fibers parallel to the direction of wounding
- B) Extension beyond original scar
- C) Improved by surgical excision alone
- D) Increased fibroblast density
- E) Location on flexor surfaces and areas of motion

The correct response is Option B.

Keloid scars differ from hypertrophic scars in that they can extend beyond the original scar, whereas hypertrophic scars are confined to the original boundary.

Collagen fibers are wavier in keloids and more parallel in hypertrophic scars. Light and electron microscopic studies demonstrate that collagen in keloids is disorganized compared with normal skin. The collagen bundles are thicker and wavier, and the keloids contain hallmark “collagen nodules” at the microstructural level.

Surgical excision alone has a high rate of recurrence for keloids.

Increased fibroblast density occurs in both hypertrophic scars and keloid scars and cannot be used to differentiate between the two. Keloids have increased fibroblast proliferation rates.

Hypertrophic scars commonly occur on flexor surfaces and joints. Keloids have a high predilection for the sternum and earlobe.

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36. A plastic surgery resident is participating in a study that involves review of outcomes of patients with breast cancer who underwent immediate breast reconstruction with tissue expanders during the past 10 years and have subsequently received radiation therapy. In collecting these data within the guidelines of the Health Insurance Portability and Accountability Act (HIPAA), which of the following patient characteristics can be collected without patient consent?

- A) Age
- B) E-mail address
- C) Medical record number
- D) Name
- E) Telephone number

The correct response is Option A.

The Health Insurance Portability and Accountability Act (HIPAA) was amended to include the Standards for Privacy of Individually Identifiable Health Information, i.e., the Privacy Rule, to protect the privacy of medical records. Implementation of the new regulations was mandatory as of April 14, 2003.

The HIPAA Privacy Rule states that patients must be notified of their rights with respect to their medical information, including the right to restrict the use and disclosure of such information, the right to inspect and copy their records, the right to amend their records, and the right to an audit of any disclosure of their records. Covered entities including health plans, health care clearinghouses, and health care providers are required to obtain specific written authorization from a patient to use or disclose health care information that is linked to that patient. This includes medical records used for the purpose of medical research.

Patient authorization can be waived and medical records accessed without institutional review board (IRB) review or individual patient consent in two circumstances: preparing a research protocol, as long as access to medical records is needed for its preparation, and no protected medical information is removed from the site; and performing research that concerns only people who have died. In all other cases, waivers can only be obtained from an IRB or privacy board if specific criteria are met. Once a waiver is granted, the medical information must be “de-identified” in one of two ways. The first is for a knowledgeable statistician to determine that the risk of identifying an individual patient from the information disclosed or used is “very small” and to document the methods and results used to arrive at this conclusion. The second is to strip the records of identifiers including name; address; telephone and fax numbers; e-mail address; Social Security, medical record, health plan, and

account numbers; certificate, license, vehicle, and medical-device serial numbers; biometric identifiers; full-face photographs; and any other unique identifying number, characteristic, or code to provide legal protection against the charge of a violation of privacy.

The collection of age (but not date of birth) and gender of patients from medical records for a retrospective research study are not identifiers that violate this policy.

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37. A 24-year-old man with T11 paraplegia is scheduled to undergo reconstruction of a Stage IV ischial pressure sore with an inferior gluteal artery thigh flap. Medications include intravenous administration of empiric clindamycin every 6 hours for osteomyelitis. To determine the presence of osteomyelitis in this patient, which of the following is the most appropriate next step?

- A) Bone biopsy
- B) CT scanning
- C) Indium scanning
- D) Plain-film x-ray study
- E) Swab culture

The correct response is Option A.

Bone biopsy is the definitive diagnostic method to determine the presence of osteomyelitis. The pathologic examination of bone biopsy specimen remains the most accurate method of diagnosing osteomyelitis underlying pressure ulcers. Lewis et al. demonstrated that core needle bone biopsy is both sensitive and specific for the diagnosis of osteomyelitis, 73% and 96% respectively. Bone biopsy has been shown to be highly sensitive and specific in predicting which patients undergoing reconstruction with a flap are at an increased risk for developing postoperative complications consistent with osteomyelitis.

CT scanning can be useful in identifying a more detailed extent of bone involvement, but the sensitivity and specificity are 50% and 88%, respectively.

Indium scanning uses radiolabeled leukocytes that accumulate in sites of infection and inflammation. Inflammation and infection in the bone marrow have very high sensitivity but low specificity, 100% and 50%, respectively.

Plain-film x-ray study can be confirmatory but not very specific with a sensitivity and specificity of 88% and 32%, respectively.

A result of more than 10 organisms per gram of tissue is diagnostic for invasive infection and is predictive of failure of surgical closure. Swab cultures are generally unreliable and discouraged. They often represent only surface contaminants and do not correlate well with bone cultures.

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38. A 41-year-old man undergoes an elective transplantation of the right hand 2 years after traumatic amputation in a machine accident. Postoperatively, the patient takes immunosuppressive medications to minimize the chance of rejection. To monitor for cellular rejection, observation and biopsy of which of the following tissue types in the postoperative period is most appropriate?

A) Blood vessel

B) Bone

C) Muscle

D) Skin

E) Tendon

The correct response is Option D.

Composite tissue allotransplantation (CTA) has been performed on a host of tissues, though more recently in plastic surgery; this has largely been in the field of hand or upper extremity and facial transplantation. This requires immunosuppressive regimens which have had varying degrees of success, as well as issues with patient compliance, especially as these medications are expensive and, at least at this time, necessary for the rest of the patient's life. Skin is thought to be the most antigenic and immunoreactive tissue in CTA. Experience from China in hand transplantation demonstrated that cellular rejection in these patients was largely limited to the skin, with relative sparing of the underlying blood vessels, bone, muscle, nerve, and tendon. However, as the skin is an easily monitored tissue (versus solid organs), it is the most sensitive indicator of acute rejection in that it is clearly visible and can be easily evaluated by both patient and physician. Therefore, this tissue type is most appropriate to be monitored and biopsied.

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

39. A 59-year-old man with hypertension, peripheral vascular disease, and coronary artery disease has sternal osteomyelitis after coronary artery bypass grafting with saphenous vein and left internal mammary artery grafts. Reconstruction with bilateral pectoralis advancement flaps is performed, but the flaps do not survive. Debridement is performed, and a defect remains. A photograph is shown. Which of the following is the most appropriate reconstruction?
- A) Adjacent tissue transfer and coverage with bilateral skin advancement flaps
 - B) Coverage with left rectus abdominis turnover flap and skin grafting
 - C) Coverage with left superior epigastric artery perforator fasciocutaneous flap
 - D) Coverage with omental flap and skin grafting
 - E) Coverage with right latissimus myocutaneous flap

The correct response is Option D.



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

The most appropriate option in the patient described is an omental flap with skin grafting. The defect encompasses the entirety of the sternum, from the sternal notch to the xiphoid. The first-line muscle flaps for this defect would usually be bilateral pectoralis muscle flaps (that do not include a left pectoralis turnover flap option due to the lack of a left internal mammary artery (IMA) used for the coronary graft). However, this option has already been used.

An omental flap has an axial blood supply that is not compromised (the gastroepiploic) and the ability to completely span the defect and obliterate the dead space; the skin graft provides the skin coverage needed to complete the reconstruction. Hence, it is the optimal choice in this patient.

An adjacent tissue transfer of random skin flaps bilaterally would not obliterate the dead space and would not provide robust axial blood supply to the necessary area, with the tenuous coverage existing along the sternal midline, exactly where the most vital blood supply would be necessary.

A left rectus abdominis turnover flap would not be an appropriate option for two reasons: 1) the left IMA has been harvested, thereby compromising the superior epigastric vessel on which this flap would be based; and 2) it would not reach the upper portion of the defect.

A left superior epigastric artery perforator fasciocutaneous flap would not be an appropriate option for two reasons: 1) the pedicle is compromised from the left IMA harvest; and 2) muscle flaps have been proven to be optimal for sternal defects more than fasciocutaneous flaps.

A right latissimus muscle flap may be a viable choice to get full coverage of the defect with dead space obliteration. However, the option indicates this is a myocutaneous flap, which would not allow for sufficient skin to be harvested to reconstruct the size of this defect.

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40. An otherwise healthy 55-year-old woman is diagnosed with squamous cell carcinoma of the vagina. Subtotal vaginectomy, vulvectomy, and inguinal lymph node dissection are performed. Bilateral sensate posterior thigh flaps are used for vaginal reconstruction. Which of the following nerves must be included in this procedure?

- A) Iliohypogastric
- B) Ilioinguinal
- C) Inferior gluteal
- D) Posterior femoral cutaneous
- E) Pudendal

The correct response is Option D.

The nerve that gives sensation to the posterior thigh flap is the posterior femoral cutaneous nerve (S1 to S3). This fasciocutaneous flap is based on the descending branch of the inferior gluteal artery and provides an abundant and reliable amount of available soft tissue for transfer from the posterior aspect of the thigh. Because of the proximal vascular pedicle, this flap can easily reach high within the pelvis and can be rotated to provide closure to both anterior and posterior vaginal defects. In addition, the flap can also be harvested with relative technical ease in a short period of time, and the donor site can typically be closed without the need of skin grafts. The skin is innervated by the posterior femoral cutaneous nerve (S1 to S3), which allows this flap to be used as a sensate flap when indicated. There are several other advantages to the posterior thigh flap that make it ideal for complex perineal reconstruction. The inferior gluteal artery is a terminal branch of the internal iliac artery. Therefore, the pedicle is usually spared in the course of radical pelvic ablative operations. In addition, the vascular pedicle is typically outside the field of pelvic radiation, which contributes to the utility of this flap in secondary procedures. The iliohypogastric, ilioinguinal, and pudendal nerves supply sensation to the groin, genital, and perineal areas. The inferior gluteal nerve is the motor nerve to the gluteus maximus muscle.

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41. An otherwise healthy 25-year-old woman comes to the emergency department because of pain, redness, swelling, and stiffness in the long, ring, and little fingers of her right hand 36 hours after being bitten by her cat. The cat is up-to-date with rabies vaccinations. The patient does not take any medications. The patient states that she was told never to take penicillin because she “stopped breathing” when she took it as a child. Examination shows multiple small, draining puncture wounds along the proximal volar and ulnar aspects of the proximal phalanges, a collar-button abscess between the ring and little fingers, and edema over the dorsum of the hand. Pending results of culture, which of the following is the most appropriate empiric antibiotic therapy?

- A) Ampicillin-sulbactam
- B) Cefazolin
- C) Ciprofloxacin and clindamycin
- D) Tetracycline and trimethoprim-sulfamethoxazole
- E) Trimethoprim-sulfamethoxazole

The correct response is Option C.

For the patient described with a penicillin or cephalosporin allergy, trimethoprim-sulfamethoxazole (TMP/SMX) and clindamycin or metronidazole, or a fluoroquinolone and clindamycin or metronidazole, are good antibiotic therapy combinations.

Cat bites account for 5 to 15% of animal bites and occur more often in women and adults (median age is 20 years). Most cat bite injuries occur on the upper extremity with “scratches” on the finger or hand. Infection rates after cat bites range from 50 to 75%. This is typically attributed to the fine, sharp teeth of cats, which produce puncture wounds and penetrate deeply into the soft tissues and joint capsules of the hand.

Wounds to the hand demonstrate an increased risk of infection; closed fist injuries have the highest risk. Initial medical management of bite wounds includes ascertaining the rabies status of the animal and updating the tetanus immunization of the patient if necessary. If rabies is suspected, irrigation with povidone-iodine solution will reduce the development by up to 90%. A careful examination of the affected hand/extremity should address the surrounding soft tissues and potential spaces of the hand, tendons, joint and joint capsules, and underlying bone. The wound should be irrigated with saline after obtaining wound cultures. Necrotic tissue should be debrided, and any cat bite with worsening pain will require incision and irrigation of the puncture site. All cat bite wounds should be left open, although large gaping wounds can be loosely approximated. Before definitive surgical treatment of any

associated abscess or debridement of devitalized tissue, empiric antibiotic therapy should be started.

The majority of cat bite wounds are polymicrobial and the anaerobic organisms are often overlooked. Common aerobic pathogens include *Staphylococcus aureus*, viridans streptococcus, *Corynebacterium*, *Pasteurella multocida*, and various gram-negative enteric organisms. The most common anaerobic pathogens include *Bacteroides*, *Fusobacterium*, *Peptostreptococcus*, and *Actinomyces* species. *Pasteurella multocida*, an aerobic, facultative anaerobic gram-negative pathogen, is the most commonly isolated pathogen in cat bites and is present in up to 50% of infected wounds. Symptoms of *Pasteurella multocida* infection develop rapidly within 24 hours and typically include cellulitis and seropurulent drainage. Other uncommon infections have been reported after cat bites, including tularemia (*Francisella tularensis*) and cat-scratch disease (*Bartonella henselae*).

Patients with severe wounds (crush injury, joint involvement, deep space infection), cellulitis, sepsis, diabetes, immunosuppression, or other high-risk factors for treatment failure should receive parenteral antibiotics. Alternatives to amoxicillin and clavulanate potassium or ampicillin and sulbactam include other penicillins or cephalosporins, provided they display adequate anaerobic coverage. In the scenario described, the choices containing amoxicillin, ampicillin, and cefazolin are not appropriate because of the patient's penicillin allergy. Additionally, this patient will require intravenous antibiotics because of the wound severity, so amoxicillin and clavulanate potassium would not be appropriate. The combination of tetracycline and TMP/SMX alone does not provide adequate anaerobic coverage.

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42. An otherwise healthy 17-year-old girl with congenital vaginal agenesis is referred to the office for reconstruction of the vagina. Physical examination shows normal external genitalia but an absent vaginal canal. She desires a single-stage procedure with minimal scarring and maximal sensation. Which of the following is the most appropriate reconstructive option for this patient?

- A) Bilateral gracilis musculocutaneous flaps
- B) Bilateral pudendal fasciocutaneous flaps
- C) Extended groin flap
- D) Split-thickness skin graft and mold (McIndoe procedure)
- E) Vertical rectus abdominis musculocutaneous flap

The correct response is Option B.

The most appropriate management is reconstruction with bilateral pudendal fasciocutaneous flaps. These flaps are based on the branches of the superficial perineal vessels, which are the terminal branches of the internal pudendal vessels. The course of the superficial perineal nerve follows these vessels; therefore, this flap can be raised as a sensate flap. These are relatively simple flaps to raise, and they are reliable and completed in one stage. They are thin, sensate flaps and are ideally suited for vaginal reconstruction. The donor site can be closed primarily and the scar is well hidden within the inner groin crease.

The McIndoe procedure involves a split-thickness skin graft reconstruction of the vagina using a mold, followed by the continued use of a vaginal dilator to prevent constriction. The skin graft donor site scar is not as inconspicuous as a linear scar in the groin crease. Extended groin flaps have been described for vaginal reconstruction; however, these flaps are insensate. Gracilis and rectus abdominis musculocutaneous flaps are workhorse flaps for vaginal and pelvic reconstruction. However, they too are insensate and have large, conspicuous donor site scars.

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43. A 27-year-old man is scheduled to undergo excision and skin grafting after sustaining a full-thickness burn to the dorsum of the hand. To optimize graft take in this patient, which of the following is the most important aspect of management?
- A) Meshing of the skin graft
 - B) Meticulous hemostasis
 - C) Negative pressure wound therapy
 - D) Use of fibrin glue
 - E) Use of a thin split-thickness skin graft

The correct response is Option B.

The most important aspect of recipient site management to optimize graft survival and outcome in this patient undergoing dorsal hand skin grafting is meticulous hemostasis. This is because hematoma is the leading cause of skin graft loss.

Meshing a skin graft may promote graft survival by providing a mode of egress for blood and seroma that might form below the graft. However, it is associated with an increased rate of secondary contraction and unfavorable cosmetic results. Both of these factors make meshing undesirable when grafting the dorsum of the hand.

Use of a negative pressure wound therapy dressing can result in improved graft survival, especially in recipient sites with irregular contours. However, it is not critical for the hand. A good dressing and proper immobilization should achieve the same result. Use of this type of dressing is not as important as meticulous hemostasis for ensuring graft survival and outcome.

Fibrin glue has been used to promote graft survival by improving hemostasis and graft adherence. There is also some evidence that fibrin glue may inhibit wound contraction. Nevertheless, it is no substitute for meticulous hemostasis and should only be used as an adjunct to the fundamental techniques of skin graft placement.

Use of a thin split-thickness skin graft is associated with improved graft survival when compared with a thick split-thickness or full-thickness skin graft, but it is also associated with an increased rate of secondary contraction that is not desirable on the dorsum of the hand. Balancing the need for graft survival versus the need to avoid secondary contraction is an important consideration in burn surgery. Using thinner grafts will optimize graft survival, but this is not as critical as ensuring good hemostasis.

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44. A 45-year-old quadriplegic woman is scheduled to undergo reconstruction of a Stage IV left ischial pressure sore that is next to the anus with a tensor fascia lata flap. Which of the following is the most appropriate treatment before flap reconstruction in this patient?

- A) Administration of baclofen
- B) Administration of ferrous sulfate
- C) Diverting colostomy
- D) Local application of collagenase

The correct response is Option C.

Alteration of the bowel routine or even a diverting colostomy should be considered in patients with perineal wounds to reduce fecal soiling of the wound. This minimizes the bacterial contamination of the wound, thus making the wound suitable for closure and reducing the likelihood of reconstructive failure.

Involuntary muscular spasms contribute significantly to pressure sore development, especially in spinal cord-injured patients. This damage occurs through shear forces on soft tissues. Medical therapies include the use of diazepam, baclofen, and dantrolene.

Special considerations in the paraplegic or quadriplegic patient include the management of fecal soilage of the wound and treatment of spasm and contractures. Medical management of spasticity should be optimized.

Anemia is common in the pressure sore population and is caused by an inability to use relatively normal iron stores. For this reason, iron treatment is useless, and it may lead to iatrogenic hemochromatosis.

For all patients with pressure sores, regardless of whether they will progress to surgical closure or not, the principles of wound management apply. Debridement of devitalized tissue and dressing care to gain control of the wound are important.

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45. A 2-year-old boy is brought to the emergency department because of a 2-day history of lethargy, fever, and a reddish purple rash on his arms and legs. Temperature is 103.0°F (39.4°C). Physical examination shows a petechial rash on the upper and lower extremities and trunk. Broad-spectrum antibiotics are initiated. After 6 hours, the rash begins to hemorrhage and blister and his digits become ischemic. Which of the following is the most appropriate management?

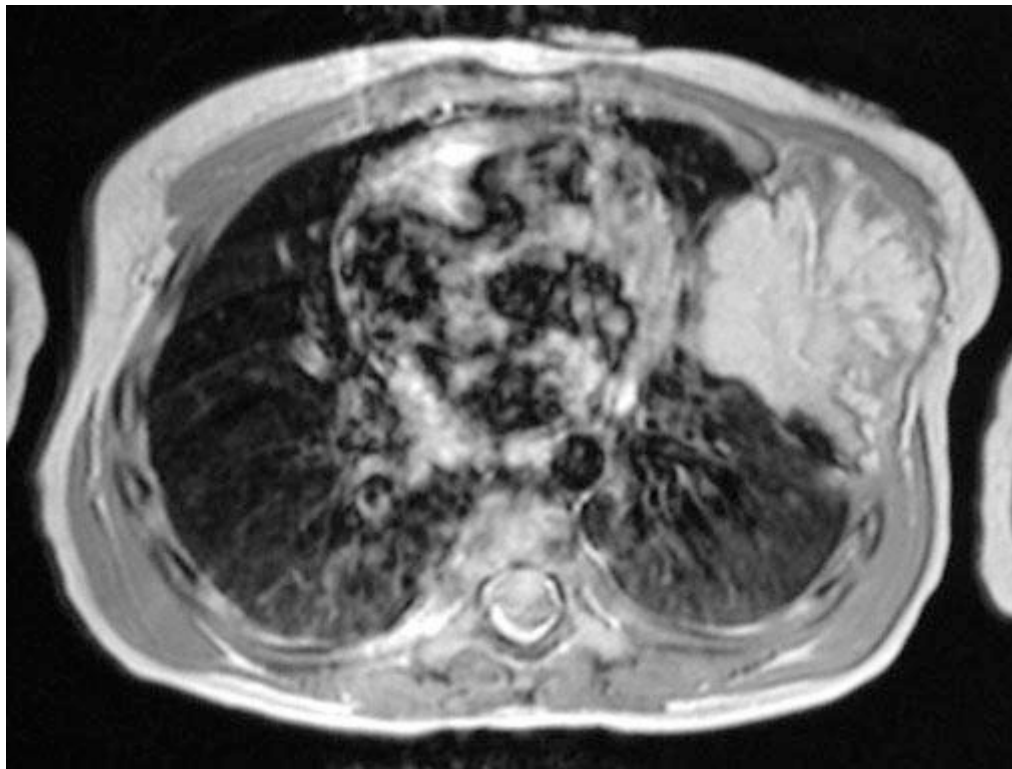
- A) Activated protein C
- B) Amputation of the ischemic digits
- C) Avoidance of inotropic support
- D) Debridement of skin
- E) Thrombolytics

The correct response is Option A.

Purpura fulminans is a rapidly evolving autoimmune syndrome of septic shock and hemorrhagic bullae that can result in massive desquamation and is frequently fatal. Management includes prompt recognition of the infection (which is usually due to *Neisseria meningitidis*), initiation of broad-spectrum antibiotics, mechanical ventilation, and aggressive fluid resuscitation with inotropic support. Patients develop disseminated intravascular coagulopathy and appear to benefit from replacement of activated protein C. A recently published, multicenter retrospective review of 70 patients documented an amputation rate of 90% and suggested the need for early fasciotomy to improve limb salvage. It is very difficult to determine tissue viability during the resuscitation period; therefore, amputation, debridement, and coverage are delayed until demarcation has occurred. Thrombolytics are not used in this situation because the patient has a hemorrhagic disorder.

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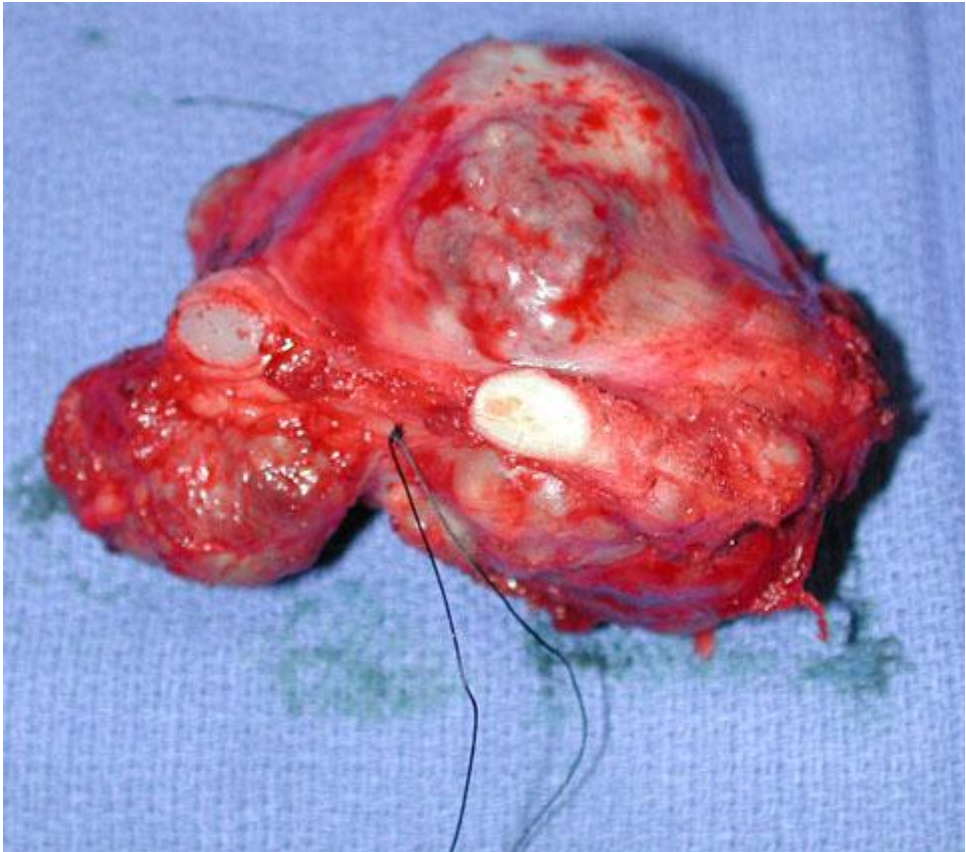


46. A 3-year-old boy is brought to the office because of a $9 \times 8 \times 6$ -cm mass of the left side of the chest. His parents report that the mass has been present for 8 months and has grown rapidly for the past 3 months. MRI confirms that the mass is calcified, lobulated, originates from the fourth and fifth ribs, and encroaches into the chest cavity to lie adjacent to the left ventricle. Other smaller lesions are identified in the scapulae, clavicles, and ribs. CT scan is shown. Examination of the specimen obtained on biopsy of the largest lesion shows osteochondroma. Which of the following is the most appropriate management at this time?
- A) Radiation therapy with adjuvant chemotherapy
 - B) Radical resection with adjuvant chemotherapy
 - C) Wide local excision, reconstruction, and adjuvant radiation therapy
 - D) Wide local excision with reconstruction
 - E) No intervention at this time

The correct response is Option D.

The lesion in the patient described is a giant calcified osteochondroma; more specifically, it is

within the setting of multiple hereditary exostoses, given the multiple smaller lesions in other areas. The resected specimen is seen in the picture shown after wide local excision.



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

An osteochondroma is a cartilage-covered bony growth, or exostosis, that arises from a surface of a bone – in the scenario described, the fourth and fifth ribs. It is the most common bone tumor in children, may be solitary or multiple, and may arise spontaneously or as a result of previous trauma. An osteochondroma can arise in any bone that develops from endochondral ossification. Multiple osteochondromas may be hereditary with an autosomal dominant pattern (Bessel-Hagen syndrome or hereditary multiple exostoses), as in the scenario described. Malignant transformation of an osteochondroma occurs in 1 to 25% of patients, with the risk being greater in hereditary multiple exostoses.

Numerous complications are associated with osteochondromas, including mechanical effects and deformity, fracture, vascular compromise, neurologic sequelae, and overlying bursa formation. Treatment of solitary lesions should be individualized – patients with small asymptomatic or minimally symptomatic lesions, typical imaging findings, and no functional

or mechanical impairment or progressive deformity should be observed regularly for the possibility of spontaneous regression or malignant transformation. Larger, or giant, symptomatic osteochondromas should be treated by wide bony resection and reconstruction of the defect.

There is no role for neoadjuvant or adjuvant chemotherapy or radiation therapy for this lesion.

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47. Elevation of the semimembranosus, semitendinosus, and biceps femoris muscles during flap harvest is most appropriate for coverage of which of the following types of pressure sore?
- A) Calcaneal
 - B) Ischial
 - C) Sacral
 - D) Trochanteric

The correct response is Option B.

The semimembranosus, semitendinosus, and biceps femoris muscles constitute a posterior thigh flap. This flap is more commonly used to treat ischial pressure wounds. Ischial pressure sores occur in patients who are sitting, and the vast majority of patients are paraplegic. These wounds are commonly large and require a bulky flap to completely close the defect. There are a wide variety of flaps available to cover defects in this area, but consideration should be given to potential recurrence as well as to the development of pressure sores in other nearby sites when a surgical ladder or algorithm is considered. Therefore, many surgeons choose to address the ischium with leg flaps first. These are reliable, can often be re-advanced, and do not interfere with more superiorly based flaps if needed for the sacrum or trochanter. Small- to medium-sized defects can be addressed with posterior thigh flaps, such as the biceps femoris alone, when a patient is ambulatory, or with the addition of the semimembranosus and semitendinosus when the patient is not ambulatory. These have an excellent blood supply, are typically designed in a V-Y fashion, and can often be re-advanced in the case of recurrence. Fasciocutaneous flaps preserve muscle, providing coverage for shallow wounds. A posteromedial fasciocutaneous flap can also be elevated based on perforators from the gracilis or adductor magnus. It has an excellent arc of rotation and does not contain muscle. The tensor fascia lata flap can also be used and, in fact, can be designed as a sensate flap in some spinal cord-injured patients with an injury below L3. The tissue over the gluteus maximus can be used and can contain either musculocutaneous or fasciocutaneous components.

Thoracolumbar and lumbar defects are best reconstructed with flaps based on the latissimus dorsi muscle. Options for closure include musculoskeletal advancement flaps, a latissimus musculocutaneous flap with a thoracolumbar extension, and, for large wounds, a composite latissimus dorsi and gluteus maximus flap. In certain cases, the omentum can be tunneled and used to cover the lumbar region when no other flaps are available.

Sacral wounds are usually covered with gluteal muscle flaps. Sacral pressure sores develop from patients lying in a supine position. If these are small and occur as a result of acute or

short-term disability, they can often heal with conservative treatment. Skin grafting is usually not successful. The recurrence rates have been reported to be as high as 70% when using these methods in this location; so again, more reliable coverage should be considered. The mainstay coverage is the soft tissue overlying or including the gluteus maximus muscle, depending on the volume of tissue needed. Again, these are commonly designed as rotational flaps but can be advanced. Additional useful options include the use of a perforator island flap, such as the superior gluteal artery perforator described by Lee, et al.

Trochanteric wounds are usually covered with tensor fascia lata muscle. Trochanteric defects result most often from patients lying in the lateral decubitus position. Unfortunately, this is often because the patients are debilitated and, in many cases, have hip and lower extremity contractures. This makes a reliable closure difficult and recurrence common. The method that has been used most commonly is the tensor fascia lata flap. It can be raised as a muscle-only flap or with skin and muscle. It can also be used as an island flap, and even a free tensor fascia lata flap has been described. Again, this can be sensate in patients with spinal innervation above L3. Of note, tissue expansion has been attempted in closure in a number of settings to bring in sensate tissue. A secondary option is the vastus lateralis flap, and a number of flaps based on the gluteus muscles have been described.

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48. A 76-year-old man undergoes radical resection of the floor of the mouth and reconstruction with a free tissue transfer. Which of the following is an absolute contraindication for the use of the microvascular arterial anastomotic coupler?

- A) Age of the patient
- B) Atherosclerotic calcification
- C) History of radiation therapy
- D) Vessel-size mismatch

The correct response is Option B.

The mechanical device used most commonly in the clinical management of microvascular anastomoses is the coupler. It is used commonly in venous anastomoses, and some centers also use it in arterial anastomoses. The ring-pin technique involves passing each end of the vessels to be anastomosed through a ring that has matching sets of pins and holes. The vessel ends are then everted over the corresponding pins, and a device operated by a thumb nut then pushes the two rings together. Theoretically, this produces a "perfect" anastomosis, with total eversion of the edges and exact intima-to-intima contact. This instrument has been shown to provide rapid microvascular repairs in experienced hands, with published reports of 2 to 3 minutes per anastomosis.

Stiff, nonpliable vessels resulting from atherosclerotic calcification should not be anastomosed using the coupler system because the technique requires pliable vessels being draped over the pins. Stiff vessels will not allow for this, and a poor technical outcome will result.

There have been reports of successful end-to-end, as well as end-to-side, venous anastomoses performed with the coupler.

Age, by itself, has not been proven to be a contraindication to microvascular surgery and, therefore, coupler anastomoses.

History of radiation therapy is not a contraindication to microvascular surgery or to the use of the coupler system. However, the vessels should be inspected for radiation-induced fibrosis and stiffness of some vessels. If this is the case, akin to stiffness from atherosclerotic calcification, the coupler should not be used.

One of the benefits of the coupler lies in its ability to handle vessel-size mismatches, more so with venous than with arterial anastomoses.

