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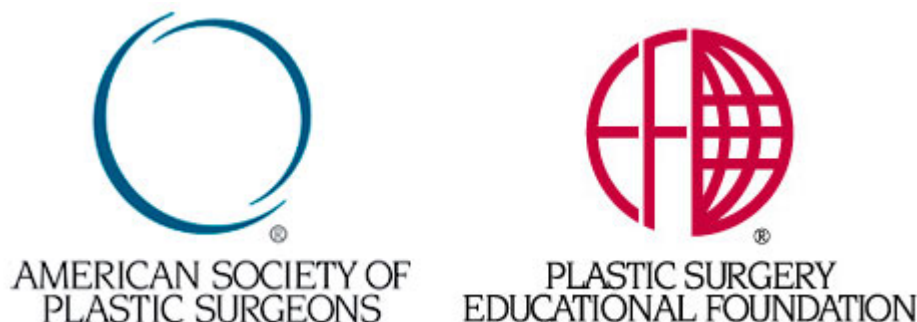
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American Society of Plastic Surgeons and the Plastic Surgery Educational Foundation In-Service Examination



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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 2007.

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for the

In-Service Examination in Plastic Surgery



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Section 1: Comprehensive

1. A 60-year-old woman with Fitzpatrick type 1 skin and coarse panfacial rhytides comes to the office for rejuvenation. Which of the following is the most effective treatment?
 - A) Dermabrasion
 - B) Glycolic acid peel
 - C) Jessner solution peel
 - D) Phenol peel
 - E) Trichloroacetic acid (TCA) peel

The correct response is Option D.

Trichloroacetic acid (TCA) chemical peels are excellent for treating rhytides of the infraorbital skin and the full face. TCA concentration can be varied, from 10% to 25% for a light peel, 30% to 35% for an intermediate peel, and 50% to 60% for a deep peel. TCA is more effective than other treatments for neck, chest, and hands because the concentration can be lowered to avoid hypertrophic scarring, which may occur in these areas. Although TCA peels result in less facial bleaching than phenol peels, TCA cannot provide as profound an effect as phenol. Therefore, phenol is better for coarse wrinkles, severe sun damage, and significant pigment problems.

Although TCA peels can provide varying levels of treatment, the response to phenol peels is "all-or-none." Histologic studies show that phenol provides double the penetration and double the amount of neocollagen formation compared with a deep TCA peel. Phenol results are long lasting. Problems associated with phenol include the bleaching effect (making it less useful for darker complected individuals), prolonged recovery period, and potential for cardiac toxicity.

Performed with a motor-driven diamond fraise or steel brush, dermabrasion is a technique of skin abrasion that can sand down scars or sculpt the surrounding tissue to a level where the defect becomes less noticeable. Dermabrasion removes the entire epidermis and the upper and mid-dermis, including the upper part of skin adnexa. Depth of treatment is controllable and may be varied to meet the needs of the patient; deeper penetration can improve deeper scars. Dermabrasion is thus better than peels for perioral rhytides and acne scarring. Re-epithelization and repigmentation take place from the residual portions of the hair follicles, sebaceous glands, and sweat ducts. Dermabrasion has less of a bleaching effect than phenol, so it is better for patients with darker complexions who need improvement in rhytides of the upper and lower lip

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and chin. Dermabrasion cannot be safely performed around the eye and is difficult to perform for full face treatment.

Glycolic acid peels and Jessner solution peels only provide treatment for superficial wrinkles, acne scars, and uneven pigmentation.

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2. A 3-month-old girl is referred to the office by her pediatrician for consultation regarding a hemangioma on the forehead that obstructs the vision of her right eye. Physical examination shows a nonulcerated, raised, 1.5-cm mass on the upper eyelid. Which of the following is the most appropriate management?
- A) Injection of a corticosteroid
 - B) Intense pulsed-light therapy
 - C) Interferon therapy
 - D) Surgical excision
 - E) Observation

The correct response is Option D.

Hemangiomas exhibit a characteristic evolution, with early rapid growth (proliferation) followed by slow involution. The earliest sign of a hemangioma is blanching of the involved skin. This may be followed by fine telangiectasias and then a red or crimson macule. Rarely, a shallow ulceration may be the first sign of an incipient hemangioma.

Rapid growth during the neonatal period (birth to four weeks) is the historical hallmark of hemangiomas. This rate is characteristically beyond the growth rate of the infant, thereby differentiating this neoplasm from vascular malformations that grow commensurate with the infant. As proliferation ensues, the hemangioma becomes elevated and may be dome-shaped, lobulated, plaque-like, tumoral, or any combination of these morphologies. The proliferation phase occurs during the first year, with the most growth occurring during the first six months of life. Proliferation slows between the middle and end of the first year of life. During this time, the hemangioma may remain quiescent or may begin to involute.

The involutional phase may be rapid or prolonged. No specific characteristics appear to influence the rate or completeness of involution. The exception is a separate type of hemangioma referred to as a rapidly involuting congenital hemangioma (proliferates in utero and is fully developed at birth), which tends to complete involution during the second year of life. A total of 50% of infantile hemangiomas complete involution by age 5 years and 70% by age 7 years; the remainder may take an additional three to five years to complete the process. Of lesions that have involuted by age 6 years, 38% will have residual evidence with scar formation, telangiectasia, or redundant or anetodermic skin. Hemangiomas that take longer to involute have a higher incidence of permanent cutaneous residua. A total of 80% of lesions that complete involution after age 6 years may exhibit significant cosmetic deformities.

The benefits to early surgical excision include saving a life or vision and decreasing the negative

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psychosocial effects associated with a cosmetically disfiguring lesion during early childhood. Other benefits of early excision include the use of naturally expanded skin to aid in primary closure and the ability to employ a relatively avascular tissue plane surrounding actively growing hemangiomas. New advancements in surgical instruments that cauterize while cutting lessen the risk of hemorrhage.

Expectant observation would not be wise in a child with blocked vision due to possibility of amblyopia. Laser surgery is beneficial in treating both proliferating and residual vessels from hemangiomas. The flash lamp-pumped pulsed dye laser has become the most widely used laser for selective ablation of vascular tissue in childhood. Intense pulsed light is not indicated in treatment of hemangiomas.

Oral and intralesional corticosteroids are effective at slowing the growth and decreasing the size of proliferating hemangiomas. The mechanism of action has not been elucidated completely; however, corticosteroids seem to act by potentiating vasoconstrictive effects of epinephrine and norepinephrine on vascular smooth muscle. Evidence indicates that corticosteroids block estradiol receptors in hemangiomas in vitro. Wide variation in response rates exists, from less than 40% to greater than 90%, depending on dose, duration of treatment, and age at which corticosteroid therapy is initiated. Corticosteroid should be administered during the proliferative phase because they have a negligible effect on involuting otherwise stable lesions; also, because they have prolonged and variable response times, they are not to be used in life- or sight-threatening scenarios.

Interferon alfa-2a can be used in lesions that are unresponsive to corticosteroids. In fact, unlike corticosteroids, interferon alfa-2a does not require administration during the proliferation phase to be effective. The onset of action is slower than that of corticosteroids, usually requiring several weeks; this makes it less attractive for use in acute life- or sight-threatening situations. Interferon alfa-2a should be used only if corticosteroid therapy fails. The most significant adverse effect limiting its use in hemangiomas is potentially irreversible spastic diplegia, now reported in several infants; although most infants displayed significant recovery of spasticity of lower extremities, it appeared permanent in other infants.

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3. A 2-year-old boy is brought to the emergency department because he has had lethargy, fever, and a rash over the extremities for the past 10 hours. Temperature is 39.9°C (103.8°F). Physical examination shows petechiae over the trunk and arms. Over the next three hours, the rash coalesces to hemorrhagic bullae, and the diagnosis of purpura fulminans is confirmed. Each of the following management interventions is appropriate EXCEPT
- A) administration of activated protein C
 - B) broad-spectrum antibiotic therapy
 - C) early wound debridement and amputation of ischemic digits
 - D) fasciotomy of extremities
 - E) fluid resuscitation with inotropic support

The correct response is Option C.

Purpura fulminans is a frequently fatal, rapidly evolving syndrome of septic shock and hemorrhagic bullae, which can result in massive desquamation. Management includes prompt recognition of the infection (which is usually caused by *Neisseria meningitidis*), initiation of broad-spectrum antibiotic therapy, mechanical ventilation, and aggressive fluid resuscitation with inotropic support. Disseminated intravascular coagulopathy (DIC) develops, and patients seem 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 difficult to determine tissue viability during the resuscitation period; therefore, debridement, coverage, and amputation are delayed until demarcation has occurred.

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4. Under average conditions, which of the following percentages represents the expected six-month resorption rate of fat injections?
- A) 10%
 - B) 30%
 - C) 50%
 - D) 70%
 - E) 90%

Please note: Question 4 has been deleted from the examination.

The correct response is Option B.

The key points of the theory of fat survival are as follows: 1) fat is a dynamic tissue; 2) cells that suffer trauma lose more volume; and 3) the recipient site makes an important difference in graft survival based on the vascularity of the bed. Careful handling of the graft is critical. Therefore, given the ideal conditions of minimal traumatic technique, meticulous fat graft size, and recipient bed selection, we should expect approximately 60% to 80% long-term graft survival based on several studies.

Moore and co-workers reported on the effects of mechanical damage to fat cells harvested with syringe suction lipectomy versus excision with local anesthetics. The mechanical damage to tissue aspirated versus tissue that was excised was unchanged. Lidocaine inhibited the glucose metabolism and lipolysis of adipocytes in culture. The effect was maintained only for as long as the lidocaine was present.

Also, as Smahel reported, fat grafts, like other grafts, must be small enough to be revascularized but large enough to maintain structural integrity and some native blood vessels. When part of the graft is not revascularized, the fat becomes necrotic and is not simply resorbed but is broken up and removed by the cellular elements.

Karaoglu and co-workers have studied the recipient site of fat grafts and seen a statistically significant increase in fat graft survival in supramuscular layer ($81.95 \pm 4.40\%$) than in subcutaneous ($41.62 \pm 3.29\%$) and submuscular layer ($37.31 \pm 5.77\%$) ($P < 0.05$). This study demonstrates that selection of an appropriate recipient site should enhance ultimate survival of the fat graft.

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5. In healthy human subjects, individual hairs develop from cells at which of the following locations?

- A) Base of the follicle
- B) Cuticle
- C) Infundibulum
- D) Outer root sheath
- E) Sebaceous gland

The correct response is Option A.

Each hair is produced through the proliferation of matrix cells at the base of the hair follicles. The progeny of these cells become displaced from below, become mature, and produce keratin.

The outermost layer of the hair is called the hair cuticle, composed of hard keratin, and is responsible for anchoring the hair in its follicle by a system of interlocking scales on its inner surface.

The infundibulum is the upper portion of the hair follicle above the sebaceous duct. It is lined by surface epithelium.

The outer root sheath covers the inner root sheath and extends upward from the matrix cells at the lower end of the hair bulb to the entrance of the sebaceous gland duct. The basal layer of the outer root sheath contains inactive pigmented amelanotic melanocytes, which can produce melanin after injury such as chemical peels or dermabrasion and migrate toward the epidermis.

Sebaceous glands produce sebum and open into the hair follicle.

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6. After harvesting of a split-thickness skin graft from the lateral aspect of the thigh, application of which of the following types of wound care agents will yield the most rapid epithelialization at the donor site?
- A) Normal saline wet-to-dry gauze
 - B) Occlusive dressing
 - C) Petrolatum-impregnated gauze
 - D) Semi-occlusive dressing
 - E) Silver sulfadiazine cream

The correct response is Option D.

The ideal donor site dressing is one that promotes rapid re-epithelialization, causes little pain, requires little care, is inexpensive, and has a low rate of infection. Options include occlusive dressings (Duoderm), semi-occlusive dressings (OpSite, Tegaderm), semi-open dressings (petrolatum-impregnated gauze, Xeroform or scarlet red), and no dressing.

Although semi-open techniques using a heat lamp to dry the donor site covered with Xeroform or scarlet red are historically popular, these dressings do not meet current concepts of promoting wound healing by providing a moist environment.

In multiple studies, the superior dressings have been shown to be semi-occlusive. These products have been shown to have the fastest healing rates (average nine days to re-epithelialization), lowest subjective pain scores, lowest infection rates (~3%), and are among the lowest in cost. They have the advantage of being transparent, which allows ongoing inspection of the site while maintaining sterility. Some fluid collects under these materials, which promotes moist wound healing and probably accounts for the more rapid healing rates and decreased subjective pain scores.

Donor sites for split-thickness skin grafts heal spontaneously from epithelial cells remaining in epithelial appendages within the dermis and at the wound edges. Healing begins within 24 hours of harvesting, and the rate of healing is directly proportional to the number of epithelial appendages remaining and inversely proportional to the thickness of graft harvested. When the epidermis has regenerated it may be reharvested; however, each harvesting removes a portion of dermis that is not regenerated. The initial epithelium that is regenerated is very delicate and easy to disrupt with tape or dressing changes. This is another reason to use the semi-occlusive dressing technique that does not need to be removed until healing is complete.

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7. A 42-year-old woman comes to the office for consultation regarding improvement of the appearance of her facial skin. Resurfacing with a carbon dioxide laser is contraindicated in this patient if she has been treated recently with which of the following drugs?

- A) Acyclovir
- B) Glycolic acid
- C) Hydroquinone
- D) Isotretinoin
- E) Tretinoin

The correct response is Option D.

Unlike the other pretreatments, isotretinoin (Accutane) is contraindicated in any skin resurfacing procedures. Although its use for the treatment of acne is regulated, because of its significant risk for causing birth defects, it may also interfere with healing after resurfacing procedures. This complication may occur even if the medication has not been used for one year. For this reason, all patients should be asked about isotretinoin use before any resurfacing procedure is performed.

The remaining treatments are not a contraindication to facial skin resurfacing. Acyclovir is frequently administered before and after resurfacing procedures, particularly in patients with a history of herpes virus outbreaks. A glycolic acid peel may also be administered before resurfacing; however, little data show that it will prevent pigment changes or decrease inflammation after resurfacing. Hydroquinone may also be administered, but again, there is lack of good data that it provides significant improvement of pigment changes. Although similar to isotretinoin, tretinoin (Renova, Retin A) does not cause an increased risk of healing complications after laser resurfacing. It is frequently used as a pretreatment in such cases.

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8. A 30-year-old man undergoes reconstruction of the right lower leg after sustaining an open fracture of the tibia. A skin graft is harvested and placed over a free muscle flap. Two days postoperatively, which of the following findings on microscopic examination of the skin graft is most likely?

- A) Early ischemic injury
- B) Increased collagen cross-linking
- C) Neovascular circulation
- D) Significant edema
- E) Venous congestion

The correct response is Option D.

Within the first 24 hours after placement, the graft survives by serum imbibition, which is absorption of nutrients from the serum leaked from the donor site (muscle in this case). At 24 hours, the healing graft will have increased in mass from edema by up to 30%. Leukocytes can be seen invading the graft, which may help stimulate endothelial migration and revascularization. By 24 hours, donor site vessels have begun to invade the graft vascular channels in a process called inosculation. The graft vessels degenerate and become replaced by the growing donor site vessels. Circulation is reestablished by day 4 to 5 at the earliest. Whereas early graft ischemia results in a lowering of the pH and a decrease in metabolism, ischemic injury and necrosis are not seen. Graft maturation and collagen turnover occur over weeks to months. Early recognition and correction of the venous thrombosis are not likely to affect early graft nourishment and healing.

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9. A 20-year-old man undergoes reduction and external fixation of a grade IIIB fracture of the right lower extremity. One day postoperatively, the plastic surgery team is called for wound care management. Which of the following is the most appropriate initial step?
- A) Application of wet-to-dry saline dressings
 - B) Enzymatic debridement
 - C) Negative-pressure wound therapy
 - D) Operative debridement
 - E) Observation

The correct response is Option D.

The tibia is a long bone, the anterior third of which is placed subcutaneously in the leg throughout most of its length. It is covered only by a thin layer of skin and subcutaneous tissue. This anatomic location may be explained by the need to protect the blood vessels and nerves of the leg, which are located deep laterally, medially, and posteriorly. This position makes the tibia easily vulnerable to trauma, often resulting in exposed fractures.

The extensive Orthopaedic Trauma Association classification of long bone fractures divides them according to the line of fracture as follows: linear (transverse, oblique, spiral), comminuted (<50%, >50%, butterfly <50%, butterfly >50%), segmental (2 level, 3 level, longitudinal split, comminuted), and bone loss (<50%, >50%, complete).

The clinical classification considers the involvement of soft tissues in open fractures. In 1984, Gustilo and colleagues described five grades in the Association of Osteosynthesis classification, as follows:

- Grade 1: Skin lesion smaller than 1 cm; clean; simple bone fracture with minimal comminution
- Grade 2: Skin lesion larger than 1 cm; no extensive soft tissue damage; minimal crushing; moderate comminution and contamination
- Grade 3: Extensive skin damage with muscle and neurovascular involvement; high-speed injuries; comminution of the fracture; instability
- Grade 3a: Extensive laceration of soft tissues with bone fragments covered; usually high-speed traumas with severe comminution or segmental fractures
- Grade 3b: Extensive lesion of soft tissues with periosteal stripping, contamination, and severe comminution due to high-speed traumas; usually, exposed bone must be replaced with a local or free flap as a cover

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Grade 3c: Exposed fracture with arterial damage that requires repair

Because of the exposure of devascularized bone in a contaminated bed, the spontaneous healing of these wounds is usually aggravated by complications such as delayed union, nonunion, infection, and osteomyelitis. It is of utmost importance to irrigate the wounds with jet lavage and debride all segments of devascularized bone in addition to skin and muscle to help prevent these complications. Application of a vacuum-assisted closure device is helpful only as an adjunct to a comprehensive irrigation and debridement of the wound.

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10. A 14-year-old boy is referred to the office by his pediatrician for consultation regarding a purple mass on the right hand. The lesion has been present since birth but has been enlarging over the past year. The patient says that the mass increases in size when he exercises. On physical examination, the lesion is warm to touch and has a palpable thrill. Which of the following is the most likely diagnosis?
- A) Arteriovenous malformation
 - B) Capillary malformation
 - C) Hemangioma
 - D) Lymphatic malformation
 - E) Venous malformation

The correct response is Option A.

Arteriovenous malformations are present at birth but may be mistaken at that time for hemangiomas. However, they do not regress and can increase in size with puberty. The fast-flow nature of these lesions results in the cutaneous warmth and palpable thrill. Hemangiomas usually grow during the first year of life and usually regress spontaneously by age 5 to 10 years. Vascular malformations are present at birth but will not spontaneously involute. They are characterized by channel type (venous and capillary) and by flow rate. Arteriovenous malformations are characterized by a red-purple color with warmth and palpable thrill.

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11. A 7-year-old girl who sustained burns to the head three years ago is scheduled to undergo reconstruction with tissue expansion. Preoperative physical examination shows a 7 × 14-cm area of alopecia on the scalp and scarring on the forehead. Which of the following is the most appropriate placement of tissue expanders in this patient?
- A) Deep to the galea and deep to the frontalis muscle
 - B) Deep to the galea and superficial to the frontalis muscle
 - C) Deep to the pericranium and deep to the frontalis muscle
 - D) Deep to the pericranium and superficial to the frontalis muscle
 - E) Superficial to the galea and deep to the frontalis muscle

The correct response is Option A.

To provide the maximal amount of safe expansion, tissue expanders are placed between the galea and periosteum in the scalp and between the frontalis muscle and periosteum in the forehead. Placement of the expander deep to the periosteum would result in difficult, painful, and unpredictable expansion. Placement of the expander superficial to the galea might result in premature extrusion of the device and an unreliable flap after its removal. Expansion of the galea and frontalis is critical in optimizing blood supply to the expanded forehead skin and scalp.

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12. A 3-year-old girl is brought to the office by her parents two months after sustaining an injury to the right ankle for evaluation of the scar shown. Which of the following is the most appropriate management?
- A) Excision
 - B) Oral administration of a corticosteroid
 - C) Radiation therapy
 - D) Topical administration of vitamin E
 - E) Observation

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The correct response is Option E.

This patient has a hypertrophic scar. Correct diagnosis of the abnormal scar will directly influence treatment options for this patient.

Hypertrophic scars and keloid scars are clinically distinct entities with different treatment approaches.

Hypertrophic scars develop soon after the injury (within six to eight weeks). They can worsen up to six months but subside with time. The extent of scarring relates to the initial depth of injury. Hypertrophic scars can produce contractures, especially over joints. The boundaries of the original scar are maintained. Hypertrophic scars have a predilection to occur over the flexor surface of joints.

Keloid scars may develop months after the injury. They seldom regress and are not associated with contractures. The boundaries of the original wound are overgrown, and the extent of the scar can far exceed the original tissue injury. Keloid scars are commonly found on the deltoid, upper back, chest, and earlobes.

Both hypertrophic and keloid scars are raised, erythematous, and often pruritic.

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13. A 12-year-old girl is brought to the office by her parents for consultation regarding a lesion on the posterior aspect of the scalp (shown). The lesion has been present since birth and has grown proportionately with the child. Which of the following is the most likely diagnosis?
- A) Compound melanocytic nevus
 - B) Keratoacanthoma
 - C) Nevus of Ito
 - D) Nevus of Ota
 - E) Nevus sebaceus of Jadassohn

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The correct response is Option A.

The lesion shown represents a compound melanocytic nevus, which is a benign neoplasm composed mostly of melanocytes. Congenital melanocytic nevi, such as this one, are believed to represent an anomaly in embryogenesis and, as such, could be considered a malformation or a hamartoma. Melanocytic nevi are common in light- or fair-skinned patients and are relatively uncommon lesions in dark-skinned individuals. There is no sexual predilection, and melanocytic nevi are most common in children and young adults. Excisional biopsy is the treatment of choice.

Keratoacanthomas are round, firm, pinkish red or flesh-colored papules that rapidly progress to dome-shaped nodules with a central crateriform ulceration or a horn-like keratin plug. It is a relatively common low-grade malignancy that originates in the pilosebaceous glands and closely and pathologically resembles squamous cell carcinoma.

A nevus of Ota is a blue-gray lesion occurring on the face in the distribution of the trigeminal nerve (particularly the ophthalmic and maxillary branches—V1 and V2).

A nevus of Ito is similar to the nevus of Ota but follows the distribution of the lateral brachial cutaneous and supraclavicular nerves.

A nevus sebaceus of Jadassohn is a yellow-orange, slightly elevated plaque that usually occurs on the face and scalp. It has the potential for malignant transformation to a basal cell carcinoma.

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14. Which of the following is an advantage of using bupivacaine over other local anesthetic agents?

- A) Increased vasoconstriction
- B) Less cardiotoxicity
- C) Less motor blockade
- D) Rapid metabolism
- E) Rapid onset of action

The correct response is Option C.

One of the advantages of using bupivacaine (Marcaine) is its ability to achieve sensory blockade at low concentrations with much less effect on motor blockade. This is also true of ropivacaine, which is the single S-enantiomer of racemic bupivacaine.

Unfortunately, bupivacaine has a much higher risk for cardiotoxicity, especially compared with lidocaine. Unlike lidocaine, which is a fast-in and fast-out sodium channel blocker, bupivacaine enters the sodium channel quickly but departs slowly and, therefore, may cause cardiac arrhythmias.

Bupivacaine does not cause significant vasoconstriction. However, used topically, cocaine produces excellent local anesthesia and vasoconstriction and, therefore, is used as a topical anesthetic for mucous membranes of the nose and mouth.

Bupivacaine has a somewhat longer time to onset of action compared with lidocaine and also has a long duration of action, lasting four to six hours. Therefore, it is indicated for longer procedures or procedures in which postoperative pain control is desired.

Unlike lidocaine, which can be added to tumescent fluid, bupivacaine is not recommended in such situations because of the high risk for cardiotoxicity.

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15. A 19-year-old man who sustained burns to 40% of the total body surface area at 4 years of age comes to the burn clinic for consultation regarding correction of the scalp defect shown. Physical examination shows patchy alopecia of the temporal scalp and hypertrophic scarring. Which of the following is the most appropriate surgical procedure for reconstruction of this patient's scalp?
- A) Hair transplantation with micrografts and minigrafts
 - B) Orticochea flap
 - C) Serial excision and closure
 - D) Temporoparietooccipital (Juri) flap
 - E) Tissue expansion

The correct response is Option E.

The patient shown has a large ($>25\text{ cm}^2$) parietal scalp defect that resulted from a flame burn. It is clear that hair transplantation has already been attempted with minimal take and coverage. Hair transplantation with micrografts and minigrafts is a technique that has been described to treat large areas of burn alopecia. However, it is usually reserved for smaller areas, or as a

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revisional procedure to camouflage incisions that result from rotational flaps.

Tissue expansion is the preferred method for secondary reconstruction of a large parietal scalp defect. Approximately 50% of scalp can be reconstructed with expanded scalp tissue, although this may require multiple stages. Expander complication rates may be as high as 25% and may include infection, exposure, extrusion, and device failure. Scalp expansion in children is difficult. There is a higher incidence of infection and decreased tolerance of pain. Moreover, there is a risk of skull deformation after a prolonged period of expansion. Therefore, deferral until the patient reaches young adulthood is reasonable.

Direct closure in a staged manner with serial excision or as a single-stage procedure with rotation advancement flaps is appropriate for small to medium-sized defects of the anterior and parietal scalp. The size of this defect would preclude this therapy in this case.

Temporoparietooccipital flaps as described by Juri are optimally suited for reconstruction of large defects of the anterior scalp. Orticochea flaps are classically described for reconstruction of large defects of the occipital scalp. They are not useful for parietal defects because tissue advancement from the contralateral parietal scalp up over the vertex is often inadequate for defect closure.

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16. A 60-year-old woman undergoes surgical excision of a 9-mm basal cell carcinoma from the dorsum of the nose. The resulting defect is 1.5 cm in diameter (shown). Which of the following modalities is most appropriate for aesthetic reconstruction of this defect?
- A) Banner flap
 - B) Bilobed flap
 - C) Full-thickness skin graft
 - D) Healing by secondary intention
 - E) Nasolabial flap

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The correct response is Option B.

The bilobed flap is the most appropriate choice for 0.5- to 1.5-cm defects of the nasal tip and ala (see photograph). Excess nasal skin high in the middle of the nose or high on the lateral aspect of the nose is the donor tissue. Generally, a laterally based design is used for defects of the tip and a medially based design is used for defects of the alar lobule. Undermining must be wide and just above the level of periosteum and perichondrium to preserve blood supply. The diameter of the first lobe is equal to the defect, and the second lobe is reduced in width to ease donor site closure. The bilobed flap donor incisions heal well in the skin of the nose. The bilobed flap is a single stage reconstruction.

Single-lobed flaps such as the banner flap are preferred in thin-skinned areas of the nose and may give a better aesthetic result than full-thickness skin grafting. In thicker skinned areas of the nose where the skin is less flexible, transposition of single-lobed flaps may distort adjacent areas.

Full-thickness skin grafting is best suited to the upper two-thirds of the nose with defects up to 2.5 cm wide. Skin grafting works well in areas of thin nasal skin and does not replace the thick

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skin of the lower nose in a cosmetically acceptable way. The skin grafts may appear depressed, shiny, and off-colored. Skin grafting requires a moist, vascularized wound bed and quilting sutures or bolster dressings for immobilization of the graft for the healing period.

Healing by secondary intention in the nasal tip will lead to distortion of the tip and is often not a viable option because of exposed cartilage in the tip after skin cancer excision.

The nasolabial flap is pedicled superiorly or inferiorly based on branches of the facial and angular arteries, and the donor site is closed in the contour of the nasolabial crease. The flap may be taken as a pedicled flap requiring pedicle division or as an island flap that may be performed in a single stage. Problems associated with use of the nasolabial flap include texture and color differences between the skin of the cheek and nose and possible loss of the cheek-nose concavity when reconstructing the nasal ala.

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17. A 53-year-old man has a Stage III pressure sore on the ischium. Negative-pressure wound therapy is planned. Which of the following wound characteristics is most likely to impair the efficacy of this treatment modality?

- A) Depth
- B) Diameter
- C) Edema
- D) Fibrosis
- E) Undermining

The correct response is Option D.

Chronic, fibrotic pressure sores are characterized by impaired wound healing and, therefore, respond poorly to negative-pressure wound therapy (NPWT). Debridement of fibrotic tissue and devitalized tissue in these pressure sores improves the response to NPWT.

NPWT is most appropriate for management of full-thickness pressure sores that are large enough for adequate contact between the foam dressing and the wound bed and for safe removal of the foam. NPWT can be used successfully for management of large pressure sores, shallow or deep pressure sores, and those with undermining or tunneling.

If the patient is a surgical candidate, NPWT can be used to temporize the wound until the patient has been readied for surgery (nutrition, antibiotics, stabilization of coagulopathy, etc.). NPWT may allow wound improvement such that a lesser surgical procedure may be done. If the pressure sore deteriorates or fails to progress in two to four weeks, NPWT may need to be discontinued.

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18. Which of the following percentages best represents the risk of transformation of a congenital giant nevus to malignant melanoma?

- A) 10%
- B) 20%
- C) 30%
- D) 40%
- E) 50%

The correct response is Option A.

Although it is generally accepted that giant congenital nevi may undergo transformation to malignant melanoma, the exact incidence is difficult to determine, due in part to limitations in methodology of the available studies. Recent reports cite an incidence ranging from 2.9% to 12.2%.

Giant congenital nevi at greatest risk for transformation to melanoma are those lesions that have a predicted largest diameter of 20 cm in adulthood. Current recommendations regarding the timing of excision are controversial, but these lesions should be removed as early as possible in childhood.

In addition to congenital melanocytic nevi, other precursor lesions that can degenerate into malignant melanoma include common acquired melanocytic nevi, dysplastic nevi, and melanoma in situ.

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19. A 37-year-old man is brought to the emergency department because he has pain, paresthesia, and difficulty extending the fingers of the right hand one hour after he sustained a high-voltage electrical injury. Physical examination shows burns over 20% of the total body surface area with an entrance wound in the right forearm and an exit wound in the left lower abdomen. Which of the following is the most appropriate management?
- A) Decompressive fasciotomy of the right forearm
 - B) Elevation and splinting of the right upper extremity
 - C) Infusion of calcium gluconate
 - D) Serial physical examinations of the right upper extremity over eight hours
 - E) Tangential excision of burned tissue and coverage with allografts

The correct response is Option A.

Compartment pressures greater than 30 mmHg, worsening paresthesia, pain on passive range of motion, or pulselessness in an extremity mandate immediate decompression as part of acute resuscitation after electrical injury. Fasciotomies should also include decompression of the median and ulnar nerves at the level of the wrist, as well as decompression of the pronator quadratus, which often sustains significant collateral injury, given its proximity to bone, which has higher resistance than the soft tissue and generates greater heat than more superficial structures. Decompression of the ulnar nerve at the level of the cubital tunnel should also be considered.

Elevation and splinting are helpful adjuncts after burn injury to an extremity, but these measures should not delay the definitive management of compartment syndrome, which is fasciotomy.

Infusion of calcium gluconate is indicated after hydrofluoric acid chemical burns.

Although serial physical examination is a guiding diagnostic principle of surgery, this approach is contraindicated in a patient who meets criteria for compartment syndrome and requires fasciotomy.

Although wide excision of burned tissue is desirable, it is often difficult to appreciate the full magnitude of tissue loss, arguing against immediate excision and definitive coverage. Staged excision, combined with temporary coverage, is acceptable after distal perfusion has been restored.

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20. A 59-year-old man comes to the office for follow-up examination three weeks after undergoing left total knee replacement. Physical examination shows a draining sinus on the distal aspect of the knee. Surgical removal of the hardware and flap reconstruction are planned. Which of the following is the dominant pedicle to the muscle flap that is most appropriate for reconstruction?
- A) Anterior tibial artery
 - B) Ascending branch of the medial circumflex femoral artery
 - C) Medial sural artery
 - D) Perforating branch of the distal superficial femoral artery
 - E) Proximal branches of the posterior tibial artery

The correct response is Option C.

The muscle flap best suited to reconstruct this defect is a medial head of gastrocnemius muscle rotation flap. Its dominant pedicle is the medial sural artery, which is a branch of the popliteal artery.

The ascending branch of the medial circumflex artery is the dominant pedicle to the gracilis flap, whereas the minor pedicles are perforating branches of the distal superficial femoral artery. A proximally based gracilis flap would not have the arc of rotation to adequately cover the knee. A distally based flap would require a delay procedure and is not the best choice for this defect.

The lateral sural artery is the dominant blood supply to the lateral head of the gastrocnemius, which is smaller, and, therefore, not as well suited for coverage of large patellar defects such as this one.

The soleus is based off the proximal two branches of the posterior tibial artery, branches of the proximal popliteal, and branches of the peroneal artery. It is used for reconstruction of defects of the middle third of the lower extremity and does not have an arc of rotation sufficient enough to cover this defect.

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21. A 49-year-old woman with a 20-year history of paraplegia comes to the office for consultation regarding a chronic ulcer of the right ischium. She has been treating the wound twice daily with saline-soaked gauze dressings. Wound drainage has increased and become foul-smelling during the past week. The patient has smoked one pack of cigarettes daily for the past 15 years. Height is 5 ft 1 in and weight is 92 lb. The patient breathes comfortably on room air, is afebrile, and is not in acute distress. Physical examination of the ischial region shows a 5-cm-deep wound that is necrotic and extends to the ischial bone. Hip flexion contractures are noted. Culture of the wound shows gram-positive cocci and gram-negative rods. Laboratory studies show the following:

Hemoglobin	9.1 g/dL
Hematocrit	27%
Leukocyte count	12.5/mm ³
Serum albumin	2.4 g/dL
Urine:	
Leukocytes	Many
Leukoesterase	Positive

Which of the following is the most appropriate next step in management?

- A) Bone scan
- B) Debridement and closure of the wound with a muscle flap
- C) Excision of the ulcer
- D) In-office debridement and application of collagenase dressings
- E) Intravenous antibiotic therapy

The correct response is Option C.

The patient described has an ischial decubitus ulcer resulting from prolonged pressure in the sitting position. The wound necrosis, elevated white blood cell count, and Gram stain merit immediate surgical intervention. The best immediate surgical option is complete ulcer excision including the underlying bursa and exposed ischium. Bone should be resected until firm, bleeding cortex is encountered and debrided bone should be sent for culture. The extension of the ulcer to bone indicates clinical osteomyelitis, and a bone scan will not change management in this patient.

Office debridement and chemical debridement dressings are not sufficient treatments for a wound of this severity. Although culture-specific antibiotics are an essential part of treatment, this patient's clinical status will not improve without debridement of all nonviable tissues. This patient has multiple risk factors for healing problems and ulcer recurrence, including malnutrition, systemic infection, smoking, and contractures that will inhibit rehabilitation and positioning. A single-stage debridement and flap reconstruction can be performed in optimal patients. Considering this patient's high risk of recurrence, debridement should be followed by wound care, antibiotics, nutritional optimization, smoking cessation, and physical therapy to improve her hip contractures. After her overall health status improves, flap reconstruction will have a higher chance of success. Recurrence of ulceration is extremely common over the long term, exceeding 50%. Having a patient willing to make the lifestyle changes and sacrifices necessary to avoid excess pressure and maintain optimal health cannot be overemphasized as the key to long-term success.

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22. A 37-year-old African American woman comes to the office for consultation regarding a 5-cm nodule on the posterior aspect of the left earlobe that has been enlarging over the past three months. There is no history of trauma. Which of the following are the most likely biologic and morphologic characteristics of this patient's lesion?

<u>Fibroblast Proliferation</u>	<u>Myofibroblast Status</u>	<u>Blood Vessel Density</u>
A) Increased	Absent	Decreased
B) Increased	Present	Increased
C) Normal	Absent	Increased
D) Normal	Present	Decreased
E) Normal	Present	Increased

The correct response is Option A.

The patient described has an earlobe keloid. The distinction between hypertrophic and keloid scars is often difficult to make based on clinical features. Keloids are more frequently associated with more darkly pigmented skin and are commonly seen on earlobes or in the deltoid or presternal region.

Keloids and hypertrophic scars can also be difficult to differentiate histopathologically and biologically. Recent advances in cellular biology have identified several key differences between the two.

The predominant cell of scar tissue is the fibroblast, which is responsible for producing collagens. Various in vitro studies have shown that fibroblasts cultured from keloids have increased proliferation rates and decreased apoptosis when compared with fibroblasts cultured from both hypertrophic scars as well as from normal skin.

While morphologic and immunohistochemical changes occur within a scar as it matures, immature hypertrophic scars express an increased density of blood vessels, whereas keloid scars show a decreased density of blood vessels. Myofibroblasts are present in hypertrophic scars but absent in keloids, which in general, are far less cellular.

Both transforming growth factor (TGF)- β 1 and TGF- β 2 have been shown to be expressed in greater levels in fibroblasts from both keloids and hypertrophic scars when compared with those from normal skin.

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

23. A 27-year-old woman with a history of intravenous drug use has a persistent abscess and cellulitis of the dorsal aspect of the left hand. A photograph of the hand is shown. Three days ago, incision and drainage were performed using local anesthesia in the emergency department, and the patient was then admitted to the hospital for intravenous administration of piperacillin with tazobactam. Results of culture of the wound tissue are pending. Current physical examination shows that the cellulitis has not resolved satisfactorily. Which of the following is the most likely causative organism of this infection?

- A) *Bacteroides fragilis*
- B) *Escherichia coli*
- C) Group B streptococcus
- D) *Pseudomonas aeruginosa*
- E) *Staphylococcus aureus*

The correct response is Option E.

The infection described is most likely caused by a subset of *Staphylococcus aureus*, which is methicillin-resistant. Although methicillin-resistant *S. aureus* (MRSA) has traditionally been

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iatrogenic in its etiology, community-acquired MRSA is becoming more prevalent. In the Emergency Department population, the proportion of soft tissue infections presenting with MRSA is increasing. MRSA is not sensitive to penicillin-related antibiotics such as piperacillin/tazobactam and typically requires vancomycin or linezolid for effective treatment. Older antibiotics such as clindamycin and trimethoprim-sulfamethoxazole may also be effective in treating MRSA. MRSA takes longer than the other bacteria listed to grow out in culture.

Bacteroides fragilis, *Escherichia coli*, group B streptococcus, and *Pseudomonas aeruginosa* are all common bacteria found in abscesses of the hand; however, they are all sensitive to penicillin-related antibiotics such as piperacillin/tazobactam.

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24. A 56-year-old woman has a 1.6-cm full-thickness defect of the alar rim after undergoing Mohs micrographic surgery of the nose because of skin cancer. Which of the following flaps is most appropriate for reconstruction of this defect?

- A) Axial frontonasal (Rieger) flap
- B) Helical root free flap
- C) Nasolabial flap
- D) Paramedian forehead flap
- E) Slide-swing lateral nasal wall flap

The correct response is Option C.

Although all of the approaches listed have been described for nasal reconstruction, a two-stage nasolabial flap provides the best reconstruction, in terms of form and function, of this 1.6-cm alar rim defect. An axial frontonasal flap, first described by Rieger and later modified by Marchac and Toth, is an excellent option for midline dorsal defects less than 2.0 cm, but this flap will not easily reach the most lateral portion of the alar rim. Although a single-stage nasolabial flap is technically possible, the base remains bulky and the cheek-sidewall junction is flattened. Finally, both the paramedian forehead flap and helical root free flap can be used for this defect but are considerably more complex procedures than the nasolabial flap and are not justified. The slide-swing flap would not provide adequate tissue for closure of the defect.