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49. A 4-year-old boy is scheduled to undergo abdominal wall repair using a component separation technique. He underwent living donor liver transplantation during infancy, at which time the graft was noted to be too large for size. A midline incisional hernia was intentionally made to facilitate organ function after transplantation. Current physical examination shows ventral herniation with marked loss of domain. During abdominal wall repair by component separation, parallel aponeurotomy is most likely to be performed immediately lateral to which of the following anatomical structures?

- A) Arcuate line of Douglas
- B) Inguinal ligament
- C) Linea semilunaris
- D) Midline
- E) Tendinous inscription

The correct response is Option C.

Separation of components of the abdominal wall is fast becoming a first-choice procedure for large ventral defects. The procedure involves medial advancement of the rectus abdominis muscle flap after division of the aponeurosis or fascia of the external oblique muscle layer.

Properly identifying the correct fascia to incise is a critical step in the procedure, and it relies on knowledge of the abdominal wall anatomy. The rectus abdominis muscles are separated by the midline linea alba, and each rectus muscle is medial to the layered triad of muscles—the external oblique, internal oblique, and transversus. Division of external oblique fascia is properly performed lateral to the linea semilunaris, which represents the lateral border of the rectus sheath, which is formed by the contributions of the external oblique, internal oblique, and transversus layers as the envelope of the rectus abdominis muscle. Above the arcuate line, the later layers split around the rectus muscle at the level of the internal oblique, forming both the anterior and posterior rectus sheaths; however, below the arcuate line, all layers travel anteriorly, forming the anterior sheath but no distinct posterior rectus sheath. The inguinal ligament exists between the anterior superior iliac spine and the pubic symphysis and should not be divided in component separation. Transverse tendinous inscriptions interrupt the rectus sheath, and division of the anterior rectus sheath or the inscriptions is not part of the classic component separation.

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50. A 45-year-old man undergoes abdominal reconstruction with a component separation technique. After release of the external oblique muscle bilaterally, which of the following best explains the preservation of flexion of the trunk?
- A) Preservation of the nerves between the anterior rectus fascia and pyramidalis muscle
 - B) Preservation of the nerves between the external oblique and internal oblique muscles
 - C) Preservation of the nerves between the internal oblique and transversalis muscles
 - D) Preservation of the nerves between the transversus abdominis and the peritoneum

The correct response is Option C.

The rectus muscle is the primary flexor of the pelvis. Its segmental nerve supply enters the rectus sheath laterally in a plane between the internal oblique and transversalis muscles. Separation of components is a versatile and powerful technique for autologous abdominal wall reconstruction. Along with the ability to close large midline ventral defects primarily, the rectus muscle remains innervated because only the aponeurosis of the external oblique is released. If correctly performed, the internal oblique layer will shield the underlying nerve supply to the rectus and result in a functional abdominal wall repair.

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Section 2: Hand and Lower Extremity

51. A 26-year-old man comes to the office after jamming the index finger of his nondominant left hand while playing baseball 2 days ago. He says he has been in pain since the incident occurred. Physical examination shows a shortened, radially deviated left index finger. X-ray study shows a well-defined radiolucent lesion in the diaphysis of the proximal phalanx with a displaced apex-volar fracture. Which of the following is the most appropriate initial treatment?
- A) Amputation of the finger at the metacarpophalangeal (MCP) joint
 - B) Closed reduction and percutaneous pin fixation only
 - C) Curettage of the mass, bone grafting, and percutaneous pin fixation
 - D) Serial x-ray studies every 3 months
 - E) Wide resection of the mass and bone grafting

The correct response is Option B.

Enchondromas are benign, cartilaginous lesions that are the most common primary bone tumors arising from the bones in the hand. Approximately 35% of all enchondromas arise in the hand, and enchondromas account for as many as 90% of bone tumors seen in the hand. The proximal phalanx is the most common site of involvement, followed by the metacarpal and middle phalanx. Enchondromas may be diagnosed as an incidental finding on x-ray study. Pathologic fractures may occur. Initial treatment is to stabilize the fractures.

Amputation of the finger is not indicated with this benign lesion. Subsequent operative treatment involves curettage of the lesion with bone grafting and fixation. Small enchondromas found incidentally in x-ray study can be followed with serial x-ray. Wide resection is not indicated given the clinical course of the lesion.

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52. A 21-year-old man is brought to the emergency department after sustaining injuries to the right volar wrist when he punched a glass window. Surgical exploration shows a complete laceration through the palmaris longus tendon. Based on the proximity of the patient's injury, which of the following additional structures is most likely injured?

- A) Flexor digitorum superficialis to index
- B) Flexor pollicis longus
- C) Median nerve
- D) Pronator quadratus
- E) Radial artery

The correct response is Option C.

The palmaris longus tendon is located in the middle of the volar wrist, and the median nerve is directly dorsal to this structure. In patients with palmaris longus lacerations at the level of the wrist, it is common to also find the median nerve to be injured.

The palmaris longus tendon is absent in 20% of patients. The superficial volar wrist tendons are the flexor carpi radialis, palmaris longus, and the flexor carpi ulnaris. The flexor superficialis tendons lie dorsal to the superficial flexors. However, the median nerve rests immediately dorsal to the palmaris longus at the level of the wrist. The flexor superficialis tendons are in a stacked position such that the long and ring finger flexor superficialis tendons rest volar to the index and little finger flexor digitorum superficialis tendons. The flexor digitorum profundus tendons are deep or dorsal to the flexor superficialis tendons and lie in a flat array corresponding to each finger the tendon is coursing to distally. The ulnar nerve and artery are found dorsal to the flexor carpi ulnaris. Accordingly, injuries involving the flexor carpi ulnaris tendon are frequently associated with ulnar nerve and artery injuries.

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53. A 17-year-old boy sustains an avulsion injury to the anterior ankle with exposed tendon in a motorcycle collision. The wound is evaluated and reconstruction with a reverse sural artery flap is planned. During elevation of the flap, which of the following is most likely to compromise flap viability?

- A) Injury to the lesser saphenous vein
- B) Injury to the median superficial sural artery
- C) Injury to the sural nerve
- D) Ligation of the gastrocnemius muscle perforators
- E) Ligation of the peroneal artery perforators

The correct response is Option E.

The predominant blood supply to the reverse sural artery flap relies on perforators from the peroneal artery, which primarily originate at a point 5 cm proximal to the lateral malleolus.

The median superficial sural artery and perforators from the gastrocnemius are involved in anterograde blood supply to the flap. Thus, these vessels are typically ligated in the reverse form of the flap.

Likewise, injury to the lesser saphenous vein would not cause significant problems with venous outflow. In dissections and venous flow studies, small concomitant veins were found along both sides of the lesser saphenous vein and were considered to be venae comitantes of accompanying arteries of the vein. These accompanying veins played a role in bypassing the valves of the lesser saphenous vein.

The sural artery flap can be harvested as a neural-veno-adipofascial flap. In this context, the sural nerve can be used to provide sensation to the flap. This nerve does not provide primary blood supply to the flap, and injury would not compromise flap viability.

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54. A 45-year-old woman comes to the office 1 week after sustaining an injury to her right hand in a golfing accident. Physical examination shows tenderness at the ulnar base of the palm and numbness of the little finger. Which of the following injuries is best exposed using a carpal tunnel x-ray view of the wrist?

- A) Hook of the hamate fracture
- B) Lunotriquetral separation
- C) Scaphoid fracture
- D) Scapholunate dissociation
- E) Trapezium body fracture

The correct response is Option A.

Specialized views of the wrist can provide better information regarding bony relationships and fractures, in addition to standard anteroposterior, lateral, and oblique films. There are many different specialized views that the plastic surgeon should be familiar with. Among these are the scaphoid, stress, and carpal tunnel views. The carpal tunnel view is a hyperextended wrist view displaying the carpal bone to carpal tunnel relationships. This view allows visualization of the hook of the hamate and the pisotriquetral joint, as well as the palmar surfaces of the trapezium, pisiform, and triquetrum.

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55. A 65-year-old woman with a 30-year history of rheumatoid arthritis comes for evaluation of a deformity of the right hand. Physical examination shows severe ulnar drift and pain on passive flexion. She is unable to extend her fingers. X-ray study (shown) demonstrates subluxation of the metacarpophalangeal (MCP) joint of all four fingers. Which of the following is the most appropriate treatment?
- A) Centralize the extensor tendons with lumbrical transfers
 - B) Crossed intrinsic transfer
 - C) Release the A1 pulley for all four fingers
 - D) Silicone prosthesis arthroplasty of the MCP joints
 - E) Synovectomy of the fourth through sixth compartments of the wrist

The correct response is Option D.

Silicone prosthesis arthroplasty for the MCP joint has been performed for over 40 years. Only recently have prospective studies attempted to quantify the improvement that the surgery provides.

Some short-term follow-up studies have demonstrated improved range of motion following surgery. The improvement in range of motion returns is not maintained at long-term follow-up, although the arc of motion of the MCP joint is in a more extended position (23 to 59 degrees) than compared with preoperative (57 to 87 degrees) reports, according to one large series. This is better for hand function. Pain control and function related to activities of daily living have been shown to improve after surgery when measured on validated outcome questionnaires such as the Michigan Hand Outcomes Questionnaire (MHQ) and the Arthritis Impact Measurement Scale (AIMS).

Ulnar dislocation of the extensor tendon is part of the deformity present in this patient. However, correction of extensor tendon position without also addressing the joint will not improve mobility or function.

Crossed intrinsic transfer would be inappropriate because it does not address the joint destruction.

A1 pulley release could be used to treat loss of extension because of trigger digit, but is not appropriate for this patient.

Synovectomy of the extensor compartments of the wrist removes inflammatory tissue from this area. It is designed to prevent tendon rupture at the wrist level.



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56. A 55-year-old man comes for evaluation of a nonhealing foot ulcer. He has a 10-year history of type 1 diabetes mellitus. Physical examination shows a deep, 4-cm plantar ulcer at the great toe metatarsal head. Which of the following is the most likely cause of this ulcer?

- A) Atherosclerosis
- B) Lymphatic obstruction
- C) Peripheral neuropathy
- D) Poor hygiene
- E) Venous stasis

The correct response is Option C.

Sensory neuropathy leads to loss of protective sensations. This then leads to neuropathic imbalance with loss of coordination which increases mechanical stresses, unperceived trauma, Charcot foot, and ulcers. Sympathetic neuropathy leads to warm, dry feet which are prone to skin breakdowns. Patients with diabetes who also have peripheral vascular disease are more prone to ischemic ulcers. Patients with diabetic foot ulcers have not been associated with large-vessel atherosclerosis.

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57. A 27-year-old man comes to the office because of an inability to extend the distal phalanx of the long finger after slamming it in a door 3 hours ago. Physical examination shows that the distal phalanx of the long finger is held in 75 degrees of flexion. The patient has no active extension of the joint. Ecchymosis and swelling over the distal interphalangeal (DIP) joint is noted. No skin laceration or abrasions exist. X-ray study shows no fracture. A congruent joint is noted. Which of the following is the most appropriate management?
- A) Arthrodesis of the DIP joint in 15 degrees of flexion
 - B) Exploration and repair of the extensor tendon
 - C) Percutaneous pin fixation of the DIP and proximal interphalangeal (PIP) joints
 - D) Splinting of the DIP joint at 0 degrees
 - E) Observation only

The correct response is Option D.

Avulsions of the terminal extensor tendon, as well as mallet fingers, are some of the most common hand injuries. Tendon avulsion from the distal phalanx may involve the tendon itself or a portion of its bony attachment. In the absence of large joint subluxation or fractures involving large fracture fragments, conservative nonoperative management with splinting is the recommended treatment.

Conservative treatment involves splinting in extension or slight hyperextension. This can involve prefabricated stack splints, malleable aluminum splints, or casting. Outcomes of each of these treatments are similar, but the type of splinting is generally more limited by skin irritation. Pin fixation for the DIP joint is recommended for patients who cannot tolerate splinting or those with special circumstances, such as a surgeon who requires unencumbered use of the hand. Pin fixation should cross the DIP joint only.

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58. A 55-year-old right-hand-dominant man comes to the office because of a 1-month history of inability to extend the interphalangeal (IP) joint of the right thumb. The patient says he first injured his thumb after falling down a flight of stairs 15 months ago, and was treated with 6 weeks of cast immobilization. Physical examination shows flexion of the IP joint is to 45 degrees with no active extension present. No abnormalities were noted. X-ray study shows a united, nondisplaced distal radius fracture. Which of the following is the most appropriate management of this patient's condition?

- A) Arthrodesis of the thumb IP joint
- B) Excision of bone spur and arthrodesis of the thumb IP joint
- C) Plate fixation of distal radius and tendon transfer of extensor indicis proprius (EIP) tendon
- D) Primary repair of extensor pollicis longus (EPL) tendon
- E) Tendon transfer of EIP to index EPL tendon

The correct response is Option E.

EPL tendon rupture occurs in 1% of fractures of the distal radius after closed reduction. The incidence of tendon rupture after closed treatment of distal radius fracture is actually greater than that of open treatment and plate fixation. Tendon ruptures may occur early, due to bone spurs, but they also may occur late, years after the fracture. This is believed to be due to an inflammatory synovitis in the area of the third dorsal compartment and a relative ischemia of the EPL tendon in this area. Ultrasound can help establish the diagnosis; the optimal treatment is tendon transfer from the EIP tendon. Arthrodesis of the thumb IP joint can prevent the flexion deformity of a tendon rupture, but it is not a preferred reconstruction method for a young, active person. Unless there is significant pathology at the distal radius, no specific treatment is required for the bone. Delayed primary repair of the EPL tendon is rarely possible.

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59. A 12-month-old boy is brought to the office for evaluation of complete absence of the right thumb. Examination shows no other extremity abnormalities. X-ray study confirms absent thumb metacarpal. Which of the following is the most appropriate method of reconstruction?

- A) Great toe-to-thumb transfer
- B) Huber transfer
- C) Index finger pollicization
- D) Osteoplastic procedure
- E) Prosthesis

The correct response is Option C.

The most appropriate reconstruction of Type V deformity is pollicization of the index finger. It is the only satisfactory method of a basal joint reconstruction. Pollicization refers to the neurovascular pedicle movement of a finger, often with its metacarpal, for thumb reconstruction.

Great toe-to-thumb microsurgical reconstruction is appropriate when most of the first metacarpal is present. When the carpometacarpal (CMC) joint is absent or unstable, a great toe-to-thumb reconstruction will not reconstruct an adequate basilar joint.

A Huber transfer is used to create functional opposition when absent. Type IIIA deformities can be reconstructed with the Huber transfer, which involves transfer of the hypothenar muscle to recreate the thenar musculature.

Osteoplastic thumb reconstruction is rarely performed today because it results in a stiff, broad, floppy thumb with limited sensation. It involves the combination of a bone graft and flap to lengthen the thumb. At least three stages are required: bone graft from iliac crest covered in a tubed distant flap; flap pedicle division; and transfer of neurovascular sensory flap from the long finger to the thumb's pinch contact surface.

A prosthesis would provide a stable post, but it would also lack sensation. The prosthesis will be more of an encumbrance and is not used in congenital thumb reconstruction.

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60. A 25-year-old man undergoes open reduction and internal fixation of a Gustilo Type IIIB tibia-fibula fracture. Coverage of the resultant soft-tissue defect with a free flap is planned. Which of the following is the ideal length of time after the injury that this procedure should be performed?

- A) 3 Days
- B) 10 Days
- C) 21 Days
- D) 60 Days
- E) 90 Days

The correct response is Option A.

Godina defined the timing of posttraumatic microsurgical lower extremity reconstruction in 1986 with recommendations for flap coverage of Gustilo Type IIIB/C fractures within 72 hours of injury. Godina's study showed the highest risk of infection and flap loss in the delayed period (72 hours to 90 days). Subsequent authors have also cited lower rates of flap loss and infection when repair was performed.

Many authors have reported good flap survival when surgery is done within 3 days and 3 months after injury, but it is accepted that this delayed time frame necessitates more meticulous dissection and going well outside the zone of injury to a patent venous system to decrease the incidence of free flap loss.

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

61. A 55-year-old man is evaluated 10 days after sustaining a traumatic amputation of the tip of the right index finger. A photograph of the debridement is shown. X-ray study shows no fractures. After debridement of loose eschar, no bone or tendon was exposed. The wound is approximately 1 cm². Which of the following is the most appropriate treatment of the resulting defect?
- A) Coverage with bilateral V-Y flaps
 - B) Coverage with volar advancement flap
 - C) Dressing changes
 - D) Periarterial sympathectomy
 - E) Split-thickness skin grafting

The correct response is Option C.

Although composite grafts will often survive in children and may be attempted in adults, aggressive defatting of the amputated segment and removal of bone fragments may still fail.

The photograph demonstrates an eschar resulting from necrosis following reattachment of an amputated fingertip pulp. In the absence of underlying exposed “white” structures such as joints, or tendon denuded of tenosynovium, optimal healing and function will occur via secondary intention. In this case, removal of any sloughing eschar will facilitate local wound care during healing.

Skin grafting is useful for covering larger defects; however, sensation over the graft will be less satisfactory than over a fingertip wound that heals by secondary intention.

A variety of local flaps have been used for fingertip tissue loss, including bilateral V-Y (Kutler) and volar advancement (Atasoy/Tranquilli-Leali) flaps. V-Y flaps place a scar directly in the midline of the pulp and are limited in the degree to which they may be advanced. The longer volar advancement flaps may be useful in covering bone or supporting the nail bed in the setting of a palmar oblique amputation through the distal phalanx; however, these flaps carry an increased risk of flexion contracture at the proximal interphalangeal (PIP) joint.

Pulp necrosis can occur in the setting of digital ischemia due to Raynaud disease or thrombotic ulnar artery occlusion (hypothenar hammer syndrome). Periarterial sympathectomy can prevent tissue loss in some cases of vascular spasm or insufficiency. In this patient with an otherwise visibly well-perfused hand and discrete history of trauma, digital ischemia would be an unlikely cause of the necrosis.

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62. A 36-year-old pregnant woman undergoes routine fetal ultrasonography. Examination of the embryo shows the formation of limb buds without digital separation. Based on the timeline of the development of the upper extremity, it is most likely that the fetus has reached which of the following points in gestation?

- A) 2 Weeks
- B) 5 Weeks
- C) 8 Weeks
- D) 11 Weeks
- E) 14 Weeks

The correct response is Option B.

Embryonic development has been studied closely. The stages of human upper extremity development have also been studied closely. The limb bud is present without digital separation at 5 weeks. At 2 weeks of gestation, the limb buds have not yet formed. At 8 weeks, digital separation is nearly complete.

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63. A 2-year-old girl is evaluated because of a rapidly enlarging mass in the left forearm that her parents first noticed 6 months ago. Physical examination shows a 3-cm firm mass in the volar aspect of the left forearm. Passive extension of the fingers and wrist elicits pain. MRI shows a mass within the deep forearm compartment suggestive of a vascular lesion. Which of the following is the most appropriate initial step in treatment?

- A) Application of a compression garment
- B) En bloc surgical resection
- C) Oral administration of prednisone
- D) Percutaneous sclerotherapy
- E) Pulsed-dye laser therapy

The correct response is Option C.

This rapidly growing vascular lesion, not present at birth, most likely represents an intramuscular hemangioma. These vascular anomalies can pose diagnostic challenges because of their depth and lack of cutaneous changes characteristic of the more common infantile hemangioma. The treatment algorithm, however, parallels that of other hemangiomas. In this case, the first line of therapy would be medical treatment with either propranolol or corticosteroids.

Compression garments may be useful in managing arteriovenous or lymphatic malformations of the extremities. In this patient, with pain caused by increased intracompartmental volume, compression may exacerbate the symptoms.

En bloc surgical resection is reserved for lesions that fail to respond to medical management or that compromise function. In the case of upper extremity lesions, this would be indicated most commonly for refractory pain or nerve compression.

Percutaneous sclerotherapy can successfully treat low-flow arteriovenous malformations and lymphatic malformations. It would not be a first-line intervention for hemangioma.

Cutaneous arteriovenous malformations may be treated with pulsed-dye laser or other light-based therapies. Deep, intramuscular lesions without a cutaneous component will not be reached by these interventions.

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64. An 8-year-old girl is brought to the office because her right breast has not developed like the left breast. Physical examination shows hypoplasia of the right breast, absence of the sternal head of the pectoralis major, and a congenital abnormality of the right hand. Which of the following categories of congenital abnormalities best describes this patient's hand condition?

- A) Constriction ring syndrome
- B) Duplication
- C) Failure of differentiation
- D) Failure of formation
- E) Overgrowth

The correct response is Option C.

The category of congenital abnormality that is most likely to be associated with the abnormality described is failure of differentiation.

In the patient with absence of the sternal head of the pectoralis major muscle, the diagnosis is Poland sequence. Poland sequence is associated with symbrachydactyly of the ipsilateral hand.

A system of classification has been adopted by the American Society for Surgery of the Hand (ASSH) and the International Federation of Societies for Surgery of the Hand (IFSSH) in an attempt to provide a unified system to catalog congenital hand deformities. In this system, congenital hand differences have been categorized into seven types:

Type I – Failure of formation

The type I congenital deformities include scenarios in which there is a lack of formation. This includes longitudinal arrest, which can be found at any level from the shoulder to the phalanx, or transverse arrest with varying degrees of preaxial, central, or postaxial deficits, such as radial or ulnar clubhand.

Type II – Failure of differentiation

Failure of differentiation involves a variety of conditions with inadequate separation of parts, such as syndactyly, carpal coalitions and synostoses, camptodactyly, and clinodactyly. Symbrachydactyly, as seen in Poland syndrome, falls into this category.

Type III – Duplication

Duplication may apply to the whole limb or occur as mirror hand. It includes radial or ulnar

polydactyly and triphalangeal thumb.

Type IV – Overgrowth

Macrodactyly and hemihypertrophy are types of overgrowth disorders.

Type V – Undergrowth

Undergrowth of the whole limb or parts of the hand may occur. Common manifestations include brachysyndactyly or brachydactyly.

Type VI – Constriction ring syndrome

Constriction ring syndrome may involve amputation at any level.

Type VII – Generalized skeletal deformities

These deformities include generalized syndromes, such as Apert syndrome, various craniosynostoses, and Holt-Oram/thrombocytopenia-absent radius (TAR) syndrome.

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65. A 36-year-old man comes to the office because of a 2-cm painless mass over the dorsum of the metacarpal of the index finger of the dominant right hand. A ganglion is suspected. The mass is excised with primary closure. Pathologic examination shows a high-grade epithelioid sarcoma with a single positive margin. After staging, which of the following is the most appropriate management?
- A) Aggressive curettage of the positive margin followed by high-dose adjuvant radiation therapy with no further treatment
 - B) Amputation at the wrist
 - C) High-dose adjuvant radiation therapy with close follow-up of the wound bed
 - D) Wide local excision

The correct response is Option D.

The most common subtypes of soft-tissue sarcoma found in the hand include epithelioid sarcoma, synovial sarcoma, and malignant fibrous histiocytoma. It is not uncommon for them to be misdiagnosed initially and treated as benign tumors of the hand.

The mainstay of treatment of extremity sarcomas is wide local excision. Although preoperative and postoperative radiation therapy is often used as an adjunct to wide local excision, adjuvant radiation therapy is not an acceptable replacement for margin-free resection. Curettage is also inadequate to obtain appropriate resection margins and would, in fact, put the patient at risk for seeding of the donor wound bed with malignant cells.

Local control and survival have been shown to be comparable in patients treated with either primary amputation or limb salvage when presenting with sarcomas of the hand. Therefore, primary amputation at the wrist is virtually never indicated.

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66. A 53-year-old man is evaluated because of a 5-month history of numbness and tingling of the right ring and little fingers. He says that symptoms are worse at night and when his elbow is flexed while holding a phone to his ear. Physical examination shows weakness of abduction of the fingers of the right hand. Which of the following structures is the most likely cause of this patient's symptoms?

- A) Arcade of Frohse
- B) Flexor digitorum superficialis
- C) Ligament of Struthers
- D) Osborne band
- E) Transverse carpal ligament

The correct response is Option D.

The structure most likely to be responsible for the condition described is Osborne band.

The patient described exhibits symptoms of ulnar nerve compression at the cubital tunnel. Cubital tunnel syndrome is characterized by numbness and tingling of the ulnar nerve distribution (ulnar side of hand, involving little finger and ulnar half of ring finger) and can lead to intrinsic weakness. The ulnar nerve passes posterior to the medial epicondyle and travels between the medial epicondyle and the olecranon at the level of the elbow. In the region of the cubital tunnel, a set of thick fascial fibers known as Osborne band or ligament forms the roof of the tunnel and can compress the ulnar nerve. A number of additional sites can contribute to ulnar nerve compression, including the arcade of Struthers, the medial intermuscular septum, anconeus epitrochlearis, and the fascia of the flexor carpi ulnaris or flexor pronator musculature.

The arcade of Frohse is a fibrous arch that comes from the lateral epicondyle, which can compress the radial nerve.

The flexor digitorum superficialis can cause compression of the median nerve in the forearm.

The ligament of Struthers is an anatomic variant which arises from the supracondylar process of the humerus. It can cause proximal median nerve compression.

The transverse carpal ligament is responsible for median nerve compression at the carpal tunnel.

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

67. An 18-year-old man undergoes open reduction with tension band wiring to treat a fracture of the olecranon he sustained in a bicycle collision. Postoperatively, he develops a wound infection, resulting in an open wound over the elbow. Coverage with a posterior interosseous fasciocutaneous flap is planned. Which of the following best describes the anatomical location of the dominant pedicle of this flap?

- A) Anterior to the pronator teres and deep to the brachioradialis
- B) Between the extensor carpi ulnaris and the extensor digiti minimi
- C) Between the flexor digitorum profundus and flexor pollicis longus
- D) Deep to the brachioradialis and lateral to the flexor carpi radialis
- E) Superficial to the anconeus and extensor digitorum muscle

The correct response is Option B.

The posterior interosseous flap is a pedicled forearm flap based off the posterior interosseous artery (PIA) proximally. It can be rotated to cover elbow, antecubital fossa, or proximal volar forearm defects. A reversed version, based off the anterior interosseous arterial connections to the PIA, can be used for wrist and hand defects.

The PIA emerges in the proximal dorsal forearm deep to the supinator. It then courses between the extensor carpi ulnaris (ECU) and the extensor digiti minimi (EDM). During dissection of a standard posterior interosseous flap, the pedicle is found distally in the forearm between the ECU and EDM then dissected proximally.

The superficial branch of the radial nerve is located anterior to the pronator teres and deep to the brachioradialis.

The anterior interosseous artery is found between the muscle bellies of flexor digitorum profundus and the flexor pollicis longus.

Distally in the forearm, the radial artery is deep to the brachioradialis and radial to the flexor carpi radialis.

Proximally in the forearm, the posterior cutaneous nerve of the forearm is found superficial to both the anconeus and extensor digitorum muscle.

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68. A 50-year-old woman has significant tenderness of the residual tip of the index finger 8 weeks after undergoing amputation of the fingertip. Physical examination shows significant stump tenderness. Which of the following therapy modalities is most appropriate for desensitization of the amputation stump?

- A) Functional electric stimulation
- B) Immobilization
- C) Kinesiology tape
- D) Semmes-Weinstein monofilaments
- E) Vibration

The correct response is Option E.

Vibration is a modality that may be used in therapy to desensitize an amputation stump neuroma. The treatment consists of vibratory stimulation applied to the periphery of the sensitive area and then gradually moving toward the center. Some additional methods used in therapy to treat neuroma pain include desensitization, massage, and transcutaneous nerve stimulation. Functional electric stimulation is similarly not a therapeutic modality. Kinesiology taping is used for edema control and comfort. It would not be used on an amputated stump. Semmes-Weinstein monofilaments are used to quantify sensation to fine touch and are not used for desensitization.

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69. A 66-year-old man comes to the office with a 2-year history of progressive ulceration at the right medial malleolus. He says he has marked calf pain when he is active, and that it has worsened progressively over time. Medical history includes cardiovascular disease and a 40-year history of smoking. Physical examination shows that the wound margins are well demarcated with a yellow fibrinous wound base. Which of the following is the most appropriate management of this patient's condition?

- A) Biopsy of the wound edge
- B) Debridement and dressing changes
- C) Debridement and local flap coverage
- D) Revascularization by vascular surgery
- E) Use of topical debriding agents

The correct response is Option D.

Arterial ulcers most commonly occur in male patients with atherosclerosis, usually in association with cardiovascular disease, diabetes, hypertension, or smoking. Patients typically have symptoms of claudication and rest pain. The leg pain improves when the leg is dependent and is exacerbated when the leg is elevated. The base of the arterial ulcer generally does not bleed and has a “punched-out” appearance. Ulcers associated with an ankle brachial index of less than 0.45 (normal range 0.90 to 1.30) generally do not heal without revascularization. Aggressive debridement would create a larger wound without the potential to heal. Continued wound care would provide no long-term benefit. The clinical picture described is not consistent with malignant degeneration of the wound.

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70. A 7-year-old girl is brought to the office because of a slowly enlarging mass of the wrist. She has a history of congenital heart disease that required hospitalization for several months after birth. Physical examination shows a nontender 3 × 3-cm radiovolar mass. The skin overlying the mass is thin; a palpable thrill is noted. Which of the following is the most appropriate management at this time?

- A) Injection of a corticosteroid to the lesion
- B) Ligation of the radial artery
- C) Referral to interventional radiology for vascular ablation
- D) Resection and vascular reconstruction with vein grafting
- E) Observation and yearly follow-up

The correct response is Option D.

Ligation of the radial artery is inappropriate because revascularization through collateral vessels will occur. Arteriovenous fistulas may be acquired during hospitalization secondary to continued intravenous access. Blood flows rapidly from the high-pressure artery to the low-pressure vein. Diagnosis of an established arteriovenous fistula is usually obvious secondary to the palpable thrill. Duplex imaging, technetium scanning, and magnetic resonance angiography are diagnostic. Arteriography is usually not necessary unless there is a question of the diagnosis or if the lesion is small enough to embolize. If surgery is selected, early exploration, excision of the fistula, and reconstruction of the artery are recommended. Vascular ablation would not be appropriate. This lesion does not represent a hemangioma and injection of a corticosteroid would be inappropriate. Observation would not be indicated because the lesion is reportedly growing and the overlying skin is becoming thin and potentially unstable.

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2. McClinton MA, Wilgis EFS. Ischemic conditions of the hand. In: Mathes SJ, Hentz VR, eds. *Plastic Surgery*. 2nd ed. Philadelphia: WB Saunders; 2006:791-822.

71. An otherwise healthy 25-year-old man is evaluated because of footdrop and paresthesia 4 weeks after undergoing open reduction and internal fixation of a fracture of the proximal tibia. Electrodiagnostic testing shows no conduction of the nerve. Which of the following is the most appropriate next step in management?
- A) Ankle arthrodesis
 - B) Peroneal nerve decompression
 - C) Posterior tibial nerve decompression
 - D) Posterior tibial tendon transfer
 - E) Repeat electrodiagnostic testing in 4 weeks

The correct response is Option E.

Peroneal nerve palsy may lead to severe disability with footdrop and paresthesia. Traumatic peroneal palsy may result from supracondylar femoral fracture, knee dislocation, and proximal tibial fracture involving both motor and sensory changes. On examination, the motor deficit manifests as a footdrop, and the sensory deficit results in a loss of sensation along the dorsum of the foot. Unlike the loss of sensation associated with the peroneal nerve, the posterior tibial nerve is clinically morbid, as it is on the plantar aspect of the foot. The chronic injury may result in wounding of the plantar aspect of the foot, which may ultimately result in amputation.

Electrodiagnostic testing should be performed within 1 month of the injury to confirm sensory and motor deficits. In patients with partial nerve palsy, greater than 80% will recover completely and can be expected to recover with observation alone. A patient with complete palsy will have a much worse prognosis, with only 40% of patients with a functional recovery. If there is no neurologic improvement after 2 to 3 months, operative decompression should be performed. If the nerve is noted to be in continuity, and nerve action potentials are transmitted across a lesion, then there may be continuity of the nerve, and neurolysis is performed. If there is a transected nerve, a direct repair or nerve grafting may be performed.

When neurolysis and nerve grafting do not provide satisfactory results, the remaining surgical options are salvage procedures such as tendon transfer or arthrodesis. Posterior tibial tendon transfer is the most commonly used tendon transfer for this injury.

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

72. A 48-year-old man is brought to the emergency department after being involved in a high-speed motorcycle collision. Physical examination shows comminuted fractures of the left radius and ulna. A photograph of his wounds is shown. After debridement of the necrotic tissue, the brachial vessels and median nerve are exposed. Microsurgical techniques are not available. Which of the following is the most appropriate choice for tissue coverage in this patient?
- A) Groin flap
 - B) Lateral arm flap
 - C) Posterior interosseous artery flap
 - D) Radial forearm flap
 - E) Split-thickness skin graft

The correct response is Option B.

The vascular supply of the lateral arm flap is from the posterior radial collateral artery, a terminal branch of the deep brachial artery. This artery communicates distally with the ulnar artery, allowing the flap to be raised in a distally based fashion, as it was for the patient in this item. For most adult patients, a 12×6 -cm flap can be harvested and still allow for primary donor site closure. The major extremity vessels are not disturbed with the harvest of this flap.



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

A groin flap would be difficult to mobilize sufficiently to reach the defect shown. It would also require leaving the arm attached to the torso for several weeks for vascular ingrowth prior to division and inset.

The posterior interosseous artery flap is based on the communication between the anterior and posterior interosseous arteries just proximal to the distal radioulnar joint. Its pedicle can be used in a distally based fashion to allow for coverage of defects of the hand and wrist. It cannot reach to cover defects at the elbow.

A radial forearm flap has two major disadvantages. It will remove a major vessel to a wrist and hand that is needed to heal a severe injury. It will also expose the radius fracture, requiring secondary flap reconstruction of the donor site.

Split-thickness skin grafting is inappropriate to place over an exposed nerve, as sensitivity and pain would be expected to persist after healing. In addition, a skin graft would suffer secondary contraction, which would impair elbow extension.

References

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2. Sauerbier M, Unglaub F. Perforator flaps in the upper extremity. *Clin Plast Surg*. 2010 Oct;37(4):667-676.

73. A 28-year-old man is evaluated in the emergency department because of a soft-tissue defect of the dorsum of the hand with exposed extensor tendons. Reconstruction is planned with a fasciocutaneous free flap that is centered on the axis between the anterior superior iliac spine and patella. Which of the following arteries is the most likely pedicle of this flap?

- A) Ascending branch of lateral femoral circumflex
- B) Ascending branch of medial femoral circumflex
- C) Descending branch of lateral femoral circumflex
- D) Descending branch of medial femoral circumflex
- E) Superficial femoral

The correct response is Option C.

The pedicle to the anterolateral thigh flap is the descending branch of the lateral femoral circumflex artery.

The anterolateral thigh flap is a fasciocutaneous flap that has gained in popularity. This flap is capable of providing pliable tissue with a fascia to allow for tendon gliding. The flap has a large skin territory and does not require the sacrifice of a major vessel.

The flap is based on perforators from the descending branch of the lateral femoral circumflex artery, which arises from the profunda femoris artery. The artery travels between the vastus lateralis and rectus femoris muscles and may travel in the septum or within the substance of the muscles.

The flap is centered on the axis between the anterior superior iliac spine and the superior lateral border of the patella. Perforators to the anterolateral thigh flap can be variable, but the majority lies within 3 cm of a circle centered along the midpoint of that line.

The ascending branch of the lateral femoral circumflex artery forms the pedicle for the tensor fascia lata flap.

The ascending branch of the medial femoral circumflex artery forms the pedicle for the gracilis muscle flap.

The descending branch of the medial femoral circumflex artery supplies the adductor muscles.

The superficial femoral artery provides the blood supply to the sartorius muscle.

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74. A 65-year-old man has a 4-cm defect in the mid portion of the metacarpal of the long finger after sustaining a gunshot wound to the left hand. Which of the following is the most appropriate treatment of this defect?
- A) Coverage with a free vascularized bone flap
 - B) Distraction osteogenesis
 - C) Injection of calcium phosphate cement
 - D) Interpose an autologous bone graft
 - E) Placement of demineralized bone matrix

The correct response is Option D.

In a patient with a noncritical (less than 6- to 8-cm) bone defect of the hand, reconstruction with an autologous bone graft provides the best combination of maximal healing and minimal morbidity. To provide the best chance of successful healing, the graft should allow rigid stabilization. Corticocancellous grafts from the iliac crest are the typical source.

Free vascularized bone flaps, such as the fibula, are essential tools when dealing with critical bone defects (greater than 6 to 8 cm). They do, however, add significant morbidity to the procedure and may not be feasible in individuals with severe peripheral vascular disease. In this patient, the noncritical defect would argue against the need for vascularized bone.

Distraction osteogenesis works well for bone defects ranging from 1.5 to 13.5 cm. A prerequisite, however, is adequate bone stock to allow pin placement for the distractor. In this case, a 4-cm defect would leave insufficient bone at the metacarpal base and head to allow distractor placement.

Calcium phosphate cement (Norian, Synthes) offers an osteoconductive substrate in bone defects that are already stabilized. In addition, its use is contraindicated in infected or potentially infected wounds.

Demineralized bone matrix is osteoinductive, but, like calcium phosphate cement, will not offer any structural stability.

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2. Seitz WH Jr, Shimko P, Patterson RW. Long-term results of callus distraction-lengthening in the hand and upper extremity for traumatic and congenital skeletal deficiencies. *J Bone Joint Surg Am*. 2010 Dec;92 Suppl 2:47-58.

75. A 58-year-old man comes to the office for follow-up 3 weeks after undergoing mandibular reconstruction with a fibular free flap. The patient reports numbness of the operated extremity and says he has difficulty walking. Which of the following sensory and motor deficits is most likely in this patient?

Absence of Sensation

Weakness

- | | |
|--------------------------------|--|
| A) First web space of the foot | Extensor hallucis longus and tibialis anterior |
| B) Medial aspect of the calf | Soleus and extensor digitorum brevis |
| C) Medial malleolus and heel | Soleus and tibialis anterior |
| D) Third web space of the foot | Soleus and extensor digitorum brevis |
| E) Upper lateral calf | Flexor hallucis longus and extensor digitorum brevis |

The correct response is Option A.

The injury in the patient described is to the common peroneal nerve.

Both the first web space of the foot and the extensor hallucis longus and tibialis anterior muscles are innervated by branches of the common peroneal nerve. The finding of absence of sensation over the medial aspect of the calf and weakness of the soleus and extensor digitorum brevis muscles is eliminated by numbness of the medial calf, which is innervated by the saphenous nerve, a branch of the femoral nerve. Absence of sensation over the medial malleolus and heel with weakness of the soleus and tibialis anterior muscles is eliminated by numbness of the medial malleolus, which is also innervated by the saphenous nerve. In addition, the soleus is innervated by the tibial nerve. The finding of absence of sensation in the third web space of the foot and weakness of the soleus and extensor digitorum brevis muscles is eliminated by the soleus muscle. The finding of absence of sensation over the upper lateral calf and weakness of the flexor hallucis longus and extensor digitorum brevis muscles is eliminated by the flexor hallucis longus, which is innervated by the tibial nerve.

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76. A 23-year-old man is brought to the emergency department after being stabbed with a knife in a fight. The patient appears alert and in no distress. Physical examination shows a 2-cm puncture wound just above the midclavicular line. Decreased strength with wrist flexion, weakness of index, long, ring, and little finger flexion at the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints, and difficulty with palmar abduction against resistance are noted. Finger, thumb, and wrist extension is intact. Elbow flexion and extension are normal. Sharp injury to which of the following structures is most likely in this patient?

- A) Lateral cord
- B) Medial cord
- C) Median nerve
- D) Middle trunk
- E) Ulnar nerve

The correct response is Option B.

The patient described demonstrates median and ulnar nerve weakness after a sharp injury to the brachial plexus. The radial nerve function appears to be preserved.

The medial cord gives fibers to the medial pectoral nerve, the medial brachial and antebrachial cutaneous nerves, the median nerve, and the ulnar nerve. Therefore, this is the appropriate response.

The lateral cord is not appropriate because although that structure does give fibers to the median nerve, it does not branch to the ulnar nerve. The lateral cord terminates in the lateral pectoral nerve, musculocutaneous nerve, and the median nerve. Also of note, as the patient has intact elbow flexion, the musculocutaneous nerve is presumably intact in the scenario described.

The median nerve in isolation is not appropriate as well for similar reasons. This patient has median and ulnar nerve deficits.

The middle trunk contains fibers that go to the radial and median nerves, but not the ulnar. This is not appropriate, therefore, as well.

The posterior cord gives off the radial nerve, axillary nerve, subscapular nerves, and the thoracodorsal. It does not contribute to the median or ulnar nerve.

At the midclavicular line, the ulnar nerve has not yet formed.

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77. A 46-year-old man is brought to the emergency department after sustaining an open comminuted fracture of the left tibia during a motor vehicle collision. Physical examination shows a wound greater than 10 cm with marked periosteal stripping near the mid shaft. Which of the following is the appropriate Gustilo classification of this patient's injury?

- A) I
- B) II
- C) IIIA
- D) IIIB
- E) IIIC

The correct response is Option D.

The Gustilo classification of open fractures is based on the severity of soft-tissue injury and the presence or absence of concurrent vascular injury. A higher grade implies a more severe injury, and correlates with a greater incidence of complications and need for amputation.

The patient in this item has a wound greater than 10 cm and a heavily comminuted tibia fracture. There is no mention of vascular injury. He has a Gustilo type IIIB injury.

The Gustilo grading scale:

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

References

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78. A 46-year-old woman comes to the office because she cut her nondominant little finger while peeling an avocado 6 months ago. Since the time of the injury, the patient says that her grip has been weak. Physical examination shows a healed 1-cm scar over the volar aspect of the proximal phalanx. The patient is unable to actively flex the distal interphalangeal (DIP) or proximal interphalangeal (PIP) joint. Two-point discrimination shows no abnormalities on both the ulnar and radial sides of the injured finger. Tendon grafting will be performed to restore little finger flexion. Which of the following is the most important consideration to confirm before performing surgery?

- A) Function of the flexor digitorum superficialis tendon
- B) Location of the proximal flexor digitorum profundus (FDP) stump
- C) Normal passive range of motion
- D) Presence of a palmaris longus at either forearm
- E) Symmetry of grip strength

The correct response is Option C.

The most important preoperative achievement is the restoration of good passive flexion of the involved digit. This will allow active range of motion in the postoperative period.

Preoperative examination clearly shows no function of the flexor digitorum superficialis tendon. Therefore, in the setting of the sharp injury, it would not be expected to be improvable.

The location of the proximal FDP stump is not appropriate because it is not a significant factor in timing secondary tendon reconstruction; it would not be reasonable to consider planning a delayed primary repair 3 months out. And with a Zone 2 laceration and no FDP function, the FDP stump will be in the palm, due to tethering by the lumbrical muscle.

Confirmation of the presence of a palmaris longus at either forearm is not appropriate because the palmaris is not the only donor tendon for secondary finger flexor reconstruction. The plantaris is a viable option as well, as are the long toe extensors.

Preoperative strengthening of grip is not appropriate because it would do nothing to prepare the little finger for reconstruction.

References

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2. Freilich AM, Chhabra AB. Secondary flexor tendon reconstruction, a review. *J Hand Surg Am*. 2007 Nov;32(9):1436-1442.

79. A 5-year-old boy is brought to the office because of a pulsatile mass in the volar forearm. His parents say the mass first appeared 10 days ago. Physical examination shows a palpable, pulsatile mass at the radial artery. CT angiography shows a true aneurysm of the radial artery. Which of the following is the most likely cause of this patient's condition?

- A) Arterial catheterization
- B) Crush injury
- C) Infective embolism
- D) Kawasaki disease
- E) Regional block with administration of a local anesthetic agent

The correct response is Option D.

There are two types of pathologic arterial dilations: “false,” or pseudoaneurysms, and true aneurysms.

Pseudoaneurysms typically result from some form of acute external or internal insult that causes rupture or laceration of the endothelium and bleeding. All layers of the artery can be involved, or it can be due to a dissection between layers. The false or pseudoaneurysm is caused by an acute injury to the endothelial layer of an otherwise normal artery, subsequent bleeding, clotting, and recanalization of the vessel. These arterial cul-de-sacs do have blood in them, but they do not have endothelial layers internally. Therefore, they are described as “false” aneurysms.

Therefore, Options A, B, C, and E are not appropriate because those types of acute insults more typically cause pseudoaneurysms.

A true aneurysm is an endothelial-lined widening of an artery that has all three layers of the vessel lining the aneurysm: endothelium, media, and adventitia. The true aneurysm typically has a more fusiform, dilated appearance, rather than the outpouching that typifies false aneurysms. True aneurysms can also result from trauma, but the trauma tends to be repetitive and blunt, rather than an acute, severe insult and a vessel rupture.

Kawasaki disease is a classic example of true aneurysm. In this disorder, arteriosclerosis is a common cause of true aneurysms. Hemophilia can lead to true and false aneurysms.

References

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80. A 25-year-old woman comes for evaluation because she has difficulty gripping things with her dominant right hand. She sustained a stab wound to the left forearm 6 months ago. Physical examination shows a Tinel sign present over the ulnar aspect of the mid volar forearm with a well-healed laceration. A neuroma in continuity is identified intraoperatively. The neuroma is resected, and a 3-cm nerve gap remains. Which of the following is the most appropriate management?

- A) Bridge the gap with a synthetic nerve conduit
- B) Dissect the nerve both proximally and distally with an end-to-end neurorrhaphy
- C) Proceed to tendon transfers to assist with grip
- D) Reconstruct the nerve defect with a lateral antebrachial cutaneous nerve graft
- E) Sural nerve cable grafting

The correct response is Option E.

The sural nerve is a common source of nerve graft material. It is formed from the medial cutaneous sural nerve that originates from the tibial nerve.

Synthetic nerve conduit repair of nerves has not proven effective in gaps larger than 2 cm and is less effective in motor nerve defects.

A tension-free repair is the goal for the nerve anastomoses. When an acute laceration occurs, primary end-to-end neurorrhaphy is indicated. When the treatment is delayed and a neuroma exists, the type of repair is dictated by the size of the nerve gap. Nerve grafting is indicated to bridge a defect when more than 10% elongation of the nerve would be necessary to bridge the gap.

Tendon transfers would not be indicated at this point.

The lateral antebrachial cutaneous nerve is the distal continuation of the musculocutaneous nerve. Given the size of the defect and the need for at least two cable grafts, this nerve would not be appropriate.

References

1. Slutsky DJ. A practical approach to nerve grafting in the upper extremity. In: Slutsky DJ, Hentz VR, eds. *Peripheral Nerve Surgery: Practical Applications in the Upper Extremity*. Philadelphia: Churchill Livingstone; 2006:61-80.

2. Trumble TE, McCallister WV. Repair of peripheral nerve defects in the upper extremity. *Hand Clin.* 2000 Feb;16(1):37-52.

81. A 45-year-old woman comes to the office with a history of a 4.1-mm irregular black lesion of the left leg. Excisional biopsy was performed by her primary physician with a 1-mm margin. The pathology result reveals a 1.8-mm thick ulcerated malignant melanoma. A wide local excision is planned. Which of the following is the most appropriate excision margin for this lesion?

- A) 0.5-cm margin
- B) 1-cm margin
- C) 2-cm margin
- D) 3-cm margin
- E) 5-cm margin

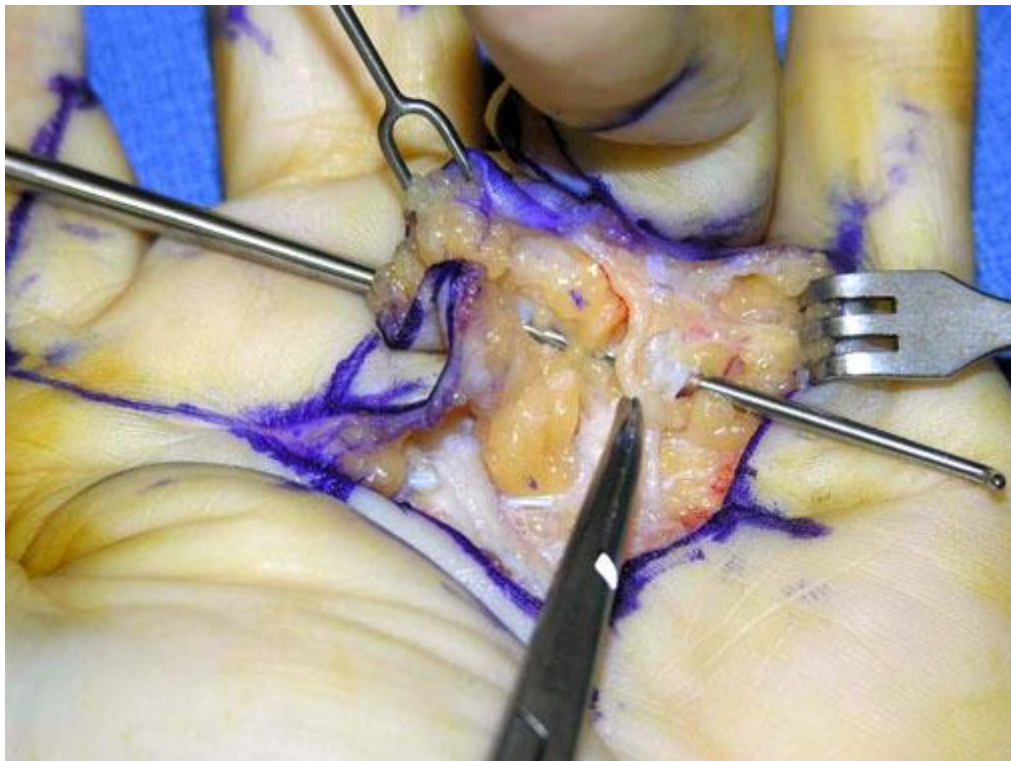
The correct response is Option C.

The diameter of the melanoma described is not taken into account for the wide local excision that is to be performed. Wide local excision surgical margins are determined by the thickness of the tumor, not the diameter. An in situ melanoma would require a 0.5-cm margin.

Melanomas with a depth of less than 1 mm (thin) require a 1-cm margin. Lesions between 1 and 4 mm (intermediate thickness) require a 2-cm margin. If the depth is greater than 4 mm (thick), a 2- to 3-cm margin is necessary. Intermediate melanomas (those of a 1- to 4-mm depth) had previously required a 4-cm margin of resection. In a landmark article in 1993, Balch, et al. recommended a 2-cm margin for intermediate-depth melanomas. Another landmark article in 1998 by Heaton, et al. advocated surgical margins of 2 cm for patients with thick melanoma.

References

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

82. A 65-year-old man undergoes fasciectomy for Dupuytren disease affecting the left ring finger. During dissection, the ulnar digital nerve is noted to be centrally displaced on the ring finger by a Dupuytren cord. A photograph is shown. Which of the following palmar fascia structures contributes to the formation of this cord?

- A) Central band
- B) Cleland ligament
- C) Lateral digital sheet
- D) Natatory ligament
- E) Septa of Legueu and Juvara

The correct response is Option C.

Except for Cleland ligament, any of the above named structures can become involved in Dupuytren contracture. Once involved in a contracture, the name of the structure is changed to include “cord” (e.g., natatory ligament becomes natatory cord).

A spiral cord is formed when Dupuytren disease affects the pretendinous band, spiral band, lateral digital sheet, and Grayson ligament. The normal palmar fascia structures pass around the neurovascular bundle in a spiral fashion. As the cord forms and contracts, it eventually becomes straight. The neurovascular bundle is then displaced centrally on the digit and is distorted to spiral around the cord.

References

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2. Rayan GM. Clinical presentation and types of Dupuytren's disease. *Hand Clin.* 1999 Feb;15(1):87-96, vii.

83. A 47-year-old man comes to the office 6 months after undergoing tenodesis and application of a removable splint because of an open mallet finger injury with a knife to the dominant right hand. The patient was lost to follow-up despite being urged to return for routine follow-up visits, and says he removed his own sutures and discontinued the splint after 2 weeks. Physical examination shows a residual extensor lag of 25 degrees to the finger. A Fowler tenotomy is discussed regarding reconstructive options. Which of the following structures is most likely to be cut to restore extension of the distal phalanx in this patient?

- A) Central slip
- B) Lateral band
- C) Oblique retinacular ligament
- D) Terminal tendon
- E) Triangular ligament

The correct response is Option A.

The Fowler central slip tenotomy is well known, but seldom used. The central slip or tendon inserts on the base of the middle phalanx and acts on the proximal interphalangeal (PIP) joint. A central slip tenotomy will rebalance the extensor mechanism such that the terminal tendon will be able to extend the distal interphalangeal (DIP) joint in patients with a chronic mallet finger. However, many clinical and anatomical studies have shown that the central slip tenotomy may not restore full extension in patients with a preexisting lag of approximately 36 degrees.

Tension on the lateral bands also extends the DIP.

Release of the oblique retinacular ligament (ORL) or the lateral bands would, therefore, not assist in extension of the DIP joint.

Releasing the terminal tendon will only worsen the mallet finger because this is the structure that is disrupted in an open or closed mallet injury. Release of the triangular ligament would likely create a boutonnière deformity. PIP extension (produced by other tissues in the extensor mechanism) elongates the ORL, creating passive tension that extends the DIP.

References

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2. Lucas GL. Fowler central slip tenotomy for old mallet deformity. *Plast Reconstr Surg*. 1987 Jul;80(1):92-94.
3. Nolan WB. Extensor tendon injuries and reconstruction. In: Mathes SJ, Hentz VR, eds. *Plastic Surgery*. 2nd ed. Philadelphia: WB Saunders; 2006:401-421.

84. A 24-year-old man is brought to the emergency department after sustaining a degloving injury of the long, ring, and little fingers of the dorsal, nondominant left hand in a high-speed, rollover motor vehicle collision. Following debridement, the patient has obvious open proximal interphalangeal (PIP) joints of each of these fingers. Which of the following is the most appropriate management of these defects?

- A) Cross-finger flap coverage
- B) Full-thickness skin grafting from the groin
- C) Pedicle lateral arm flap coverage
- D) Reverse radial forearm flap coverage
- E) Split-thickness skin grafting from the thigh

The correct response is Option D.

Pedicled fascial flaps to the hand provide an excellent reconstructive option in cases of exposed tendon, joint, or bone where soft-tissue coverage is needed. They provide thin, broad, well-vascularized coverage and a gliding surface for tendons and joints. The pedicled reverse radial forearm flap is the most appropriate option for this defect. The cross-finger flap may be an option for a single digit, but not in the large zone-of-injury described. The groin flap, although reliable, is bulky and requires the attachment of the upper extremity to the trunk, followed by division and inset of the flap at a later time. The pedicle lateral arm flap cannot reach the fingers. The reverse radial forearm flap may be harvested with skin or simply as a fascial flap. Skin grafting, either full- or split-thickness, would not be appropriate coverage for exposed joint surfaces.

References

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2. Taghinia AH, Carty M, Upton J. Fascial flaps for hand reconstruction. *J Hand Surg Am*. 2010 Aug;35(8):1351-1355.

85. An 8-year-old girl is brought to the office for evaluation because her right forearm is severely contracted at the wrist and fingers. Upon questioning, the patient's parents note that she was treated 1 year ago for a humerus fracture. Physical examination shows a pronated forearm, flexed wrist, hyperextended metacarpophalangeal (MCP) joints, and flexed proximal (PIP) and distal interphalangeal (DIP) joints. She can make a full active fist. Which of the following is the most appropriate management?
- A) Exploration at the level of the humerus fracture with neurolysis and/or repair of the radial nerve
 - B) Exploration of the forearm, neurolysis of the median and ulnar nerves, and muscle slide technique performed
 - C) Exploration of the upper arm with median and ulnar nerve neurolysis
 - D) Flexor carpi radialis to extensor carpi radialis brevis tendon transfer

The correct response is Option B.

Volkman described the sequelae of compartment syndrome following a supracondylar fracture of the humerus in a child with the development of a severely contracted and functionless forearm. The forearm is typically fixed in pronation, the wrist is flexed, and the hand is postured in the "claw" position with the MCP joints hyperextended and the PIP and DIP joints flexed. The hand is usually insensate. Treatment depends on the severity of the deformity. Moderate contractures are treated with exploration and release of both the median and ulnar nerves and a tendon lengthening procedure (muscle slide). This condition is not due to a radial nerve injury; therefore, exploration of the fracture site and neurolysis of the radial nerve are not indicated. Tendon transfer is not appropriate because it does not address the nerve compression. Revascularization with a bypass graft is not needed because it is no longer ischemic.

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86. A 23-year-old man is brought to the emergency department 4 hours after sustaining an open tibia and fibula fracture to the middle third of the leg in a motorcycle collision. A proximally based soleus flap is chosen to reconstruct the defect. Which of the following arteries is the most likely blood supply of this flap?

- A) Anterior tibial
- B) Inferior geniculate
- C) Peroneal
- D) Profunda femoris
- E) Superior geniculate

The correct response is Option C.

The soleus muscle is a broad, powerful muscle of the posterior calf which, along with the gastrocnemius muscle, forms the triceps surae. The soleus takes its origin from the upper third of the fibula and medial border of the tibia and inserts into the calcaneus with the gastrocnemius muscle by way of the Achilles tendon. The blood supply of the soleus muscle is from the peroneal artery proximally and the posterior tibial artery distally. This soleus muscle flap is used as a pedicle muscle flap for coverage of defects of the middle third of the lower leg.

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87. A 43-year-old man sustains a traumatic disruption of the central slip of the extensor tendon of the proximal interphalangeal (PIP) joint of the ring finger. If this injury is left untreated, which of the following is most likely to initiate a boutonnière deformity in this patient?

- A) Disruption of the sagittal band
- B) Disruption of the terminal extensor tendon
- C) Intrinsic tightness of the lumbricals
- D) Quadriga effect
- E) Volar subluxation of the lateral bands

The correct response is Option E.

Disruption of the central slip of the extensor tendon at its insertion into the base of the middle phalanx results in extensor lag at the PIP joint of the finger. If this deformity is left untreated, then a boutonnière deformity may result. This deformity results from subsequent volar subluxation of the lateral bands.

Disruption of the terminal extensor tendon does not result in boutonnière deformity; in fact, the use of the extensor tenotomy distal to the triangular ligament may be used for correction of chronic boutonnière deformity. Intrinsic tightness of the lumbricals and sagittal band disruption do not initiate boutonnière deformity. Quadriga effect results from an imbalance of tendon forces between adjacent fingers and is also not responsible for progression to boutonnière deformity.

Many surgeons consider the results of surgical treatment for boutonnière deformity unpredictable, and so they try splint immobilization to first regain extension and then allow the central slip to heal, even in delayed presentations. Surgical options include reattachment of the central slip and various reconstructions of the lateral bands including tenotomy, tendon grafting, and tendon transfer. Management strategies vary depending on the time since injury and the degree and ability to correct a PIP joint flexion contracture.

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2. Souter WA. The Boutonniere deformity: a review of 101 patients with division of the central slip of the extensor expansion of the fingers. *J Bone Joint Surg Br.* 1967;49-B:710-721.

3. Dolphin JA. Extensor tenotomy for chronic boutonnière deformity of the finger; report of two cases. *J Bone Joint Surg Am.* 1965 Jan;47:161-164.

88. A 22-year-old man who has consumed alcoholic beverages punches a concrete wall with both hands and sustains multiple metacarpal fractures. Which of the following will cause the most significant long-term hand impairment in this patient?

- A) Fifth metacarpal neck fracture with 40-degree angulation
- B) Fourth metacarpal neck fracture with 35-degree angulation
- C) Fourth metacarpal shaft fracture with 10-degree angulation
- D) Third metacarpal neck fracture with 25-degree angulation
- E) Third metacarpal shaft fracture with 0-degree angulation

The correct response is Option D.

Angulation is better compensated for in the ring and little fingers. The carpometacarpal (CMC) joints of these digits have 20 to 30 degrees of mobility in the sagittal plane.

Angulation deformities in the little finger up to 40 to 70 degrees have been followed and found to have no functional impairment.

However, because of the lack of compensatory CMC motion in the index and long metacarpal neck fractures, there is universal agreement that residual angulation greater than 10 to 15 degrees should not be accepted.

Metacarpal shaft fractures generally require reduction for angulation greater than 30 degrees in the little finger, 20 degrees in the ring finger, and any angulation in the long and index fingers.

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89. Which of the following is the most likely indication to consider replantation of a lower extremity?

- A) Bilateral sharp injury
- B) Crush mechanism of injury
- C) Ischemia time over 8 hours
- D) Multilevel injury
- E) Patient over age 50 years

The correct response is Option A.

The indications for lower extremity replantation are limited. The best candidate for a lower extremity replantation would be a young patient who has had both legs amputated with a clean mechanism. Contraindications for lower extremity replantation include crush mechanism of injury, ischemia time over 8 hours, multiple-level injury, poor baseline health, and a patient of advanced age.

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2. Datiashvili R.O. Simultaneous replantation of both lower legs in a child: 23 years later. *J Reconstr Microsurg*. 2009 Jun;25(5):323-329.
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90. An 18-year-old football player comes to the office because he has been unable to flex his ring finger since tackling an opponent during a game 3 hours ago. Physical examination shows the distal joint in the neutral position with an inability to actively flex. Which of the following is the most likely mechanism of injury?
- A) Forced axial load compression
 - B) Forced distal interphalangeal (DIP) joint extension with simultaneous maximal flexion effort
 - C) Forced metacarpophalangeal (MCP) joint extension with simultaneous maximal abduction effort
 - D) Forced pylon style crush
 - E) Forced proximal interphalangeal (PIP) joint extension with simultaneous maximal extension effort

The correct response is Option B.

Jersey injury occurs when a player grabs the opposing player's jersey. The DIP joint is in a flexed position and when the tackle is broken, there is a forced extension. Flexor digitorum profundus (FDP) avulsion occurs 75% of the time in the ring finger. In Type I, the tendon only retracts into the palm and requires urgent repair and reinsertion within 7 to 10 days. In Type II, the tendon retracts to the PIP joint level being tethered by the long vinculum. Repair can be delayed 6 to 12 weeks. In Type III, a large bony fragment blocks the tendon from entering the A4 pulley and can be repaired at any time. The FDP insertion is avulsed from the distal phalanx with or without bone fragments. Force applied in any of the other vectors would not create FDP avulsion.

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2. Strickland JW. Flexor tendon injuries: II. Operative technique. *J Am Acad Orthop Surg.* 1995 Jan;3(1):55-62.
3. Leddy JP. Flexor tendons-acute injuries. In Green DP, ed. *Operative Hand Surgery.* 2nd ed. New York: Churchill Livingstone; 1988.
4. Lalonde DH. An evidence-based approach to flexor tendon laceration repair. *Plast Reconstr Surg.* 2011 Feb;127(2):885-890.



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

91. A 23-year-old male rugby player is evaluated because of the inability to flex the ring finger at the distal interphalangeal (DIP) joint 2 days after injuring the finger during a match. The patient reports tenderness over the pulp and distal flexion crease. A clinical photograph and x-ray studies are shown. Which of the following is the most appropriate management?
- A) Closed reduction and percutaneous pin fixation
 - B) DIP arthrodesis
 - C) Extension block splinting
 - D) Open reduction and internal fixation
 - E) Volar plate arthroplasty

The correct response is Option D.