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25. A 37-year-old woman who underwent full-face resurfacing with a carbon dioxide laser seven days ago comes to the office because she has chills, malaise, and painful lesions of the face. Temperature is 38.7°C (101.7°F). Physical examination shows ulcerated, diffusely distributed lesions over the face. A four-day regimen of acyclovir 400 mg three times daily has not alleviated the patient's symptoms. Results of Tzanck smear and viral culture are pending. Which of the following therapies is the most appropriate next step in management?

- A) Intravenous acyclovir and ciprofloxacin
- B) Oral acyclovir at a higher dose
- C) Oral acyclovir at a more frequent dose
- D) Oral valacyclovir
- E) Oral valacyclovir and ciprofloxacin

The correct response is Option A.

The patient described has a presumptive diagnosis of cutaneous herpes simplex. Herpes simplex commonly is activated by laser resurfacing, spreads readily, and may scar. To avoid this complication, antiviral prophylaxis with one of the established drugs (acyclovir [Zovirax], famciclovir [Famvir], or valacyclovir [Valtrex]) should be started 24 to 48 hours before a laser resurfacing procedure and continued for 10 days until re-epithelialization is complete.

Herpes simplex is difficult to recognize on resurfaced skin. Moreover, primary or secondary bacterial infection cannot be overlooked. Therefore, antibiotic coverage is prudent, particularly until culture results are available.

When a patient experiences an outbreak of herpes simplex despite the use of antiviral prophylaxis, the physician should perform a Tzanck smear and send viral, fungal, and bacterial cultures. The anti-herpetic dosage should be increased to zoster levels as well (acyclovir 800 mg five times a day, valacyclovir 500 mg three times a day).

This patient presented with signs and symptoms of systemic herpetic infection, which may include disseminated cutaneous lesions, shortness of breath, high fever and chills, malaise, headache, and neurologic changes. When these are present, hospital-based treatment with intravenous antiviral and antibiotic therapy is warranted.

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26. A healthy 7-year-old boy with anotia undergoes reconstruction of the right ear via implantation of a high-density porous polyethylene prosthesis. Compared with use of autologous cartilage, which of the following is the most likely result of this procedure?

- A) Higher incidence of contour deformities
- B) Higher incidence of extrusion
- C) Increased likelihood of malposition
- D) Lower incidence of infection
- E) More resorption of the implant over time

The correct response is Option B.

High-density porous polyethylene (Medpor) is an alloplastic implant material that is nonresorbable and highly biocompatible. It has an intramaterial porosity with a pore size between 125 and 250 μm , which permits extensive fibrovascular ingrowth throughout the implant. Although limited bony ingrowth may occur in select clinical circumstances, the material should not be considered truly osteoconductive. This bony and fibrovascular ingrowth can make this type of material somewhat difficult to remove. Studies have shown less underlying bone resorption occurs with high-density polyethylene than with other implant materials. As an alloplastic material, it should not be placed in contaminated wound beds, because it can get easily infected, and should always be positioned in areas of adequate soft tissue cover to prevent extrusion. The incidence of extrusion is higher in microtia reconstruction and nasal dorsum augmentation for this reason.

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27. A 38-year-old man undergoes extensive debridement of skin, subcutaneous tissue, and fascia on the right chest wall (shown) for progressive Type II monomicrobial necrotizing fasciitis. Results of culture are pending. In combination with penicillin, which of the following antibiotics is the most appropriate initial therapy?

- A) Ciprofloxacin
- B) Clindamycin
- C) Gentamicin
- D) Metronidazole
- E) Vancomycin

The correct response is Option B.

Necrotizing fasciitis is a severe form of subcutaneous infection that tracks along fascial planes often extending beyond the superficial signs of infections. Early diagnosis and treatment are critical in reducing mortality. Early surgical intervention is often required for diagnosis and treatment.

Initial antibiotic therapy is directed at the most likely pathogens. Two clinical subtypes of

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necrotizing fasciitis have been identified. Type I is a polymicrobial infection caused by aerobic and anaerobic bacteria occurring primarily in patients who are immunocompromised or have certain chronic diseases like diabetes.

Type II is a monomicrobial infection that can occur in healthy individuals in any age group. Often, the individual has a history of blunt trauma, penetrating injuries or lacerations (often minor), surgical procedures, childbirth, or burns.

In Type II fasciitis, the most common causative organisms are group A streptococci. Clindamycin and penicillin in combination are recommended. Clindamycin has been shown to suppress toxin production, whereas metronidazole has not. Clindamycin also facilitates phagocytosis of *Streptococcus pyogenes*. Penicillin is added because of increasing resistance of group A streptococci to clindamycin.

Infection with *Staphylococcus aureus* is a less common cause of Type II necrotizing fasciitis. Oxacillin could be used to treat susceptible *S. aureus* infection, whereas vancomycin is appropriate therapy for methicillin-resistant *S. aureus* (MRSA).

Type I necrotizing fasciitis requires a multiple antibiotic regimen to cover aerobic and anaerobic bacteria. Therefore, broad-spectrum coverage with ampicillin-sulbactam, clindamycin, ciprofloxacin, or gentamicin is recommended.

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28. A 45-year-old woman comes to the office for consultation regarding multiple actinic keratoses on the face. Physical examination shows fair-skinned complexion and small scaly patches on the face and ears. Which of the following interventions will result in the most desirable long-term aesthetic appearance in this patient?

- A) Cryosurgery
- B) Electrodesiccation and curettage
- C) Excision of the lesions with 2-mm margins
- D) Microdermabrasion
- E) Topical application of 0.5% fluorouracil cream

The correct response is Option E.

Several formulations and concentrations of topical fluorouracil have received U.S. Food & Drug Administration (FDA) approval for the treatment of keratotic lesions. Fluorouracil 5% and 0.5% creams have demonstrated, in clinical trials, a marked ability to eradicate keratotic lesions. The cosmetic result is often far better than surgical excision. Irritation at the application site, erythema, and burning are common side effects of both formulations, but comparative data suggest that the fluorouracil 0.5% cream is more cost-effective and may be safer, more tolerable, and as effective as fluorouracil 5% cream. Actinic keratosis is a common sun-induced skin disease. Recent molecular studies indicate an association between actinic keratosis and squamous cell carcinoma. Although 60% of squamous cell carcinoma cases begin as actinic keratosis, the risk of progression to squamous cell carcinoma is minimal. Other methods of treatment such as cryosurgery, topical trichloroacetic acid, and curettage should be used with caution because hypopigmentation with scarring may result. Microdermabrasion is not an acceptable treatment for actinic keratosis.

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29. Which of the following injectable fillers has the highest concentration of hyaluronic acid per volume of injectate?

- A) CosmoDerm
- B) CosmoPlast
- C) Radiesse
- D) Restylane
- E) Sculptra

The correct response is Option D.

Restylane is a U.S. Food & Drug Administration (FDA)-approved non-animal-stabilized hyaluronic acid derivative used for soft-tissue augmentation. Unlike Hylaform gel, it is derived from streptococcal bacterial fermentation and does not require an animal source. At 20 mg/ml, Restylane has a higher concentration of hyaluronic acid than Hylaform gel. It is used to treat rhytides and scars and in lip augmentation. Restylane correction was noted to be 82% at three months and 33% at one year in a study involving 285 wrinkles treated in 113 patients.

Hylaform gel, previously known as Hylan B gel, is a form of cross-linked hyaluronic acid (5.5 mg/ml) derived from the rooster combs of domestic fowl. It is reported to be less immunogenic and longer lasting than bovine collagen. One study showed 86% histologic persistence of Hylaform gel compared with 25% of bovine collagen in guinea pigs at 26 weeks. Besides being longer lasting than collagen, proponents say it has less risk of clumping and goes in more smoothly. Overcorrection is not needed with this product.

CosmoDerm and CosmoPlast are FDA-approved fillers consisting of natural human collagen grown under controlled laboratory conditions. Pretreatment skin tests are not necessary, and the materials are screened for purity. Both products contain 35 mg/ml of human-derived collagen in phosphate-buffered physiologic saline containing 0.3% lidocaine. CosmoDerm is not cross-linked and is used to treat superficial lines and wrinkles, whereas CosmoPlast is cross-linked with glutaraldehyde and can be used for deeper wrinkles.

Radiesse is composed of microspheres of calcium hydroxyl apatite suspended in an aqueous gel carrier. These biodegradable microspheres serve as a lattice upon which the body forms a scaffold for tissue infiltration. The spheres degrade slowly over years for a longer-lasting, semipermanent effect.

Sculptra is a poly-L-lactic acid that is FDA approved for management of HIV facial lipoatrophy. It serves as a volume enhancer and is used for indications similar to those for autologous fat transfer. Results are not immediate; treatment is performed as a series of three to five treatments

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30. A 17-year-old girl comes to the office because she has had lesions on the upper arms and in the axillary folds for the past eight years. Physical examination shows clusters of white, vesicular lesions ranging from 2 to 5 mm in diameter. The lesions are obliterated with gentle pressure but refill when pressure is removed. Diffuse swelling is palpable in the underlying subcutaneous tissue. Which of the following is the most likely diagnosis?
- A) Blue rubber bleb nevus syndrome
 - B) Lymphangioma circumscriptum
 - C) Maffucci syndrome
 - D) Osler-Weber-Rendu syndrome
 - E) Sebaceous nevus

The correct response is Option B.

Lymphangioma circumscriptum consists of clusters of small to moderate-sized, clear to whitish-appearing vesicular lesions. These lesions can be obliterated with gentle pressure, but they refill with the lymph when the pressure is removed due to the presence of communications with larger underlying cisterns of lymphatic malformation. Clear vesicles may be present on apparently normal skin or may top small papules. Although the classic lesion can occur anywhere on the body, it is particularly common over proximal parts of limbs and adjacent parts of the limb girdle including the upper arm, axillary, pectoral, and scapular regions. Adequate treatment of lymphangioma circumscriptum usually involves excision of the involved skin as well as the deeper lymphatic components.

Blue rubber bleb nevi usually present as raised blue to purple rubbery cutaneous lesions that are easily compressible. This is a rare morphogenetic disorder consisting of malformed vascular channels within the skin and bowel. When blood is expressed from the vesicles, the deflated blister becomes a wrinkled sac. When pressure is released, the deflated blisters refill with blood. The lesions sometime present at birth, but more frequently appear throughout adolescence. Subtotal excisions of tender or painful skin lesions can be of symptomatic relief.

Maffucci syndrome classically presents as blood-like, spongy, papular, or pedunculated vascular malformations in association with enchondromas. Visceral vascular malformations may also be present, and the involved bones are usually shortened and deformed. Approximately 20% of the enchondromas can degenerate into chondrosarcoma, which is usually manifest by increasing size and pain of a particular lesion.

Osler-Weber-Rendu syndrome presents as malformed ectatic vessels in the skin, mucous

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membranes, and viscera appearing after puberty and multiplying with advancing age. Hemorrhage from the lesions presents as epistaxis, hematemesis, hematuria, or melena.

Sebaceous nevi usually develop as firm, plaque-like, waxy-appearing yellowish lesions developing on the scalp. These are potentially premalignant lesions. Generally, these lesions should be excised, because there is an approximately 5% incidence of malignant degeneration, particularly during adolescence. Hair growth in these lesions is sparse to absent.

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31. A 27-year-old woman is scheduled to undergo rhinoplasty using homograft rib cartilage for reconstruction of the dorsum of the nose. Which of the following interventions during this procedure is most effective to reduce long-term warping of the graft?
- A) Access to a peripheral segment
 - B) Insertion of the graft at least 30 minutes after carving
 - C) Scoring of the graft
 - D) Suture fixation
 - E) Use of nonirradiated material

The correct response is Option B.

To minimize the long-term clinical effects of cartilage warping, it is recommended to wait at least 30 minutes after carving the graft to allow initial warping to occur. The observed warping can then be accounted for in the final graft placement. Further warping may continue for some time, but the majority will occur within the first 30 to 60 minutes.

Use of nonirradiated graft material may predispose more warping than irradiated material; however, this may depend on the dose of radiation. Doses of 3 to 4 million rads are less likely to result in graft warping compared with no radiation, but at doses of 1.5 to 2.5 million rads, the warping may be similar to that of nonirradiated grafts.

Central cuts of cartilage grafts are less likely to warp than are peripheral cuts. Scoring of the graft will result in warping of the graft. Suture fixation will not prevent graft warping.

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32. A 23-year-old woman with neurofibromatosis comes to the office for consultation regarding lesions on the face and trunk that have appeared during the past 10 years. She is dissatisfied with the cosmetic appearance of a lesion on her nose and is concerned about a lesion on the left hip that has been enlarging and is painful on application of pressure. Physical examination shows multiple small, flesh-colored masses on the face and trunk ranging from 5 to 35 mm in diameter. Punch biopsy shows neurofibromas. Which of the following is the most appropriate management of the lesions on the patient's nose and hip?
- A) Injection of a corticosteroid
 - B) Nd:YAG laser resurfacing
 - C) Radiation therapy
 - D) Surgical excision
 - E) Observation only

The correct response is Option D.

Neurofibromatosis is an autosomal-dominant disorder that can affect the skin, soft tissues, bone, and central nervous system. The treatment of isolated soft tissue and skin nodules is primarily surgical. Lesions are composed of Schwann cells, fibroblasts, and mast cells. Malignant transformation may occur in 3% to 15% of patients over their lifetime. Any lesions that grow rapidly or cause pain should be excised or biopsied to exclude neurofibrosarcoma. Observation is, therefore, not appropriate in this case. Laser resurfacing is not useful for lesions that originate in the subcutaneous tissues. Injection of corticosteroids and radiation have no role in treatment. In healthy patients, lesions may also be removed for cosmetic reasons.

This condition is known as von Recklinghausen's neurofibromatosis. The disease can range from mild, as in this case, to severe and devastating deformity. Café-au-lait macules may develop in early childhood. Other physical signs may include hamartomas of the iris (Lisch nodules) and axillary freckling. Central nervous system lesions, such as acoustic neuromas and meningiomas, may occur. Many patients have learning disabilities, and up to 10% may have mental retardation. Pheochromocytomas are also more common in this patient population.

Multiple variants of the disease exist with neurofibromatosis type 1 (NF-1) primarily affecting the peripheral nervous system and neurofibromatosis type 2 (NF-2) affecting the central nervous system. The incidence is approximately 1 in 3000 live births for NF-1 and 1 in 50,000-120,000 live births for NF-2. It occurs with equal frequency across all races and among men and women. Genetic mutations have been identified in the production of a protein, neurofibromin, which acts as a tumor suppressor.

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33. Which of the following laboratory results of fluid analysis is increased in chronic wounds relative to acute wounds?

- A) Growth factor level
- B) Matrix deposition
- C) Metalloproteinase level
- D) Protease inhibitor level
- E) Tissue oxygen tension

The correct response is Option C.

Chronic wounds have an interruption in the natural sequence of wound healing involving a highly regulated cascade of events among many cell types, soluble factors, and matrix components. The chronic wound microenvironment is characterized by an imbalance between matrix-degrading enzymes and their inhibitors. Metalloproteinase levels are elevated relative to acute wounds, resulting in extracellular matrix degradation.

In chronic wounds, the healing process is disrupted by a prolonged inflammatory phase. Proinflammatory cytokines are elevated, which leads to an increase in protease activity and a decrease in protease inhibitor and growth factor levels. This results in decreased matrix deposition, which prevents epithelization and healing.

Tissue oxygen tension is abnormally low in the central aspect of chronic wounds.

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34. A 14-year-old boy is brought to the emergency department by his parents one hour after he had sudden onset of swelling, tenderness, and tension of a lymphatic malformation on the right leg. The boy's parents say that the lesion has been present since 3 years of age and has been enlarging since that time. Which of the following is the most appropriate initial management?

- A) Administration of an antibiotic
- B) Compression of the entire leg
- C) Lymphovenous shunting
- D) Pulsed-dye laser therapy
- E) Surgical decompression

The correct response is Option A.

In a patient with a large lymphatic malformation who presents with sudden expansion of a lesion along with tenderness and tenseness, the most likely diagnosis is infection. Although prophylactic antibiotics are generally not indicated for patients with lymphatic malformations, it is wise to prescribe a broad-spectrum antibiotic with instructions to administer it and see a physician at the first signs of infection.

Although elevation of the extremity may be reasonable, there is no role for compression if infection is ongoing. Laser therapy may be used to treat lymphatic vesicles on a mucosal surface but will not treat the deeper malformations. In the case of acute infection, there is no role for surgical decompression, and lymphatic malformations do not respond to shunting of the lymphatic fluid.

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35. Alopecia results when which of the following changes in the hair growth cycle occur?

- | <u>Shortened</u> | <u>Prolonged</u> |
|------------------|------------------|
| A) Anagen phase | Catagen phase |
| B) Anagen phase | Telogen phase |
| C) Catagen phase | Telogen phase |
| D) Telogen phase | Anagen phase |
| E) Telogen phase | Catagen phase |

The correct response is Option B.

Balding occurs when the anagen phase is shortened and the telogen phase is prolonged.

Human hair undergoes a normal cycle of growth and rest characterized by three stages: anagen, catagen, and telogen. The anagen (active) phase lasts 1000 days in men and two to five years longer in women. At any one time, 85% to 90% of hairs are in the anagen phase. The catagen (degradation) phase follows anagen and lasts several weeks. During this phase, the follicular bulb atrophies and degrades. After this, the telogen (resting) phase begins and lasts two to four months. At any given time, approximately 10% of hairs are in the telogen phase. On average, 50 to 100 telogen hairs fall out every day and are replaced with new growing hairs. Balding occurs when the anagen (active) phase is shortened and the telogen (resting) phase is prolonged.

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36. Which of the following is most appropriate in preparation of deep partial-thickness burn injuries to the hand before skin grafting?

- A) Application of topical enzymatic debriding agents
- B) Delay of surgical intervention until natural separation of eschar occurs
- C) Excision of the skin to the viable subcutaneous fat
- D) Tangential excision until pinpoint bleeding occurs
- E) Whirlpool hydrotherapy until indeterminate areas are declared

The correct response is Option D.

The best treatment of eschar in deep partial thickness or indeterminate burn injuries is early tangential excision until pinpoint bleeding occurs.

Proper diagnosis, evaluation, stabilization, and resuscitation are required in every case. In patients with multiple traumatic injuries, other injuries must be assessed and treated before excision of the primary burn. After it has been established that no contraindications to immediate primary excision exist, the patient is taken to the operating room, where all burn excisions, tangential or full thickness, are performed with the patient under general anesthesia administered by personnel experienced in burn injuries. Areas of obvious full-thickness burn are excised to the level of viable fat or fascia using electrocautery.

Delay of surgical intervention until natural eschar separation has been shown to significantly increase mortality, increase hospitalization, increase incidence of burn wound sepsis, and also contribute to burn scar hypertrophy and contracture.

Early surgical excision into viable subcutaneous fat is not appropriate for partial-thickness or indeterminate burns. It is, however, appropriate management of obvious full-thickness burns.

Deep partial-thickness eschars, and also areas of indeterminate burn, are treated by tangential excision using a Goulian knife. Tangential excision continues in these areas until pinpoint bleeding is seen. The points of bleeding are close together in the upper layers of the dermis, known as the papillary dermis. Burn wounds at this level are partial-thickness injuries that heal adequately with a biologic barrier material. If tangential excision proceeds to the reticular dermis, which is in the deeper dermal layers, bleeding points become more widely separated. At these deeper levels of tangential excision, the yellow hue of subcutaneous fat may become visible. Tangential excision to this deeper layer is best treated with a biologic barrier material followed by skin grafting.

Application of topical enzymatic debriding agents and whirlpool hydrotherapy are inappropriate

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for management of burn eschar.