The clinical scenario, photograph, and x-ray studies demonstrate classic symptoms of a “jersey finger,” or avulsion of the insertion of the flexor digitorum profundus (FDP) tendon. In this instance, the rupture involves a large bone fragment to which the FDP tendon remains attached (Type III). The large size of the bone fragment lends itself to repair via open reduction and internal fixation of the fracture. Use of mini-screws or transosseous wiring will provide suitable internal fixation. Type II (retraction of the tendon to the proximal interphalangeal [PIP] joint) and Type I (retraction to the palm) injuries can be addressed through transosseous suture reattachment or suture anchor.

Inadequate closed reduction would make percutaneous pin fixation a poor choice of treatment.

Arthrodesis offers a salvage procedure for failed or unrepaired FDP avulsion injuries. In this young patient with an acute condition, arthrodesis would be too aggressive an intervention.

Extension block splinting can be useful in volar plate injuries, which are often identified by a small, palmar avulsion fragment seen on the lateral x-ray study. This fracture would not be successfully reduced by attempts at flexion or splinting.

Volar plate arthroplasty can restore a functional articular surface following intra-articular fractures of the PIP joint but are not useful in the DIP.

References

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92. A 55-year-old man comes to the emergency department because of a saw injury to the thumb. Physical examination shows a 3 × 2-cm soft-tissue defect from the interphalangeal crease to the tip of the right volar thumb with exposed bone and tendon. Which of the following is the most appropriate management?

- A) Amputation at the interphalangeal joint
- B) First dorsal metacarpal artery flap coverage
- C) Free great toe pulp transfer
- D) Split-thickness skin grafting
- E) Spontaneous healing

The correct response is Option B.

The thumb tip is an important structure for opposition and holding objects to the fingers. Thumb function depends on restoration of sensation and durable, reliable padding. When there is bone or tendon exposure, coverage with a flap is preferred. Small thumb tip defects (1 to 1.5 cm) can be reconstructed with a volar rectangular advancement flap, popularized by Moberg. Larger thumb tip defects require other flaps, such as the first dorsal metacarpal artery (FDMA) flap or the Little flap (dorsoulnar aspect of long finger). The FDMA flap can provide a larger wide flap than the Little flap and can be harvested with both venae comitantes and additional subcutaneous vein to provide more reliable venous drainage than the Little flap. Also, the FDMA flap donor site carries less risk of functional compromise of the donor finger than the Little flap donor site. The Little flap donor site can develop flexion contracture if the flap is harvested too volar over the finger, the interphalangeal creases are not preserved, and full-thickness skin grafting is not used on the donor. Both flaps are innervated and sensate and will require cortical reorientation, which can take approximately 1 year, more reliably for younger patients. Free toe pulp transfer would be excessive for this magnitude of injury.

When no bone or tendon is exposed, the defect can be reconstructed with a skin graft if greater than 1 cm or allowed to heal spontaneously if less than 1 cm.

References

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93. A 40-year-old man comes to the office for evaluation of sudden-onset difficulty flexing the thumb at the interphalangeal joint. He sustained a displaced scaphoid fracture 6 months ago after a bicycle collision. Which of the following tendons is most likely injured in this patient?

- A) Abductor pollicis brevis
- B) Abductor pollicis longus
- C) Adductor pollicis
- D) Flexor pollicis longus
- E) Opponens pollicis brevis

The correct response is Option D.

The flexor pollicis longus tendon courses through the vicinity of the scaphoid. Scaphoid fracture malunion or scaphoid arthritic spurs can result in ruptures to the flexor pollicis longus tendon. The other tendons described do not course in the area of the scaphoid and would not be injured with disease in the area of the scaphoid.

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94. A 43-year-old healthy man comes to the office because of acute swelling over the dorsum of his dominant right wrist. He says that movement of the wrist is painful. No preceding trauma is noted. Which of the following is the most sensitive test to diagnose septic wrist arthritis in this patient?

- A) Carpal bone radiographic destructive changes
- B) Joint aspirate Gram stain
- C) Serum erythrocyte sedimentation rate
- D) Serum white cell count
- E) Synovial fluid white cell count

The correct response is Option E.

Analysis of synovial fluid is the most useful diagnostic test. The most definitive test of the joint fluid, bacterial Gram stain and culture, is unfortunately not consistently positive in an acute septic joint. Culture may be negative in about 50% of cases, especially gonococcal, and Gram stain is even less frequently positive. One has to wait a few days for culture results.

As one lowers the threshold for the white cell count in a joint aspirate, the test becomes more sensitive, but less specific. If the white cell count threshold is set at 50,000/mL, which is traditionally the value considered to be the threshold for diagnosis of a septic joint, the sensitivity is 61%. If a white cell count at 17,500 is set as the threshold, the sensitivity is 83%, but specificity is 67%. The specificity rises to 77% if the threshold for the white cell count is raised to 100,000.

Sedimentation rate, serum white cell count, and C-reactive protein do little to change pretest probability of a septic joint.

Radiographic changes are a late finding in septic arthritis.

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95. A 52-year-old man comes for evaluation of a 2-year history of gradual swelling of the right lower extremity. He says he first noticed symptoms after returning from a year working in Africa. Physical examination shows pitting edema to the level of the knee. The skin over the toes cannot be tented. Results of thyroid function studies are within the reference ranges. Which of the following is the most likely diagnosis?

A) Deep venous thrombosis

B) Lymphedema

C) Myxedema

D) Venous insufficiency

The correct response is Option B.

The most appropriate diagnosis is lymphedema.

Lymphedema is caused by inadequate clearance of fluid from the interstitial space, resulting in buildup of fluid and protein. The classic finding involves pitting edema beginning in the distal extremity. Measurements of extremity circumference at multiple levels may show enlargement compared with the contralateral side. Other conditions may cause peripheral edema, but, in general, bilateral lower extremity edema is due to systemic disease, while unilateral edema is more likely a result of venous insufficiency or lymphedema. Worldwide prevalence of lymphedema is estimated at 90 million cases, with approximately 90% of these attributed to filariasis. This is relatively rare in the United States, however, and surgery or radiation therapy is a much more likely etiology for secondary lymphedema in this country. A history of residence in an endemic area, such as Africa, may increase the suspicion of lymphedema resulting from filariasis.

Diagnosis of lymphedema is typically made through history and physical examination. Classic signs include peau d'orange changes in skin, inability to tent the skin over the toes (Stemmer sign), and blunted appearance of the digits.

Deep venous thrombosis can lead to lower extremity swelling but would have a faster onset and more rapid time course. Generally, this would be unilateral in nature.

Myxedema is typically associated with thyroid disease and can be distinguished from lymphedema by finding dry and roughened skin, dry thinning hair, reduced sweat production, and yellowish skin.

Venous insufficiency can also result in extremity swelling, but it is usually associated with skin changes, pruritus, and hemosiderin deposits. Patients may also have symptoms of

varicosities and ulceration. Additionally, the Stemmer sign is negative in venous insufficiency.

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96. A 54-year-old man is brought to the emergency department after sustaining a laceration of the right hand from a box cutter. Physical examination shows a laceration over the palmar proximal phalanx of the long finger. Complete laceration of the A2 pulley is found at exploration. If the pulley is not repaired, which of the following best describes how flexor tendon mechanics will be affected?

	Length of moment arm	Motion of proximal interphalangeal (PIP) joint
A)	Decrease	Decrease
B)	Decrease	Increase
C)	Increase	Decrease
D)	Increase	Increase

The correct response is Option C.

The moment arm of the joint refers to a perpendicular line drawn from the mid axis of the joint to the tendon causing movement in the joint. The moment arm represents torque and can be thought of as power at an individual joint. The system can be broken down into simpler terms by thinking of wrenches of different lengths. The longer the wrench, the greater the amount of power can be placed in the turning of a nut onto a bolt. The same applies to the joints of the hand. As the tendon itself gets farther away from the center of rotation of the joint (increased moment arm), there is an increase in the torque on that joint, and, in turn, the power acting upon the rotation of the joint. As a flexor tendon gets farther away from the PIP joint (increase in moment arm), for the same strength of pull, there is an increase in force to that joint. However, there is also a loss of efficiency because the excursion of the tendon needs to increase more and more as the tendon itself gets farther away from the axis of rotation. A greater amount of excursion is required to flex the joint through to a given angle. Therefore, only an increase in moment arm, decrease in PIP joint motion, and increase in power is an appropriate response. This has clinical significance in situations such as those presented in the scenario described. Cutting the A2 pulley allows the tendon to migrate farther in a palmar direction, or "bowstring" away, from the axis of rotation. This yields an increase in the moment arm, a decrease in tendon excursion, and, ultimately, an increase in power, with the loss of efficiency. The range of motion is decreased as the flexor tendons can no longer flex the joint fully. This effect is strongest in the A2 and A4 pulleys, which prevent bowstringing of the tendons at the proximal and middle phalanges, respectively.

References

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

97. A 25-year-old man comes to the emergency department because of swelling and pain in the finger. He says that he first started noticing symptoms 4 days ago. Physical examination shows warmth of the fingertip and fluctuance of the nail fold. A photograph is shown. Which of the following bacteria is the most likely cause of this infection?

- A) *Enterococcus faecalis*
- B) *Mycobacterium marinum*
- C) *Pasteurella multocida*
- D) *Pseudomonas aeruginosa*
- E) *Staphylococcus aureus*

The correct response is Option E.

A paronychia is an infection occurring in the space between the nail plate and the paronychial or eponychial fold. Common causes include nail biting and aggressive manicuring. In an otherwise healthy individual, *Staphylococcus aureus* and *Streptococcus* species are the most common pathogens causing a paronychia.

The remaining bacteria listed would only be expected to cause a paronychia in special circumstances. *Enterococcus* is an enteric bacterium. *Mycobacterium marinum* can be present in aquatic environments including fish tanks and has also been reported in the Chesapeake Bay. *Pasteurella multocida* is a common flora of cat mouths. *Pseudomonas* occurs in areas with moist environments and can be problematic in a burn unit.

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98. A 36-year-old man is brought to the emergency department 2 hours after being stabbed in the hand with a knife. Physical examination shows a wound over the dorsum of the first web space. Exploration with administration of a local anesthetic agent is planned. Which of the following is the most appropriate landmark for injection of the local anesthetic?

- A) A1 pulley
- B) Flexor carpi radialis
- C) Medial epicondyle
- D) Pisiform
- E) Radial styloid

The correct response is Option E.

The most appropriate location for injection of local anesthesia is the radial styloid.

Wrist blocks are useful for providing anesthesia during hand surgery. Sensation is blocked, while preserving movement of the extrinsic musculature. The sensory supply to the hand is provided by the median, ulnar, and radial nerves. The median nerve innervates the volar radial aspect of the hand, including thumb, index, long, and the radial half of the ring finger. The median nerve can be blocked as it travels between the flexor carpi radialis and palmaris longus tendons. Sensation to the thenar eminence is provided by the palmar cutaneous branch, which divides about 5 to 7 cm proximal to the wrist crease. The ulnar nerve innervates the ulnar aspect of the hand, including the ulnar aspect of the ring finger and the little finger. At the level of the wrist, the ulnar nerve lies radial to the flexor carpi ulnaris tendon, and ulnar to the ulnar artery. The dorsal cutaneous branch of the ulnar nerve branches proximal to the wrist crease and travels dorsally to innervate the ulnar aspect of the dorsum of the hand. It can be blocked as it crosses the region of the ulnar styloid. The radial nerve provides sensation to the dorsal radial aspect of the hand, including the first web space. The superficial radial nerve divides into several branches in the region of the radial styloid and can be blocked by subcutaneous infiltration over the radial styloid proximal to the anatomical snuffbox. This patient has a wound in the dorsal first web space, which is innervated by the radial nerve; hence, injection at the radial styloid level will provide anesthesia to the area.

A digital block can be performed with local injection in the region of the A1 pulley but would result in anesthesia too distal to the area of interest in this case.

The median nerve can be anesthetized by injecting local anesthetic just ulnar to the flexor carpi radialis tendon.

Injection just posterior to the medial epicondyle would result in blockade of the ulnar nerve at the elbow.

The ulnar nerve can be blocked at the level of the wrist by injecting radial to the flexor carpi ulnaris tendon and pisiform bone.

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99. A 23-year-old man is brought to the emergency department after twisting the long finger of his dominant right hand while playing basketball. Physical examination shows dorsal instability of the proximal interphalangeal (PIP) joint. X-ray study shows a volar buttress fracture involving 40% of the articular surface of the base of the middle phalanx. X-ray joint reduction is attained by passively flexing the PIP joint to 30 degrees. Which of the following is the most appropriate management?

- A) Dynamic force-coupler external fixation
- B) Extension block splinting
- C) Hemi-hamate reconstruction of the volar buttress
- D) Open reduction and internal fixation of the fracture fragments
- E) Volar plate arthroplasty

The correct response is Option B.

If the PIP fracture/dislocation can be maintained stable with 30 degrees of flexion, then this is suitable to treat by extension block splinting. This will be the case with an approximate 40% volar articular fracture of the base of the middle phalanx. There is a risk of late flexion contracture if greater than 30 degrees of flexion is required to maintain PIP joint stability. More complex injuries may be treated with force-coupler dynamic splinting or with hemi-hamate reconstruction. For a larger fracture fragment with greater instability, open reduction and internal fixation may be required. Volar plate arthroplasty may be suitable with more chronic injuries and is limited to 60% of the articular surface.

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100. A 30-year-old woman comes for follow-up 1 week after undergoing repair of the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) tendons in Zone II following a stab wound to her little finger. Physical examination shows that she is unable to flex her distal joint. MRI shows FDP tendon rupture. Which of the following is the most appropriate next step in management?

- A) FDS IV tendon transfer
- B) Free-tendon graft
- C) Fuse the distal interphalangeal (DIP) joint
- D) Repair FDP tendon
- E) No intervention at this time

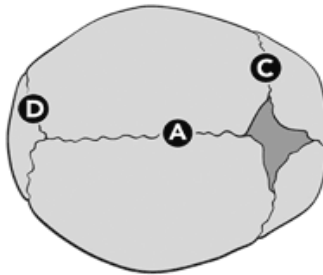
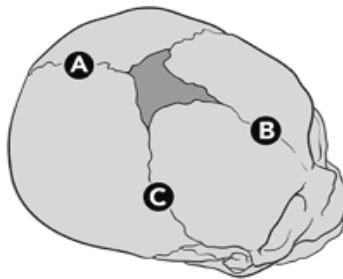
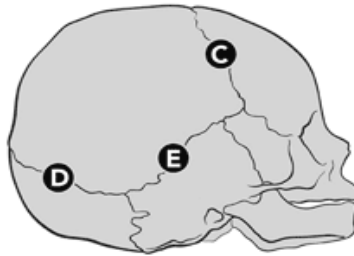
The correct response is Option D.

Ruptures of repaired tendons usually occur postoperative days 7 through 10. The best way to diagnose the rupture is MRI when active flexion is relatively contraindicated. Early ruptures can be managed with urgent re-repair. Tendon transfers and grafting should be reserved as secondary reconstruction procedures and should not be needed when the native FDP is available and not shortened. Fusion should be reserved for salvage and in patients where shorter recovery times are beneficial, such as laborers. Doing nothing can lead to swan-neck deformities, adhesions, and stiffness.

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Section 3: Craniomaxillofacial



101. Which of the following sutures (A-E) in the figures shown is the first to close in the nonpathologic state?

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

The correct response is Option B.

Physiologic or normal closure of the metopic suture occurs first. Recent studies report an earlier closure date than originally thought. The metopic suture may start to close as early as 6 months.

The rest of the sutures identified close much later, with the sagittal suture (A) closing at 22 years, the coronal suture (C) closing at 24 years, the lambdoid suture (D) closing around 26 years, and the squamosal suture (E) closing at 35 years.

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102. A 1-year-old male infant is brought to the office because of congenital ptosis of the left eye. On examination, the eyelid margin covers 4 mm of the upper limbus, and levator excursion is 4 mm. Which of the following is the most appropriate treatment?

- A) Fasanella-Servat procedure
- B) Frontalis suspension with sling
- C) Levator advancement
- D) Müller muscle resection
- E) Observation

The correct response is Option B.

With more than 4 mm of the upper limbus covered by the eyelid margin, the ptosis is considered severe, and with levator function at 4 mm, it is considered poor. Therefore, a frontalis suspension is the appropriate procedure. It can achieve excellent symmetry and long-lasting results. Most patients with congenital ptosis have severe ptosis and poor levator function and will need frontalis suspension.

Ptosis is defined by how much the upper limbus is covered by the lid margin at rest and forward gaze. It is 1 to 2 mm normally.

Ptosis:

Mild = 2 mm

Moderate = 3 mm

Severe = 4+ mm

Levator function:

Excellent = 12–15 mm

Good = 8–12 mm

Fair = 5–7 mm

Poor = 2–4 mm

In terms of treatment:

Fasanella-Servat: mild ptosis and good levator function

Frontalis suspension: severe ptosis and poor levator function

Levator advancement: moderate ptosis and fair levator function

Müller muscle resection: mild ptosis, fair to good levator function

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103. A 41-year-old man comes to the emergency department because he is unable to close his mouth after yawning. He reports pain in the jaw. Which of the following is the most appropriate initial treatment?

- A) Arthroplasty
- B) Closed reduction during sedation
- C) Eminectomy
- D) Injection of botulinum toxin type A
- E) Intra-articular sclerosing

The correct response is Option B.

This patient has an acute anterior dislocation of his temporomandibular joint. Anterior dislocations are usually secondary to an interruption in the normal sequence of muscle action when the mouth closes from extreme opening. The masseter and temporalis muscles elevate the mandible before the lateral pterygoid muscle relaxes resulting in the mandibular condyle being pulled anterior to the bony eminence and out of the temporal fossa. Spasm of the masseter, temporalis, and pterygoid muscles causes trismus and keeps the condyle from returning into the glenoid fossa. Dislocations can be both unilateral and bilateral.

The most appropriate initial treatment is attempted closed reduction. Local anesthesia or sedation can help relax the muscles that are in spasm. Reduction involves downward and posterior movement of the mandible.

All other choices are options that have been tried with variable success to prevent chronic, recurrent temporomandibular joint dislocation. Arthroplasty or eminoplasty refers to augmentation of the articular eminence with a bone graft or an alloplastic material, or even titanium hardware. In contrast to the eminectomy, an eminoplasty seeks to confine the condyle to the glenoid fossa.

Eminectomy involves reducing or removing the articular eminence, which is the anterior wall of the glenoid fossa, surgically so that spontaneous reduction is possible.

Injection of botulinum toxin type A has been suggested as a treatment. The theoretic mechanism of action is relaxation of the masseter and temporalis muscles, allowing spontaneous reduction.

Intra-articular injection of a sclerosing agent, such as alcohol, usually followed by a period of interdental fixation has been described but has fallen out of favor due to lack of proven long-

term efficacy. It was thought to be a noninvasive way of preventing the mandible from opening excessively wide and allowing dislocation of the condyle from the glenoid fossa by inducing fibrosis of the temporomandibular joint.

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104. A male newborn is brought to the office because of bilateral prominent ears. His ears are symmetric in size and shape. The superior crura are undefined and the conchal-scaphal angle is greater than 150 degrees. Conchal depth and projection show no abnormalities. The newborn's parents desire correction of the ear prominence. Which of the following is the most appropriate management?

- A) Cartilage abrasion
- B) Conchal-mastoid sutures
- C) Conchal-scaphal sutures
- D) Ear molding
- E) Observation

The correct response is Option D.

Auricular deformation, including prominent ears, is a relatively common problem in infants. The position of the ear can change with growth and development but this process is inconsistent and unreliable. Some anomalies, such as Stahl ear, lop ear, and constricted ear, do not typically improve as the child grows. Ear molding in young infants is a very effective method to permanently improve auricular position and shape. The process is most effective in infants who are younger than 3 months of age, and is generally ineffective in older children. A custom-made mold is typically fashioned out of soft putty and affixed into the ear with surgical tape or adhesive strips. A commercial version is also available. Depending on the severity of the deformity and the age of the infant, molding is continued for several weeks to a few months. The reported results of properly done ear molding are impressive.

Cartilage abrasion along the anterior scapha and posterior cartilage suturing are surgical techniques that have been successfully employed to treat prominent ears. However, operative treatment of prominent ears is typically reserved for older children with unresolved deformities. A period of observation is unlikely to result in a significant change in ear position and will leave surgery as the family's only remaining treatment option.

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

105. A 55-year-old man comes for evaluation of epiphora in the right eye 6 months after sustaining a soft-tissue injury to the face in a motor vehicle collision. Physical examination shows that the punctum and lacrimal sac are open. A picture taken at the time of injury is shown. Results of Jones I and Jones II testing are negative. No other abnormalities are noted. Which of the following is the most appropriate next step in management?
- A) Botulinum toxin type A injections of lacrimal gland
 - B) Conjunctivodacryocystorhinostomy
 - C) Dacryocystorhinostomy
 - D) Dilation of lacrimal apparatus
 - E) Placement of lacrimal stent

The correct response is Option C.

Abnormalities of tear drainage may be subdivided into functional and anatomical. Functional failure is related to poor lacrimal pump function, which may be due to a displaced punctum, eyelid laxity, weak orbicular muscle of the eye, or cranial nerve VII palsy. Anatomical obstruction may occur at any point along the lacrimal drainage pathway and may be

congenital or acquired. Primary acquired lacrimal duct obstruction occurs in the elderly as a result of fibrosis. Secondary acquired obstruction causes include neoplastic, traumatic, and mechanical mechanisms.

Conjunctivodacryocystorhinostomy is performed in cases of flaccid canaliculi, paralysis of lacrimal pump, and when the site of obstruction is proximal (punctum, canaliculi, lacrimal sac). It is not required when these structures are intact.

The dacryocystorhinostomy procedure, which involves fistulization of the lacrimal sac into the nasal cavity, alleviates the symptoms of epiphora.

The lacrimal probe demonstrates that the punctum and the sac are intact. The negative result on both Jones I and II – failure of any fluorescein dye to show up in the nasopharynx – demonstrates complete obstruction distal to the lacrimal sac. Dilation or stent placement is not possible.

With a history of trauma and the laceration shown, this patient does not have epiphora secondary to excess tear production.

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106. A 34-year-old man comes to the office because of a 10-mm nevus on the right cheek. He is concerned because it bleeds every time he shaves. Excision of the nevus is planned. In addition to Current Procedural Terminology ICD-9-CM diagnosis code 216.3 (nevus), which of the following diagnosis codes is most appropriate to use when coding the lesion described?

- A) 173.30 (neoplasm skin, primary)
- B) 238.2 (neoplasm skin, uncertain behavior)
- C) 459.0 (bleeding)
- D) 782.9 (changing skin lesion)
- E) No additional code needed

The correct response is Option C.

Documentation of “complicating pathology” is required in the medical record as well as the ICD-9-CM diagnosis codes for Medicare to cover the excisions of benign lesions. If a “complicating pathology” code is not included, the procedure is considered “not covered” or “cosmetic” by Medicare. According to the Centers for Medicare & Medicaid Services, bleeding, intertrigo, pain, and pruritus are all considered complicating pathologies that justify Medicare payment. ICD-9-CM diagnosis code 782.9 constitutes a changing skin lesion or a growing skin lesion. This may also be a useful ICD-9-CM diagnosis code to support the excision of a nevus, but not specifically in the scenario described. Because there was no history of the lesion changing or growing, ICD-9-CM diagnosis code 782.9 would not be appropriate. The lesion described was repeatedly traumatized and bled; therefore, the complication code 459.0 would be most appropriate. ICD-9-CM diagnosis code codes 173.30, 198.2, and 238.2 imply a skin lesion which is malignant (173.30), metastatic (198.2), or of uncertain behavior (238.2). These would not be appropriate in this scenario as the lesion is benign (216.7).

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107. A 3-year-old girl is brought to the emergency department because of a 6-hour history of right-sided facial weakness. On physical examination, the patient has an asymmetric smile, and the right eyelid does not close completely. Which of the following is the most likely cause of this deformity?

- A) Congenital
- B) Idiopathic
- C) Infection
- D) Neoplastic
- E) Trauma

The correct response is Option B.

The most common etiology of new-onset facial nerve paralysis in a child is Bell palsy. While some studies with small cohorts have shown that many cases of Bell palsy may miss the underlying diagnosis, the large reviews still report Bell palsy as the most common etiology. Infection and trauma are the next most frequent causes, followed by neoplastic and congenital. Etiology is important because it guides treatment, and early treatment with antibiotics, antivirals, and in some cases, surgical decompression, results in a better long-term recovery of facial nerve function.

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108. A 25-year-old man comes to the office 12 hours after sustaining a maxillofacial injury during a bicycle collision. Physical examination shows that the injured tooth is stable but sensitive to cold liquids, hot liquids, and air. No other abnormalities are noted. The patient's pain suggests a fracture extending into which of the following?

- A) Alveolar bone
- B) Cementum
- C) Dentin
- D) Enamel
- E) Pulp

The correct response is Option C.

Dental trauma can result from a variety of mechanisms. Significant trauma should be evaluated completely in the emergency department, but injury that is isolated to the teeth can be managed in an outpatient setting. Tooth fractures can be minor, involving only the outer enamel layer, or more significant. Beneath the enamel is the dentin. This yellowish substance overlays and protects the inner tooth pulp. The visible and exposed one third of the tooth is the crown; it consists of outer enamel, inner dentin, and a small amount of the pulp. The two thirds of the tooth in the alveolar bone is called the root and consists of outer cementum, inner dentin, and the pulp chamber.

X-ray studies are useful to diagnose the extent of a dental fracture. The sensitivity to cold and air that the patient is experiencing suggests a deeper fracture extending into the dentin. Prolonged exposure of the dentin is not only painful but also risks infection that can progress into the pulp and destroy the tooth. The tooth should be capped soon, and follow-up x-ray studies should be performed in 3 to 4 months to make sure that the pulp has not died.

Treatment of an injury to the pulp itself would require extracting the dying tooth and replacing it with a prosthetic. Alternatively, a root canal — removing all the dying pulp and filling the tooth — can be performed to avoid extraction.

Fractures of the alveolar bone cause the teeth to be very unstable. An arch wire is applied while the bone heals. The tooth is then assessed with x-ray study to make sure it is viable. A root canal may be required in the future.

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109. A 5-year-old boy is evaluated because of downward and lateral displacement of the left globe and diplopia that has increased steadily for the past 18 months. History includes open reduction and internal fixation of a frontal bone fracture at 2 years of age. An image is shown. This deformity was most likely caused by which of the following at the time of repair?

- A) Failure to obliterate the frontal sinus
- B) Failure to recognize dural injury and insufficiency
- C) Failure to repair periorbital lacerations
- D) Poorly aligned bony fixation
- E) Use of absorbable plates

The correct response is Option B.

Head injuries in infants and young children accompanied with skull fracture often contain dural laceration. Although rare in occurrence, when these dural tears are not recognized (especially when extensive), a growing skull fracture (GSF) can occur. Repair of these dural tears acutely prevents the development of GSF and the potential for secondary cortical injury. The frontal sinus, unlike the maxillary and ethmoid sinuses, is not present at birth and only starts to develop at age 2 years, which, in this case, was when the original repair was performed. Thus, obliteration of the sinus was not warranted. Lacerations of the periorbita, poor bone fixation, and the use of absorbable plates are not linked to GSF.

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110. A 3-year-old boy is brought to the office because of swelling of the right upper and lower eyelids 4 days after sustaining a dog bite to the ipsilateral cheek. Oral temperature is 101.3°F (38.5°C). Examination shows two puncture marks with scant purulent discharge on the right mid cheek, proptosis of the right eye, and swelling of the right eyelids. Which of the following is the most appropriate next step to establish the diagnosis?

- A) Blood cultures
- B) Complete blood count
- C) CT scan
- D) Waters view x-ray study
- E) Wound swab

The correct response is Option C.

Orbital cellulitis may be caused by local extension of a superficial infection such as a hordeolum, or from adjacent infected sinuses, or by hematogenous seeding from a dental or facial abscess. It is important to distinguish between preseptal and orbital cellulitis, which should be suspected when unilateral proptosis is present, and to identify the presence of an intraorbital abscess. Infection within the orbit has implications for management and prognosis due to the effect of high mechanical pressures generated in an unyielding compartment, which will manifest as proptosis, and other symptoms including diplopia, ophthalmoplegia, and chemosis. Orbital cellulitis requires hospitalization and prompt initiation of parenteral antibiotics. An intraorbital abscess can form if treatment is delayed, further compounding the intraorbital pressure and causing tissue necrosis. An intraorbital abscess requires immediate surgical drainage due to risk of blindness. Preseptal cellulitis is an infection of periorbital tissues superficial to the orbital septum, and if the source is from a nearby superficial skin infection, then initial management may be done with oral antibiotics and close follow-up. Preseptal cellulitis from a hematogenous source is more likely to become complicated with orbital cellulitis and abscess if it is not managed with parenteral antibiotics. Infections inside the orbit may extend to the central nervous system and may also cause cavernous sinus thrombosis. CT scan or MRI will confirm intraorbital infection, and related sources such as a facial or dental abscess or a sinusitis, and can direct the surgeon to areas requiring surgical drainage.

Blood cultures are useful in identifying the causative organism of the infection during periods of bacteremia, and are an appropriate test in the general workup of the patient; however, blood cultures alone do not diagnose or exclude intraorbital infection.

Cell counts are also useful in the general workup of the patient to characterize the systemic impact of the infection, and to be used as a guide in the responsiveness to treatment. The counts do not diagnose or exclude intraorbital infection specifically.

On Waters view x-ray studies, increased facial or eyelid edema may be seen as a slight diffuse opacification, but they are unable to delineate orbital and periorbital soft tissues individually. Sinus opacification can be suggestive of active sinusitis and a potential cause of orbital cellulitis. In general, plain x-ray study offers far less information than CT scan or MRI and is not diagnostic of intraorbital infection.

Wound swabs are helpful in identifying the causative organism of the infection when there is an obvious source, and are an appropriate test in the general workup of the patient; however, wound swabs alone do not diagnose, exclude, or characterize the extent of intraorbital infection.

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2. Bradley JS. Cellulitis. In: Jenson HB, Baltimore RS, eds. *Pediatric Infectious Diseases*. 2nd ed. Philadelphia: WB Saunders; 2002:578-586.

111. A 50-year-old man is evaluated for a 6-month history of clicking of the left temporomandibular joint and pain with joint movement. Physical examination shows an interincisal opening of 20 mm and recurrent locking in the open position; no signs of infection or ankylosis are noted. Which of the following is the most appropriate treatment?

- A) Botulinum toxin type A injection
- B) Intracapsular disk repositioning and reduction of the articular eminence
- C) Removal of disk and placement of an interpositional temporalis fascia flap
- D) Temporomandibular joint replacement
- E) Observation

The correct response is Option B.

Surgical reduction of the articular eminence is indicated for patients who have symptomatic open locking of the mandible. Surgical options for symptomatic patients and secondary functional limitations with internal joint abnormalities on MRI include: intracapsular disk repositioning; discectomy; and an interpositional temporalis fascia flap. Botulinum toxin type A is not an approved use in this clinical setting. Discectomy is appropriate as a salvage procedure. Temporomandibular joint replacement is rarely warranted unless signs of infection, as part of cancer resection, or severe ankylosis are noted. Conservative management is appropriate in cases with no functional abnormalities.

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112. A 73-year-old man with a history of squamous cell cancer of the mid portion of the lower lip undergoes resection and reconstruction with a Karapandzic technique. The flap measures 6 × 2 cm. Which of the following Current Procedural Terminology (CPT) codes is most appropriate for this procedure?

- A) 12052 (Repair intermediate, lip 5.1 to 7.5 cm)
- B) 13132 (Repair complex, lip 2.6 to 7.6 cm)
- C) 14041 (Adjacent tissue transfer, head neck 10.1 to 30 cm²)
- D) 15732 (Musculocutaneous flap)

The correct response is Option D.

The Karapandzic technique is an axial pattern musculocutaneous flap based on the facial artery/vein. The flap is dissected together with its nerve and blood supply and is used to transfer a compound flap of skin and muscle for function repair of lip defects. The intermediate repair code (12052) is used to describe a layered closure of one or more deeper layers of subcutaneous and superficial tissues but does not include muscle closure that is performed with a Karapandzic technique. The complex repair code (13132) is used to describe repairs of wounds requiring more than a layered closure. These wounds include, for example, extensive debridement of traumatic injuries, extensive undermining, and use of retention sutures. The adjacent tissue transfer codes (14041) are used to describe repairs using transfer of adjacent tissues or rotation flaps that are not based on an axial blood supply (eg, Z-plasty, V-Y advancement flaps, rotation flaps, and random island flaps). This code is not appropriate for the Karapandzic technique, as this flap is an axial pattern flap.

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113. A 4-year-old girl who has velocardiofacial syndrome is evaluated because of severe velopharyngeal insufficiency. Reconstruction using a superiorly based pharyngeal flap is planned. Which of the following is the most important factor in determining the width of the flap?

- A) Ability to close the pharyngeal donor defect
- B) Lateral pharyngeal wall motion
- C) Length of the soft palate
- D) Palatal movement (coronal closure)
- E) Position of the carotid arteries in the posterior pharynx

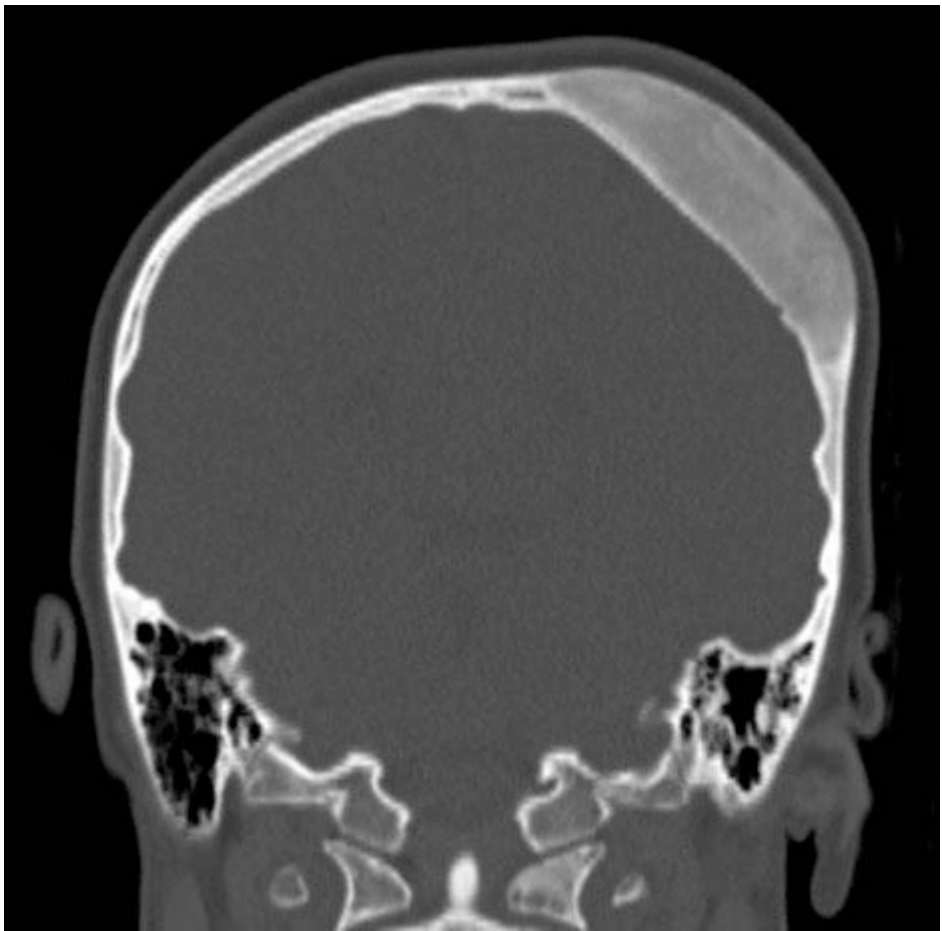
The correct response is Option B.

Reconstruction with a pharyngeal flap is a highly effective method of treating velopharyngeal insufficiency. This procedure involves elevating a rectangular flap, based superiorly or inferiorly, from the posterior pharynx and inseting it into the soft palate. The posterior raw surface of the flap is typically lined with trapezoidal flaps raised from the nasal side of the soft palate to limit contraction. The flap serves to obstruct air leakage into the nasal passage during speech. Extremely wide flaps can, consequently, also result in obstructive sleep apnea. In such situations, sphincter pharyngoplasties (Hynes) are sometimes used to avoid this potential complication.

The width of the flap is based on the degree of lateral pharyngeal wall motion. Since this creates a static bridge between the soft palate and the nasopharynx, the length of the palate and the degree of palatal movement have no influence on the choice of flap width. Although closing the donor defect expedites healing and decreases pain, this step is not necessary. Medial displacement of the internal carotid arteries as they pass along the posterior pharynx has been described in patients with velocardiofacial syndrome and should be considered when raising the flap. However, this should not impact the ability to raise a flap of sufficient width.

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114. A 9-year-old girl is brought for evaluation by her mother because of a 1-year history of headaches and precocious puberty. Physical examination shows café-au-lait spots over her abdomen and a bony prominence of her right parieto-occipital area. CT scan of the calvarium is shown. Which of the following is the most likely diagnosis?

- A) Klippel-Feil syndrome
- B) McCune-Albright syndrome
- C) Paget disease
- D) Proteus syndrome
- E) Renal osteodystrophy

The correct response is Option B.

The entity represented in the CT scan shown is fibrous dysplasia, which, in combination with precocious puberty and café-au-lait spots, is known as McCune-Albright syndrome. These patients typically have polyostotic fibrous dysplasia, most commonly affecting the skull, long bones, and ribs. Affected bone may show minor changes that are detectable only on imaging studies such as CT scans or bone scans. Such scans may also show severe change or overgrowth resulting in impingement of the optic nerves, mass effect on the brain, or disfigurement.

The precocious puberty in the scenario described is the result of gonadotropin-independent autonomous ovarian or testicular function and is more common in girls than in boys. Klippel-Feil syndrome is characterized by congenital fusion of any two of the seven cervical vertebrae. Traits of this condition include a short neck, low occipital hairline, and restricted mobility of the upper spine. Paget disease of the bone is also known as osteitis deformans and is a chronic disorder resulting in enlarged, deformed bones. It is typically diagnosed in the third or fourth decade of life by a blood test for alkaline phosphatase. The excessive breakdown and formation of bone can result in weakening of the bone.

Proteus syndrome causes atypical bone development and skin overgrowth. It is an extremely rare congenital disorder, and it is variable in its symptoms. Renal osteodystrophy is a bone mineralization deficiency resulting from electrolyte and endocrine abnormalities associated with chronic kidney disease.

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115. A 28-year-old woman comes to the office for consultation regarding rhinoplasty. The only camera available for preoperative photographs is a handheld digital camera with a built-in flash to the left of the lens. To avoid shadows while taking photographs of the patient's right-sided facial profile, which of the following is the optimal orientation of the camera?

- A) Horizontal orientation, flash from the left
- B) Horizontal orientation, flash from the right
- C) Oblique orientation, flash from above
- D) Vertical orientation, flash from above
- E) Vertical orientation, flash from below

The correct response is Option B.

Horizontal orientation of the camera with the flash coming from the right for a right-sided profile will cast the shadow behind the subject. In this case, it is necessary to invert the camera so that the flash, which is left of the lens, is now on the right, the same side as the nose.

With variations in camera position, the shadows can be markedly altered, thereby affecting the consistency of your images.

Horizontal orientation with the flash from the left would cast the patient's shadow in front of her profile.

Oblique camera orientation should never be used in medical photography. Photographs should be taken orthogonally, either along the longitudinal axis of the patient or at right angles; oblique images are more difficult for the viewer to interpret.

Vertical orientation is acceptable under proper lighting conditions. In this case, a shadow would be cast below the nose with the flash from above and above the nose with the flash from below.

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116. Which of the following best describes the anatomical location of the nerve that supplies sensation to the frontoparietal scalp at the level of the forehead?

- A) In the subcutaneous fat
- B) Superficial to the frontalis muscle
- C) Superficial to the galea aponeurosis
- D) Superficial to the periosteum
- E) Through the medial corrugator supercilii muscle

The correct response is Option D.

The supraorbital nerve (SON) supplies sensation to the forehead skin (paramedian) and anterior scalp as well as the frontoparietal scalp. The latter scalp is supplied by the deep division of the nerve, whereas the rest is supplied by its superficial division. Medially passing through the corrugator supercilii muscle is the supratrochlear nerve, which supplies the medial skin of the forehead. The deep division of the SON travels initially (just medial to the superotemporal line) along the temporal periosteum and then more cephalad pierces the deep galea plane and enters the galea fat pad. This information is the key to avoid injury when performing a forehead lift. Also, when planning a bicoronal incision for craniofacial surgery, one can use this information to preserve the sensation of the related scalp. The superficial branch of the SON, on the other hand, travels superficial to the frontalis muscle in the paramedian forehead area.

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117. A 75-year-old man has a biopsy-proven basal cell carcinoma of the eyelid that measures 5 mm in diameter. After a discussion about the patient's options of resection, he declines Mohs micrographic surgery. Which of the following is the smallest clinical margin beyond the edge of the tumor that will yield at least a 95% chance of cure?

- A) 1 mm
- B) 3 mm
- C) 5 mm
- D) 7 mm

The correct response is Option B.

Many studies have had various observations as to the least margin required to cure a basal cell carcinoma. Almost all are retrospective, and conclusions have ranged greatly. Most articles recommend a 4-mm margin. However, in aesthetically sensitive areas like the eyelid, knowing the minimum margin of resection is crucial. Of course, Mohs micrographic surgery is an alternative, but it is not always feasible because of cost, availability, and the difficulty in coordinating two physicians' schedules. A recent meta-analysis of the literature concluded that for basal cell carcinomas 2 cm or less, a 3-mm margin is sufficient to achieve at least a 95% chance of cure. A surgical margin difference of 1 mm can mean the difference in flap requirements, aesthetic outcome, and in some cases, functionality of the affected area.

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118. A 12-year-old girl is evaluated because of a 1-year history of progressive mandibular retrognathia and bilateral temporomandibular joint pain. There is no history of trauma. Examination shows slightly decreased interincisal opening without chin point deviation and an Angle class II malocclusion with an anterior open bite. Which of the following is the most likely cause of this patient's symptoms?

- A) Bruxism
- B) Condylar hyperplasia
- C) Infection
- D) Myofascial pain syndrome
- E) Rheumatoid arthritis

The correct response is Option E.

Disorders that can affect the temporomandibular joint (TMJ) include ankylosis, arthritis, trauma, dislocation, congenital and developmental anomalies, and neoplasms. Rheumatoid arthritis (RA) can cause tenderness, swelling, and decreased motion in any joint, including the TMJ. The TMJ can be affected in up to 33% of patients with RA. Chronic inflammation can, eventually, result in articular erosions, joint destruction, and ankylosis. When RA develops in childhood or early adolescence (juvenile idiopathic arthritis), erosion of the condyles can lead to progressive mandibular retrognathism and anterior open bite.

Bruxism is grinding of the teeth and can lead to progressive dental wear, myofascial pain, and TMJ derangement. It does not affect the facial profile. Condylar hyperplasia is overgrowth of the condyle. It is most commonly unilateral, painless, and can lead to chin point deviation. Infection can cause tenderness and, ultimately, degeneration of the TMJ. However, infection is rarely bilateral and there are usually concurrent systemic symptoms. Myofascial pain syndrome is a common cause of pain in the TMJ region. It is more common in girls and is considered a localized form of fibromyalgia in the head and neck. It usually is unilateral and does not typically lead to joint degeneration or alterations in occlusion.

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119. A 67-year-old woman comes to the office because of an asymmetric smile 1 week after undergoing rhytidectomy and neck lift. Physical examination shows that the left lower lip is lower than the right lower lip in a full-denture smile. Which of the following nerves is most likely injured?

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

The correct response is Option E.

In the patient with weakness of the right lower lip depressors, the mentalis muscle, and the orbicular muscle of the mouth described, the nerve most likely to have been injured is the right marginal mandibular branch of the facial nerve.

The marginal mandibular nerve is located deep to the platysma and superficial musculoaponeurotic system. However, in the area of the mandibular notch, these layers are thin and leave the nerve susceptible to injury from both inadvertent subplatysmal dissection and cautery injury. The anatomy of the marginal mandibular nerve varies, as it can travel as low as 1 to 2 cm below the mandible along its entire course. Injury to this nerve causes weakness of the ipsilateral lip depressors, resulting in the contralateral lower lip to appear lower in a full-denture smile. Injury to the nerve also causes weakness of the mentalis and orbicularis oris muscle, resulting in asymmetry upon pursing of the lips. Although injury to the marginal mandibular nerve can be permanent, spontaneous recovery is noted within 6 months in 80% of patients.

Although cervical branch injury could also cause decreased function of lower lip depressors, it does not cause weakness of the mentalis or the orbicular muscle of the mouth (symmetry on pursing lips). The mental nerve is a sensory nerve.

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120. A male newborn is evaluated because of left-sided microtia. Examination shows a small amount of vestigial cartilage and an anteriorly rotated earlobe. Which of the following is the most appropriate management?
- A) Canaloplasty prior to 1 year of age
 - B) Costochondral ear reconstruction at 7 years of age
 - C) Earlobe rotation after 3 months of age
 - D) Excision of the vestigial ear structures prior to 1 year of age
 - E) Placement of silicone framework at 7 years of age

The correct response is Option B.

Treatment of microtia is frequently performed with autologous tissue when the patient is approximately 6 to 7 years old. At this time, there is sufficient material at the areas of costal cartilage fusion to permit adequate reconstruction. Furthermore, normal ear development is largely complete, although the width of the ear and its distance from the scalp continue to increase until the patient is approximately 10 years old. Reconstruction is not an option for younger children, especially infants. However, surgery to place bone-conduction hearing aids will improve hearing on the affected side and may be performed when the patient is 6 to 12 months old. In patients with unilateral microtia, creation of an ear canal should be delayed until the patient is 13 to 19 years old to minimize scarring and not interfere with external reconstruction. Placement of an alloplastic framework, such as porous polyethylene, has been described in younger patients. However, silicone, which has a greater incidence of extrusion and infection, is not an option.

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121. A 64-year-old man undergoes radial forearm free muscle flap reconstruction of a hemiglossectomy defect from resection of a squamous cell carcinoma. The procedure is uneventful. During which of the following periods of time is microvascular thrombosis most likely to occur after reconstruction?

- A) Within the first day
- B) Between 1 and 2 days
- C) Between 3 and 4 days
- D) Between 5 and 7 days
- E) Between 8 and 14 days

The correct response is Option A.

The most common time for a microvascular thrombosis to occur during head and neck reconstruction is within 12 hours of completion of the anastomosis. Often, the thrombosis occurs intraoperatively or upon arrival in the postanesthesia care unit. Nearly 90% of all thromboses occur within 24 hours. Most commonly, thromboses occur as a result of technical issues. Microvascular thrombosis can occur in a delayed manner, even 7 to 14 days postoperatively. However, the rate of these events is much lower than the initial 24 hours.

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122. A 37-year-old man sustains a deep laceration of the cheek from a broken bottle resulting in injuries to the facial (VII) nerve and the parotid duct. The nerve is repaired, and the parotid duct is repaired just distal to the masseter muscle over a stent. Treatment with ampicillin-sulbactam is started. Two days later, there is marked swelling and fluctuance in the cheek but no erythema or fever. Which of the following is the most appropriate next step in management?

- A) Aspiration and application of compression dressings
- B) External incision and placement of a passive drain
- C) Intraoral incision and placement of a passive drain
- D) Reexploration and revision of the parotid duct repair
- E) Reoperation for ligation of the parotid duct proximal to the site of injury

The correct response is Option A.

The patient described has a sialocele, either from a leak at the site of the parotid duct repair or from direct injury to the gland. An abscess is less likely, given the prophylactic antibiotic treatment, no erythema, and no fever. Most occurrences of sialocele after parotid duct injury or repair will resolve with compression with or without repeated aspiration. Anticholinergic medications may help by decreasing salivary flow.

External drainage of a sialocele may result in a fistula and should be avoided. Spontaneous external fistulas after parotid duct repair may be treated with intraoral drainage and compression.

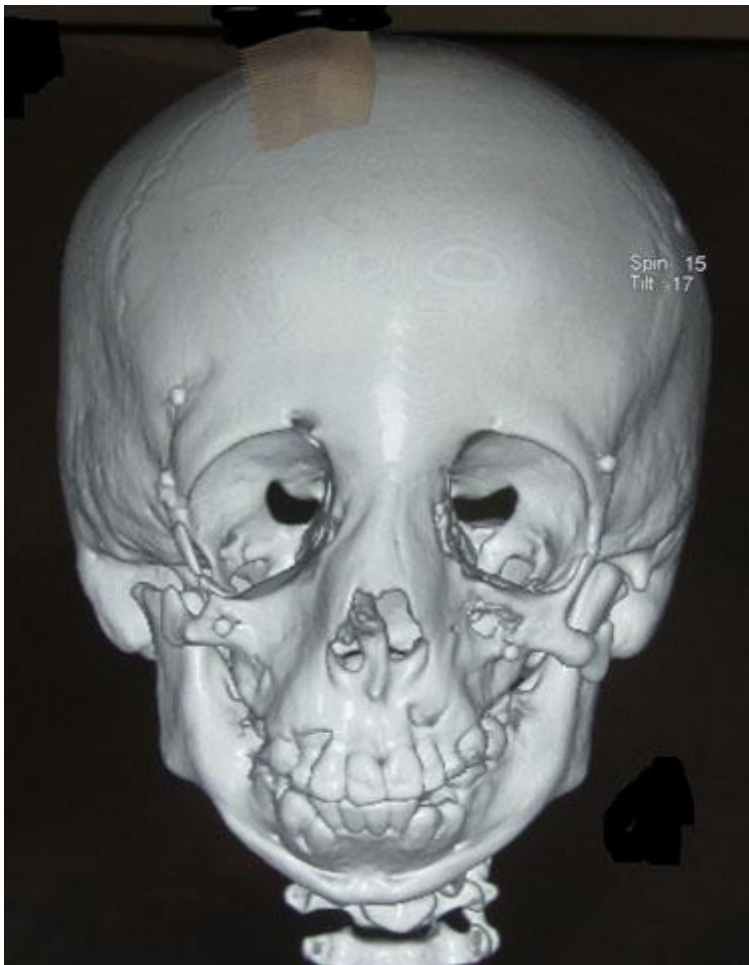
If the sialocele persists, excision of the cyst or pseudocyst may be required, with intraoral drainage over a stent, but this would not be appropriate initial management.

Attempts to revise the parotid duct repair would not likely be fruitful because of postoperative inflammation and unnecessary if an adequate stent were in place and compression were applied.

Ligation is indicated for initial management of proximal injuries to the parotid duct. Significant swelling of the parotid gland will generally occur after this procedure but typically resolves rapidly with atrophy of the gland.

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123. The CT scan shown is obtained from a 21-year-old woman. Which of the following is the risk of transmission of this patient's disease to her offspring?

- A) 25%
- B) 50%
- C) 75%
- D) 100%
- E) Cannot be determined

The correct response is Option B.

The patient described has the characteristic craniofacial findings of Treacher

Collins syndrome, notably hypoplasia of the zygomatic bones and mandible, external ear abnormalities, coloboma (notching) of the lower eyelid, absence of the lower eyelid cilia, and preauricular hair displacement. Mutation of the gene *TCOF1* is the only gene known to be associated with Treacher Collins syndrome, and it is inherited in an autosomal dominant fashion.

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124. A 7-year-old boy with Pfeiffer syndrome is brought to the office because of snoring that has worsened progressively for the past 6 months. Treatment with tonsillectomy and adenoidectomy failed to correct the obstruction. Physical examination shows moderate proptosis, Angle class III malocclusion, and inadequate malar projection. Nasendoscopy shows pharyngeal obstruction by the soft palate. Which of the following is the most appropriate management?

- A) Le Fort I osteotomy and advancement
- B) Le Fort II osteotomy and advancement
- C) Le Fort III osteotomy and advancement
- D) Mandibular setback with glossopexy and tongue-lip adhesion
- E) Mandibular setback with vertical ramus osteotomies

The correct response is Option C.

In a patient with Pfeiffer syndrome who is found to have worsening nasopharyngeal airway obstruction, mid face advancement is indicated to obviate a tracheostomy. Until the adult dentition has erupted, a Le Fort I osteotomy is contraindicated to avoid injuring the developing teeth in the maxilla. A Le Fort II osteotomy will fail to advance the deficient malar processes. A mandibular setback, by any means, will worsen the airway.

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125. A 2-year-old girl is evaluated because of bifid uvula, notching of the posterior hard palate, and midline thinning of the posterior palate. She feeds well and has normal hearing. Which of the following is the most appropriate management at this time?
- A) Furlow double-opposing Z-plasty
 - B) Nasendoscopy
 - C) Speech evaluation
 - D) Straight-line veloplasty
 - E) Veau-Wardill-Kilner push-back palatoplasty

The correct response is Option C.

This patient has physical findings suggestive of a submucous cleft palate: bifid uvula, notching of the posterior hard palate, and a thin midline region in the soft and/or hard palate termed the zona pellucida. The presence of any or all of these features is not required to secure the diagnosis and some patients will have none of them (occult submucous cleft palate). This anomaly is characterized by abnormal attachment of the palatal muscles (usually to the posterior edge of the hard palate) with intact nasal and oral mucosa.

Most patients with submucous cleft palate are asymptomatic; however, about 10 to 15% of affected individuals will demonstrate some degree of velopharyngeal insufficiency (VPI) and hypernasal speech. Other symptoms may include early feeding difficulties and recurrent middle ear effusion/infection. Borderline VPI may improve with speech therapy alone and early operative treatment should be deferred. Patients with severe or frank VPI, or those with less severe VPI who do not respond to speech therapy, will likely require operative intervention to improve speech.

The child in the scenario described is too young to reliably determine the presence of VPI by speech evaluation or diagnostic tests and, therefore, operative treatment of the submucous cleft using Furlow Z-plasty, straight-line veloplasty, or Veau-Wardill-Kilner push-back palatoplasty would be premature and potentially unnecessary. While the diagnosis of VPI can be made by a careful speech evaluation, it is difficult to obtain a reliable evaluation before 2 years of age. Nasendoscopy and videofluoroscopy are very useful to confirm the presence of VPI and to characterize the nature and degree of the deficiency. However, these important diagnostic tests are most informative in a cooperative patient and are rarely used in children younger than 3 years of age. Nasendoscopy could help confirm the presence of a submucous cleft palate, but such information will not change management unless the child develops hypernasal speech. Early evaluation and follow-up with a speech therapist would be appropriate to facilitate and monitor speech development.

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126. A 21-year-old man has an intercanthal distance of 37 mm (N = 30 mm), and an interorbital distance of 35 mm (N = 28 mm). Which of the following is the most likely diagnosis?
- A) Esotropia
 - B) Exophthalmos
 - C) Exotropia
 - D) Hypertelorism
 - E) Pseudohypertelorism

The correct response is Option D.

Orbital hypertelorism refers to a condition in which the interorbital distance, measured from dacryon (the junction of the frontal, lacrimal, and maxillary bones) to dacryon is increased. Orbital hypertelorism occurs in the setting of a number of conditions, including frontonasal malformations, craniofrontonasal dysplasia, craniofacial clefts, encephaloceles, and other mostly syndromic disorders. Some authors distinguish orbital hypertelorism from interorbital hypertelorism. In the latter, the distance between the medial orbital walls is increased just as in orbital hypertelorism but the lateral orbital walls are in a normal position. The mean interorbital distance is 28 mm in men and 25 mm in women.

Exotropia refers to a form of strabismus where the eyes are deviated outward (laterally), in contrast to esotropia, where the eyes are deviated inward (medially). Either exotropia or esotropia may exist in hypertelorism and data are not provided in the question to make this diagnosis. Pseudohypertelorism, or telecanthus, occurs when the intercanthal distance, defined as the distance between the medial canthal tendon insertions, is increased but the interorbital distance is normal. Telecanthus may give the appearance of hypertelorism, but can be differentiated on plain film x-rays or computed tomography. Exophthalmos refers to protrusion of the globe due to an increase in the size of the orbital contents in the presence of a normal bony orbit. Graves disease is one of the most common causes of exophthalmos. This is in contrast to exorbitism, which is protrusion of the globe due to a decrease in the capacity of the bony orbit, which may be seen in hypertelorism.

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127. A 13-year-old boy who underwent repair of left unilateral cleft lip and palate is brought to the office because he is dissatisfied with his “underbite.” He reports no other symptoms. Cephalometric analysis shows an SNA angle of 76 degrees ($N = 81 \pm 3$) and an SNB angle of 81 degrees ($N = 79 \pm 3$). A negative overjet of 5 mm is noted. Which of the following is the most appropriate management?

- A) Bimaxillary advancement
- B) Le Fort I advancement of the maxilla with internal fixation
- C) Le Fort I osteotomy and distraction
- D) Mandibular setback
- E) Orthodontics and follow-up in 1 year

The correct response is Option E.

At 13 years of age, the facial skeletal growth is not complete. Therefore, the patient should wait until his facial skeletal growth is complete, usually at age 18 for boys. Meanwhile, he should follow up regularly with his craniofacial team. The Angle class III malocclusion is not uncommonly seen in patients after cleft palate repair. The scarring from bony dissection in the palate repair restricts maxillary growth. However, unless there are severe symptoms (such as respiratory compromise), the definitive orthognathic surgery is deferred until skeletal maturation. When skeletal maturation is complete, a Le Fort I osteotomy with immediate fixation, or distraction osteogenesis (DO), can be done. DO is reserved for those cases where the advancement is calculated to exceed 10 mm. His SNB angle is within normal limits, therefore a setback is not indicated, nor is bimaxillary surgery.

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128. An otherwise healthy 13-year-old girl comes to the office because of a 3-year history of facial asymmetry that has worsened progressively. Examination shows a coup de sabre deformity on the right with the depression extending to the neck. There is thinning of the skin and fat of the right cheek. Which of the following additional findings is most likely in this patient?

- A) Bilateral disease
- B) Inflammatory changes in the skin
- C) Involvement of the tongue in the disease process
- D) Mandibular and maxillary hypoplasia
- E) Vascular malformations

The correct response is Option D.

The patient described has Romberg disease, also known as progressive hemifacial atrophy. Hypoplasia is seen in both maxillary and mandibular dental arches. The disorder may be associated with disturbance in normal dental growth, with foreshortening of the dental roots.

The disease is of unknown origin, and characteristically it begins in the first or second decade of life as a localized and progressive atrophy of skin and subcutaneous tissue within the dermatome of one of the branches of the trigeminal nerve. The classic earliest sign is the “coup de sabre,” which affects only about half of the patients. In progressive facial hemiatrophy or Parry-Romberg syndrome, cutaneous inflammation, induration, and adhesion are absent or minimal, and atrophy usually involves only one entire side of the face. The disease is rarely bilateral. Despite the fact that the frontal region is the most commonly affected, the frontal bone is infrequently involved. Vascular malformations are not associated with Romberg disease.

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

129. A 1-year-old boy is brought to the office because his mother is concerned about the appearance of his mouth (shown). This patient's condition is most likely the result of incomplete merging of which of the following structures?
- A) Anterior and posterior hillocks
 - B) Frontonasal and maxillary prominences
 - C) Mandibular and maxillary prominences
 - D) Maxillary prominence and medial nasal process
 - E) Second and third pharyngeal arches

The correct response is Option C.

The patient described has a transverse facial cleft, or macrostomia, resulting from incomplete merging of the mandibular and maxillary prominences of the first pharyngeal arch. This orofacial cleft, also known as a Tessier No. 7 cleft, can vary in size from a minor lateral displacement of the oral commissure to a more extensive defect involving the skin and muscle of the lateral mouth and cheek; the zygomatic arch; and, rarely, the temporal region. Macrostomia can occur in isolation but is associated more commonly with hemifacial microsomia, occurring in up to 23% of this population.

The anterior and posterior auricular hillocks, derived from the first and second pharyngeal arches, respectively, form on either side of the first pharyngeal groove at 6 weeks' gestation

and coalesce to form the external ear. The hillocks begin as swellings of mesenchyme at the upper aspect of the embryonic neck and ascend to the side of the head during development. The confluence of the second and third arches takes place in the upper neck, not the face. Cleft lip results from failed merging of the maxillary prominence and the medial nasal process. The frontonasal prominence forms the central forehead, the nasal and perinasal structures, the central portion of the upper lip, and the premaxilla. Failed merging with the maxillary prominence can result in a Tessier No. 2, No. 3, or No. 4 facial cleft.

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130. Which of the following is characteristic of a Merkel cell tumor of the head and neck?

- A) Arise from minor salivary glands
- B) Higher mortality than malignant melanoma
- C) Rarely metastasize
- D) Treated with radiation therapy alone
- E) Typically involve intraoral structures

The correct response is Option B.

Merkel cell tumors are rare neuroendocrine tumors that are highly aggressive. Even despite wide surgical resections, up to one third of patients with Merkel cell tumors have local recurrences. The 5-year mortality rate of Merkel cell tumors is approximately 33%. This is more than double the mortality rate of malignant melanoma (15%). Merkel cell tumors are best treated with wide local excision and sentinel lymph node biopsy. Adjuvant radiation therapy is also used; however, radiation alone is not considered to be the best treatment. Finally, Merkel cell tumors usually arise in sun-damaged skin of the head and neck, not intraoral structures.

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131. A 30-year-old woman with cerebral palsy has excessive salivation at rest (unstimulated) that is not controlled with administration of glycopyrrolate (Robinul). Removal of which of the following salivary glands is most likely to reduce salivary flow in this patient?

- A) Minor
- B) Parotid
- C) Sublingual
- D) Submandibular

The correct response is Option D.

The parotid and submandibular glands are the main contributors to salivary flow. Minor salivary glands are present in the oral cavity and pharynx. They are minor contributors, creating less than 10% of the saliva. The secretory unit of the salivary glands is constructed of acinar cells, myoepithelial cells, intercalated duct, striated duct, and excretory duct. The acini are responsible for secreting serous and mucous constituents of saliva. The parotid gland is purely a serous-secreting gland, whereas the submandibular is predominately serous, with 10% of the acinar cells producing mucous secretions. In the unstimulated state, the submandibular gland produces most of the saliva, whereas the parotid gland is responsible for most of the saliva produced in the stimulated state. Total salivary flow can reach 1.5 L daily in healthy individuals.

Xerostomia is a common complication resulting from radiation therapy for head and neck cancer. Xerostomia is defined as dry mouth (reduced or absent saliva flow) caused by damage to the salivary glands. Xerostomia has late effects on oral health, specifically dry mouth, sore throat, altered taste, dental decay, changes in voice quality, and impaired chewing and swallowing function. Xerostomia may also contribute to the development of mandibular osteoradionecrosis after radiation.

Salivary flow reduces to 50 to 70% of baseline after 10 to 16 Gy radiation and is undetectable after 40 to 42 Gy radiation. Xerostomia has been reported to occur in 60 to 90% of survivors of head and neck cancers treated with radiation therapy.