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37. Compared with cortical bone, which of the following best characterizes autologous cancellous bone grafts?

- A) Effective in bridging defects larger than 6 cm
- B) Greater structural strength
- C) Less osteoconductive
- D) Less osteoinductive
- E) More readily revascularized and remodeled

The correct response is Option E.

Relative to cortical bone, cancellous bone grafts are more osteoconductive (the property of the scaffold-like matrix to accommodate the ingrowth of new bone) and more osteoinductive (the capacity to induce mesenchymal cells from the recipient bed to produce active osteoblasts). Cancellous bone is more quickly revascularized, which usually occurs within two weeks of grafting, whereas cortical bone can take up to two months to revascularize. Cancellous grafts are also more easily remodeled. Cancellous bone grafts are ideal for bridging bone gaps of less than 5 to 6 cm, but suffer from a lack of structural rigidity until 6 to 12 months after grafting, when they are generally as strong as cortical bone grafts.

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38. The dominant pedicle of the gracilis muscle flap is located between the adductor longus and which of the following muscles?

- A) Adductor brevis
- B) Adductor magnus
- C) Pectineus
- D) Sartorius
- E) Semitendinosus

The correct response is Option A.

The dominant pedicle of the gracilis muscle flap is located between the adductor longus and adductor brevis muscles. The pectineus, adductor magnus, sartorius, and semitendinosus muscles are anatomically incorrect relative to the location of this pedicle.

Although the origin of the dominant vascular pedicle to the gracilis muscle flap may originate from either the profundus femoris or medial circumflex femoral vessels, the course of this vascular pedicle is consistent and runs between the adductor longus and adductor brevis muscles. This vascular pedicle enters the gracilis muscle approximately 8 to 10 cm below the pubic tubercle. The superficial position of the gracilis muscle, its thin, ribbon-like character, and also its consistent vascular anatomy allow this muscle flap to remain one of the most useful muscles in the field of microvascular surgery. Although the dominant vascular pedicle easily nourishes the entire muscle, the distal third of the skin overlying the gracilis muscle does not receive sufficient blood supply for reliable transfer.

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39. A 22-year-old man comes to the emergency department because he has a lump on the distal volar forearm three weeks after he sustained a stab wound just proximal to the wrist. He did not seek treatment at the time of the injury. Current physical examination shows a warm 2 × 2-cm mass with surrounding prominent veins. A thrill is palpated and a bruit is heard over the mass. A positive Branham sign is noted. Which of the following is the most appropriate next step?
- A) Comparative plethysmography with the contralateral limb
 - B) Ligation of feeding vessels without resection
 - C) Magnetic resonance angiogram of the affected wrist
 - D) Percutaneous biopsy of the mass
 - E) Observation

The correct response is Option C.

The patient described has an acquired arteriovenous fistula after penetrating trauma, which represents an abnormal connection between an artery and vein. The affected area is usually enlarged, warm, and has distended and often pulsatile superficial veins. A thrill can be palpated over the fistula, and a bruit may be present. In severe cases, altered hemodynamics may cause heart failure if a significant portion of the cardiac output is diverted through the fistula. The Branham sign indicates slowing of the heart rate upon compression proximal to the arteriovenous malformation.

The next appropriate step is a magnetic resonance angiogram of the affected wrist to delineate the nature and extent of the fistula. It also helps rule out traumatic pseudoaneurysm and helps plan for the subsequent surgical procedure.

Comparative plethysmography with the contralateral limb is typically used to quantify flow in an entire limb, but assessing blood flow through localized areas is difficult.

Ligation of feeding vessels without surgical resection will result in rapid recruitment of collateral vessels and is contraindicated.

Percutaneous biopsy is contraindicated in pulsatile lesions.

Observation in a case of an enlarging pulsatile lesion is not appropriate.

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40. A 57-year-old man comes to the office for follow-up examination eight days after he underwent composite grafting from the right auricle for repair of a 1.4-cm alar defect. He does not smoke cigarettes. Physical examination shows a 5-mm region of yellow eschar in the center of the graft, which is cyanotic. Which of the following is the most appropriate next step in management?

- A) Application of ice compresses
- B) Debridement of eschar and coverage with a local flap
- C) Leech therapy
- D) Continued observation

The correct response is Option D.

Auricular composite grafts are frequently used to reconstruct small defects of the alar rim. Unlike skin grafts, composite grafts only interface with the recipient bed along their perimeter; therefore, graft size should be no larger than 1.5 cm in diameter, so the center of the graft is never more than 5–8 mm from a blood supply.

The clinical appearance of a healing composite graft follows a reproducible pattern. The graft can look very white for the first six to eight hours. A slight pink tinge thereafter signals the earliest stage of revascularization. Within one to two days, the graft should appear cyanotic secondary to venous congestion, and this can persist for approximately one week. The graft will ultimately become pink and then more red as revascularization intensifies. The redness will fade, and the tissue acquires its final tone within six months to one year.

A lingering whitish area in the center of a cyanotic graft most likely represents impending necrosis. However, even if eschar develops, it should not be debrided. It may only be superficial, with the underlying dermis and cartilage still viable. Removing the eschar may dislodge the surviving portion of the graft and also places it at increased risk for infection. The eschar will likely slough within three to four weeks. Therefore, continued observation is the most prudent initial step in management.

Postoperative cooling is recommended to decrease the metabolic rate of the grafted tissue until secondary revascularization has taken place. This therapy would likely be ineffective one week after surgery and may compromise the neovascularization through vasoconstriction.

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41. During dissection for a microsurgical free parascapular flap, the circumflex scapular artery is located in the triangular space bordered by the teres minor, the long head of the triceps, and which of the following muscles?
- A) Infraspinatus
 - B) Latissimus dorsi
 - C) Subscapularis
 - D) Teres major
 - E) Trapezius

The correct response is Option D.

The scapular area supplied by the circumflex scapular artery is a commonly used donor site in reconstructive microsurgery because of the consistent and reliable vascular anatomy, easily accessible pedicle, and good vessel diameter and length. The circumflex scapular artery arises from scapular artery approximately 3 to 4 cm from its origin at the axillary artery. It then passes through the triangular space, which is bordered above by the teres minor, the teres major below, and the long head of triceps laterally. Flap size can reach 10 × 25 cm with generally closure of the defect directly with acceptable scarring. Parascapular osteocutaneous flaps can also be harvested using the lateral border of the scapula, which is useful for reconstruction of the hand and face.

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42. Which of the following skin lesions meets criteria for sentinel lymph node biopsy (SLNBx)?

- A) Basal cell carcinoma (8 cm wide) on the anterior chest
- B) Melanoma (1.6 mm thick) of the breast with bulky axillary adenopathy
- C) Melanoma-in-situ on the shoulder
- D) Squamous cell carcinoma (1.8 cm wide) on the dorsum of the hand
- E) Squamous cell carcinoma (2 cm wide) in a 26-year-old burn scar of the foot

The correct response is Option E.

Sentinel lymph node biopsy (SLNBx) is a well-established staging procedure for melanoma and breast cancer. A patient with melanoma in situ, by definition, does not have invasion and, therefore, would not benefit from SLNBx. Conversely, the patient with bulky adenopathy most likely has regional metastatic disease and requires formal lymphadenectomy. Indications for SLNBx in non-melanoma skin cancers are evolving and currently include squamous cell carcinoma greater than 2 cm in diameter, Merkel cell carcinoma, and Marjolin ulcer (burn scar carcinoma). Basal cell carcinomas almost never demonstrate lymphatic spread; therefore, SLNBx would not add any diagnostic information.

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43. Which of the following is the mechanism of action of pressure garments in management of fibroproliferative scars?

- A) Alteration in cell shape
- B) Hypoxia of local tissue
- C) Increase in synthesis of tissue proteinases
- D) Increase in temperature of the scar
- E) Induction of matrix-specific autoantibodies

The correct response is Option B.

The mechanisms of pressure garments in management of fibroproliferative scars include local tissue hypoxia, reduced fibroblast proliferation, and reduced collagen synthesis.

Pressure therapy is a conservative treatment modality that has been used for many years, particularly in the treatment of hypertrophic scars after burn injury. Numerous studies have documented that pressure therapy reduces the size as well as softens hypertrophic scars. The mechanism of action behind pressure garments is believed to be secondary to tissue ischemia. The pressure leads to local hypoxia, which, in turn, decreases tissue metabolism and increases collagenase activity. It also reduces fibroblast proliferation and collagen synthesis. The exerted pressure is effective between 24 and 30 mmHg. Studies have shown a response to pressures as low as 5 to 15 mmHg. At these pressures, the inherent capillary flow, but not the peripheral circulation, is overcome, and there is occlusion of the small vessels within the scar. Pressure therapy should begin as soon as re-epithelialization occurs.

Alteration in cell shape has not been shown to occur with use of pressure garments in management of fibroproliferative scars.

Increased synthesis of tissue proteinases is a mechanism of corticosteroids. When used as a single therapy in fibroproliferative scars, corticosteroid injections have a variable response rate that ranges from 50% to 100%. In addition to softening the scars, corticosteroid injections often provide symptomatic relief of itching and pain.

Increased temperature of the scar has not been proven as a possible effect of topical silicone gel sheeting. Other possible mechanisms of action of silicone are changes in skin hydration and downregulation of wound healing by the negative charge of the silicone.

Induction of matrix-specific autoantibodies is a molecular mechanism that blocks the effect of transforming growth factor (TGF)- β . The inhibition of TGF- β may serve as a new approach to scar therapy. Autoantibodies and binding proteins that function against TGF- β are still

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experimental and are not available for routine clinical use.

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44. A 42-year-old woman is scheduled to undergo augmentation of the malar region with an alloplastic prosthesis. Which of the following tissue planes is most appropriate for placement of the prosthesis to decrease risk of infection and extrusion?

- A) Subcutaneous
- B) Submalar
- C) Submuscular
- D) Subperiosteal
- E) Sub-SMAS

The correct response is Option D.

The single most important concept for promoting healing over alloplastic material is providing ample soft-tissue coverage. By placing a malar or genial implant directly on bone, a well-perfused musculocutaneous coverage layer is ensured and the desired aesthetic augmentation of the overlying soft tissues is accomplished. Dissection in the subperiosteal plane also allows for good visualization of the infraorbital nerve.

Dissection in the immediate submuscular plane offers no advantages over subperiosteal placement and risks injury or division of the overlying muscles or the motor nerve supply. Sub-SMAS and subcutaneous placements are also inferior options in regard to soft-tissue coverage. Submalar placement refers to the position of the implant in relation to the malar bone. Submalar augmentation helps to correct the malar and nasolabial atrophy associated with aging. Direct malar placement augments a deficiency in the projection of the malar bone. Submalar versus malar placement is an aesthetic judgment and does not influence extrusion or infection rates.

Other important considerations for alloplastic augmentation include antibiotic prophylaxis, sterile implant handling, correct pocket size dissection, and avoidance of skin incisions directly over implants.

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45. A 45-year-old woman is referred to the office because she has had chronic infection, drainage, and pain of the left armpit for the past 10 years. The contralateral axilla is similarly affected. Medical history includes multiple courses of antibiotic therapy and intermittent drainage procedures. Physical examination shows a 10 x 15-cm area of involvement. Which of the following is the most effective management?
- A) Oral administration of an antibiotic
 - B) Intravenous administration of an antibiotic
 - C) Injection of botulinum toxin A
 - D) Incision and drainage of the region
 - E) Complete excision of the scarred area

The correct response is Option E.

Hidradenitis suppurativa is an inflammatory disease of the apocrine glands and follicular epithelium, presenting most commonly as deep recurrent infections or chronic sinus tracts in hair-bearing regions of the skin. It is most commonly seen in the axillary region in young women, but the groin and perineum may also be affected.

After the diagnosis has been confirmed, a short course of treatment with local drainage and suppressive antibiotics is appropriate. However, once the disease process is established, the only appropriate therapy is complete excision of the scarred area.

The successful treatment of chronic hidradenitis with injection of botulinum toxin A has been reported. Sweat glands have a sympathetic innervation. Botulinum toxin works by blocking the release of acetylcholine from nerve endings, thus decreasing sweat production. However, this is expensive and represents a temporary treatment of a chronic problem.

The mainstay of treatment for larger areas is complete excision of axillary skin followed by split-thickness skin grafting. Negative pressure dressings are helpful to stabilize the graft. Although numerous local fasciocutaneous pedicled and free flaps have been described, they increase the risk of donor site morbidity and are generally not necessary. Healing by secondary intention has also been described. However, it is preferable to undertake excision of one axilla at a time so the patient is not disabled in the perioperative period.

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46. A 48-year-old woman comes to the office for consultation regarding reconstruction of the right breast after mastectomy because of cancer. The patient is concerned about maximizing the aesthetic result and minimizing any donor site deformity. Physical examination shows a well-healed chest wall and a B-cup left breast with Grade 3 ptosis. Soft-tissue reconstruction with a superior gluteal artery perforator (SGAP) free flap is planned. Which of the following is a disadvantage of this procedure?
- A) Difficulty molding the gluteal fat
 - B) Gait dysfunction
 - C) Inability to fully hide the donor scar
 - D) Inability to provide a sensate flap
 - E) Lack of abundant soft tissue

The correct response is Option A.

In soft-tissue reconstruction with a superior gluteal artery perforator (SGAP) free flap, the firmer consistency of gluteal fat causes difficulty in molding tissue, particularly in breast reconstruction. Secondary procedures may be necessary to obtain the desired shape.

Gait dysfunction is extremely uncommon after a SGAP flap if care is taken to avoid injury to the motor branch. The scar is generally well hidden by clothing and the donor site deformities are generally minimal. Even in thin patients there is an abundance of adipose tissue in the gluteal area. Although not commonly done, a sensate branch of the nervi clunium superiores can provide sensation to the flap.

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47. A 26-year-old woman of Asian descent who underwent rhinoplasty five years ago has erosion of the silicone rubber (Silastic) prosthesis through the skin of the nasal tip. Physical examination shows a depressed scar in this region. Secondary rhinoplasty is planned. Use of which of the following grafts for this procedure is most appropriate to minimize volume loss?

- A) Dermis
- B) Fat
- C) Muscle
- D) Cartilage
- E) Bone

The correct response is Option D.

A cartilaginous graft would be most appropriate to correct the deformity described. The low metabolic rate of cartilage leads to minimal volume loss. Fat graft survival depends on early neovascularization and only approximately 50% of lipocytes in an autogenous graft survive. Owing to the traumatic nature of the suction technique, fewer viable micrografts are transferred with potential for survival so that surgically removed grafts (macrografts) have a greater longevity. Animal studies have also demonstrated that adipocytes implanted in a vascularized bed (muscle) survive better than those in dermis. Considerable resorption is seen in nonvascularized bone grafts. Muscle alone is not routinely transferred as a graft. There are not sufficient studies in the literature to support the routine use of dermis to correct this deformity.

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48. A previously healthy 55-year-old man is brought to the emergency department three hours after sustaining partial-thickness scald burns to the arms, torso, and legs, comprising 35% of the total body surface area. He has smoked one half pack of cigarettes daily for the past 20 years. The patient is breathing comfortably on room air and oxygen saturation is 99%. On physical examination, he is alert, calm, and cooperative. The patient is admitted to the hospital for wound care. Three days after the injury, respiratory distress develops and he is intubated. Which of the following is the most likely mechanism of respiratory failure in this patient?
- A) Aspiration pneumonia
 - B) Inflammatory interstitial edema
 - C) Inhalation injury
 - D) Pulmonary embolism
 - E) Severe chronic obstructive pulmonary disease

The correct response is Option B.

Burn injury results in local production of immunoregulatory mediators, which results in the production of prostaglandins, thromboxane A₂, and reactive oxygen metabolites. These vasoactive inflammatory mediators result in edema and fluid extravasation from the vascular system. Burns of more than 20% or 30% of the total body surface area result in significant distant soft tissue edema and microvasacular injury. In the lungs, interstitial edema results in decreased oxygenation and may progress to respiratory distress syndrome. Gram-negative pneumonia is common among critically ill burn patients, especially intubated patients.

Aspiration is not a likely source in an alert patient. Smoking is likely to have contributed to this patient's susceptibility to lung disease, although the primary, overwhelming factor involved is the inflammatory response to a critical burn injury. His normal breathing and oxygen saturation on admission rule out a severe underlying pulmonary process. Inhalation injury is common in fires but not scald injury. Pulmonary embolism may result after prolonged immobilization but is much less likely the source of respiratory failure and pneumonia in the acute burn patient.

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49. A 65-year-old man who underwent three-vessel coronary artery bypass grafting (CABG) five weeks ago comes to the office because he has a draining lesion near the sternotomy incision. The CABG procedure included harvest of the patient's left internal mammary artery. Temperature is 38.7°C (101.7°F). Physical examination shows a 3-mm papule at the manubrium of the healed sternotomy incision. CT scan of the chest shows a sinus tract leading to the internal sternal plate. In addition to removal of sternal wires and debridement of the wound, which of the following is the most appropriate management?
- A) Continuous irrigation
 - B) Negative-pressure wound therapy
 - C) Omental flap
 - D) Pectoralis major muscle flaps
 - E) Rectus abdominis muscle flaps

The correct response is Option D.

The most effective treatment of the sternal wound infection described is initial debridement to healthy bleeding tissue and bone, removal of all foreign bodies, and immediate closure with bilateral pectoralis major muscle flaps. Post-sternotomy wounds are classified according to the duration of time that has elapsed between the sternotomy and the clinical onset of the infection. Type I infections occur within the first week after sternotomy and have no bony involvement. Type II infections occur during the second to fourth weeks after sternotomy. Bony involvement is frequent, but chondrochondritis is rare. Type III infections occur months to years after sternotomy and typically involve chronic draining sinus tracts. Osteomyelitis, chondrochondritis, and retained foreign bodies are all common.

The patient described had a Type III infection with a deep sinus tract as confirmed by CT scan. Although delayed closure had previously been considered the treatment of choice for Type III sternotomy wounds, more recent data suggest that a single-stage approach with bilateral pectoralis major muscle flaps results in quicker recovery, improved cosmesis, and decreased morbidity and mortality compared with staged approaches. Given the chronicity of the wound, all foreign bodies, including retained suture material and wires, should be removed.

Pectoralis major turnover flaps provide additional bulk and might therefore be considered preferable. However, the left internal mammary artery has been harvested in this patient, compromising the blood supply to the left pectoralis major turnover flap.

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50. A 60-year-old woman comes to the office for evaluation of a pigmented skin lesion on the left cheek (shown). The patient wants the lesion to be removed because it often becomes irritated. She has a history of sun exposure and basal cell carcinoma. Melanoma was diagnosed in the patient's father at 60 years of age. Physical examination shows a slightly elevated, irregularly pigmented brown plaque on the cheek and similar lesions on the chest. Biopsy of the lesion on the cheek rules out malignancy. Which of the following is the most likely diagnosis?
- A) Actinic keratosis
 - B) Compound nevus
 - C) Keratoacanthoma
 - D) Melasma
 - E) Seborrheic keratosis

The correct response is Option E.

Seborrheic keratosis is a common benign, pigmented lesion often seen in large numbers, especially on the trunk, face, and arms of individuals older than 30 years. Seborrheic keratosis

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typically presents as a sharply circumscribed, waxy, papillomatous plaque with a friable, hyperkeratotic surface, most often described as having a "stuck on" appearance. Pigmentation is variable, from mild to deep black. Seborrheic keratosis is rarely symptomatic but may become irritated and secondarily infected. Adequate treatment of seborrheic keratosis includes shave excision, superficial electrodesiccation, and freezing with liquid nitrogen, because this type of lesion does not undergo malignant transformation.

Actinic (solar) keratosis must be distinguished from seborrheic keratosis because it represents dysplasia and is premalignant. Actinic keratoses, which are found primarily on exposed surfaces, are discrete, flat, or elevated lesions with rough adherent hyperkeratosis. They are skin-colored, yellow-brown or brown, possibly with a reddish tinge, and are often numerous in elderly patients, making excision of all lesions impractical. Treatment with topical 5% 5-fluorouracil (5-FU) is common. Nodular lesions should be excised.

Keratoacanthomas clinically and microscopically resemble squamous cell carcinomas. Keratoacanthomas present as nodules (typically > 1 cm in diameter) with a crater-like center that contains a keratin plug and are often found in hair-bearing sites of sun-exposed skin in elderly patients. Although it is generally accepted that keratoacanthomas are benign neoplasms, because of their potential for spontaneous regression over a four- to eight-week period after a four- to six-week period of rapid growth, excision of these lesions is critical for proper diagnosis and management.

Melasma presents as brown patches on the face, typically affecting both sides. The most common sites of involvement are the cheeks, bridge of nose, forehead, and upper lip. Melasma mostly occurs in women. A change in hormonal status may trigger melasma, and it is commonly associated with pregnancy.

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Section 2: Cosmetic

51. A 45-year-old woman who has had a 100-lb weight loss since undergoing gastric banding two years ago comes to the office for consultation regarding loose skin on her upper arms. Physical examination shows significant ptosis of the posteromedial aspect of the upper arms and relaxation of the soft tissue. Fascia in which of the following regions is also relaxed in this patient and is appropriate for use as an anchor during brachioplasty to reduce widening and hypertrophy of the scars?
- A) Axillary
 - B) Bicipital
 - C) Deltoid
 - D) Pectoral
 - E) Tricipital

The correct response is Option A.

An important etiologic mechanism of the aesthetic arm deformity is relaxation of a longitudinal fascial system sling that extends from the clavicle to the soft tissues of the posteromedial aspect of the arm via the clavipectoral and axillary fascia. Reanchoring the soft tissues of the posteromedial aspect of the arm to the axillary fascia with nonabsorbable sutures addresses the relaxation of the axillary fascia sling and forms the basis for the anchor brachioplasty. Similarly to anchoring the soft tissues of the medial aspect of the thigh to the Colles fascia (perineum) in medial thigh lifts, fascial anchoring in brachioplasties provides more predictable results while reducing complications.

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52. A 32-year-old woman who underwent submuscular placement of smooth 240-ml saline breast prostheses 10 years ago comes to the office for consultation regarding replacement of the implants. She says she wants her breasts to be two cup sizes larger. Currently, she wears a size 36C brassiere. Physical examination shows good aesthetic outcome and no evidence of capsular contracture or rippling. Which of the following is the most likely adverse effect of implant exchange in this patient?
- A) Inability to breast-feed
 - B) Increased capsular contracture
 - C) Increased risk of breast cancer
 - D) Increased risk of collagen vascular disease
 - E) Shrinkage of breast tissue

The correct response is Option E.

Patients seeking reoperation for dissatisfaction with breast size after initial implantation of breast prostheses must be informed of the following long-term negative effects: thinning of tissue, stretching of tissue, shrinkage of breast tissue, additional and more rapid sagging, palpable implant edges and shell, visible implant edges, visible traction rippling, and possible additional sensory loss. Shrinkage of breast tissue occurs with all prostheses; the larger the prosthesis, the more shrinkage that occurs. Larger implants will not give this patient a more natural appearance. The potential for lactation should not be impaired by breast prostheses, especially when the prostheses are positioned in the subpectoral pocket.

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53. A 48-year-old man comes to the office six days after undergoing bilateral transcutaneous lower eyelid blepharoplasty because he has diplopia and pain in the left orbit. Injury to the left inferior oblique muscle is suspected. Which of the following findings will confirm the diagnosis?
- A) Absent depression, extorsion, adduction of the left eye
 - B) Absent elevation, intorsion, adduction of the left eye
 - C) Absent extorsion, elevation, and abduction of the left eye
 - D) Absent intorsion, depression, and abduction of the left eye

The correct response is Option C.

The patient described has sustained injury to the inferior oblique muscle during a lower lid blepharoplasty, which is characterized by absent extorsion, elevation, and abduction of the eye.

Elevation, intorsion, and abduction are controlled by the superior rectus muscle. Adduction is controlled by the medial rectus muscle. Intorsion, depression, and abduction are caused by the superior oblique muscle. Depression, extorsion, and adduction are controlled by the inferior rectus muscle.

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54. When referring to nasal anatomy, the angle of divergence is made between which of the following structures?

- A) Lateral crura of the lower lateral cartilages
- B) Middle and lateral crura of the lower lateral cartilages
- C) Middle and medial crura of the lower lateral cartilages
- D) Middle crura of the lower lateral cartilages
- E) Septum and upper lateral cartilage

The correct response is Option D.

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 makes 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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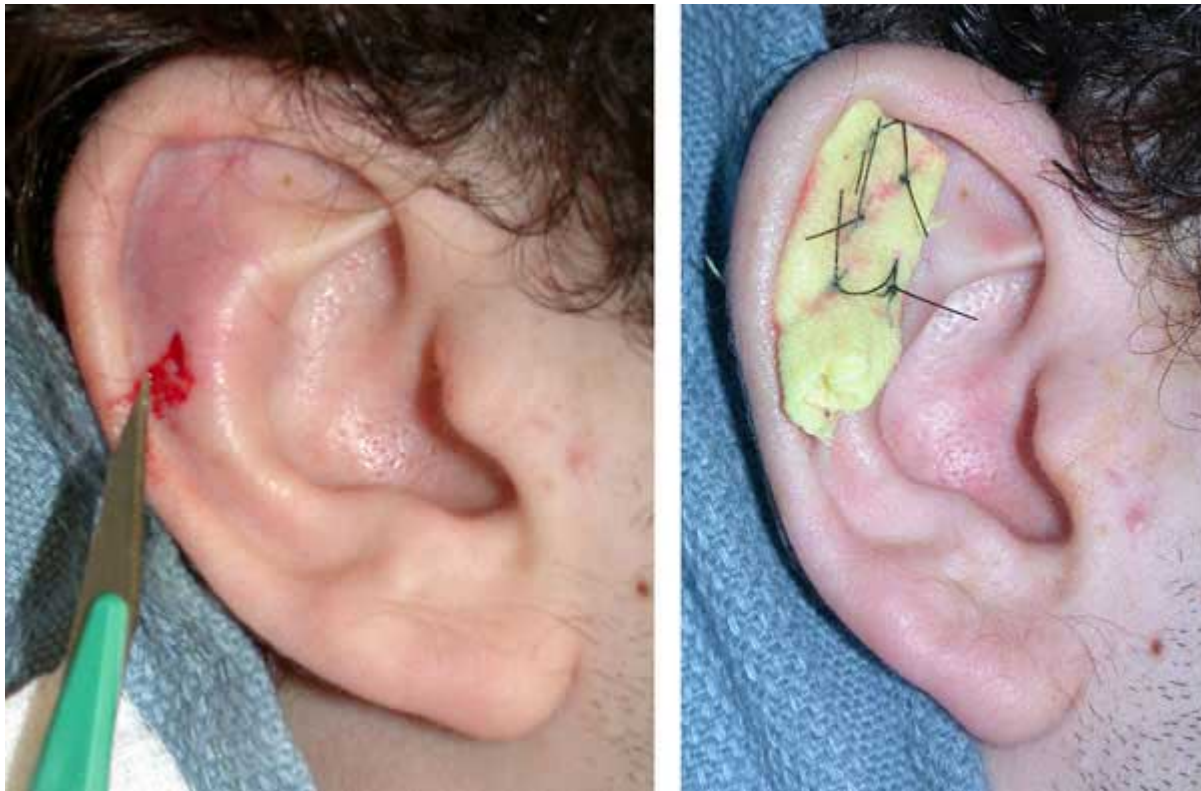
55. A 17-year-old boy is brought to the office three days after he sustained trauma to the ear during practice with his wrestling team. A photograph is shown. Which of the following is the most appropriate management?
- A) Incision and evacuation followed by application of a bolster dressing
 - B) Intravenous administration of an antibiotic for 48 hours followed by oral administration of an antibiotic for five days
 - C) Needle aspiration
 - D) Observation for two weeks followed by drainage if fluid is present in the wound
 - E) Resection of the posterior cartilage and sculpting of the anterior cartilage

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The correct response is Option A.

The history and photograph of the patient described indicate an othematoma caused by shearing of the skin from the cartilage. Early diagnosis of this hematoma will prevent cauliflower ear deformity. Complete evacuation via a small incision with application of a bolster dressing to prevent reaccumulation of the fluid or blood is the most appropriate management.

The use of intravenous antibiotics to treat the hematoma is inappropriate, and there is no sign of infection. Needle aspiration may help, but the hematoma is unlikely to be completely evacuated. Allowing the hematoma to remain can result in calcification. Observation may lead to cauliflower ear deformity. Resection of the posterior cartilage and sculpting of the anterior cartilage is the treatment option for chronic calcification or cauliflower ear deformity, but not for acute othematoma.



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56. For reduction mammoplasty, which of the following is the greatest advantage of a vertical procedure over an inverted-T method?

- A) Decreased risk of hematoma
- B) Greater ability to breast-feed
- C) Increased sensation of the nipple
- D) Initial natural shape of the breast
- E) Smaller scar

The correct response is Option E.

Vertical mammoplasty is a technique that uses adjustable markings, an upper pedicle for the areola, and a central breast reduction with decreased undermining of the skin. Key features of the vertical scar reduction mammoplasty include skin excision in only one direction, which reduces scar burden, and central vertical glandular excision, which contributes to improved postoperative shape by narrowing the breast while maximizing projection as a result of suturing the medial and lateral pillars together. There is no wide periareolar skin excision; therefore, circumareolar scar quality is not compromised by excess tension.

However, this method is more intuitive and inherently less precise than the inverted-T method. Because of the central and posterior nature of glandular resection in vertical mammoplasty, it is more difficult to determine the end point of resection.

A recent study comparing vertical mammary reduction with the Wise pattern technique showed no statistical differences in the rate of hematomas and nipple numbness. Breast-feeding is possible with either technique but may require supplementation with formula. The initial shape in a vertical mammoplasty is poor; it has a flattened lower pole, and dog-ears are frequently present. This improves after three to six months, although small revisions are sometimes necessary.

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57. A 23-year-old man comes to the office for follow-up examination four months after undergoing rhinoplasty and horizontal sliding osseous genioplasty with miniplate fixation. He says he has noticed increasing show of his lower teeth since the surgery. Physical examination shows ptosis of the lower lip and a deep inferior gingivobuccal sulcus. Which of the following is the most likely cause of these findings?

- A) Excessive traction by the digastric muscle
- B) Inadequate fixation of the osteotomy segment
- C) Inadequate repair of the mentalis muscle
- D) Injury to the marginal mandibular nerve
- E) Injury to the mental nerve

The correct response is Option C.

The patient described has a witch's chin deformity as a complication of a lower buccal sulcus incision for access during an osseous genioplasty. In making this incision, the mentalis muscle is divided. Leaving a cuff of muscle superiorly is helpful because it provides a good tissue base for suturing the muscle when closing the incision. This closure of the muscle helps to resuspend the soft tissue of the chin and prevents ptosis of the lower lip and soft tissues.

Excessive traction by the digastric muscle and inadequate fixation of the osteotomy segment are not likely causes for the findings in the patient described. Miniplate fixation should provide adequate fixation to the osteotomy segment. Furthermore, relapse or traction of the osteotomy segment would not account for all of the findings in the patient described.

Injury to the marginal mandibular nerve is not likely to have caused the findings in the patient described because it is not in the field of dissection for the procedure.

Injury to the mental nerve would cause numbness of the lower lip on the side of the injury and would have no effect on lip position.

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58. A 40-year-old woman comes to the office for follow-up examination three weeks after undergoing traditional brachioplasty for correction of skin laxity in the proximal aspect of the upper arms. She has had persistent numbness along the medial aspect of the elbow and forearm, extending to the level of the wrist. Which of the following nerves was most likely injured during brachioplasty in this patient?

- A) Intercostobrachial
- B) Medial antebrachial cutaneous
- C) Medial brachial cutaneous
- D) Musculocutaneous
- E) Posterior brachial cutaneous

The correct response is Option B.

Traditional methods of brachioplasty use a medial or posteromedial longitudinal incision to resect excess skin and fat. The medial antebrachial cutaneous nerve branches, together with the basilic vein, exit the deep fascia of the medial arm at the transition between the middle and distal thirds of the arm. Care should be taken at the time of surgery to identify this nerve at this level and maintain more fat on the deep fascia to prevent injury.

The intercostobrachial nerve and the medial brachial cutaneous nerve innervate the medial arm skin. The musculocutaneous nerve terminates in the lateral antebrachial cutaneous nerve, supplying sensation to the lateral forearm. The posterior brachial cutaneous nerve, a branch of the radial nerve, supplies sensation to the posterior arm.

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59. A 55-year-old woman who underwent an upper and lower blepharoplasty procedure via a subciliary approach five years ago comes to the office for consultation regarding dry eyes. She says that the symptoms are worse in the left eye and that she has to tape her eyes closed before sleeping to minimize dryness. Physical examination shows prominent globes with 1 mm of scleral show on the left and no scleral show on the right. Severe bilateral lid laxity is noted, along with 8 mm of anterior distraction of the lower lids. Snap-back test is greater than one second. Schirmer's test indicates adequate tear production. Results of thyroid testing are within normal limits. Which of the following is the most appropriate management of this patient's symptoms?
- A) Full-thickness skin grafting to the lower eyelid
 - B) Lateral canthotomy and canthoplasty
 - C) Lateral tarsorrhaphy
 - D) Suspension via a sub-orbicularis oculi fat (SOOF) lift
 - E) Wedge resection lower lid tightening

The correct response is Option B.

The main symptom of dry eyes in the patient described is not likely caused by poor tear production but by accelerated evaporative loss from poor tone of the lower eyelids. The patient's excess laxity is best described by the 8 mm of distraction of the anterior lower lid and the poor snap-back test results. The most appropriate management of this patient's symptoms is lateral canthal support.

The minimal scleral show/ectropion indicates that full-thickness skin grafting is not likely to be beneficial.

For 1–2 mm of distraction, lateral suspension via a sub-orbicularis oculi fat (SOOF) lift is effective. For 3–6 mm of distraction, a lateral canthopexy lid tightening without shortening is effective. For greater than 6 mm of distraction, a lateral canthal division and canthoplasty with resection with 2–3 mm of full-thickness lid margin is effective.

With this patient's prominent eyes, the placement of the tendon should be more superior to avoid clotheslining or tightening the lid underneath the limbus, such as would happen with wedge resection.

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60. A 25-year-old woman is scheduled to undergo rhinoplasty using lateral nasal osteotomy using an external perforating technique. Which of the following arteries is most susceptible to injury during this procedure?

- A) Angular
- B) Anterior ethmoidal
- C) Dorsal nasal
- D) Infraorbital
- E) Lateral nasal

The correct response is Option A.

An external perforating osteotomy is performed at the nasofacial junction. When performing this osteotomy, care must be taken to avoid the angular artery. This artery arises from the facial artery and makes its way toward the nose. Once on the nose proper, the angular artery becomes the lateral nasal artery. The lateral nasal artery provides blood supply to the nasal tip and is not located in the region where the osteotomy is performed.

The external nasal branch of the anterior ethmoidal artery and the dorsal nasal artery supply blood to the lateral nasal tissues and dorsum. These vessels are both located on the nose itself and are above the level of the osteotomy. Finally, the infraorbital artery and its foramen are located lateral to the osteotomy site.

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61. A 58-year-old nulligravid woman who is scheduled to undergo bilateral prophylactic mastectomy comes to the office for consultation regarding immediate breast reconstruction. She works full time as a fitness instructor. The patient currently wears a size 34B brassiere and wants her brassiere size to be increased to a C cup, but she wants to make sure that scarring is minimized. Height is 5 ft 5 in and weight is 120 lb. Physical examination of the abdomen shows paucity of extra tissue. Which of the following is the most appropriate breast reconstruction procedure for this patient?
- A) Bilateral autogenous reconstruction
 - B) Bilateral tissue expansion followed by implantation of prostheses
 - C) Delayed breast reconstruction after pathology is confirmed
 - D) Single-stage reconstruction with prostheses
 - E) TRAM flap followed by implantation of prostheses

The correct response is Option B.

In the thin patient described, autogenous tissue transfer often requires implantation of prostheses to provide enough volume to create a breast mound. This can be done alone or in combination with either the latissimus dorsi myocutaneous flap or the TRAM flap. A recent study suggests that there may be less risk of recipient site morbidity in reconstruction with a TRAM flap with prostheses placed or completely filled subsequently compared with immediate placement of prostheses.

Bilateral latissimus dorsi or TRAM flaps may not be the first choice for a fitness instructor who will most likely require prostheses. The recovery time and the associated donor site morbidity may prevent her from returning to the gym as an instructor. Tissue expander placement and placement of prostheses can often be done through the same incisions used for extirpation and as such have the least amount of visible scar. No additional tissue is used to create the breast mound. Immediate breast reconstruction can offer some psychological benefits for the woman and may be associated with fewer surgeries overall. Prostheses placed without an expanded pocket may not be as reliable in reconstruction of moderate-sized breasts.

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62. Which of the following structures of the eye acts as a suspensory system for the globe?

- A) Lockwood ligament
- B) Medial canthal tendon
- C) Orbital septum
- D) Superior oblique tendon
- E) Whitnall ligament

The correct response is Option A.

The Lockwood ligament, which attaches posterior to the lacrimal sac, acts as a suspensory system for the globe. Together with the intermuscular septa and the Tenon capsule, it forms the lower eyelid retractor system. Posteriorly, it arises from fibrous attachments to the inferior side of the inferior rectus muscle and continues anteriorly as the capsulopalpebral fascia (lower eyelid retractors). The medial aspect of the Lockwood ligament attaches to the posterior lacrimal crest, and the lateral retinaculum attaches to the lateral orbital (Whitnall) tubercle.

The other structures do not function as part of the suspensory system for the globe. The medial canthal tendon, the deep head of the preseptal orbicularis, and the deep head of the preseptal orbicularis muscles are important in maintaining apposition of the eyelids to the globe. The orbital septum and the superior oblique tendon do not suspend the globe. The Whitnall (superior transverse) ligament attaches medially to the trochlea, laterally to the capsule of the lacrimal gland, and to the lateral orbital wall.

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63. A 28-year-old woman comes to the clinic for consultation regarding augmentation of the right breast to achieve symmetry with the left breast. She is happy with the size of the left breast and does not want any alteration to it. Physical examination shows asymmetry of breast volume and shape; the right breast is 40% smaller than the left. The nipple-areola complex is much smaller on the ipsilateral hypoplastic right side, and the anterior axillary fold is absent. Which of the following is the most likely diagnosis?
- A) Cystosarcoma phylloides
 - B) Poland syndrome
 - C) Scoliosis
 - D) Tuberous breast deformity
 - E) Normal asymmetry of the breasts

The correct response is Option B.

Poland syndrome is an anomaly associated with underdevelopment of the breast. It is believed to be related to a vascular compromise of the subclavian vessel supplying the breast, ribs, pectoralis major muscle, and ipsilateral upper extremity. The sternal head of the pectoralis muscle is most often missing.

Options for reconstruction include autologous and prosthetic implants. If the deformity is minor and good tissue cover exists, implant reconstruction is often adequate.

Tuberous breast deformity involves lack of breast tissue forming between the pectoralis muscle and the skin. It is often defined by a high inframammary fold, large areola, and herniated breast tissue through the enlarged areola. Anterior lateral thoracotomies performed before breast development can be associated with underdeveloped breasts, but this does not explain all of the findings in this patient. Previous breast surgery is also associated with asymmetries of volume and shape but not with absence of the anterior axillary fold.

Cystosarcoma phylloides is similar to fibroadenoma. It usually presents as unilateral asymmetry and can be benign. However, this would not explain all of the abnormalities in this patient.