Management of xerostomia is focused on prevention and treatment. Although there are multiple options and advances that have been made in the management of this condition, there are no specific regimens that will prevent or completely treat xerostomia. Prevention of xerostomia includes cytoprotection using amifostine or pilocarpine. Radiation therapy techniques that spare the salivary gland may be more effective than cytoprotective agents. Such techniques include the use of intensity-modulated radiation therapy to spare the parotid

gland and submandibular gland. Surgical submandibular gland transfer has also been described. Treatment of radiation-induced xerostomia includes salivary substitutes, salivary stimulants, acupuncture, and gene therapy.

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132. Which of the following skeletal anomalies of the anterior nasal spine are most commonly found in unilateral cleft lip and palate patients?
- A) Deviation to the cleft side and decreased projection of the pyriform aperture and dentoalveolar arch on the cleft side
 - B) Deviation to the cleft side and increased projection of the pyriform aperture and dentoalveolar arch on the cleft side
 - C) Deviation to the noncleft side and decreased projection of the pyriform aperture and dentoalveolar arch on the cleft side
 - D) Deviation to the noncleft side and increased projection of the pyriform aperture and dentoalveolar arch on the cleft side

The correct response is Option C.

The inferior border of the bony septum is deviated to the cleft side, while the anterior nasal spine is deviated to the noncleft side. There is decreased sagittal projection of the pyriform sinus and dentoalveolar arch.

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133. A 32-year-old man comes to the office because he has had painless swelling of the right side of the jaw for the past 4 months. Examination shows a 6-cm mass over the mandibular angle. Panoramic x-ray study (Panorex) of the mouth is shown. Examination of the specimens obtained on biopsy of the lesion shows palisading odontogenic cells. Which of the following is the most appropriate management?
- A) Curettage and cancellous bone graft
 - B) Curettage only
 - C) Induction chemotherapy followed by irradiation
 - D) Segmental resection and immediate reconstruction with a vascularized bone graft
 - E) Segmental resection and nonvascularized bone graft

The correct response is Option D.

This patient has an ameloblastoma, which is a rare cystic tumor involving the mandible. Characteristic findings include a multilocular radiolucent lesion with a “soap bubble” appearance, usually in association with an impacted molar. X-ray studies show unilocular or multilocular cystic masses associated with thinning of the surrounding bone. Examination of a biopsy specimen shows palisading odontogenic cells.

Appropriate treatment consists of segmental mandibular resection, including a margin of normal bone and any adjacent teeth, and immediate reconstruction. Immediate reconstruction will rapidly restore facial function and improve facial aesthetics. Curettage is inadequate and is associated with a recurrence rate of 50 to 100%.

Ameloblastomas are generally benign. Malignant forms of ameloblastoma may occasionally be treated with adjuvant radiation therapy in addition to surgical resection.

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134. A 34-year-old woman comes to the office because she would like to improve the appearance of her face. She recently completed orthodontic therapy with lingual braces. When she smiles, no upper incisal show is noted. Occlusion is Angle class I. Which of the following is the most appropriate management?

- A) Cosmetic dental laminates
- B) Horizontal excision of the upper lip
- C) Mandibular osteotomy and advancement of the mandible with a genioplasty
- D) Maxillary osteotomy with vertical lengthening of the maxilla
- E) Vertical shortening of the upper lip using a scar hidden under the nostril

The correct response is Option D.

This case describes an adult with vertical maxillary deficiency resulting in inadequate upper incisal show. This is corrected with a maxillary osteotomy and vertical lengthening while maintaining the occlusive relationship. Excision of the upper lip is not the best solution of the patient described with vertical maxillary deficiency. A mandibular advancement should not be recommended as cephalometric evaluation is noted to be normal. Shortening the upper lip is not recommended for vertical maxillary deficiency.

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135. A 23-year-old male pitcher is struck in the face with a baseball during practice and sustains an isolated blowout fracture of the medial orbital wall. A transcaruncular approach is chosen for exposure. After incising the medial conjunctiva, dissection is best carried out between which of the following two structures to reach the posterior lacrimal crest?

- A) Inferior rectus muscle and capsulopalpebral fascia
- B) Lockwood ligament and inferior oblique muscle
- C) Medial canthal ligament and lacrimal duct
- D) Medial orbital septum and Horner muscle
- E) Whitnall ligament and medial rectus muscle

The correct response is Option D.

The appropriate plane of dissection is between the medial orbital septum and Horner muscle to expose the periosteum immediately posterior to the posterior lacrimal crest. This approach attempts to minimize injury to the Lockwood ligament which is more inferior and the lacrimal sac which is more anterior. Preservation of the septum will minimize spillage of fat into the surgical field.

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

136. A 78-year-old woman has a 6.5-cm defect of the right cheek (shown) just below the lower eyelid after wide local excision for a lentigo maligna melanoma. All final pathologic margins are negative. Which of the following is the most appropriate management?
- A) Cervicofacial flap closure
 - B) Full-thickness skin grafting
 - C) Healing by secondary intention
 - D) Internal mammary artery perforator flap closure
 - E) Primary closure

The correct response is Option A.

Optimal color and texture matches for cheek reconstruction are obtained from using local cheek tissues (see photograph below). The cervicofacial flap is classically an inferomedially based flap that allows for transfer of large amounts of cutaneous and subcutaneous soft tissues from the loose preauricular and neck regions to the medial cheek. The incision begins at the superior margin of the defect and extends along the outer canthus toward the zygoma and down the preauricular crease. The incision ends in the retroauricular hairline or curves anteriorly in the region of the neck, preferably within a cervical rhytid. The flap is advanced and rotated into the defect, and primary closure of the donor site can usually be achieved via wide subcutaneous undermining. Anchoring of the flap to the zygoma is recommended to reduce tension on the lower eyelid that could lead to ectropion.



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

Full-thickness skin grafts tend to appear shiny and patch-like with a poor contour match. Split-thickness or very thin full-thickness grafts are also associated with graft contracture. Split- or full-thickness skin grafts are sometimes used as a “temporary” method of reconstruction during a period of tumor surveillance to rule out early recurrence prior to definitive reconstruction.

Closure by secondary intention would require a prolonged period of healing and result in a poor final appearance with significant scar contracture, resulting in lower lid ectropion and possibly an upper lip deformity.

The internal mammary artery perforator (IMAP) flap is based on perforating blood vessels from the internal mammary artery and vein. The IMAP flap is an island variant of the deltopectoral flap and can be transferred as a free flap with good color match to the cheek compared with more distant tissues, such as the thigh or forearm. Use of the IMAP flap may result in breast distortion in a female and would require a microvascular anastomosis while not necessarily resulting in a superior cosmetic outcome to the cervicofacial flap.

Primary closure is often the reconstructive method of choice for small defects with excellent cosmetic results when the scar can be oriented along lines of minimal tension or natural cheek borders. However, for such a large defect, primary closure cannot be achieved without significant wound tension and excessive distortion of surrounding structures.

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137. An 18-year-old woman is referred for evaluation because of bulging of the right upper eyelid that has progressed slowly for the past 6 years. Physical examination shows soft enlargement of the right upper eyelid with ptosis; skin color shows no abnormalities and vision is preserved. CT scan shows no intraorbital, intracranial, or bony involvement. Examination of a specimen obtained on biopsy shows spindle cells and mast cells in a collagenous myxoid stroma. Which of the following is the most likely diagnosis?

- A) Cobb syndrome
- B) Fibrous dysplasia
- C) Klippel-Trénaunay syndrome
- D) Neurofibroma
- E) Sturge-Weber syndrome

The correct response is Option D.

These orbitofacial tumors may be part of a syndrome of neurofibromatosis 1 (NF1), which is an autosomal dominant disorder. When the full syndrome is present, skeletal dysplasia such as absence of the greater wing of the sphenoid (5 to 7%) and macrocephaly may be present. However, solitary neurofibromas unassociated with other features are not uncommon. There are three subtypes of neurofibromas: localized, plexiform, and diffuse. About 30% of plexiform neurofibromas outside of the central nervous system are associated with NF1, and the remainder are isolated. The tumors of NF2 are nearly all confined to the central nervous system and are similar to schwannomas. The scenario describes a case of plexiform neurofibroma. The majority of plexiform neurofibromas are present at birth, and half are found in the head and neck region. These tumors tend to grow in the prepubescent ages as a result of hormonal stimuli. Pathology is distinctive, and there is a 13% rate of malignant transformation. Surgical debulking and reconstruction remains the best treatment option.

Cobb syndrome consists of a capillary malformation in the midline scalp region overlying an encephalocele, or in the skin posterior to an area of dysraphism in the cervical or lumbosacral spine. It does not involve the face or orbit.

Fibrous dysplasia is an overgrowth syndrome of bones only, due to abnormal proliferation of bone-forming mesenchyme. It does not involve soft-tissue hypertrophy, nor is it associated with vascular malformations. Albright syndrome is a specific variety of polyostotic fibrous dysplasia and includes endocrine abnormalities and café-au-lait spots.

Klippel-Trénaunay syndrome is a capillary-lymphatic-venous malformation typically

involving hypertrophy of the extremities and sometimes the thorax of one side of the body, and does not involve the head and neck. The skin surface shows deep red staining with hemolymphatic vesicles. A pathognomonic feature of this condition is the presence of the embryonal lateral vein of Servelle in the lower extremity. Parkes-Weber syndrome is similar to Klippel-Trénaunay syndrome in that it may be confined to an upper or lower extremity. Overgrowth of the extremity is characteristic along with microscopic arteriovenous fistulas, and unlike Klippel-Trénaunay, lymphatic anomalies are rare. It does not involve the head or neck.

Sturge-Weber syndrome is characterized by capillary malformations in the distribution of the ophthalmic or the maxillary division of the trigeminal nerve, and may be unilateral or bilateral. Frequently, there is also gradual enlargement and hypertrophy of the cheek, lip, maxilla, and occasionally the mandible. MRI may show additional vascular anomalies of the leptomeninges and choroid plexus.

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138. A 60-year-old man with a benign, 4-cm tumor of the superficial parotid gland undergoes tumor resection with a 12-cm preauricular incision. Which of the following is the most appropriate Current Procedural Terminology (CPT) coding for the procedure?

Code	Explanation
21013	Excision subfascial soft-tissue tumor of the face less than 5 cm
42420	Excision of parotid tumor or parotid gland total with dissection and preservation of the facial nerve
64716	Neuroplasty and/or transposition cranial nerve
14041	Adjacent tissue transfer or rearrangement cheek defect 10.1 to 30.0 sq cm ²
12054	Repair intermediate wound of the face 7.6 to 12.5 cm

- A) 21013 alone
- B) 21013 and 64716
- C) 21013, 64716, and 12054
- D) 42420 alone
- E) 42420 and 64716

The correct response is Option D.

Code 42420 is the most appropriate code because it includes the tumor resection, dissection of the facial nerve, and wound closure all bundled. Code 21013 is inappropriate because there is a specific code for a parotid tumor. Code 64716 is inappropriate because that is included in the parotid resection codes. It would not include code 14041 because primary wound closure is included in the surgical package. Code 12054 should not be used because this surgical procedure always implies a layered closure.

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139. A 45-year-old man comes to the office for consultation regarding improvement of facial movement and symmetry 1 year after a hypoglossal facial nerve transfer for treatment of a right facial nerve palsy. Today, examination shows gross hyperkinesis of the right side when he chews. Which of the following is the most appropriate treatment for the hyperkinetic side of this patient?

- A) Gabapentin
- B) Injection of botulinum toxin type A
- C) Myomectomy
- D) Neurectomy
- E) Reversal of the hypoglossal-facial anastomosis

The correct response is Option B.

Patients who undergo hypoglossal-facial nerve anastomosis for facial reanimation generally regain good facial tone. However, they will exhibit mass movement (synkinesis) of the treated side when they chew. In some cases, the movements are excessive (hyperkinesis) and disturbing. The treatment of choice is injection of botulinum toxin type A into the facial muscles that are most hyperkinetic, varying between 6 and 12 points of injection, until the desired effect is achieved, up to 24 units per treatment. The treated muscles will show attenuation rather than complete paralysis.

Gabapentin is a drug used for neurogenic pain and select seizure disorders. The use of gabapentin in hyperkinetic disorders has shown mixed results. It has no value in hyperkinesis associated with hypoglossal facial disorders.

Some patients with untreated facial paralysis may experience hyperkinesis on the unparalyzed side as the central nervous system attempts to compensate by overfiring signals on both sides of the face. These patients will benefit equally from treatment with botulinum toxin type A on the unparalyzed side. Similarly, myomectomy and neurectomy are procedures reserved for the normal side to improve symmetry and facial balance.

Reversal of the nerve transfer is unnecessary, as the use of botulinum toxin type A is a much simpler procedure that can control the symptoms and preserve motion in the paralyzed side. In fact, experience has shown that patients prefer the embarrassing movements over disconnecting the anastomosis.

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140. Which of the following best approximates the 3-year survival rate of osseointegrated dental prostheses used in reconstruction with a nonirradiated free fibula flap?
- A) 5%
 - B) 25%
 - C) 50%
 - D) 75%
 - E) 95%

The correct response is Option E.

Osseointegrated prostheses are currently used to anchor dental crowns, auricular and facial prosthetics, and hearing aids (bone-anchored hearing aids, or BAHAs). This technology has improved since it was first introduced, and long-term survival rates are generally good. Several studies have confirmed short to intermediate survival rates of around 95% for dental prostheses in nonirradiated free fibula flap reconstruction. The results are significantly worse in irradiated tissues.

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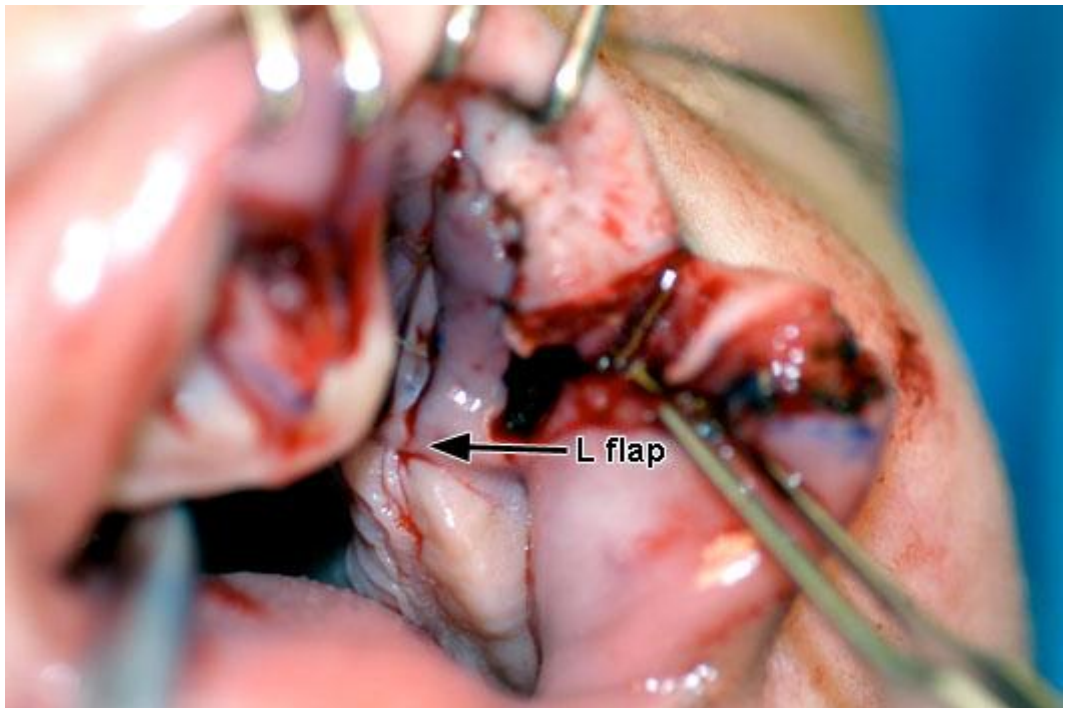
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141. The L flap used in the rotation-advancement technique of cleft lip repair is implemented to accomplish which of the following?

- A) Add bulk to the vermilion
- B) Allow for sagittal expansion of the nasal sidewall
- C) Lengthen the columella
- D) Provide lining in the gingivobuccal sulcus
- E) Restore symmetry along the philtral column

The correct response is Option B.

The L flap is a medially based flap of mucosa from the surface of the lateral lip element. It is used to line the lateral nasal vault between the internal mucosa and the more external hair-bearing skin. A photograph is shown.



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

References

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142. When coding surgery for an orbital fracture, which of the following is considered a separate Current Procedural Terminology (CPT) code?

- A) Elevation of the fracture
- B) Exploration of the infraorbital nerve
- C) Fixation of the malar fracture
- D) Orbital floor exploration
- E) Release of entrapment of orbital contents

The correct response is Option C.

Orbital fractures most commonly involve the orbital floor and are often isolated fractures, ie, not associated with other fractures, including those involving the tripod. Although the orbital floor is part of the orbit, a separate series of codes is used to describe procedures for fractures. Each of these codes is global and includes:

- Elevation of the fracture
- Exploration of the infraorbital nerve
- Orbital floor exploration
- Release of entrapment of orbital contents (inferior rectus muscle, orbital fat).

The CPT codes for fracture differ in their surgical approaches and in whether or not implants or bone grafts are used. A transantral (Caldwell-Luc) orbital floor fracture reduction is reported with code 21385. If the procedure is performed through a periorbital incision, 21386 is used. A combined approach (both periorbital and transantral) is described with code 21387. Code 21387 includes both approaches — each approach is not coded separately. If an implant is placed through a periorbital approach to reinforce the orbital floor, code 21390 is used. If a bone graft is placed, code 21395 is used; this includes harvesting of the bone graft.

There are instances where a facial injury results in a depressed malar fracture and an orbital fracture, both of which must be surgically treated. The elevation of a fracture is not considered part of the global malar fracture reduction codes, although some commercial software bundling packages used by third-party payers may incorrectly “overbundle” these codes together. If, for example, an open reduction and internal fixation (ORIF) of a malar fracture is performed, and through the periorbital incision an orbital fracture is elevated with release of entrapped soft tissue, code as follows:

Code	Description
21386	Elevation of orbital blowout fracture
21360-59-51	ORIF malar fracture

Common Codes for Orbital Floor Fractures

Code	Description
21360	ORIF malar fracture
21365	ORIF malar fracture, “complicated” (comminuted, involving cranial nerve foramina), including multiple approaches, without bone grafting
21366	ORIF malar fracture, “complicated” (comminuted, involving cranial nerve foramina), including multiple approaches, with bone grafting (includes obtaining graft)
21385	Orbital blowout, Caldwell-Luc approach
21386	Orbital blowout, periorbital approach
21387	Orbital blowout, combined approach
21390	Orbital blowout, periorbital approach with alloplastic or other implant
21395	Orbital blowout, periorbital approach with bone graft (includes obtaining graft)
21401	Orbital fracture, non-blowout, closed reduction
21406	Orbital fracture, non-blowout, open reduction, without implant
21407	Orbital fracture, non-blowout, open reduction, with implant
21408	Orbital fracture, non-blowout, open reduction, with bone graft (includes obtaining graft)

References

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143. A 45-year-old woman is evaluated because of enophthalmos caused by trauma to the left orbit sustained 6 months ago. Which of the following is the minimum increase of orbital volume that can result in post-traumatic enophthalmos?
- A) 1%
 - B) 5%
 - C) 10%
 - D) 25%
 - E) 50%

The correct response is Option B.

If the anatomical volume of the bony orbit is increased as a result of fracture displacement following trauma or inadequate restoration of the normal anatomy, patients may develop enophthalmos. This may be seen with an increase in volume in excess of 5% and may be commonly encountered following fracture of the orbital floor or the medial wall of the orbit.

References

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144. A 75-year-old man is scheduled to undergo a 5-cm composite resection including selective neck dissection and adjuvant radiation therapy because of a floor-of-mouth squamous cell carcinoma that is invading the anterior mandible. History includes hypertension. He had smoked a pack of cigarettes daily for 50 years and quit 8 years ago. He has no other cardiac risk factors and walks a mile daily. Which of the following is the most appropriate reconstruction to maximize this patient's postoperative function?

- A) Iliac crest bone grafting
- B) Reconstruction with a 2.0-mm titanium plate and coverage with a pectoralis major musculocutaneous pedicled flap
- C) Reconstruction with a fibula osteocutaneous free flap
- D) Reconstruction with a radial forearm fasciocutaneous free flap
- E) Reconstruction with a supraclavicular island pedicled flap

The correct response is Option C.

Failure to reconstruct the anterior mandibular bone results in the so-called “Andy Gump” defect and is associated with disfigurement, as well as impaired speech, swallowing, and mastication. Of the choices listed, the fibula osteocutaneous free flap is the most reliable reconstruction of the anterior mandible, particularly when radiation therapy is administered. The fibula provides a large amount of good-quality bone stock that can tolerate osteotomies, which are needed to restore the shape of the anterior mandible. A skin paddle based on perforating vessels from the peroneal artery can be included to simultaneously reconstruct the floor-of-mouth mucosal defect. Age alone is not a contraindication to reconstruction with a microvascular free flap, provided the patient is in otherwise good medical condition and has patent blood circulation to his distal lower extremity.

A nonvascularized iliac crest bone graft can be used to reconstruct small mandibular defects (under 5 cm in length), but will most likely not tolerate radiation, so it would not be a good option in this case.

Mandibular reconstruction with a titanium plate, alone or covered with a soft-tissue flap, such as the pectoralis major myocutaneous pedicled flap, is associated with a very high rate of complications, including infection, exposure, and plate fracture, particularly in the setting of an anterior location and radiation therapy.

The radial forearm fasciocutaneous free flap can be used to close the floor-of-mouth mucosal defect, but will not restore the bony mandible.

The supraclavicular island pedicled flap is based on the supraclavicular artery, a branch of the transverse cervical artery, and can be used to close oral soft-tissue defects, but, like the radial forearm fasciocutaneous free flap, will not restore the mandible.

References

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

145. Which of the following treatments is most likely to provide the best aesthetic result in the condition shown in the photograph?
- A) Laser ablation
 - B) Oral administration of antibiotics
 - C) Proper skin hygiene
 - D) Tangential excision
 - E) Topical application of retinoids

The correct response is Option D.

Rhinophyma is thought to represent the most severe expression of acne rosacea. There are

significant variations in incidence according to sex and race. Although rosacea is much more common in women, rhinophyma occurs almost exclusively in men. It is an uncommon disease that primarily affects Caucasian men in the fifth to seventh decades of life. The disease is rare in Japanese and African Americans. There is a popular but unfounded association between rhinophyma and alcohol abuse. This stigma leads many rhinophyma patients to seek surgical attention.

Rhinophyma is characterized by a tuberous enlargement of the lower half of the nose. The skin is irregularly thickened, and follicles are prominent with foul-smelling inspissated sebum. The excess growth is due to enlargement of the sebaceous glands and surrounding connective tissue, and the lymphedema is associated with late rosacea. Malignant degeneration to basal cell carcinoma has been reported rarely.

Tangential shaving of the rhinophyma is the most precise method of surgical treatment. Previously, electrocautery was frequently used for debulking, but the risk of scarring and hypopigmentation is less with cold steel because there is no chance of thermal injury to surrounding tissue. Bleeding may be difficult to control and may obscure the surgical field because of the hypervascular nature of rhinophyma. The carbon dioxide and argon laser, the Shaw knife, and electrocautery excision use heat to provide hemostasis but have the disadvantage of creating a greater zone of injury than cold-knife excision.

References

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146. A 28-year-old man comes to the office for consultation regarding correction of a residual deformity of the right infraorbital region 2 years after undergoing open reduction and internal fixation and repair of lacerations for an open orbitozygomatic fracture. Examination shows infraorbital soft-tissue atrophy. No enophthalmos or bony stepoff is noted. Examination of the eyes shows no abnormalities. CT scan shows healed fractures with good bony alignment. Which of the following is the most appropriate surgical intervention for correction of this deformity?

- A) Alloplastic prosthesis
- B) Fat grafting
- C) Rhytidectomy
- D) Rib grafting
- E) Scapular flap coverage

The correct response is Option B.

The patient has a small area of soft-tissue atrophy, which in the context of his history is likely due to fat atrophy. His bony structure is adequate and symmetrical, but he lacks subcutaneous fat. For this reason, restoration of the defect is best approached by replacing missing soft tissues, rather than enhancing the support framework. The localized nature of the defect makes it ideal for an injectable soft-tissue filler. When harvested and transferred correctly, fat grafting has shown to have high percentage rates in permanency, serving well as a soft-tissue filler. Other fillers that are based with collagen, hyaluronic acid, calcium hydroxyapatite, and poly-L lactic acid have the drawback of being temporary, but could also be considered in the absence of donor areas for fat graft.

Alloplastic prostheses are more suited for framework deficiencies. Besides, the unique configuration of the contour deficiency in the scenario described makes it less likely that a pre-shaped prosthesis is going to provide symmetry. A prosthesis in this case would be very palpable, due to the thin soft-tissue covering. Alloplastic prostheses are more likely to cause infection and seroma compared with autologous tissue.

A rhytidectomy would not be indicated in this case because it is a procedure that is designed to reposition and/or suspend displaced soft tissues. The contour defect would most likely persist following rhytidectomy.

Rib grafts have been used for the correction of late deformities following inadequate treatment of depressed orbitozygomatic fractures. The aim is to reestablish facial projection

as determined by the degree of depression of the skeletal framework. Rib grafts are not indicated as a soft-tissue filler.

Free scapular flaps are too bulky for the limited size defect of this patient's face. However, for a larger defect, such as in Romberg disease, it provides suitable correction.

References

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

147. A 45-year-old man is scheduled to undergo reconstruction after resection of an adenoid cystic carcinoma. An intraoperative photograph is shown. Closure of the palate, support of the orbit, and contour for the cheek are planned. Which of the following is the most appropriate reconstructive procedure?
- A) Free dorsalis pedis flap coverage with vascularized toe
 - B) Free radial forearm flap coverage with vascularized radius
 - C) Free rectus abdominis flap coverage and iliac crest bone grafting
 - D) Pedicled pectoralis flap coverage with vascularized rib
 - E) Pedicled temporalis flap coverage with vascularized split calvarial bone flap

The correct response is Option C.

Reconstruction of mid face defects after oncologic resection is challenging. The defect described involves a large portion of the mid face with resection of the hard palate and orbital floor (Cordeiro type IIIb). Therefore, reconstruction should aim to provide closure of the palate, support for the orbit, and contour for the cheek. Of the choices given, the free rectus abdominis flap with iliac crest bone graft is the most appropriate option because it provides volume for reconstruction of the maxillary defect, closure of the palatal defect, and support of the eye structures with an iliac crest bone graft.

The dorsalis pedis flap is not an appropriate choice because of its low volume and donor site defect.

The free radial forearm flap lacks sufficient volume to reconstruct this extensive defect of the mid face.

The pedicled pectoralis flap does not reach this mid face defect reliably.

The pedicled temporalis flap with vascularized split calvarial bone flap similarly does not reach this defect because of its short arc of rotation.

References

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2. Cordeiro PG, Santamaria E, Kraus DH, et al. Reconstruction of total maxillectomy defects with preservation of the orbital contents. *Plast Reconstr Surg*. 1998 Nov;102(6):1874-1884.

148. An otherwise healthy 10-month-old female infant is brought to the office because her parents are concerned about the appearance of her head. Examination shows left frontal and left posterior flattening with deviation of the nasal root to the left side. Which of the following is the most appropriate management?

- A) Molding helmet
- B) MRI of the head
- C) Positioning
- D) Surgery
- E) Observation only

The correct response is Option D.

In the scenario described, flattening of the left side of the forehead, deviation of the nasal root to the left side, and flattening of the left occiput are consistent with left coronal synostosis, and surgery is ultimately the treatment of choice. The scenario does not describe deformational plagiocephaly, which may be treated with a molding helmet, positioning, or observation. In an otherwise healthy baby with these findings, there is no indication for an MRI of the head.

References

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149. A 40-year-old man is referred for evaluation 1 year after undergoing rhinoplasty because he reports losing the sense of taste and smell. The patient states that this “complication of surgery” is affecting him in his daily activities. The patient’s inability to smell which of the following items most likely indicates that he is malingering?

- A) Alcohol
- B) Ammonia
- C) Cinnamon
- D) Licorice
- E) Mint

The correct response is Option B.

Although there are many prefabricated tests for anosmia, they all eventually rely on the fact that a patient who has olfactory disturbances can still identify irritants recognized by the trigeminal nervous system, eg, ammonia. In a recent study, malingering was found to be highly associated with self-reporting loss of smell and taste, involvement in litigation, and a report of broad negative effect on daily activities.

References

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

150. A 46-year-old man undergoes resection of a sarcoma involving the posterior neck. Photographs are shown. Which of the following arteries supplies the musculocutaneous flap used to reconstruct this defect?

- A) Circumflex scapular
- B) Deep temporal
- C) Internal carotid
- D) Superficial temporal
- E) Transverse cervical

The correct response is Option E.

The transverse cervical artery is the blood supply to the trapezius flap which is used to reconstruct the defect described. The circumflex scapular artery is the blood supply to the scapular/parascapular flap. This artery has a length of approximately 6 to 7 cm and does not have the arc of rotation to reach a posterior neck defect. The deep temporal artery is the blood supply of the temporalis muscle. The arc of rotation of this muscle does not enable repair of posterior neck defects. The internal carotid artery does not give rise to branches that supply the muscles of the neck/back that may be useful for reconstruction of this defect. The superficial temporal artery is the blood supply of the superficial temporal fascia. This flap is quite thin with a limited reach and would not be appropriate for reconstruction of an extensive

resection that includes skin, subcutaneous tissues, and muscle as shown.

References

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Section 4: Breast and Cosmetic

151. A 32-year-old man with Bell palsy comes for evaluation of nasal obstruction. He says that the left side of his nose constantly feels clogged. Physical examination shows left facial paralysis and collapse of the left external valve. Which of the following muscles is most likely paralyzed?

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

The correct response is Option B.

The muscles of the nose are crucial to the dynamic function of the nasal valve and airway. Patients with facial paralysis may often have symptoms of nasal airway dysfunction. The muscles of the nose are innervated by cranial nerve VII; therefore, nasal airway obstruction is noted on the ipsilateral side of the paralysis.

The levator labii superioris muscle dilates the nares. Paralysis of the muscle allows for collapse of the external valve resulting in airway obstruction.

Paralysis of these muscles would not result in collapse of the external nasal valve. The depressor septi nasi muscle depresses the nasal tip. The procerus muscle moves the eyebrows caudally, producing rhytides over the cephalic portion of the nose. The risorius acts to retract the oral commissures laterally. The transverse nasalis compresses the nose and contracts the nostrils.

References

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152. A 43-year-old woman comes to the office for consultation regarding augmentation mammoplasty. She has never had any lumps or nipple discharge from her breasts, and has no family history of breast cancer. After discussion, she chooses saline prostheses. She is concerned about breast cancer and inquires about screening. Which of the following screening studies is most appropriate for this patient after augmentation?

- A) CT scan
- B) Mammography
- C) MRI
- D) Positron emission tomography
- E) Ultrasonography

The correct response is Option B.

Current recommendations for breast cancer screening in women with augmentation mammoplasty include mammography with Eklund views. In the Eklund technique, the prosthesis is pushed back against the chest wall, and the breast tissue is pulled forward and around the prosthesis. The use of this technique increases the sensitivity of mammography for breast cancer. Breast prostheses may affect the visualization of breast tissue, and it has been suggested that diagnostic mammography be obtained instead of screening mammography, even for the asymptomatic patient.

CT scanning has been studied for the evaluation of the breast but is not routinely used as a tool for breast imaging.

MRI is recommended for the evaluation of a ruptured silicone prosthesis. The technique has high sensitivity, but lower specificity and high cost. It is not recommended as a screening tool for breast cancer in the general population at this time, but it may play a role in the high-risk patient.