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64. A 60-year-old woman has a persistent asymmetric smile resulting from an injury to the right marginal mandibular nerve during rhytidectomy with SMAS plication two years ago. Physical examination shows elevation of the right oral commissure. Which of the following interventions is the most appropriate initial step in restoring symmetry of this patient's smile?
- A) Anesthetic motor block of the left depressor labii inferioris muscle
 - B) Botulinum toxin (Botox) injection into the left depressor labii inferioris muscle
 - C) Repair of right marginal mandibular nerve
 - D) Resection of the left oral depressor muscles
 - E) Transection of the left marginal mandibular nerve

The correct response is Option A.

Performing an anesthetic motor block of the left depressor labii inferioris muscle is the most appropriate initial step in restoring symmetry of the smile of the patient described because it will demonstrate the potential outcome of resection of this muscle. If the patient is satisfied with these temporary results, then longer-lasting (Botox) or permanent resection of the left depressor labii inferioris muscle can be performed.

Marginal mandibular nerve palsy is a known complication of facelift procedures. After two years, the neuromuscular junctions in the denervated muscle will not likely recover function. Repairing the nerve will have little effect on the patient's smile.

Resuspension with a dynamic temporalis sling is adequate for restoration of oral competence and establishment of movement in patients with global facial nerve palsy. It will not likely result in the restoration of a symmetric smile.

Although resection of the left oral depressor muscles or transection of the left marginal mandibular nerve may also improve the symmetry of the patient's smile, these procedures are permanent and may not have the desired effect.

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

65. A 16-year-old girl is brought to the office by her parents because she has had worsening pain in the right breast (shown) for the past eight months. Ten years ago, she sustained a full-thickness burn to the back, right chest, and abdomen requiring excision and split-thickness skin grafting. Physical examination shows contracture of the scar and lateral expansion of the breast. After release of the burn scar contractures, a defect of 200 cm² is created. Which of the following is most appropriate for coverage of this defect?
- A) Dermal regeneration template (Integra)
 - B) Latissimus dorsi musculocutaneous flap
 - C) Meshed split-thickness skin graft
 - D) Nonmeshed thin split-thickness skin graft
 - E) Z-plasty release of the constricted scar

The correct response is Option A.

The patient described is suffering from pain caused by a developing breast that is constricted under a nonexpanding split-thickness skin graft placed at the time of the burn excision. The burn

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scar contractures are first released to allow expansion of the underlying breast. The decision for coverage material is then based on what will most likely permit further expansion of the breast.

Dermal regeneration template (Integra) has been shown to allow secondary expansion and is the most appropriate choice for the scenario described. The wound is covered with an expandable dermal layer, which is then covered again by a split-thickness skin graft, leaving a minimal donor scar.

A Z-plasty would be inadequate to release this large scar.

Full-thickness skin grafting would allow greater breast expansion and less secondary burn scar contracture, but a graft of the size needed would be difficult to obtain.

A latissimus dorsi flap would not be the best option for the patient described because she has a history of burns on the back. Also, a latissimus dorsi flap would be bulky, and the patient described does not require additional volume.

Nonmeshed thin split-thickness skin grafting would give a superior aesthetic result compared with meshed split-thickness skin grafting; however, both would result in secondary burn scar contracture, which would not allow further expansion of the breast.

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66. A 41-year-old woman comes to the office for consultation regarding irregular skin tone and uneven skin surface on the outer thighs one year after she underwent liposuction of the hips and thighs. On physical examination, the irregularities are radially oriented around a single small scar approximately 1 cm wide. No other scars are visible. The most likely explanation for these findings is use of which of the following during the liposuction procedure?
- A) Deep large cannula suction with cross-tunneling
 - B) Fine cannula suction with cross-tunneling
 - C) Fine cannula suction without cross-tunneling
 - D) Superficial large cannula suction through a single port site
 - E) Superficial large cannula suction with cross-tunneling

The correct response is Option D.

One of the most common deformities of liposuction is surface irregularity, which can result from several etiologies. A large cannula will create a large furrow that may be visualized if the liposuction is not done evenly. Use of a single port may also lead to irregularities because the suctioning is done from only one angle. Superficial suctioning is also more prone to visible irregularities. The best way to avoid this problem is to use small cannulas in the deep fat, with cross-tunneling from two sites such that the tunnels are at right angles to each other.

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67. Which of the following is the estimated incidence of detection of occult breast cancer during reduction mammoplasty?

- A) 0.002%
- B) 0.02%
- C) 0.2%
- D) 2%
- E) 20%

The correct response is Option C.

The average risk of occult breast cancer in patients undergoing breast reduction has been estimated to be 0.27% (0.11%, 0.75%, 0.71%, 0.05%, 0.06%, 0.16%, and 0.09% in seven journal articles published between 1997 and 2006). Cancer is often found at the in situ or early stages. Definitive therapy depends on size, pathology, location, and status of margins. Consultation with an oncologist and further pathologic analysis are generally necessary.

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68. A 32-year-old woman comes to the office for consultation regarding wrinkling along the sides of her nose. She received botulinum toxin (Botox) injections for forehead lines, glabellar furrowing, and crow's feet one month ago. Physical examination shows vertical rhytides on the nasal sidewalls. Contraction of which of the following muscles is the most likely cause of these findings?

- A) Corrugator
- B) Frontalis
- C) Nasalis
- D) Orbicularis oculi
- E) Procerus

The correct response is Option C.

Activity of the transverse portion of the nasalis muscle causes bunny lines.

The frontalis muscle and the corrugators are responsible for forehead lines and glabellar lines, respectively. The lateral portions of the orbicularis oculi are responsible for crow's feet. The procerus is responsible for horizontal nasal lines, but not wrinkles on the sides of the nose.

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69. A 55-year-old woman is referred to the office by her primary physician because she has had a painful, chronic area of scabbing on the right ear for the past three months. Physical examination shows a 2 x 1-mm area of skin ulceration on the superior helix of the ear. Surrounding inflammation and exposed cartilage are noted. Which of the following is the most appropriate initial step in management?
- A) Daily wound dressing with bacitracin ointment and avoidance of pressure on the ear
 - B) Excision with 5-mm margins and coverage with a retroauricular trap door flap
 - C) Excision with 5-mm margins and reconstruction with an Antia-Buch advancement flap
 - D) Excisional biopsy and primary wound closure
 - E) Injection of triamcinolone and daily topical application of hydrocortisone cream

The correct response is Option D.

The patient described most likely has a benign condition referred to as chondrodermatitis nodularis helices, an inflammation of the cartilage of the ear that often leads to a painful open area. This condition can mimic a skin cancer on physical examination. Unless the area is clearly benign, biopsy is warranted to rule out skin cancer. Recurrence rate for this condition is high. Excisional biopsy and primary wound closure will give a pathological confirmation and may suffice as treatment.

Daily wound dressing with bacitracin ointment or injection of triamcinolone and daily topical application of hydrocortisone cream are both inappropriate because neither would give the appropriate tissue diagnosis. Excision and reconstruction or coverage with a flap are unwarranted given no pathological diagnosis.

Chondrodermatitis nodularis helices is a condition of unknown etiology predominantly found in older men and often is associated with trauma from sleeping. It begins as an area of cartilage inflammation and then ulcerates through the skin. The treatment is excision of the cartilage and closure of the skin. Recurrence rates remain high. Preventive measures to decrease the recurrence rate include avoidance of sleeping on the affected ear.

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70. A 27-year-old woman (weight, 60 kg) undergoes suction lipectomy of the abdomen, flanks, and outer thighs in an outpatient setting. During the procedure, 3 L of tumescent solution containing 0.1% lidocaine and 1:1,000,000 epinephrine in normal saline are infused and 3 L of aspirate are removed using a 20-cm-long, 4-mm-wide cannula. The patient is discharged in good condition two hours after completion of the procedure. She is found dead in her bed the next morning. Which of the following is the most likely cause of death?
- A) Epinephrine toxicity
 - B) Lidocaine toxicity
 - C) Perforation of the abdominal wall and colon
 - D) Perforation of the diaphragm and tension pneumothorax
 - E) Pulmonary embolism

The correct response is Option E.

Pulmonary embolization with fat or thrombus is the most common cause of death from suction lipectomy. One survey of 917 aesthetic plastic surgeons showed the leading cause of death from suction lipectomy to be thromboembolism (23%), followed by perforation of the abdomen/viscera (15%), anesthesia/sedation/medication (10%), fat embolism (9%), and unknown or confidential causes (29%).

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Figure reproduced with permission from Massiha H. Augmentation in ptotic and densely glandular breasts: prevention, treatment, and classification of double-bubble deformity. *Ann Plast Surg.* 2000;44:143-146.

71. A 28-year-old woman comes to the office one year after undergoing transaxillary augmentation mammoplasty because she is dissatisfied with the shape of her breasts (shown). Physical examination shows large prostheses positioned slightly low on the chest and a transverse crease that is clearly visible in the lower pole of each breast (double-bubble deformity). Which of the following is the most likely cause of these findings?
- A) Contractile forces of the muscles
 - B) Excessive lowering of the inframammary fold
 - C) Formation of capsular contracture
 - D) Poland syndrome
 - E) Ptosis of the overlying natural breast parenchyma

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The correct response is Option B.

The most likely cause of this deformity is excessive or inadvertent lowering of the inframammary fold. This deformity is difficult to correct without further surgery, so the surgeon should be cognizant of this crucial fold area. If a patient desires a large prosthesis and/or if the distance from the inframammary fold to the nipple is short, it may be desirable to lower the inframammary fold. In these patients, the original inframammary fold must be completely obliterated with serial cuts, often up to the dermis. If the inframammary fold is inadvertently lowered, it is best to repair the fold with 2-0 sutures and reposition the prosthesis superiorly.

In the literature, both this defect and the defect of native breast tissue sagging over the lower pole of a high prosthesis are called a "double bubble." Each deformity is caused by a different problem and should be recognized and treated differently.

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72. In a worm's eye view of the Caucasian nose, which of the following is the most common ratio of the lobular portion of the nose to the columella?

- A) 3:1
- B) 2:1
- C) 1:1
- D) 1:2
- E) 1:3

The correct response is Option D.

The lobular portion of the nose from the worm's eye view should be in a 1:2 ratio with the columella and nasal apertures. The lobular portion comprises one third and the columellar portion comprises two thirds of the total distance from the tip to the base. The nostrils should have a teardrop configuration with the diameter of the base slightly larger than the diameter of the apex. The long axis of each nostril points in a slight medial direction.

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73. A 32-year-old woman comes to the office for follow-up examination six months after she underwent repair of a fracture of the left orbit. A preoperative photograph is shown. Physical examination shows cicatricial ectropion of the lower eyelid. Which of the following is the most appropriate management?
- A) Complete tarsorrhaphy
 - B) Pentagonal wedge resection of the lower eyelid
 - C) Placement of a graft to the lower eyelid
 - D) Punctal occlusion of the lower eyelid
 - E) Resuspension of the lower eyelid retractors

The correct response is Option C.

Protection of the ocular surfaces is the primary goal in managing the cicatricial ectropion of the lower eyelid in the patient described. The patient's lower eyelid lacks height. Scarring between the capsulopalpebral fascia (lower eyelid retractors) and the orbital septum because of trauma or following aggressive lower eyelid blepharoplasty can cause vertical contracture of the lower eyelid, resulting in corneal exposure. Lower eyelid position can only be restored by placement of an autogenous or alloplastic spacer graft (hard palate, donor sclera, auricular cartilage, tarsus, and others), as in the postoperative image shown. In conjunction, eyelid-tightening procedures such as lateral canthopexy and canthoplasty address horizontal skin laxity.

Complete tarsorrhaphy is not an option for a young and active patient. It is an acceptable temporizing solution in cases of paralytic ectropion.

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Pentagonal wedge resection of the lower eyelid is an adjunct procedure for cases of lower eyelid laxity with horizontal skin excess.

Punctal occlusion of the lower eyelid would alleviate the dryness caused by the increased exposure but would not restore normal anatomy of the lower eyelid in the patient described.

Repair of the lower eyelid retractors in conjunction with lateral canthal resuspension is used to correct lower eyelid entropion. The procedure would not address the scarring present in the patient described.



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74. A 16-year-old girl is referred to the office by her pediatrician for reduction mammoplasty because of breast hypertrophy that has been worsening over the past two years. She wears a size 36DD brassiere and has constant pain in the shoulders and back from the weight of her breasts. Height is 5 ft 4 in, weight is 165 lb, and menarche was at 10 years of age. Physical examination shows juvenile breast hypertrophy, shoulder grooving, intertrigal dermatitis, and striae. Abnormality of which of the following is the most likely cause of this patient's condition?
- A) End-organ responsiveness to estrogen
 - B) Estrogen level
 - C) Number of estrogen receptors
 - D) Progesterone level
 - E) Prolactin level

The correct response is Option A.

Abnormal end-organ responsiveness to estrogen is the predominant factor leading to breast hypertrophy. It has been demonstrated that normal levels of estrogen, progesterone, and prolactin exist in patients with juvenile breast hypertrophy. These patients also have a normal number of estrogen receptors.

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75. A 5-year-old boy is brought to the office by his parents for consultation regarding correction of Stahl's ear deformity. Which of the following is the most appropriate surgical management?
- A) Partial detachment of the folded segment of helical cartilage from the scapha and repositioning of the helix
 - B) Placement of sutures from the conchal bowl to the mastoid fascia
 - C) Rasping of the anterior surface of the antihelical cartilage to create the antihelix
 - D) Release of the superior auricle from the temporal skin with skin grafting to create a retroauricular sulcus
 - E) Wedge excision of the third crus with helical advancement

The correct response is Option E.

Stahl's ear is an auricular deformity that primarily includes a third antihelical crus. One of the many methods of repair involves wedge excision of the third crus with helical advancement. The other techniques listed are used for other deformities of the ear.

The constricted ear is a deformity that involves a “constricted” helical rim with the superior portion of the helix often folding over the scapha. This deformity has also been referred to as “cup” or “lop” ear and occurs with varying degrees of severity. One method of repair includes partially detaching the helix from the scapha and resuturing it to the scapha at the proper angle.

Prominent ears are characterized by a wide conchoscaphal angle and are often associated with flattening of the antihelical fold. Various corrective methods have been described, including rasping of the anterior surface of the antihelix, placement of retention sutures to recreate the antihelical fold, conchal bowl resection, and suturing of the conchal bowl to the mastoid fascia.

Cryptotia is an adherence of the superior portion of the helix to the temporal skin with varying degrees of severity. Surgical correction involves release of this abnormal connection and frequently requires skin grafting, depending on the severity of the deformity.

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76. A 55-year-old woman undergoes modified radical mastectomy with immediate first-stage reconstruction of the right breast with a tissue expander. Before the second stage to exchange the tissue expander with a permanent prosthesis is initiated, pathology results from analysis of tissue from the right breast indicate metastatic carcinoma of four axillary lymph nodes. Radiation therapy is recommended. Which of the following interventions will result in the best long-term appearance of the reconstructed breast?
- A) Complete the tissue expansion before radiation and exchange the tissue expander with a prosthesis after radiation
 - B) Deflate the tissue expander before radiation and reinflate the tissue expander and exchange with a prosthesis after radiation
 - C) Remove the tissue expander and reconstruct the breast with a TRAM flap before radiation
 - D) Remove the tissue expander before radiation; after radiation, reinsert and expand a tissue expander and then exchange with a prosthesis
 - E) Remove the tissue expander before radiation and reconstruct the breast with a TRAM flap after radiation

The correct response is Option E.

Breast reconstruction after radiation therapy is best accomplished with autologous tissue such as a TRAM flap. Any reconstruction method that uses prostheses or tissue expanders after radiation therapy has a higher risk of complications and poor cosmetic outcome when compared with reconstruction using autologous tissue. Radiation increases the risk of infection and exposure of the prosthesis, leading to failure of breast reconstruction procedures using prostheses. Radiation also increases the risk for capsular contracture, resulting in a poor aesthetic result.

Breasts that are reconstructed with a TRAM flap and subsequently radiated are prone to distortion, shrinkage, and fibrosis, leading to a poor aesthetic outcome. Therefore, the best long-term results are obtained when the breast is reconstructed with a TRAM flap after radiation therapy has been completed.

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77. A 50-year-old woman undergoes endoscopic brow lift for rejuvenation of the forehead region. Which of the following interventions is necessary for proper elevation of the lateral brow areas during this procedure?

- A) Injection of botulinum toxin
- B) Release of the orbital ligament
- C) Resection of the corrugator supercilii muscles
- D) Supraperiosteal dissection
- E) Upper eyelid blepharoplasty

The correct response is Option B.

The orbital ligament is a band of connective tissue that fixes the superficial temporal fascia to the bone of the lateral orbital rim. This tissue must be released during the course of the brow lift to achieve adequate elevation of the lateral brow.

Injection of botulinum toxin and upper eyelid blepharoplasty can be used as adjunctive procedures to improve the appearance of the forehead, brow, and periorbital regions, but these procedures are not necessary for lateral brow elevation in a brow-lift procedure. Resection of the corrugator supercilii muscles can be performed in the course of the brow-lift procedure to improve the appearance of glabellar rhytides and furrows. Similarly, this procedure is not a necessary component for lateral brow elevation.

The optimal plane of dissection in an endoscopic brow lift, supraperiosteal (subgaleal) versus subperiosteal, is a controversial issue. One advantage of the subperiosteal plane of dissection is the minimal bleeding encountered in this avascular plane. Also, sensory nerve damage may better be avoided with subperiosteal dissection, which occurs below the plane of the supraorbital nerve.

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78. A 20-year-old woman comes to the office for follow-up examination two years after she sustained burns over 80% of the total body surface area. She has difficulty balancing her eyeglasses on her remnant ears. Physical examination shows a bilateral burned pinna deformity with loss of the superior helix. A photograph of the left ear is shown. Which of the following interventions is most appropriate at this time?
- A) Bilateral conchal transposition flap and skin grafting
 - B) Bilateral insertion of costochondral grafts under existing skin
 - C) Reconstruction of the ears with auricular osteointegrated prostheses
 - D) Reconstruction of the ears with Silastic prostheses and temporoparietal flap coverage
 - E) Retroauricular release and grafting

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The correct response is Option A.

The patient described has sustained a significant injury and multiple reconstructive procedures are required. Although reconstruction of the ears may not be a high priority, it can be relatively easily accomplished with a bilateral conchal transposition flap and skin grafting. A conchal transposition flap has minimal donor site morbidity with a low complication rate and the results can address the patient's difficulty regarding eyeglasses.

Bilateral reconstruction of the ears with costochondral grafts is not appropriate because it is associated with significant donor site problems and is often a marginal result due to the severe burned skin.

Reconstruction of the ears with auricular osteointegrated prostheses is not appropriate because it has a high complication rate in burn patients.

Reconstruction with Silastic prostheses and temporoparietal flap coverage has a very high exposure and infection rate and is rarely done. Reconstruction with Medpor has a lower complication rate and is a potential option to consider for the patient described.

The chondrocutaneous composite flap based on the crux helix was described by Davis in 1974. It has been advocated by many to assist in the reconstruction in the acquired deformities of the superior helix. The flap is very reliable and has minimal donor site morbidity.



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79. A 38-year-old woman comes to the office for consultation regarding reduction mammoplasty. She currently wears a size 36DD brassiere and wants to be able to wear a C cup brassiere postoperatively. Height is 5 ft 6 in and weight is 120 lb. On physical examination, the distance from nipple to sternal notch is 35 cm. Selection of a vertical mammoplasty technique in this patient is limited by which of the following?

- A) Desired postoperative cup size
- B) Fat content of the breasts
- C) Lateral positioning of the nipples
- D) Length of the pedicle
- E) Preoperative cup size

The correct response is Option D.