Positron emission tomography is not used as a screening test for breast cancer. It is often used as an adjunct in patients diagnosed with breast cancer to determine if the cancer has spread to the lymph nodes or other parts of the body.

Ultrasonography may be used for screening but is not recommended because it is very operator dependent. It will often be used as an adjunct to mammography in screening or if a suspected lesion is found.

References

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153. A 30-year-old woman comes to the office because of difficulty breathing. She requests rhinoplasty. Physical examination shows a moderate-sized dorsal hump. Nasal examination shows normal mucosa, septum, and turbinates, and an angle of less than 10 degrees between the septum and the upper lateral cartilages. Which of the following surgical maneuvers for functional airway improvement is most appropriate in this patient?

- A) Avoidance of nasal bone infracture
- B) Dorsal onlay graft
- C) Septoplasty
- D) Spreader grafts
- E) Turbinate outfracture

The correct response is Option D.

This patient has a narrow internal nasal valve at less than the normal 10- to 15-degree angle. This likely represents the site of the airway obstruction.

During rhinoplasty, a spreader graft may be used to open this area and give symptomatic relief to the patient's functional issue.

Avoidance of nasal bone infracture would not correct the internal nasal valve issue. A dorsal onlay graft is used for cosmetic enhancement of the dorsal profile and would not have a functional improvement. In this case, with a normal straight septum and turbinates, modifications of these structures would not be required.

References

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154. A 38-year-old woman comes for consultation regarding facial laser resurfacing. Physical examination shows Fitzpatrick Type III skin with facial dyschromia. Which of the following is the most likely side effect of fractional carbon dioxide laser resurfacing in this patient?

- A) Contact dermatitis
- B) Dermal scarring
- C) Ectropion
- D) Hyperpigmentation
- E) Rosacea

The correct response is Option D.

Pigmented skin, Fitzpatrick Type III or IV, tends to absorb about 40% more laser energy than nonpigmented skin. Thermal damage can extend beyond the area of treatment. For these reasons, physicians should be aware of the side effects and complications of ablative laser treatment in pigmented skin.

The most common side effect is hyperpigmentation. Hyperpigmentation usually occurs within 6 weeks to 6 months following laser ablation and is present in 100% of darkly skinned patients. Hyperpigmentation is most often transient and can persist for 9 months to 1 year. Recommended treatment is hydroquinone.

Contact dermatitis can occur secondary to topical antibiotic therapy such as neomycin or bacitracin. Less common side effects include dermal scarring, herpetic infections, or ectropion.

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

155. A 50-year-old woman comes to the office for consultation about improving the appearance of her "saggy" breasts. She has lost 100 lb (45 kg) during the past 18 months by diet. Photographs are shown. Physical examination shows breast deflation and marked ptosis. A Wise pattern mastopexy with augmentation mammoplasty is planned. Which of the following arteries is most likely to provide circulation to the breast gland and nipple during submuscular augmentation in this patient?

- A) Intercostal
- B) Pectoral
- C) Superior epigastric
- D) Thoracoacromial
- E) Thoracodorsal

The correct response is Option D.

The thoracoacromial artery and vein travel just deep to the pectoralis major muscle, supplying circulation to the overlying breast tissue and skin. Subglandular augmentation mammoplasty disrupts the connection between the thoracoacromial vessels and the overlying breast. This leads to a higher risk of wound-healing complications when placing the prosthesis in the subglandular plane. The submuscular plane of dissection maintains the connection between the thoracoacromial vessel and overlying breast and skin, allowing better potential healing.

Intercostal arteries are multiple and are not completely disconnected with either subglandular or subpectoral augmentation mammoplasty.

The superior epigastric artery provides circulation to the rectus abdominis muscle and abdomen. This artery would be injured with the mastopexy procedure.

The thoracodorsal artery supplies the latissimus dorsi muscle and not the chest.

References

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156. A 48-year-old man comes to the office for consultation because he is dissatisfied with the appearance of his puffy, swollen eyelids and dry eyes. Physical examination shows mild bilateral proptosis and injected conjunctivae. Visual acuity and visual field testing are both normal. Extraocular motion testing reveals lid lag. Which of the following is the most likely cause of this patient's condition?

- A) Allergic conjunctivitis
- B) Myasthenia gravis
- C) Optic neuritis
- D) Sjögren syndrome
- E) Thyroid ophthalmopathy

The correct response is Option E.

The most appropriate answer is thyroid eye disease, or thyroid ophthalmopathy. This is the most common cause of proptosis and diplopia in adults. It affects women approximately 4 to 6 times more frequently than men. Puffy, swollen eyelids, injected conjunctivae, eyelid lag, and proptosis are common in thyroid ophthalmopathy.

Optic neuritis is typically associated with visual loss, which is not a symptom in this scenario. Similarly, myasthenia gravis is associated with eyelid ptosis, worsening toward the end of the day—which is not a symptom in this scenario.

Although both allergic conjunctivitis and Sjögren syndrome could cause conjunctival injection, neither would be associated with proptosis or eyelid lag.

Vision loss, due to compression of the optic nerve, can occur in the most severe cases. Fortunately, this situation is rare in thyroid eye disease, affecting less than 5% of patients with Graves orbitopathy. Treatment with prednisone, radiation therapy, and/or surgery may be required to restore vision.

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157. A 41-year-old man is referred to the office because of a mass on his left breast that has been growing rapidly for 1 month. Examination of the specimen obtained on core needle biopsy confirms invasive mammary carcinoma. Genetic testing results are positive for *BRCA2*. In addition to an increased risk of male breast cancer, which of the following other types of cancer is most likely to be associated with this patient?

- A) Colon
- B) Lung
- C) Pancreatic
- D) Renal
- E) Thyroid

The correct response is Option C.

Men with harmful *BRCA1* mutations also have an increased risk of breast cancer and, possibly, pancreatic cancer, testicular cancer, and early onset prostate cancer. However, male breast cancer, pancreatic cancer, and prostate cancer appear to be more strongly associated with *BRCA2* gene mutations. Colon, lung, renal, and thyroid cancers are not associated with the *BRCA1* and *BRCA2* gene mutations.

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158. The blood supply to the mid-abdomen originates primarily from which of the following arcade regions?

- A) Deep epigastric
- B) Deep internal mammary
- C) Mid epigastric
- D) Superficial epigastric
- E) Superficial internal mammary

The correct response is Option A.

Blood is supplied to the abdominal wall both by direct cutaneous vessels and musculocutaneous vessels. Haddad demonstrated the exact locations of these vessels using arteriography. Huger later classified the vascular supply into simple zones for use in abdominal lipectomy. This classification can be applied to abdominal reconstruction.

The mid-abdomen is supplied primarily by the deep epigastric arcade. The superior epigastric artery arises from the internal thoracic artery and descends with the posterior rectus sheath. The deep inferior epigastric artery arises from the external iliac artery and ascends with the posterior rectus sheath. Each of these vessels supplies branches to the rectus muscle and overlying skin.

The lower abdomen is supplied by branches of the epigastric arcade and the external iliac artery. The superficial epigastric and superficial external pudendal arteries originate from the femoral artery running superficial to the fascia to supply the overlying skin. The inferior epigastric artery on the posterior rectus sheath supplies the underlying muscle in this zone. The deep circumflex iliac artery supplies the muscles in the area of the anterior iliac spine.

The flanks and lateral abdomen are supplied by the intercostal, subcostal, and lumbar arteries. These vessels arise from the aorta and give off perforators to the back and flank. They travel circumferentially on the transversus abdominis, perforating the oblique muscles and supplying the overlying skin.

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159. A 22-year-old man comes to the office because he is dissatisfied with the appearance of his ears. Physical examination shows bilateral effacement of the antihelical folds, conchal hypertrophy, and severe prominence of the lobules. Otoplasty is performed with a posterior incision and placement of permanent sutures from the scaphal cartilage and helical sulcus cartilage to the mastoid fascia. Following surgery, the patient is satisfied with the appearance of the upper and middle parts of the ears but notes persistent prominence of the lobules. Which of the following is the most likely cause?

- A) Inadequate reduction of the antitragus
- B) Inadequate reduction of the cavum conchae
- C) Overtightening of the scapha-mastoid sutures
- D) Suturing the triangular fossa to the temporal fascia

The correct response is Option B.

As the cartilage angle between the cavum conchae and the antitragus becomes more acute, hypertrophy of the cavum conchae projects the lower third of the ear, forcing the lobule outward. Failure to adequately reduce the cavum conchae before suture placement will lead to persistent prominence of the lobule.

The antitragus and lobule are not directly excised during standard otoplasty. Overtightening of the scapha-mastoid sutures leads to a “pinned-back” appearance. Suturing the triangular fossa to the temporal fascia corrects prominence of the upper ear.

References

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160. A 29-year-old woman comes to the office for evaluation of upper arm fullness. Physical examination shows moderate excess subcutaneous fat and minimal skin laxity. Circumferential liposuction is planned. Which of the following is the most likely complication after liposuction of the bicipital groove region?

- A) Compartment syndrome
- B) Contour deformity
- C) Paresthesia
- D) Seroma
- E) Skin necrosis

The correct response is Option B.

When performing suction lipoplasty of the upper arm, the medial portion around and below the area of the bicipital groove should be avoided. The fat layer in this area is very thin, and wrinkling and poor skin contraction may occur. The most common areas of liposuction of the upper arm include the posterior brachial and the lateral aspects. The treatment of the para-axillary region, the deltoid bulge, and the upper back were popularized in the 1980s and the 1990s and are still performed today.

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161. A 22-year-old man comes for consultation regarding laser removal of a tattoo located on the upper lateral arm. He said his friend tattooed him 6 years ago using a sewing needle and black pen ink. Physical examination shows Fitzpatrick Type IV skin. Which of the following laser treatments is most likely to decrease the risk of scarring in this patient?

- A) Argon-pumped tunable dye
- B) Carbon dioxide
- C) Er:YAG
- D) Flash lamp-pumped pulsed-dye
- E) Q-switched ruby

The correct response is Option E.

Most amateur tattoos are characterized by pigment deposited at variable, sometimes excessive depths compared with those produced by a professional apparatus. This may compromise the ability to erase the tattoo in a single session or at all without resorting to more traditional measures, such as direct excision. The chromophore of the carbon dioxide laser is water; therefore, it will indiscriminately destroy unaffected skin, as well as the skin containing tattoo pigment. Fitzpatrick Type IV skin is that which, while resistant to sunburn, is more likely to demonstrate a genetic predisposition to hypertrophic scarring. Ablative laser treatment has been shown to adversely affect the risk of hypertrophism. Current safety guidelines require that all individuals present during laser therapy don appropriate eyewear, selected according to the laser wavelength. Q-switched lasers, including ruby, Nd:YAG, and alexandrite types, are based on the principle of selective photothermolysis. They are suited for removal of black tattoo pigments as well as a variety of colors while minimizing the risk of scar.

References

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162. A 52-year-old woman comes to the office 4 days after undergoing a sub-superficial musculoaponeurotic system rhytidectomy. Examination shows an asymmetric full-denture smile. Lip depressor function is normal on the right and absent on the left. Eversion of the lip is normal. Which of the following is the most appropriate initial management?

- A) Electromyography
- B) Operative exploration for cervical branch transection
- C) Operative exploration for marginal mandibular branch transection
- D) Paralysis of right lip depressors with botulinum toxin type A
- E) Observation

The correct response is Option E.

The patient described has marginal mandibular branch pseudoparalysis. Even if the cervical or marginal mandibular branch had been injured in the patient described, the best management would be to observe and allow the patient to retrain her smile to a more symmetric form. Electromyography studies are unnecessary. Operative exploration is not indicated. Depressor function should be expected to return between 3 weeks and 6 months. Marginal mandibular branch pseudoparalysis is a sequela of rhytidectomy surgery when an SMAS/platysma flap is dissected in the mandibular region. Transient dysfunction of lip depression in patients who exhibit a preoperative full-denture smile has been observed by many different authors who perform SMAS rhytidectomies. If the problem persists beyond 6 months, the use of botulinum toxin type A may be considered.

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163. A 46-year-old woman comes to the office for consultation regarding abdominal contouring surgery 18 months after gastric bypass surgery. She has lost 125 lb (57 kg). Physical examination shows excess abdominal, flank, and back skin. Which of the following nutritional parameters is most likely abnormal in this patient at this time?

- A) Albumin
- B) Calcium
- C) Folate
- D) Iron
- E) Vitamin B₁₂ (cobalamin)

The correct response is Option D.

Following gastric bypass, many patients have poor nutrition that may adversely affect post-bariatric surgical outcomes. Advanced age, changes in body mass index, and presence of dumping syndrome may contribute to the patient's overall nutritional status. Preoperative assessment is important in identifying patients with inadequate nutrition. Evaluation should include protein-calorie intake, serum protein measures, vitamin and mineral status, coagulation, liver function, and electrolytes.

Iron deficiency is the most common abnormality found in post-gastric bypass patients. Despite iron supplementation, 50% of patients show evidence of low ferritin concentrations. Vitamin B₁₂ (cobalamin) deficiency is often detected. Deficiencies in calcium and folate are less common.

Protein deficiency identified by hypoalbuminemia has been reported to be as high as 14% in patients following gastric bypass surgery.

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164. A 43-year-old woman comes for a follow-up visit 1 week after undergoing right modified radical mastectomy for breast cancer and subsequent reconstruction with a transverse rectus abdominis musculocutaneous (TRAM) flap. She says she is worried that she might not be able to afford additional follow-up visits should she be obligated to pay. Which of the following is the most likely duration of the global period for this patient?

- A) 1 Week
- B) 1 Month
- C) 3 Months
- D) 6 Months
- E) 1 Year

The correct response is Option C.

A global period is a specific period of time (generally 90 days after a surgery) that the patient receives follow-up care and postoperative visits without billing the insurance company. Patients must wait until their global period is complete before proceeding with the next stage of breast reconstruction. Global periods are federally mandated and cannot be changed. The global period for skin lesion is 1 week.

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1. US Department of Health and Human Services. Centers for Medicare & Medicaid Services. Medicare claims processing manual. Available at: <http://www.cms.gov/manuals/downloads/clm104c12.pdf>.

165. A 37-year-old woman comes for evaluation of symptomatic macromastia after failure of conservative treatment. Height is 5 ft 4 in (163 cm) and weight is 245 lb (111 kg). BMI is 42 kg/m². Physical examination shows Grade II ptosis and symmetrical macromastia. The estimated weight of tissue resection is 1200 g per side. An inferior pedicle reduction mammoplasty is planned. Which of the following places this patient at greatest risk for postoperative hematoma?

- A) Hypotensive general anesthesia
- B) Obesity
- C) Omitting closed suction drains
- D) The patient's age
- E) Weight of the resected specimen

The correct response is Option A.

The risks associated with reduction mammoplasty include local complications such as healing problems, nipple necrosis, loss of nipple sensitivity, infection, hematoma, hypertrophic scarring, fat necrosis, and asymmetry; systemic effects include deep venous thrombosis, pulmonary embolism, atelectasis, and a number of other surgical and anesthesia-related complications. The quantified risk of complications resulting from reduction mammoplasty increases with the weight of the resected specimen. These include wound-healing problems and nipple sensitivity. Some authors have recommended that normotensive anesthesia be administered throughout the procedure. While local and systemic risks are associated with elevated BMI, the degree of obesity does not demonstrate a correlation between risks and elevated body weight. The rate of hypertrophic scarring was shown to decrease with larger resections, possibly because of relief of skin tension or the presence of attenuated dermal thickness. Intraoperative hypotension, utilized to diminish blood loss during surgery, results in a higher rate of subsequent hematoma. Randomized studies documenting the risk of hematoma have shown no difference between patients with and without the use of closed suction drains.

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166. A 36-year-old woman is scheduled for lower blepharoplasty and mid face rhytidectomy using a transconjunctival approach. Which of the following structures is released to access the mid face for suborbicular muscle of the eye fat redraping?

- A) Capsulopalpebral fascia
- B) Lockwood ligament
- C) Orbital septum
- D) Orbitomalar ligament
- E) Parotid masseteric fascia

The correct response is Option D.

The orbitomalar ligament attaches the orbicular muscle of the eye to the orbital rim. It separates the lower eyelid from the mid face. Release of this structure is required to obtain access to the mid face when approaching it from the lower eyelid.

The capsulopalpebral fascia inserts on the inferior border of the tarsus. It makes up the anterior superior portion of the lower eyelid retractors distal to the Lockwood ligament. The capsulopalpebral fascia is divided during the transconjunctival incision. This affords access to the lower eyelid for the blepharoplasty procedure.

The Lockwood ligament is a fascial thickening that supports the globe. It surrounds the inferior rectus and inferior oblique muscles and fuses with the capsulopalpebral fascia. It is analogous to the Whitnall ligament in the upper eyelid.

The orbital septum acts to contain the orbital contents. It attaches inferiorly to the periosteum at the arcus marginalis and superiorly to the eyelid margin. A transconjunctival blepharoplasty can be performed by a pre- or postseptal approach.

The parotid masseteric fascia is within the mid face. It is distal to the orbitomalar ligament when approached from the eyelid. It does not need to be released to access the mid face.

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167. A 42-year-old woman comes for follow-up examination 1 day after undergoing injection of 0.8 mL of hyaluronic acid into the glabella. She has had severe pain since the procedure. Physical examination shows marked swelling and violaceous discoloration of the skin overlying the glabella. Massage and warm compresses produce minimal improvement. Which of the following is the most appropriate next step in management?

- A) Antibiotic therapy
- B) Aspiration of injected material
- C) Conservative operative debridement
- D) Hyperbaric oxygen therapy
- E) Injection of hyaluronidase

The correct response is Option E.

Although the use of injectable soft-tissue fillers is relatively simple, it is not completely without risk. Patients should be consulted with respect to the possibility of the potential complications, and surgeons must be familiar with their incidence and treatment.

The patient in the scenario described has atypically severe pain, swelling, and discoloration 1 day after the procedure. While most patients will report some mild discomfort and bruising, these symptoms are usually not severe, and have usually begun to resolve within the first few days of the procedure. Severe persistent pain prompts further evaluation and potentially early intervention. The presence of persistent pain, swelling, and violaceous discoloration can be an indication of vascular compromise, which is most often seen after injection of the glabellar region. Direct arterial injection will result in immediate blanching in the distribution of the artery. Venous compression, on the other hand, results when too large a volume of filler is injected into a small area, resulting in venous congestion of the overlying skin.

Treatment of vascular compromise should be prompt and aggressive. If blanching is noticed on injection and an arterial occlusion is suspected, injection should be stopped and aspiration attempted. Patients with venous compromise usually have symptoms 1 or 2 days after the procedure, and aspiration at this point is rarely feasible. Massage and warm compresses should be initiated to disperse the contained material and vasodilate the compromised dermal vasculature. Nitroglycerin paste may also be helpful. Injection of hyaluronidase will further debulk the filler and is an important tool in the treatment of both early and late filler complications. If skin necrosis seems imminent, more aggressive measures, such as hyperbaric oxygen therapy, may be helpful. Once present, necrosis is treated with topical antibiotics and, potentially, surgical debridement.

Prevention of this complication is more likely to occur if the surgeon uses a smaller needle and the smallest possible volume of filler to correct the problem. Superficial injection should also be avoided. Patients should be informed of the potential complications of this procedure, and surgeons should be swift in the treatment of these problems when they arise.

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168. A 35-year-old woman comes to the office 2 weeks after undergoing abdominoplasty. She says she has felt bloated for the past week, and that she expects her menstrual period in 2 days. Physical examination shows ballotable swelling of the infraumbilical region. Which of the following is the most appropriate next step in management?

- A) Application of a compression garment
- B) Diagnostic ultrasonography
- C) Doxycycline sclerosis
- D) Needle aspiration
- E) Oral administration of a diuretic agent

The correct response is Option D.

Seroma formation is the most frequent complication of abdominoplasty procedures. The occurrence rate quoted in the literature varies from 0.3 to 90%. The most common figure is 7 to 35%. The diagnosis of seroma can usually be made on physical examination. Ballotable swelling or fluid wave is both visible and palpable and represents the sine qua non of seroma.

In this patient, a needle aspiration should be performed. It is not unusual for seroma to recur, and additional aspirations may be required on a weekly basis. The average seroma takes two to three aspirations to eradicate. If seroma is ignored, it can lead to a permanent condition that requires operative excision. Risk factors for increased seroma formation include BMI greater than or equal to 30, concomitant liposuction, large skin resections, and shear forces.

Most plastic surgeons put their patients in compression garments postoperatively; however, studies have shown that garments do not prevent seromas.

Diagnostic ultrasound is an unnecessary test when the patient has a ballotable mass.

Doxycycline sclerosis is indicated when aspiration is unsuccessful or if the suction drains cannot be removed because of persistent high-volume output.

Oral diuretics will not cure seroma.

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169. A 48-year-old woman is brought to the emergency department after sustaining facial injuries in a motor vehicle collision. Physical examination shows a 4-cm laceration of the left upper eyelid. The levator palpebrae superioris is transected just superior to the tarsus, exposing underlying structures. Which of the following intact structures is now exposed?

- A) Lacrimal sac
- B) Müller muscle
- C) Orbital septum
- D) Preaponeurotic fat
- E) Retro-orbicularis oculi fat

The correct response is Option B.

Knowledge of periorbital anatomy is critical for plastic surgeons who perform eyelid procedures, both cosmetic and reconstructive. The levator complex originates at the orbital apex at the lesser wing of the sphenoid and travels horizontally until it reaches the Whitnall ligaments, where it changes to a more vertical direction before its aponeurosis inserts on the tarsus, orbital septum, and skin. Above the level of the tarsus, the orbital septum lies anterior to the levator, and preaponeurotic fat lies posterior to the orbital septum.

Retro-orbicularis oculi fat lies anterior to the septum and posterior to the orbicularis oculi.

Müller muscle inserts directly on the tarsus and lies just posterior to the levator directly superior to the tarsus.

References

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170. A 40-year-old woman is referred for reconstruction following mastectomy for a peripherally located ductal carcinoma in situ. A nipple-sparing mastectomy with immediate, single-stage prosthesis reconstruction with acellular dermal matrix is planned. Which of the following interventions is most appropriate to ensure that no residual cancer exists?

- A) Chemotherapy
- B) Ductal washing
- C) Radiation therapy
- D) Retroareolar frozen section
- E) Sentinel lymph node evaluation

The correct response is Option D.

More plastic surgeons are performing reconstruction for women pursuing prophylactic mastectomy, which is requested quite frequently to avoid cancer recurrence and to achieve optimal aesthetic outcome. Exclusion criteria for nipple-sparing mastectomy include tumors greater than 3 cm, clinical invasion of the nipple-areola complex, tumors within 2 cm of the nipple, evidence of multicentric disease, positive intraoperative retroareolar frozen section, or nodal disease. If carcinoma is found in the retroareolar tissue, the nipple-areola complex must be removed. A patient who would require sentinel lymph node evaluation, radiation therapy, or chemotherapy would not be an appropriate candidate for nipple-sparing mastectomy. Annual mammography is recommended for any patient with a history of breast cancer and is not specific to the issue of nipple-sparing mastectomy. Ductal washing is not relevant for this pathology.

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

171. A 40-year-old woman comes to the office because she is dissatisfied with the “deflated” appearance of her buttocks (shown) after undergoing gastric bypass surgery, followed by a 100-lb (45-kg) weight loss. Physical examination shows skin laxity and deflation of the buttocks. In addition to performing a lower body lift, which of the following is the most appropriate management of the buttock deformity?

- A) Application of external radiofrequency (Thermage)
- B) Augmentation with gluteal artery perforator flap coverage
- C) Fat grafting
- D) Implantation of prostheses
- E) Suction lipectomy

The correct response is Option B.

Gluteal changes related to loss of volume, ptosis, and skin laxity following massive weight loss require aggressive surgical techniques to improve contour and augmentation.

External radiofrequency (Thermage) does not address deflation and has shown conservative results with regard to skin tightening. It does not offer the degree of tightening that would adequately treat the massive weight-loss patient.

The gluteal region in patients who have sustained massive weight loss following gastric bypass surgery is characterized by excessive skin and exaggerated fat loss. Lower body lift procedures remove excess skin and lift sagging buttock tissue, but they do not address deflation and may result in further gluteal flattening. Autologous gluteal augmentation flaps, such as those vascularized by the superior and inferior gluteal artery perforator arteries, can be transferred reliably during lower body lifts to add volume and projection to the buttocks.

Fat grafting is the most prevalent form of gluteal augmentation with the greatest safety profile, currently surpassing gluteal prostheses. The greatest challenge in using autologous fat in a patient who has sustained massive weight loss is assessing whether the patient has adequate donor fat to overcome severe volume loss and skin laxity. The amount of donor fat needed to achieve a pleasing shape is much greater than it seems, ranging from 450 to 1100 mL per side, depending on patient size and gluteal dimension. The ideal candidate for autologous buttock augmentation is slightly overweight, but in good health.

Implantation of gluteal prostheses is not often performed by plastic surgeons due to well-known risks that include wound dehiscence, extrusion, seroma, and infection. Furthermore, gluteal prostheses carry risks of rotation, capsular contracture, and displacement.

Suction lipectomy would exacerbate volume deficiency and result in little to no skin tightening.

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172. The angle of divergence of the nasal tip is determined using which of the following structures of the lower cartilages?

- A) Middle and lateral crura
- B) Middle and medial crura
- C) Right and left foot plates
- D) Right and left lateral crura
- E) Right and left middle crura

The correct response is Option E.

The angle of divergence refers to the middle crura of the lower lateral cartilages. The angle of divergence is the angle between the right middle crus and the left middle crus, running from the medial genu to the lateral genu, while looking at the nose from the anteroposterior view. The angle from the middle and medial crura refers to the angle of rotation as the tip gently bends cephalad from the columella to the tip-defining point. There is no specific name given to the angle made by the lateral crura of the lower lateral cartilages. The septum and the upper lateral cartilage form the angle of the internal valve and relate to issues of occlusion of the airway. The middle and lateral crura form the lateral genu. The ideal angle of divergence is approximately 30 to 60 degrees. A more obtuse angle produces a long intercrural distance and a more “boxy” tip. A very acute angle of divergence creates a shorter intercrural distance and a narrow lobule. Optimally, the angle of rotation is approximately 60 degrees. A more obtuse angle often results in a lower nostril-lobule ratio and a more “square” tip. A shorter or absent middle crus will cause the tip to appear stubbed with inadequate projection.

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173. A 15-year-old girl is brought to the office because her breasts have enlarged rapidly. She says she has severe back pain and posture problems. Her parents report that her brassiere size increased from 34B to 34E at age 13 years. There has been no increase in size for the past 12 months. Height is 5 ft 5 in (165 cm) and weight is 140 lb (63 kg). Which of the following is the most appropriate management?

- A) Antiestrogen hormone therapy
- B) Diet and exercise program to lose 15 lb (6.8 kg)
- C) Reduction mammoplasty
- D) Six-month testosterone injection protocol
- E) Observation until the patient is age 18 years

The correct response is Option C.

The accurate diagnosis of benign pediatric breast tumors is essential for proper treatment. When bilateral enlargement that is grossly out of proportion occurs at menarche, it is termed juvenile hypertrophy. After the enlargement has stabilized for approximately 1 year, the treatment is surgical. There is only anecdotal evidence for using antiestrogen hormone therapy (Tamoxifen). Proper diet and exercise would be expected to reduce the size slightly, but the usual resection in these cases is 1800 g or more.

The use of testosterone injection is not indicated for juvenile hypertrophy.

Observation, while indicated at first to allow the process to be fully manifested, would be appropriate after the size had stabilized for about a year. Then it would be appropriate for the surgeon to reduce the size if necessary.

The differential diagnosis for pediatric breast enlargement includes fibroadenomas, phyllodes tumor, and cancer.

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174. A 42-year-old woman is undergoing brachioplasty after a massive weight loss. The surgeon is most likely to avoid injury to the medial antebrachial cutaneous nerve during the procedure if he or she is able to identify it in the elbow at which of the following locations?

- A) Deep to the deep fascia traveling with the basilic vein
- B) Deep to the deep fascia traveling with the cephalic vein
- C) Superficial to the deep fascia traveling with the basilic vein
- D) Superficial to the deep fascia traveling with the cephalic vein

The correct response is Option C.

The position of the medial antebrachial cutaneous nerve (MABC) makes it vulnerable to injury during a brachioplasty. Understanding its course and relationship to other structures allows the surgeon to identify and protect it.

The MABC is a sensory nerve. It is a terminal branch of the medial cord of the brachial plexus. It travels with the basilic vein medial to the biceps brachii muscle, and it pierces the fascia at the basilic hiatus proximal to the elbow.

Injury to the MABC can cause areas of numbness of the median forearm, as well as painful neuromas. The MABC is best identified in the distal aspect of the brachioplasty incision with the basilic vein and protected during the dissection.

References

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175. An otherwise healthy 35-year-old man comes to the office because of a 15-year history of bilateral Grade III gynecomastia. Height is 5 ft 10 in (178 cm) and weight is 187 lb (85 kg). BMI is 27 kg/m^2 . Physical examination shows breast enlargement with skin redundancy and palpable glandular and fatty tissue. Ultrasound-assisted lipectomy is planned because the patient wishes to avoid visible scars. Which of the following is most likely to minimize the need for skin resection?
- A) Disruption of the inframammary fold
 - B) High energy setting
 - C) Peripheral feathering with standard liposuction
 - D) Treatment of the intermediate fat layer
 - E) Tumescent infiltration with a 3:1 ratio

The correct response is Option A.

Although surgery remains the mainstay of treatment for gynecomastia in this country, results have been inconsistent, with reported dissatisfaction rates as high as 50%. Common aesthetic problems reported after surgery include unacceptable scarring and nipple and areolar deformities such as tethering and malposition. As a result, less invasive techniques have evolved and are now the mainstay of treatment for all but the most severe forms of gynecomastia.

The use of ultrasound-assisted lipectomy has improved the outcomes in the treatment of all grades of gynecomastia. In the more severe grades, certain maneuvers will improve skin retraction and redraping and may thus eliminate the need for a subsequent procedure for skin excision. While fatty and fibrous tissue is best approached from a deeper subcutaneous plane, transition to a subdermal plane can allow for greater skin retraction. Moreover, disruption of the inframammary fold is essential in that it allows the skin to drape more naturally onto the abdomen, which is typical of a male breast.

The use of wetting solutions is imperative with ultrasound-assisted lipectomy to avoid burns. Both superwet (1:1) and tumescent (3:1) techniques are acceptable. The power of the unit should generally not exceed 90% to avoid burns and dermal injuries. Peripheral feathering improves contour, providing a smoother transition to the outer border of the breast, but does not specifically address skin excess.

References

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176. A 76-year-old man comes to the office for consultation regarding a 5-year history of upper eyelid ptosis. He has no history of serious illness or trauma and takes no medications. Which of the following is the most likely cause?

- A) Levator dehiscence
- B) Muscular dystrophy
- C) Myoneural dysfunction
- D) Oculomotor (III) nerve palsy
- E) Paralysis of the Müller muscle

The correct response is Option A.

Elderly patients most commonly have symptoms of ptosis from dehiscence of the levator aponeurosis insertion. The resting eyelid position migrates inferiorly as the supratarsal crease moves to a more superior position. Muscular dystrophy affecting the extraocular muscles, chronic progressive external ophthalmoplegia, may affect extraocular muscles and the levator. Nonetheless, this is infrequent relative to levator dehiscence. Myoneural dysfunction that worsens with fatigue or at the end of the day is pathognomonic for myasthenia gravis. This disorder primarily affects young women and may be identified by improvement with neostigmine or edrophonium administration. Paralysis of the Müller muscle may occur following injury to sympathetic inflow, as seen in Horner syndrome.