The contraindications to performing a vertical reduction mammoplasty are the length of the pedicle and the amount and quality of the remaining skin. Blood supply to the nipple may be compromised in a very long pedicle. It is impossible to give a numeric value to this length. Lassus recommends a transposition of no more than 9 cm.

Vertical reduction mammoplasty more easily achieves consistently high-quality results when the method is applied to a small or moderate reduction (< 800 g per side). Although reductions of more than 1000 g are technically difficult to achieve, they are not impossible and have been reported by some centers. With the adjunct of the L-shaped scar, larger amounts of skin can be resected, limiting the need for postoperative revisions.

The lateral positioning of the nipples is not a contraindication to vertical reduction mammoplasty. Although Lejour reported delayed wound healing in cases with high fat content of the breast, this does not preclude the vertical method.

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80. A 45-year-old woman comes to the office for consultation regarding severe skin laxity of the lower abdomen and medial aspect of the thighs two years after she underwent gastric bypass surgery. Weight loss during the first 12 months postoperatively was 120 lb. The patient's weight has been steady at 140 lb for the past eight months. Which of the following incisional approaches is most appropriate for contour of the thighs in this patient?

- A) Anterior oblique
- B) Crescentic groin
- C) Medial longitudinal
- D) Posterior oblique
- E) Transverse

The correct response is Option C.

In a patient with severe medial thigh skin redundancy after massive weight loss, a medial longitudinal approach is currently preferred because it removes a maximal amount of skin redundancy along the entire length of the thigh while concealing the incision in the medial thigh skin. A crescentic groin incision does attempt to conceal the scar in the groin but can distort the vulvar structures when placed under tension, and is less effective when medial thigh laxity is severe. An anterior oblique or posterior oblique incision is not preferred because of the conspicuous location of the resulting scars. A transverse incision is inadequate to remove enough skin and results in a poor cosmetic outcome.

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81. A 48-year-old woman comes to the office for consultation regarding a breast lift procedure. Physical examination shows location of the nipples 3 cm inferior to the inframammary fold and below the lower contour of the breast and skin envelopes. Which of the following is the most likely diagnosis of this patient's deformity?

- A) No ptosis
- B) Grade 1 ptosis
- C) Grade 2 ptosis
- D) Grade 3 ptosis
- E) Pseudoptosis

The correct response is Option D.

Regnault defined the degree of ptosis by evaluating the relationship of the nipple to the inframammary fold.

In Grade 1 or mild ptosis, the nipple is within 1 cm of the level of the inframammary fold and above the lower contour of the breast and skin envelopes. In Grade 2 or moderate ptosis, the nipple is 1 to 3 cm below the inframammary fold but above the lower contour of the breast and skin envelopes. In Grade 3 or severe ptosis, the nipple is more than 3 cm below the inframammary fold and below the lower contour of the breast and skin envelopes.

In cases of pseudoptosis, the nipple is above or at the level of the inframammary fold with the majority of the breast tissue below, giving the impression of true ptosis.

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82. A 53-year-old woman comes to the office for consultation because she is dissatisfied with the appearance of her eyebrows and forehead. Physical examination shows hooding of the lateral orbital brow. The most appropriate management is a brow lift procedure to move the peak of the eyebrow to which of the following anatomic locations?
- A) At the level of the supraorbital rim
 - B) Between the lateral limbus and lateral canthus
 - C) Between the midpupil and lateral limbus
 - D) Medial brow above the orbital rim
 - E) Medial to the medial canthus

The correct response is Option B.

With aging, the lateral brow often descends more noticeably than the medial brow. Brow lifts are performed to restore the brow to a more pleasing shape and position. However, patients may fear brow lift procedures because they do not want to have the brows overly elevated, resulting in a constant surprised appearance. Several studies have examined eyebrow aesthetics. Although no one brow position or shape is ideal, given our multicultural society and changes in fashion aesthetics over time, there is a consensus in the literature regarding eyebrow aesthetics.

In women, the eyebrow should have a gentle arch shape with the peak residing between the lateral limbus and lateral canthus. The medial brow should begin above or just medial to the medial canthus and should be lower than the lateral peak. The peak of the brow arch should be no more than 10 mm above the most caudal portion of the medial brow. The eyebrow should arch above the supraorbital rim, with the medial portion at or below the supraorbital rim.

In men, eyebrows should be horizontal or flat with no arch shape. The male eyebrow is lower than the female eyebrow and usually follows the orbital rim. The lateral portion of the brow is typically fuller in men than in women.

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

83. A 16-year-old boy who underwent costochondral reconstruction of the right ear 20 days ago because of microtia has had pain, erythema, fluctuance, and swelling of the ear as well as fever for the past 48 hours. A photograph is shown. In addition to intravenous administration of an antibiotic, which of the following is the most appropriate management?
- A) Application of mafenide acetate (Sulfamylon)
 - B) Incision and drainage, washout, and placement of irrigating drains
 - C) Incision and removal of the cartilage construct and placement of irrigating drains
 - D) Needle aspiration and application of a compressive bolster dressing
 - E) Observation

The correct response is Option B.

The clinical scenario described is dire because of the likely loss of the costochondral ear

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reconstruction. The cartilage may have gained enough vascularity to help avoid loss of the construct. In addition to intravenous administration of an antibiotic, incision and removal of the construct must be considered, but a trial of incision and drainage, washout, and placement of irrigating drains is warranted in an attempt to avoid loss of this graft. If the fever and cellulitis do not improve quickly, then removal of the construct is warranted as a secondary procedure.

Application of Sulfamylon, needle aspiration, and observation are not aggressive enough for this severe infection.

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84. A 45-year-old woman with T3 N0 invasive ductal carcinoma in the inferior pole of the left breast is scheduled to undergo segmental mastectomy and subsequent radiation therapy. She currently wears a size 36DDD brassiere and is willing to accept any cup size from C to DDD. Which of the following interventions will yield the best cosmetic result in this patient?
- A) Bilateral reduction mammoplasty
 - B) Implantation of a prosthesis in the left breast and mastopexy of the right breast
 - C) Latissimus dorsi musculocutaneous flap reconstruction of the left breast and mastopexy of the right breast
 - D) TRAM reconstruction of the defect
 - E) No reconstruction

The correct response is Option A.

In a patient with large breasts, in whom a partial mastectomy is required, reduction mammoplasty is a very good option. This procedure will potentially relieve symptoms of macromastia, reduce the amount of breast tissue present in both breasts, and offer the best aesthetic outcome.

Implantation of a prosthesis in a breast that will undergo radiation therapy increases the risk for complications and would likely lead to a less symmetrical result.

The latissimus dorsi (or TRAM) flap could be used for immediate partial reconstruction but is ideal for delayed reconstruction of partial mastectomy defects. Reduction mammoplasty does not preclude future reconstruction options, but a latissimus flap reconstruction would.

With a T3 tumor, a significant portion of the lower pole of the breast is removed to obtain clear margins. Even though the patient described has moderate to large breasts, there is a high likelihood that she will develop a deformity of the left breast and asymmetry with the right breast if no reconstruction is performed.

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85. A 42-year-old woman comes to the office for consultation regarding removal of transverse wrinkles over the bridge of the nose. Administration of botulinum toxin type A is planned. Targeting of which of the following muscles is most appropriate?

- A) Corrugator supercilii
- B) Frontalis
- C) Orbicularis oculi
- D) Procerus
- E) Zygomaticus minor

The correct response is Option D.

The procerus muscle produces transverse wrinkles over the bridge of the nose. The corrugator supercilii serves to draw the eyebrow inferiorly and medially, and as such produces the vertical glabellar frown lines. The main antagonist of all of the eyebrow depressors is the frontalis muscle. Contraction of the orbicularis oculi enhances the radially oriented folds at the lateral canthus. The zygomaticus major muscle draws the angle of the mouth superiorly, laterally, and posteriorly with actions of laughing, smiling, and chewing. The zygomaticus minor muscle functions as one of the lip elevators and, with the zygomaticus major, contributes to the nasolabial fold.

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86. A 32-year-old woman comes to the office because she has persistent paresthesia of the lower lip three weeks after undergoing alloplastic chin augmentation via the submental approach. Which of the following is the most appropriate management?

- A) Gentle external massage
- B) Oral administration of a corticosteroid
- C) Surgical readjustment of the prosthesis
- D) Surgical release of the mentalis muscle fibers
- E) Observation

The correct response is Option C.

Paresthesia of the lip after insertion of an alloplastic chin prosthesis should be resolving or decreasing by two to three weeks postoperatively. If not, the prosthesis should be removed and trimmed superiorly at the level of the mental nerve foramen, or the implant wing should be positioned lower to prevent continued impingement of the mental nerve. Leaving a prosthesis in situ for eight weeks or longer with persistent numbness of the lip may result in some permanent loss of sensation. It is best to adjust prostheses as early as possible—or by four weeks at the latest—for satisfactory results.

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87. A 50-year-old man who underwent uncomplicated full abdominoplasty with suction lipectomy two weeks ago comes to the emergency department because he has had painless swelling of the right lower extremity for the past 24 hours. He currently smokes one pack of cigarettes daily. Medical history includes no serious disease conditions. Vital signs are stable and within normal limits. Physical examination shows 7-cm enlargement of the circumference of the right leg with a positive Homans sign. The chest is clear to auscultation, and the patient is not in acute distress. Which of the following diagnostic studies is the most appropriate initial step?
- A) Doppler ultrasonography of the lower extremities
 - B) Lymphangiography
 - C) Spiral CT of the chest
 - D) Venography of the lower extremities
 - E) Ventilation-perfusion (VQ) scan

The correct response is Option A.

Among plastic surgery procedures, abdominoplasty has one of the highest rates of deep vein thrombosis (DVT) and pulmonary embolism. It is essential to know the proper course of management of this major cause of postoperative morbidity and mortality. Clinical workup may vary with the severity of the symptoms and physical examination of the patient, and not all clinical investigations may be available to the surgeon. However, a clear path of investigation and treatment should be developed.

A Doppler ultrasonography is the most appropriate initial test for DVT because it is quick, noninvasive, and readily available in most centers.

Venography of the lower extremities is also a diagnostic test, but it is invasive and has increased risks.

Lymphangiography is a diagnostic test for lymphedema, not for DVT.

If pulmonary embolism is suspected, a spiral CT of the chest or a VQ scan of the lungs is indicated.

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For each patient with blepharoptosis, select the most likely diagnosis (A–D).

- A. Horner syndrome
- B. Injury to the facial (VII) nerve
- C. Myasthenia gravis
- D. Senile ptosis

88. A 66-year-old man with visual obstruction of the left eye and elevation of the supratarsal crease

89. A 60-year-old woman with general muscle fatigue and bilateral upper visual field obstruction that worsens at the end of the day

The correct response for Item 88 is D and for Item 89 is C.

Horner syndrome is marked by ptosis, miosis, and anhidrosis. It occurs after loss of sympathetic innervations of the superior cervical ganglion. The eyelid crease is usually not affected.

Injury to the facial (VII) nerve results in brow ptosis, not blepharoptosis.

Myasthenia gravis may cause unilateral or bilateral ptosis, which would be exaggerated by fatigue. The condition typically affects young women or elderly men. Pharmacologic testing establishes the diagnosis.

Senile ptosis is characterized by dehiscence of the levator aponeurosis, which is the most common cause of ptosis in elderly individuals. Elevation of the supratarsal crease is seen. Levator plication or advancement is required for correction.

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90. During a reduction mammoplasty procedure, preservation of sensation in the nipple-areola complex is most dependent on which of the following?

- A) Amount of tissue resected
- B) Nipple-to-notch distance
- C) Pedicle location
- D) Preoperative breast volume
- E) Skin incision used

The correct response is Option C.

The most important determinant in preserving sensation in the nipple-areola complex is the anatomic location of glandular resection. Superior glandular pedicle techniques with tissue resections at the base of the breast are associated with higher risk of injury to the nerve supply. Lateral, inferior, and medial-based pedicles allow for better preservation of the nerve supply.

The amount of tissue resected has not been shown to have a statistically significant effect on preservation of sensation in the nipple-areola complex.

Preoperative breast volume is a factor in preoperative nipple-areola sensation (ie, the sensitivity of the nipple-areola decreases as the breast volume increases). However, preoperative breast volume, type of skin incision used, or nipple-to-notch distance have not been found to be the most important factor in preservation of nipple sensation.

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91. A 50-year-old man is brought to the emergency department 90 minutes after he sustained injuries in a motor vehicle collision. Physical examination shows a severe abrasion injury to the right ear with partial degloving of the superior helical rim extending into the concha. The skin over the upper third of the ear is missing at variable depths. Which of the following is the most appropriate initial step in management?
- A) Conservative debridement and topical wound care
 - B) Debridement and coverage with a local flap
 - C) Debridement and skin grafting
 - D) Debridement, coverage with a temporoparietal fascia flap, and skin grafting
 - E) Resection and primary wound closure

The correct response is Option A.

The patient described has a partial-thickness injury involving the upper third of the ear. It is often not clear initially if the perichondrium is viable in this situation. Although the patient may require coverage of the exposed cartilage with a flap, initial management is most often conservative. The most appropriate initial step is conservative debridement and topical wound care including dressing changes until the devitalized tissues demarcate. This management allows for a full assessment of the extent of the injury. It is important that the dressings prevent desiccation and infection of the exposed perichondrium.

Debridement followed by immediate skin grafting is not appropriate because skin graft take is often unreliable if the cartilage is exposed. Also, the extent of tissue injury caused by shearing and blunt trauma is difficult to assess initially because of the soiled and edematous tissues of the fresh trauma.

Debridement, coverage with a temporoparietal fascia flap, and skin grafting is effective in providing a bed for skin grafting but is not the most appropriate initial step in management.

Resection and closure of a defect of this size can be performed, often with an Antia-Buch flap after wedge resection with a pentagonal design. However, this procedure will reduce the size of the ear and, therefore, is not appropriate.

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92. A 10-year-old girl is brought to the office by her parents for consultation regarding congenital unilateral facial paralysis. She has had no previous treatment of this condition. Physical examination shows no muscle activity on the affected side. Which of the following is the most appropriate first step in management to restore voluntary animation to the paralyzed side of the face?
- A) Cross-facial nerve grafting
 - B) Gracilis neurovascular free tissue transfer
 - C) Masseter muscle transfer
 - D) Temporalis muscle transposition
 - E) Tensor fascia lata suspension

The correct response is Option A.

The best treatment for this child with unilateral facial paralysis involving the eye is a two-stage surgical correction resulting in dynamic reanimation. In the first stage, cross-facial nerve grafting is constructed from the unparalyzed side of the face to the paralyzed side. The sural nerve is commonly used as a graft. The second stage consists of free tissue transfer of muscle, such as the gracilis or pectoralis minor, to the paralyzed side of the face. Microvascular anastomoses are completed, with the goal of functional reanimation of the paralyzed face.

Eyelid closure is a priority issue in treatment of facial paralysis. Lack of corneal protection can result in keratitis, conjunctivitis, corneal ulceration, and visual impairment. Although use of artificial tears and ointments is necessary, such treatment is neither permanently effective nor corrective in any type of functional repair.

Transposition of the temporalis muscle is another option for dynamic reconstruction of the eye in patients with facial paralysis. It has the advantage of immediate functional correction, compared with the lag period required for muscle reinnervation by cross-facial nerve grafting. However, one long-term study has shown overall better functional results, measured by eyelid closure and movement, in patients undergoing correction with two-stage cross-facial nerve grafting and muscle transfer compared with transposition of temporalis muscle. In addition, microvascular tissue transfer is a better choice in children with facial paralysis, who may be the best candidates to achieve functional adaptation after such a procedure. Furthermore, the use of a muscle of mastication in children may have potential deleterious effects on skeletal maturation.

Static correction of eyelid closure by means such as fascial or tendon sling creation, tarsorrhaphy, and placement of a gold weight does not produce dynamic movement and,

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therefore, does not fully correct the obvious functional deficit apparent on the paralyzed side with animation of the face. These options are more suitable for older patients with facial paralysis, in whom static correction may be more desirable and who may not be optimal candidates for more complex procedures such as free tissue transfer.

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93. A 37-year-old woman is undergoing infiltration of wetting solution in preparation for liposuction of the trochanteric region. As the infiltration progresses, supraventricular tachycardia is noted on the electrocardiography monitor. Blood pressure remains within normal limits. Which of the following is the most appropriate next step?
- A) Administer procainamide 100 mg slowly over 5 minutes to a maximum dose of 1000 mg and perform 12-lead electrocardiography
 - B) Administer protamine 25 mg by intravenous infusion over 10 minutes and perform 12-lead electrocardiography
 - C) Continue the procedure as planned after obtaining chest radiographs
 - D) Discontinue the infiltration, check the composition of the infiltrate, and assess for possible accidental intravascular injection
 - E) Discontinue the infiltration until the tachycardia resolves and immediately cardiovert

The correct response is Option D.

The infiltration of large amounts of lidocaine and epinephrine is not without risk. Medication errors are missed because the surgeon fails to check that the operating room personnel have properly constituted the wetting solution, with severe consequences. Wetting solution preparation is often relegated to junior personnel who are unaware of the importance of correct formulation. Intravascular injections can also contribute to lidocaine or epinephrine complications and toxicity.

Supraventricular tachycardia is a normal heart response to adrenaline, but it nevertheless should be assessed by the surgeon and anesthesiologist with a good electrocardiogram. The infiltration should be discontinued. The vital signs of the patient described will determine further treatment.

Beta blockers, calcium channel blockers, procainamide, and other medications may be used if the patient's rhythm does not normalize. Protamine is used to reverse heparin and is not used for arrhythmia. Chest radiographs will not diagnose the etiology or the arrhythmia. Cardioversion is not used if the patient's blood pressure is stable.

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94. An active 72-year-old man with squamous cell carcinoma of the ear is scheduled to undergo total resection. Medical history includes only well-controlled hypertension. Which of the following is the primary limitation of autologous reconstruction in this patient?

- A) Cartilage framework
- B) Medical comorbidities
- C) Nutritional factors
- D) Skin envelope
- E) Temporal wasting

The correct response is Option A.

The most difficult problem in auricular reconstruction in elderly patients is in the fabrication of the three-dimensional cartilage frame. This is because the harvested costal cartilages are calcified and extremely brittle; therefore, modifications in the construction of the cartilage frame may be required.

Limitations in elasticity and flexibility of the costal cartilage may not allow the fabrication of the crus helices–helical rim as one unit as in younger patients. However, it is possible to perform auricular reconstruction in elderly patients with extreme caution in the construction of the cartilage frame.

In younger patients, the major difficulty in auricular reconstruction is attainment of sufficient skin surface area to cover the fabricated cartilage frame without resorting to skin grafts, but in an elderly patient with a nontraumatic injury, there is ample skin. Medical comorbidities, if severe, may limit surgery, but the ear and rib incisions are usually well tolerated. Temporal wasting may make the use of a temporoparietal flap problematic, but this is generally not needed in an elective case with normal postauricular skin. Nutritional factors are generally optimized before surgery.

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95. A 40-year-old woman is scheduled to undergo reconstruction of the right breast via a free TRAM flap. She has smoked two packs of cigarettes daily for the past eight years. This patient's smoking history increases her risk of which of the following postoperative complications?

- A) Hematoma
- B) Mastectomy flap necrosis
- C) Seroma
- D) TRAM flap loss
- E) Vessel thrombosis

The correct response is Option B.

One study found no significant increased risk of flap loss, vessel thrombosis, or fat necrosis in free TRAM flaps performed on smokers. However, smokers did have an increased risk over their nonsmoking counterparts in the area of mastectomy skin flap necrosis, abdominal hernia, and abdominal flap necrosis.

Another study of 569 free TRAM flaps found that smokers had an increased rate of fat necrosis, wound infection, abdominal flap necrosis, and mastectomy flap necrosis. There was no correlation with free flap loss, thrombosis, hematoma, or seroma.