References

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177. A hospital would like to run a marketing campaign for the use of botulinum toxin type A in the treatment of facial rhytides on behalf of the plastic surgery department. Which of the following areas of the face is most appropriate to address in this campaign?

- A) Chin
- B) “Crow’s feet”
- C) Forehead
- D) Glabella
- E) Jowls

The correct response is Option D.

Botulinum toxin type A is Food and Drug Administration-approved only for use in the glabellar area. While off-label uses of FDA-approved drugs, such as the use of botulinum toxin type A in the treatment of forehead rhytides and brow ptosis, is legal, only FDA-approved uses may be advertised.

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178. Which of the following is the most common hyperplastic childhood breast anomaly?

- A) Giant fibroadenoma
- B) Gynecomastia
- C) Juvenile hypertrophy
- D) Polymastia
- E) Polythelia

The correct response is Option B.

Breast anomalies in children are a relatively common finding. A recent study showed that hyperplastic abnormalities were the most common category, with the most common anomalies being gynecomastia, followed by juvenile hypertrophy or hyperplasia. The average age at initial surgery for the group was age 17.4 years; the average number of operations per patient was 1.14. Patients most likely to require revisional surgery were those with giant fibroadenoma.

References

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179. A 54-year-old woman comes to the office because she is unhappy with the appearance of her forehead 1 year after undergoing endoscopic brow lift surgery and upper and lower blepharoplasty. She says there is an indentation between her eyebrows when she frowns. Physical examination shows irregular dimpling in the glabellar area upon frowning. Which of the following is the most likely cause of this patient's postoperative outcome?

- A) Excessive removal of muscle
- B) Inadequate removal of muscle
- C) Non-matching suspension forces
- D) Overelevation of the eyebrows
- E) Underelevation of the eyebrows

The correct response is Option B.

An observation following endoscopic forehead rejuvenation is inadequate removal of the glabellar muscles, resulting in early recurrence of glabellar lines and frowning action. This can be avoided by removal of all of the muscle fibers between the frontal bone and the subcutaneous plane and replacement with fat grafts. Application of the fat graft in this area will not only improve the contour but also reduce the potential for the full gain of muscle function, even if some fibers are left intact. The residual or regenerated muscle fibers will not be as effective or as powerful without bone insertion. Furthermore, the fat graft will eliminate the flatness of the glabella as a consequence of aging. This flaw could also be the result of contraction of retained muscle fibers in those patients with very thin glabellar skin. These irregularities may only become noticeable on animation. Complete removal of the glabellar muscles and replacement with fat grafts will prevent this undesirable outcome.

Non-matching suspension forces may result in eyebrow asymmetry. Overelevation of the eyebrows is caused by overzealous dissection and too high a suspensory force. Underelevation of the eyebrows can occur as a result of inadequate release of the eyebrow suspensory ligaments.

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180. A 60-year-old woman undergoes a full abdominoplasty for cosmetic purposes. An uncomplicated full-length rectus diastasis repair, transposition of the umbilicus, resection of the excess skin and subcutaneous fat, and a meticulous, layered closure are performed. Which of the following Current Procedural Terminology (CPT) codes is most appropriate in this scenario?

- A) Abdominoplasty (15847) with excision, excess skin, trunk (15830)
- B) Abdominoplasty (15847) with layered closure, trunk, over 30 cm (12037)
- C) Abdominoplasty (15847) with muscle flap, trunk (15734)
- D) Abdominoplasty (15847) with umbilicoplasty (14000)
- E) Abdominoplasty (15847) with ventral hernia repair (49560)

The correct response is Option A.

The CPT code for abdominoplasty is added to the code for skin excision of the abdomen (15830), and represents the additional steps of superior abdominal flap elevation, umbilical transposition, and rectus fascial plication that are not included in a panniculectomy or simple skin excision.

Even though the rectus muscles move as they are imbricated for diastasis repair, this maneuver is not reported as a muscle flap coverage.

Coding separately for the umbilical transposition (umbilicoplasty) or for the closure of the incision would also be considered unbundling.

The fascial diastasis repair is not a formal hernia repair. To code the diastasis correction as a ventral hernia repair would be unbundling.

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181. A 67-year-old woman undergoes bilateral reattachment of the levator muscles because of eyelid ptosis 6 months after undergoing cataract surgery. During the procedure, the levator aponeurosis is reattached to which of the following structures?

- A) Lockwood ligament
- B) Müller muscle
- C) Orbital septum
- D) Tarsal plate
- E) Whitnall ligament

The correct response is Option D.

The levator aponeurosis attaches to the tarsal plate and is detached or attenuated in senile ptosis. The levator aponeurosis is reattached in senile ptosis procedures. The Lockwood ligament is found in the lower eyelid. It forms a “hammock” stretching below the eyeball between the medial and lateral check ligaments and enclosing the inferior rectus and inferior oblique muscles. The Müller muscle is an accessory levator. The orbital septum lies anterior to the fat pads and the levator aponeurosis. The Whitnall ligament is a condensation of the sheath overlying the anterior superior part of the levator muscle. Injury to the levator muscle during cataract surgery and retractors to the open eye can cause traumatic dehiscence of the levator muscle.

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182. A 45-year-old man comes to the office because he is dissatisfied with the “sagging” skin around his thighs 2 years after a gastric bypass procedure. His BMI has decreased from 50 kg/m² to 30 kg/m². Physical examination shows multiple folds of skin with little remaining adipose tissue in the abdomen and thighs. Which of the following is the most likely complication of excisional treatment of this patient’s deformities?

- A) Dehiscence
- B) Hematoma
- C) Infection
- D) Seroma
- E) Tissue necrosis

The correct response is Option A.

The most common complication of excisional body-contouring procedures following massive weight loss is dehiscence of portions of the wound closure. This remains true whether single or multiple areas of the body are addressed simultaneously. Increasing the number of procedures performed in the same setting appears to increase the incidence of wound dehiscence.

Seromas pose the second most common complication of excisional body contouring following massive weight loss. When viewed in the setting of circumferential (“belt”) lipectomy, the incidence can approach that of wound dehiscence.

Infection, tissue necrosis, and hematoma comprise the remaining complications that are common enough to warrant preoperative discussion during informed consent. However, the incidence is lower than that of both seroma and wound dehiscence.

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183. A 35-year-old woman comes for consultation regarding breast prosthesis removal because she is concerned about her risk of cancer. Specifically, she has read about anaplastic large cell lymphoma in women with breast prostheses. She underwent augmentation mammoplasty with saline breast prostheses 5 years ago. Physical examination shows absence of contracture and satisfactory position. Which of the following is the most appropriate next step in management?

- A) Complete blood cell count
- B) Evaluation by a hematologist
- C) MRI of the breasts
- D) Prosthesis removal
- E) Reassurance

The correct response is Option E.

The US Food and Drug Administration (FDA) searched its adverse event reporting systems for reports received between January 1, 1995 and December 1, 2010, including information submitted by manufacturers as part of their required post-approval studies. This search identified 17 reports of possible anaplastic large cell lymphoma (ALCL) in women with breast prostheses. Although ALCL is extremely rare, the FDA believes that women with breast prostheses may have a very small but increased risk of developing this disease in the scar capsule adjacent to the prosthesis. Based on available information, it is not possible to confirm with statistical certainty that breast prostheses cause ALCL. Currently, it is not possible to identify a type of prosthesis (silicone gel versus saline) or a reason for implantation (reconstruction versus aesthetic augmentation) associated with a smaller or greater risk.

When ALCL occurs, it has been most often identified in patients undergoing prosthesis revision procedures for late-onset, persistent seroma. Because it is so rare and most often identified in patients with late onset of symptoms such as pain, lumps, swelling, or asymmetry, it is unlikely that increased screening of asymptomatic patients would change their clinical outcomes. The FDA does not recommend prophylactic breast prosthesis removal in patients without symptoms or other abnormalities.

A patient with suspected ALCL should be referred to an appropriate specialist for evaluation. When testing for ALCL, fresh seroma fluid and representative portions of the capsule should be collected and sent for pathology tests to rule out ALCL. Diagnostic evaluation should include cytologic evaluation of seroma fluid with Wright-Giemsa–stained smears and cell block immunohistochemistry testing for cluster of differentiation and anaplastic lymphoma kinase markers. Any confirmed cases of ALCL in women with breast prostheses must be

reported to the FDA.

References

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184. A 46-year-old woman is referred for evaluation regarding neck rejuvenation. Physical examination shows a full neck with an indistinct mandibular border and an obtuse cervicomental angle. Which of the following is the most likely cause of this obtuse angle in this patient?

- A) Anteriorly displaced chin
- B) High position of the hyoid bone
- C) Increased preplatysmal fat
- D) Posteriorly displaced thyroid cartilage
- E) Ptosis of the submandibular gland

The correct response is Option C.

Patient evaluation for neck rejuvenation should include assessment of skin laxity, degree of preplatysmal and subplatysmal fat, and position of the chin, hyoid bone, and thyroid cartilage. In addition, the presence of a malpositioned or ptotic submandibular gland should be noted. The ideal aesthetic neck has been described as having a cervicomental angle of 105 to 120 degrees, a distinct mandibular border with a subhyoid depression, a visible sternocleidomastoid muscle, and thyroid cartilage.

An obtuse cervicomental angle can result from loose, excess skin; low position of the hyoid bone; excess preplatysmal or subplatysmal fat; and a retrodisplaced or small chin.

Excess preplatysmal fat is the most common cause of an obtuse cervicomental angle. Removal of the preplatysmal fat is corrected through direct excision or liposuction. Often, removal of the subplatysmal fat may also be required to improve the overall contour of the neck.

Excess skin laxity of the neck contributes significantly to the overall shape of the neck, resulting in poor definition of the mandibular border, sternocleidomastoid muscle, and the thyroid cartilage.

Poor chin definition caused by lack of projection or size can also result in an obtuse cervicomental angle.

The position of the hyoid bone can influence the aesthetic contour of the neck. The normal position for the hyoid bone lies in line with the fourth cervical vertebra. In patients with an obtuse cervicomental angle, the hyoid bone is low, projecting inferior to the fourth cervical vertebra and creating a full, obtuse neck contour.

Position of the thyroid cartilage or ptosis of the submandibular gland does not influence the overall aesthetic contour of the neck.

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185. Which of the following is the beneficial effect of pretreatment with tretinoin prior to facial chemical peel and laser resurfacing?

- A) Decreased epidermal proliferation
- B) Decreased fibroblast deposition of glycosaminoglycans
- C) Increased collagen IV deposition
- D) Increased epidermal melanin
- E) Increased transit rate of keratinocytes through the epidermis

The correct response is Option E.

Tretinoin has long been established as a topical treatment that can improve photoaged skin by decreasing pigmentation and fine and coarse wrinkles. This is accomplished via activation of retinoic acid receptors and other not yet well-characterized molecular mechanisms. Epidermal hyperproliferation is induced, which results in a normalization of epidermal disarray and thickening of the epidermis. Additionally, fibroblast deposition of collagen and glycosaminoglycans is stimulated, increasing skin turgor and elasticity. The breakdown of collagen is reduced via the reduction of collagenase and promotion of collagenase inhibitors. Epidermal melanin is reduced because of the stable rate of melanin transfer from melanocytes to keratinocytes, whereas the transit rate of keratinocytes through the epidermis is increased.

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186. A 65-year-old woman comes for evaluation of persistent sharp, stabbing pain in the lower abdomen that radiates to the groin. She underwent abdominoplasty 6 months ago, and the pain first occurred 1 month after the procedure. The patient says that the pain is aggravated when she walks. Weight is 154 lb (70 kg). Which of the following is the most appropriate initial step in management?

- A) Electromyography and nerve conduction studies
- B) Initiation of a 6-month course of gabapentin
- C) MRI of the abdomen and pelvis
- D) Nerve block with lidocaine
- E) Surgical exploration and excision of neuroma

The correct response is Option D.

Although nerve injury is not the most common complication of abdominoplasty, it does occur in approximately 1% of patients undergoing cosmetic procedures and in 2 to 4% of patients who have similarly located Pfannenstiel incisions for obstetric and/or gynecologic procedures. Patients with symptoms of neuropathic pain after abdominoplasty are often referred for a series of diagnostic tests and consultations that may not be necessary, delaying definitive treatment.

Patients experiencing neuropathic pain after abdominoplasty have most often sustained an injury to the lateral femoral cutaneous, iliohypogastric, or ilioinguinal nerve. The typical symptom is pain that can occur immediately or develop over time. Patients usually report a stabbing pain at the corner of the incision that may radiate to the pubic area and/or upper leg. Hyperextension or “twisting” upper body movements can aggravate the pain. If abdominal muscle contraction intensifies the pain (Carnett sign), the pain is probably located in the abdominal wall. When nerve entrapment is suspected, a nerve block using a short-acting anesthetic injected into the trigger point is the next step in diagnosis. MRI and nerve conduction studies are rarely useful in this setting. If the patient reports relief with the injection, a second block with corticosteroids may provide long-term relief. If not, a well-targeted exploration with possible neurectomy and replantation may be indicated. While treatment with gabapentin (Neurontin) may provide temporary relief, its use is poorly tolerated in the long term and does not aid in the diagnosis or the definitive treatment of the problem.

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187. Which of the following best represents the likelihood of malignancy in adolescents undergoing subcutaneous mastectomy for gynecomastia?

- A) 1%
- B) 5%
- C) 10%
- D) 15%

The correct response is Option A.

A literature search yielded over 2000 articles in total; however, only 36 articles have discussed cases of adolescent gynecomastia and the associated pathologic results, resulting in data for 615 individuals. Of these 615 individuals, there have been six cases of cancer and five cases of atypical ductal hyperplasia associated with adolescent gynecomastia. Specific patient information was only available for seven of the individuals (six breast cancer and one atypical ductal hyperplasia), which revealed that the average age of patients involved was age 17.4 years (range, age 16 to 20 years), 43% of cases had symptoms of unilateral gynecomastia, and an abnormal physical examination was present in only one case. In the cases with histologic characterization, five cases were ductal carcinoma in situ with low to intermediate grades, and the other case had been diagnosed as invasive carcinoma of the secretory carcinoma type. Sixty percent of the cases of ductal carcinoma in situ had associated atypical ductal hyperplasia as well.

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188. A 27-year-old man with a deviated septum and inferior turbinate hypertrophy undergoes septoplasty, inferior turbinate outfracture, and placement of bilateral spreader grafts. Preoperative evaluation showed a narrow middle vault and internal nasal valve. Cottle maneuver improved nasal airflow. Following septoplasty, a 6-mm dorsal strut and 10-mm caudal strut remain. Which of the following is the most likely complication in this patient postoperatively?

- A) External nasal valve collapse
- B) Open roof deformity
- C) Pollybeak deformity
- D) Rocker deformity
- E) Saddle-nose deformity

The correct response is Option E.

When performing a septoplasty procedure in which the septal cartilage will be resected, most authors recommend preserving a 1-cm L strut (1-cm caudal strut and 1-cm dorsal strut) to preserve its strength. In the patient described, only 6 mm is preserved as a dorsal strut. This results in weakening of the dorsum that can become subject to fracture, dislocation from the bony septum, or collapse caused by the force of soft-tissue contraction. A saddle-nose deformity is the result of a collapsed dorsum.

External nasal valve collapse generally results from maneuvers that weaken the lower lateral cartilage.

An open roof deformity occurs when taking down the dorsal hump to the amount that there is separation between the sidewalls and the septum. This can be closed by either nasal bone infrafracture or the placement of spreader grafts.

A pollybeak deformity is the result of fullness in the supratip area that pushes down and underprojects the nasal tip. More common etiologies for the pollybeak deformity are excess scar formation in the supratip region or inadequate resection of the lower dorsal septum.

A rocker deformity occurs after a medial osteotomy of the nasal bones that goes beyond the thick bone of the radix. It is the contour deformity that results when, upon medially repositioning the nasal bone, the portion distal to the radix rocks out laterally.

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189. Which of the following is more likely to occur with internal ultrasound-assisted lipoplasty when compared with traditional suction-assisted lipectomy?

- A) Contour deformities
- B) Infection
- C) Seroma
- D) Skin laxity
- E) Surgeon fatigue

The correct response is Option C.

Internal ultrasound-assisted lipoplasty (UAL) has been associated with an increased incidence of seroma formation, tissue damage, and thermal damage, as well as neurapraxia. With the use of a cannula or solid probe, ultrasound energy is transmitted to the fat layer, where it disrupts the fat cell. The “liquefied” fat is then aspirated with suction. To prevent thermal injuries to the skin, infiltration of solution is mandatory, and the cannula or probe needs to be in constant motion.

Although there are unique advantages and disadvantages of each lipoplasty technique, in experienced hands, excellent results can be achieved with any of the techniques, including suction-assisted lipectomy, power-assisted lipoplasty, UAL, and laser-assisted lipoplasty. Contour deformities are related to how the operator performs the technique rather than the technique itself.

Infection rates are similar for the two procedures.

Some studies have noted a decrease in both skin laxity and surgeon fatigue with UAL.

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190. Which of the following statements is most appropriate to ask when interviewing a potential hire?
- A) If the applicant has any physical disabilities
 - B) What the applicant's age is
 - C) What the total amount of hours the applicant is available to work per week
 - D) Whether the applicant has ever been arrested
 - E) Whether or not the applicant has children

The correct response is Option C.

Employment practices include measures of personnel management principles as well as knowledge of state and federal laws governing the hiring of employees. Plastic surgeons and office managers must comply in accordance with guidelines in government publications and practice management handbooks. The hours worked per week and the likelihood for overtime may be discussed but no promises of total monthly or annual hours should be made to any candidate lest a contract be implied. Among the questions that interviewers should always avoid are those relating to the candidate's age, religion, country of origin, race, child care responsibilities, health-related disabilities, and arrest history. While inquiring about prior arrests should be avoided, knowledge of the applicant's prior convictions for such acts as embezzlement from a former employer or violent crime activities is pertinent. A background check may elucidate this more clearly and help to avoid a potential lawsuit.

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191. A 7-year-old girl is brought to the office by her parents because of prominent ears. Physical examination shows a classic cup ear deformity. Surgical correction is planned. Which of the following is the most likely complication?

- A) Epidermolysis
- B) Hematoma
- C) Hypertrophic scarring
- D) Infection
- E) Recurrence

The correct response is Option E.

In 1845, Dieffenbach described the first treatment of protruding ear (post-traumatic) through the resection of the posterior skin and suturing of the auricular cartilage to the mastoid region. Ely described his technique for correcting prominent ears by elective surgery in 1881. As it was then, it still is today; the most common complication is recurrence. The rate has been quoted as low as 3% to as high as 24%. Other complications include hematoma (2%), epidermolysis (3%), suture granulomas/extrusions (3%), dehiscence (1%), hypertrophic scarring (3%), keloid formation (2%), overcorrection (1.5%), infection (1%), palpability (2%), hypersensitivity (2%), asymmetry (3%), and unnatural appearance (2%).

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192. A 27-year-old woman comes to the office for consultation regarding liposuction of the abdomen, hips, flanks, and thighs. Height is 5 ft 5 in (165 cm) and weight is 156 lb (71 kg). BMI is 26 kg/m². Physical examination shows lipodystrophy of the abdomen, hips, flanks, and thighs. Aspiration of 4 L using suction-assisted lipectomy and a superwet technique is planned. Which of the following is the most likely complication in this patient?

- A) Contour irregularities
- B) Deep venous thrombosis
- C) Hyperpigmentation
- D) Seroma
- E) Wound infection

The correct response is Option A.

Contour irregularity is reported to occur in 20% of cases and is the most common complication in liposuction. Deep venous thrombosis is reported in less than 1% of patients. Cutaneous hyperpigmentation is reported in about 4% of patients. It is often related to friction burns or cutaneous compromise. Seromas are relatively uncommon and are believed to occur more frequently in patients with an increased body mass index. Finally, wound infections are rare following liposuction.

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193. An 8-year-old girl is brought to the office by her mother because her daughter's breasts have begun to develop. The mother says that her daughter has no history of serious illness. Height is 4 ft 2 in (127 cm, in 50th percentile) and weight is 55 lb (25 kg, in 50th percentile). Physical examination shows that her current cup size is a B. No pubic hair or vaginal mucosal thickening is noted. Which of the following is the most likely diagnosis?

- A) Benign premature thelarche
- B) Cushing syndrome
- C) Gynecomastia
- D) McCune-Albright syndrome
- E) Precocious puberty

The correct response is Option A.

Knowledge of normal puberty and abnormal conditions of puberty is critical for any plastic surgeon evaluating the pediatric breast.

Tanner staging requires evaluation of pubic hair (males and females), genitals (males), and breasts (females). Because the patient described lacks pubic hair (Tanner I) and vaginal mucosal thickening, she has not started puberty in other areas. This excludes precocious puberty. If breasts develop before puberty has begun in other areas, it is considered benign premature thelarche and requires no intervention.

Gynecomastia is a hyperplastic condition of breast tissue. The patient described does not have hyperplastic breasts. In one series, hyperplastic breast abnormalities such as gynecomastia were the most common indication for operative intervention, with an average age of operation in the late teens.

McCune-Albright syndrome, also known as polyostotic fibrous dysplasia, is a condition characterized by premature puberty. Patients often begin menstruation before breast development. Patients also develop bony abnormalities, gigantism, and café-au-lait spots.

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194. A 46-year-old woman comes to the office because she cannot completely close her eye 1 week following bilateral upper eyelid blepharoplasty with levator advancement. Physical examination shows overcorrection of the right eyelid by 2 mm. Slit lamp examination shows no abnormalities. Which of the following is the most appropriate step in management?

- A) Perform a downward massage of the right eyelid
- B) Perform an edrophonium (Tensilon) test
- C) Perform skin grafting to the right eyelid
- D) Remove the skin and levator sutures
- E) Revise the left eyelid to obtain symmetry

The correct response is Option A.

The ability to predict postoperative levels in ptosis surgery has been refined over the years, but there is no completely reliable formula to predict the final tension of the upper eyelid that determines the final upper eyelid level. Revisions are common. Aponeurotic repair is not a measured resection procedure. It does not require patient cooperation and can be performed during general anesthesia.

Early management of postoperative asymmetry includes conservative treatment with downward massage. Aggressive lubrication should be used to protect the cornea. The Tensilon test is useful in the diagnosis of ocular myasthenia.

Skin grafting is not appropriate since there is no shortage in skin. Removal of the levator sutures will not correct the problem, and could result in ptosis recurrence. Revision of the left eyelid will lead to dry eye symptoms and unfavorable aesthetics.

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195. An 8-month-old boy is brought to the office for evaluation of a capillary malformation involving the right side of the chest and right cheek. Physical examination shows red cutaneous discolorations in a dermatomal distribution. Which of the following lasers is most appropriate to treat this condition?

- A) Carbon dioxide laser (10,200 nm)
- B) Nd:YAG (1064 nm)
- C) Pulsed-dye (585 nm)
- D) Q-switched alexandrite (755 nm)
- E) Q-switched ruby (694 nm)

The correct response is Option C.

Pulsed-dye laser with epidermal cooling remains the standard means of treating port-wine stains in the pediatric population. Intense pulsed-light devices have also been used with some effectiveness. The principles of selective thermolysis play a critical role in optimizing the treatment of port-wine stains. Oxyhemoglobin serves as the target chromophore, exhibiting three absorption peaks (418, 542, and 577 nm). Currently, the 585-nm and 595-nm pulsed-dye lasers appear to be the most popular choices and are most effective because of their proximity to an absorption peak and even deeper penetration. Depth of penetration is further enhanced by using a larger spot size (10 mm).

Neodymium: yttrium-aluminum-garnet (Nd:YAG) laser treatment has surfaced as an effective treatment for superficial venous malformations. The Q-switched alexandrite laser is effective in tattoo removal of black, blue, and green inks. The Q-switched ruby laser is effective in removing tattoos with minimal scarring and removes black, blue-black, and green ink.

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196. Which of the following medications is most likely to trigger malignant hyperthermia?

- A) Dantrolene
- B) Isoflurane
- C) Nitrous oxide
- D) Pancuronium
- E) Propofol

The correct response is Option B.

Malignant hyperthermia is a rare but potentially fatal sensitivity to volatile anesthetics and depolarizing neuromuscular blocking agents. A commonly used volatile inhalation agent is isoflurane. Succinylcholine is a depolarizing muscle relaxant frequently present in the operating room. 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.

Dantrolene is not a trigger for malignant hyperthermia. It is the only drug recommended for the treatment of malignant hyperthermia.

Propofol and nitrous oxide are not malignant hyperthermia triggers.

Pancuronium is a non-depolarizing muscle relaxant and is therefore safe to use.

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

197. A 55-year-old woman comes to the office for consultation about arm contouring. She underwent gastric bypass surgery 18 months ago, followed by a 100-lb (45-kg) weight loss. She says she has difficulty finding clothing that fits her upper arms. A photograph is shown. Physical examination shows skin laxity and lipodystrophy of the upper arms. Brachioplasty with a T-scar and posterior liposuction is planned. Which of the following complications is most likely to occur in this patient?

- A) Cellulitis
- B) Lymphedema
- C) Numbness
- D) Thromboembolism
- E) Wound dehiscence

The correct response is Option E.

The most likely risk of a combination brachioplasty liposuction procedure is wound dehiscence. Wound dehiscence has been most commonly reported when liposuction is performed in conjunction with brachioplasty, and most commonly reported with the excisional technique alone. Dehiscence most often occurs in the axilla at the T point in traditional brachioplasty and in the axilla in the L-brachioplasty approach.

Lymphedema also may occur after brachioplasty with or without liposuction and is also often temporary. There is no increased risk with liposuction. Lymphedema occurs because of scarring around the axillary lymph nodes. Cellulitis may also be associated with lymphatic obstruction or interruption in the arm.

Numbness is a common complication following brachioplasty but is often temporary in nature. The medial antebrachial cutaneous nerve is located within the field of surgery in the distal arm and may undergo traction injury or laceration.

Thromboembolism is a rare occurrence after brachioplasty.

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198. A 35-year-old woman with diffuse hair thinning comes to the office for evaluation of hair transplantation. Physical examination shows facial hirsutism, acne, and diffusely decreased hair density over the crown and frontal scalp, except for the frontal hairline, which is quite well preserved. The scalp skin appears normal. Which of the following is the most likely underlying cause?

- A) Alopecia totalis
- B) Polycystic ovary syndrome
- C) Psoriasis
- D) Tinea capitis
- E) Trichotillomania

The correct response is Option B.

Although all options listed can cause hair loss, psoriasis and tinea capitis would be associated with visible scalp changes, such as scaling or crusting. Trichotillomania, which is traction alopecia from compulsive hair pulling, would be unlikely to show a diffuse hair loss with sparing of the frontal hairline. Alopecia totalis, by definition, is total hair loss over the entire scalp, and does not fit the patient's description.

This woman has female pattern hair loss (FPHL), which is the preferred term for androgenetic alopecia in females. Typically there is a reduction in hair density over the crown and frontal scalp, with relative sparing and preservation of the frontal hairline, as described for this patient. Between 10 and 40% of women with FPHL have been found to be hyperandrogenic. The presence of menstrual irregularities, marked acne, or hirsutism in this patient should prompt an investigation for polycystic ovary syndrome or other underlying causes.

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199. A 45-year-old woman comes for evaluation 1 year after undergoing vertical mastopexy without placement of prostheses because she thinks her breasts have started to sag. An increase in which of the following breast dimensions has most likely occurred since the patient's last visit?

- A) Breast base diameter
- B) Nipple to inframammary crease
- C) Nipple-areola diameter
- D) Suprasternal notch to inframammary crease
- E) Suprasternal notch to nipple

The correct response is Option B.

The nipple-to-inframammary crease dimension is most likely to increase over time. This leads to pseudoptosis (bottoming out) and the appearance of a sagging breast. Pseudoptosis occurs when the breast gland migrates lower than the inframammary crease while the nipple stays in normal position. It is essential that patients be informed that their breasts will eventually sag following mastopexy. Procedures to prevent this from occurring include the use of permanent mesh encircling the breast mound. Mastopexy and reduction mammoplasty share similar operative strategies as well as complications. All techniques suffer bottoming out to different degrees.

Breast base diameter will change very little over time as long as the breast volume remains constant; eg, weight gain can increase breast volume.

An increase in the nipple-areola diameter is unlikely with vertical mastopexy; however, increased areola diameter is associated with periareolar mastopexy. To minimize this complication, a permanent purse-string suture is recommended.

Suprasternal notch-to-inframammary crease distance changes very little in comparison with the nipple-to-inframammary crease distance.

The suprasternal notch-to-nipple distance changes very little postoperatively. When a prosthesis is used during mastopexy, this distance will increase; however, the nipple-to-inframammary crease will usually increase to a greater extent.

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200. A 38-year-old man is evaluated because of nasal airway obstruction. The obstruction has been present since he underwent functional septorhinoplasty 9 months ago. Acoustic rhinometry shows external nasal valve collapse. Which of the following is the most effective treatment of this patient's condition?

- A) Alar batten grafting
- B) Butterfly grafting
- C) Flaring sutures
- D) Splay grafting
- E) Spreader grafting

The correct response is Option A.

The most common treatment for the repair of external nasal valve collapse is the placement of alar batten grafts. These grafts help to augment and strengthen the weakened or absent lateral crus of the lower lateral cartilage. Dysfunction of the external nasal valve is most often seen after overresection of the lateral crus of the lower lateral cartilage from a previous rhinoplasty, in an attempt at tip modification. Butterfly grafts, flaring sutures, splay grafts, and spreader grafts and flaps are used to correct internal nasal valve collapse.

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Thank you for your participation.

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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)	
160	(A)	(B)	(C)	(D)	(E)
161	(A)	(B)	(C)	(D)	(E)
162	(A)	(B)	(C)	(D)	(E)
163	(A)	(B)	(C)	(D)	(E)
164	(A)	(B)	(C)	(D)	(E)
165	(A)	(B)	(C)	(D)	(E)
166	(A)	(B)	(C)	(D)	(E)
167	(A)	(B)	(C)	(D)	(E)
168	(A)	(B)	(C)	(D)	(E)
169	(A)	(B)	(C)	(D)	(E)
170	(A)	(B)	(C)	(D)	(E)
171	(A)	(B)	(C)	(D)	(E)
172	(A)	(B)	(C)	(D)	(E)
173	(A)	(B)	(C)	(D)	(E)
174	(A)	(B)	(C)	(D)	
175	(A)	(B)	(C)	(D)	(E)
176	(A)	(B)	(C)	(D)	(E)
177	(A)	(B)	(C)	(D)	(E)
178	(A)	(B)	(C)	(D)	(E)
179	(A)	(B)	(C)	(D)	(E)
180	(A)	(B)	(C)	(D)	(E)
181	(A)	(B)	(C)	(D)	(E)
182	(A)	(B)	(C)	(D)	(E)
183	(A)	(B)	(C)	(D)	(E)
184	(A)	(B)	(C)	(D)	(E)
185	(A)	(B)	(C)	(D)	(E)
186	(A)	(B)	(C)	(D)	(E)
187	(A)	(B)	(C)	(D)	
188	(A)	(B)	(C)	(D)	(E)
189	(A)	(B)	(C)	(D)	(E)
190	(A)	(B)	(C)	(D)	(E)
191	(A)	(B)	(C)	(D)	(E)
192	(A)	(B)	(C)	(D)	(E)
193	(A)	(B)	(C)	(D)	(E)
194	(A)	(B)	(C)	(D)	(E)
195	(A)	(B)	(C)	(D)	(E)
196	(A)	(B)	(C)	(D)	(E)
197	(A)	(B)	(C)	(D)	(E)
198	(A)	(B)	(C)	(D)	(E)
199	(A)	(B)	(C)	(D)	(E)
200	(A)	(B)	(C)	(D)	(E)