By using the deep inferior epigastric vessels, which are the primary blood supply to the TRAM flap, risks to the flap itself are minimized even in smokers. But smoking continues to increase the risk of donor site morbidity and native breast skin necrosis.

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96. A 26-year-old woman comes to the office after being referred by an ophthalmologist because of scleral show of the left lower eyelid. Three weeks ago, she sustained a laceration of the lower eyelid, which was sutured in the emergency department. Which of the following is the most appropriate next step in management?
- A) Tear supplementation and massage of the scar
 - B) Injection of a corticosteroid into the scar and silicone sheeting
 - C) Lysis of scar adhesions and septal cartilage interposition grafting
 - D) Excision of the scar and full-thickness skin grafting
 - E) Lateral canthopexy and cheek advancement flap

The correct response is Option A.

This patient has ectropion with eversion of the lower eyelid. In general, ectropion is classified as involutional, cicatricial, or neurogenic. The patient described has a cicatricial ectropion. At three weeks into the postoperative period, the wounds are still in the active phase of healing. Over the next six to nine months, as the collagen with the scar remodels, the lid may return to a more normal position. Therefore, during this time frame, the ectropion should be managed with scar tissue massage and a regimen to prevent complications related to dry eyes, such as tear supplementation and eye patching. Surgical intervention is warranted if there is no improvement after this time frame or if conservative therapy is ineffective and there is a risk of visual compromise.

Injection of a corticosteroid can reduce inflammation and soften the scar, allowing the eyelid to return to a better position. However, use of corticosteroids in the lower eyelid is not advocated because of the risks of tissue atrophy and skin discoloration.

Lysis of scar adhesions and the placement of an interpositional graft are indicated for cases of midlamellar scar. Placing upward traction on the eyelid can identify scar contracture in this location. If adequate skin is present, the lower eyelid should reach at least the level of the midpupil. If this movement is restricted, midlamellar scarring is likely.

Lateral canthopexy is indicated for lower eyelid malposition associated with lower eyelid laxity. Excision of the scar and skin grafting are indicated for ectropion secondary to cutaneous deficiency.

Excision of the scar and cheek advancement with a lateral canthopexy would not be a primary reconstruction procedure for this lesion.

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97. During rhytidectomy in a 52-year-old man, the external jugular vein is entered. During hemostasis, an adjacent nerve is noted to be cauterized. Which of the following postoperative complications is most likely to occur in this patient?

- A) Asymmetry of the lower lip
- B) Difficulty swallowing
- C) Gustatory sweating
- D) Hoarseness
- E) Paresthesia of the earlobe

The correct response is Option E.

The earlobe is innervated by the great auricular nerve, which follows closely with the external jugular vein and runs on the same plane. The vein and the nerve run superficial to the platysma and can often be injured while raising the tissue plane for rhytidectomy. Injury can occur when the plane is adherent between the sternocleidomastoid muscle and the lateral border of the platysma muscle.

Asymmetry of the lower lip would result from injury to the marginal mandibular nerve, which lies deep to the platysma. The great occipital nerve may also be injured, which would cause numbness of the mastoid area, but this nerve runs in a more posterior direction than the external jugular vein and great auricular nerve. Difficulty swallowing may occur with injury to the ansa cervicalis or to the pharyngeal musculature. Pharyngeal muscles are innervated by the branches of trigeminal (V) nerve running deep within the carotid sheath. Hoarseness would result from injury to the recurrent laryngeal nerve, which runs much deeper along the tracheoesophageal groove, caudal to the thyroid.

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98. A 38-year-old woman comes to the office three months after undergoing augmentation mammoplasty to correct Grade 2 ptosis of the breasts because she has become increasingly dissatisfied with the results. During the procedure, 350-ml saline prostheses were placed submuscularly. Current physical examination shows excess superior fullness and inferior positioning of the natural breast over the lower pole of the prostheses. Which of the following is the most effective method of correcting this result?
- A) Closed capsulotomy
 - B) Exchange for larger implants
 - C) Mastopexy
 - D) Open capsulotomy
 - E) Radial scoring of the inframammary fold

The correct response is Option C.

Augmentation of the Grade 2 ptotic breast will result in a "double-bubble" appearance if the nipple-areola complex is not also elevated with a skin excision. Therefore, Grade 2 ptosis, in which the nipple is below the inframammary crease, requires a mastopexy. Attempting to correct greater degrees of ptosis with implantation of a prosthesis alone requires the use of large volume prostheses that may be aesthetically unpleasing. In addition, the poor quality skin envelope may not be able to tolerate such expansion. Without the necessary skin tightening, the native ptotic breast may hang over the less mobile and higher positioned underlying prosthesis. This postoperative contour deformity (double bubble) can worsen as the patient ages. It is corrected with a mastopexy.

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99. A 24-year-old man who sustained total amputation of the left ear during an explosion three months ago comes to the office for consultation regarding reconstruction of the ear. Physical examination shows loss of the auricle and tragus with scarring of the skin and scalp surrounding the external auditory canal. Which of the following materials is most appropriate for the first stage of the reconstruction of this patient's ear?
- A) Full-thickness skin grafting to replace the scar and subsequent expansion
 - B) Radial forearm flap and Silastic framework
 - C) Temporalis muscle turnover flap and rib framework
 - D) Temporoparietal flap and rib graft framework
 - E) Tissue expansion of retroauricular skin and Medpor framework

The correct response is Option D.

The goal of reconstruction of the ear is to restore the cosmesis of the auricle and the function of the superior helical rim in providing support for eyeglasses. Total reconstruction of the ear most likely requires two to three stages. The first stage typically involves creating a cartilage framework and placing it under vascularized tissue. In the scenario described, an ipsilateral temporoparietal fascia pedicled flap or a contralateral free temporoparietal fascia flap (TPFF) covered with a split-thickness skin graft (STSG) is most appropriate. STSGs are generally used because they will shrink and form fit to the auricular cartilage over the TPFF or in the posterior auricular skin crease.

Other options include a local tissue flap or a pre-expanded local tissue flap. A tissue expander can be placed and may be appropriate for some patients. However, it is not likely to be successful in the patient described because of the scarred skin in the region of expander placement. A second surgery is usually necessary to recreate the posterior auricular crease and the tragus or lobule. In young patients, rib cartilage is the most common first choice for autogenous framework creation because it has less risk of exposure and is readily available. In the patient described, Medpor would not be the most appropriate choice for the first stage of reconstruction because it is associated with a high exposure rate when used with thin atrophic or scarred soft tissue. The quality and quantity of skin redraping the auricular framework play a significant role in the aesthetics of the final result. In older patients with postablative defects and compromised surrounding tissue, prosthetic reconstruction can be offered as a viable, perhaps simplistic, solution to staged auricular reconstruction. A younger patient is seldom compliant with a prosthesis, and autologous reconstruction is a better option.

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100. One year after undergoing gastric bypass surgery, a 36-year-old woman comes to the office for consultation regarding cosmetic improvement of the lower torso. She has lost 120 lb since the procedure was performed, and her weight has been stable for the past three months. She does not smoke cigarettes. Height is 5 ft 4 in and weight is 175 lb. Physical examination shows circumferential laxity of the truncal skin with lipodystrophy of the hips and rectus diastasis as well as an upper midline incision. No hernias are noted. A lower body lift is scheduled. Which of the following is the most likely complication of this procedure in this patient?

- A) Infection
- B) Postoperative hemorrhage
- C) Pulmonary embolism
- D) Seroma
- E) Wound dehiscence

The correct response is Option D.

The most common complication of a lower body lift procedure is seroma. In a large retrospective series, seromas occurred in 37.5% of all patients; wound dehiscence (12%), infection (8%), and pulmonary embolism (6%) also occurred frequently after this type of surgery. Other complications such as psychiatric difficulties, unscheduled hospitalizations, skin necrosis, and postoperative hematomas may be common but are not reported as often. Complications seem to be associated with higher preoperative body mass index (weight) and history of smoking.

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Section 3: Craniomaxillofacial



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

101. A 14-year-old girl is brought to the office by her parents for consultation regarding facial asymmetry. On the basis of the photograph shown, which of the following is the most likely diagnosis?

- A) Congenital cranial (VII) nerve palsy
- B) Craniofacial microsomia
- C) Goldenhar syndrome
- D) Romberg disease
- E) Unilateral coronal craniosynostosis

The correct response is Option D.

The patient shown has Romberg disease (progressive hemifacial atrophy). This is a unilateral condition that affects girls more commonly than boys, and onset is in childhood with progression from 2 to 10 years of age. It usually involves skin, subcutaneous tissue, muscle, and bone but

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spares the cranial nerves and their function. Treatment is complex, with reconstruction of facial bone structure and augmentation followed by cutaneous contour correction with free tissue transfer. Parascapular flap is the flap of choice.

Unilateral coronal craniosynostosis can result in incomplete correction of vertical dystopia, secondary to continued growth constriction at the affected side cranial base. Soft-tissue loss and lower face asymmetry are not associated features. Hemifacial microsomia is a congenital, nonprogressive abnormality of the first branchial arch derivatives (ie, mandible and auricle). The mandibular ramus and condyle are variably hypoplastic, and overlying soft tissues (muscle, subcutaneous fat) are often hypoplastic. Ipsilateral macrostomia (transverse facial cleft) can also present in this syndrome. Goldenhar syndrome is a variant of craniofacial microsomia and is distinguished by presence of concomitant ocular abnormalities, including epibulbar dermoid.

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

102. A 7-year-old boy is brought to the office for consultation regarding the congenital nerve palsy shown. The affected nerve is derived from which of the following branchial arches?

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

The correct response is Option B.

The facial nerve (cranial nerve VII) is derived from the second branchial arch and consists primarily of motor fibers that are distributed to the muscles of facial expression. Branchial arches begin to develop in the fourth week as neural crest cells migrate into the head and neck region. By the end of the fourth week, four pairs of branchial arches are visible externally. The fifth and

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sixth arches are small and not visible on the surface of the embryo yet. The branchial arches are separated by prominent clefts called branchial grooves.

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103. A 24-year-old woman comes to the office because she has had popping of the left temporomandibular joint and associated mild pain that have been worsening over the past six months. The patient says she also has intermittent inability to fully open her mouth, but she does not believe her symptoms restrict her daily routine. Physical examination shows mild bilateral tenderness of the preauricular region but no popping, clicking, or crepitus. Maximal incisal opening is 20 to 25 mm, and lateral and protrusive excursions are reduced. MRI of the temporomandibular joints shows mild anterior dislocation of the left meniscus with reduction in the open mouth position. Which of the following is the most appropriate initial management?
- A) Administration of a nonsteroidal anti-inflammatory drug, occlusal splint therapy, and restriction to soft diet
 - B) Comprehensive orthodontic therapy with bilateral sagittal ramus osteotomies of the mandible
 - C) Initial intra-articular injection of a corticosteroid followed by serial injections if symptoms do not resolve
 - D) Open arthrotomy with meniscectomy followed by a brief period of joint immobilization and then physical therapy
 - E) Open arthrotomy with plication of the meniscus followed by a brief period of joint immobilization and then physical therapy

The correct response is Option A.

With symptoms and clinical findings of mild pain and popping of the temporomandibular joint, mild tenderness of the preauricular region, and transient joint locking, the patient described has an early/intermediate stage internal derangement. MRI shows only mild changes in meniscal position. Therefore, conservative therapy such as a soft diet, use of nonsteroidal anti-inflammatory drugs, and splinting is indicated. Most patients with temporomandibular joint disorders will achieve some relief of symptoms with nonsurgical therapy within a period of two to three years. However, the pathologic process may continue, and follow-up is recommended.

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104. A 24-year-old man who underwent repair of isolated cleft lip and palate in infancy comes to the office with his wife for consultation regarding the risk of their children having cleft deformities because they are planning their first pregnancy. The patient's family history includes isolated cleft lip and palate in his mother. The patient's wife has no congenital deformities and has no known family history of cleft palate. Which of the following percentages best represents the chance that this couple will have a child with a cleft deformity?

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

The correct response is Option A.

Although there are cases in which clefting does transmit in an autosomal-dominant or autosomal-recessive fashion, most isolated cleft lip/palate deformities follow a multifactorial model of genetic transmission. Therefore, the risk that this patient will have a child with a cleft is only slightly higher than the general population.

Families with Van der Woude syndrome, for example, are known to have an autosomal-dominant clefting mutation. If this were the case, this patient would then have a 50% chance of transmitting the cleft locus to a child. Similar Mendelian genetic models would apply to other scenarios.

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105. A 76-year-old man undergoes a radial forearm flap procedure for reconstruction of a defect of the floor of the mouth resulting from excision of carcinoma. During dissection of vessels in the neck for microsurgical anastomosis, the surgeon has difficulty visualizing an appropriate recipient artery because of high bifurcation of the carotid artery. Which of the following muscles can be cut to provide better exposure of the recipient artery?
- A) Digastric
 - B) Geniohyoid
 - C) Omohyoid
 - D) Sternohyoid
 - E) Styloglossus

The correct response is Option A.

There are only two muscles that would be in the area of a high bifurcation of the carotid that may need to be cut for better exposure: posterior belly of the digastric and the stylohyoid, which span across the skull base to the hyoid. Because the stylohyoid is not mentioned, the digastric muscle is the correct choice. The microsurgeon usually divides the digastric muscle at the level of the fibrous loop for the intermediate digastric tendon. The other muscles are never dissected or divided during this procedure.

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106. A 37-year-old woman is brought to the emergency department two hours after she sustained injuries to the face in a motor vehicle collision. Radiographs show an orbital zygomatic fracture on the left side. On ophthalmologic examination, the left pupil fails to constrict when direct light is shined in the eye; consensual pupillary constriction is normal. Color perception is diminished in the left eye. Findings in the right eye are normal. Which of the following is the most likely cause of these findings?
- A) Detachment of the retina
 - B) Extension of the fracture through the optic canal
 - C) Impingement of bone fragments on the optic (II) nerve
 - D) Shear force injury to the optic (II) nerve
 - E) Thrombosis of the retinal artery

The correct response is Option D.

Physical examination of the patient with an orbital zygomatic fracture includes an ophthalmologic assessment. Along with evaluation for motility disturbances of the globe and diplopia, a direct visual assessment is performed. The finding of traumatic optic neuropathy has been reported in 2% to 5% of patients with severe facial trauma. In its most severe form, traumatic optic neuropathy results in visual loss; however, findings may be more subtle, such as diminished color perception. It is also possible to find an afferent pupillary defect in the affected eye (if the pupil fails to constrict with direct light stimulation but constricts normally in a consensual response when light is directed to the contralateral eye). Injury to the optic (II) nerve can result from either mechanical or ischemic insults. The most likely mechanism of injury is shear force to the optic (II) nerve. The dural sheath is firmly attached to the optic nerve at its entrance into the optic foramen. Rapid deceleration injuries of the head can generate forces that are concentrated at the optic foramen. An optic nerve injury can also result from fracture fragments directly damaging the optic nerve or globe, thrombosis of the retinal artery, or retinal detachment; however, these are less common than injury resulting from shear force.

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107. Which of the following muscles of facial expression is innervated on its anterior surface?

- A) Depressor anguli oris
- B) Levator anguli oris
- C) Levator labii superioris
- D) Orbicularis oris
- E) Zygomaticus major

The correct response is Option B.

The muscles of facial expression receive their innervation from cranial nerve VII (facial nerve). The facial nerve innervates the muscles of facial expression along the posterior surface of the muscle in most cases. The exceptions to this rule include the levator anguli oris, the buccinator, and the mentalis muscle. At the modiolus, the fibers of the levator anguli oris coalesce with fibers of the zygomaticus major, orbicularis oris, risorius, buccinator, and depressor anguli oris. The levator anguli oris lies deep to the other muscles and receives its innervation along its anterior surface.

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108. A 20-year-old woman comes to the office for consultation regarding malocclusion. Cephalometric analysis shows SNA angle of 83 degrees (normal = 82 ± 3 degrees) and SNB angle of 85 degrees (normal = 80 ± 3 degrees). Which of the following is the most likely cause of this patient's deformity?

- A) Mandibular prognathism
- B) Mandibular retrognathism
- C) Maxillary retrusion
- D) Retrogenia
- E) Vertical maxillary excess

The correct response is Option A.

A normal SNA (sella-nasion-point A) angle is defined as 82 ± 3 degrees and measures the position of point A (anterior maxilla) relative to the anterior cranial base (SN). A normal SNB (sella-nasion-point B) angle is defined as 80 ± 3 degrees and measures the position of point B (anterior mandible) relative to the cranial base (SN). The most common cause of a normal SNA with an increased SNB is mandibular prognathism. Mandibular retrognathism would have a normal SNA with a decreased SNB. Maxillary retrusion is associated with a decreased SNA and a normal SNB. Vertical maxillary excess alone would not change the SNB but describes a patient with long face syndrome.

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109. Which of the following muscles is typically reoriented during repair of cleft palate?

- A) Levator veli palatini
- B) Muscularis uvulae
- C) Palatoglossus
- D) Palatopharyngeus
- E) Superior pharyngeal constrictor

The correct response is Option A.

Within the normal soft palate, the levator veli palatine muscle forms a dynamic sling that elevates the velum toward the posterior pharyngeal wall during the production of certain sounds. In children born with cleft palate, there is a division of the musculature of the velum into separate muscle bellies with abnormal insertions along the posterior edge of the hard palate. The goals of cleft palate repair during infancy are twofold. The first goal is to establish a complete, watertight closure of the secondary palate for separation of the oral and nasal cavities. The second goal is to reorient and repair the levator musculature to allow for normal speech formation. The muscularis uvulae is also repaired in cleft palate repair. However, this muscle is typically not reoriented. Instead, it is simply approximated in the midline.

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110. A 74-year-old man who is edentulous is scheduled to undergo resection of T4 NO squamous cell carcinoma of the anterior aspect of the floor of the mouth. Bilateral anterior segmental mandibulectomy from the middle of the body of the mandible is planned. Which of the following is the most appropriate method of reconstruction?
- A) Free fibular osteocutaneous flap
 - B) Nonvascularized iliac bone graft
 - C) Pectoralis myocutaneous flap with a reconstruction plate
 - D) Pectoralis myocutaneous flap with a rib graft
 - E) Platysmal myocutaneous flap with a reconstruction plate

The correct response is Option A.

Resection of the anterior mandible can result in poor oral competence. When reconstruction is not attempted, the retained segments of the mandible tend to collapse toward the midline. This lack of support results in the “Andy Gump” deformity with the associated oral incontinence and cosmetic deformity. The approximate plate extrusion rate in patients with anterior defects who have been reconstructed with plates and soft tissue flaps has been reported to be as high as 66%. Free tissue transfer of a composite, osteocutaneous flap is thus advocated as the reconstructive method of choice. Nonvascularized bone grafts are not indicated in patients who are expected to receive postoperative radiation therapy and who have defects greater than 6 cm. With the advent of free tissue transfer, the transfer of a vascularized rib on the pectoralis muscle is not a first choice for reconstruction.

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111. A 25-year-old man is brought to the emergency department 30 minutes after he fell while riding a bicycle. He says he was thrown over the handlebars onto the road surface and landed on his chin. Physical examination shows swelling along the mandible and anterior open bite. Radiographs show a parasymphiseal fracture of the mandible and bilateral fractures of the condylar neck. The left condylar head is displaced medially out of the glenoid fossa. No other associated injuries are noted. Which of the following is the most appropriate management of this fracture?

- A) Mandibular-maxillary fixation for six weeks
- B) Open reduction and internal fixation of the parasymphiseal fracture followed by mandibular-maxillary fixation for six weeks
- C) Open reduction and internal fixation of the parasymphiseal and left condylar neck fractures followed by mandibular-maxillary fixation with elastics
- D) Open reduction and internal fixation of the parasymphiseal and right condylar neck fractures followed by mandibular-maxillary fixation with elastics

The correct response is Option C.

Rigid fixation of mandible fractures allows early mobilization and restoration of jaw function, airway control, improved nutritional status, improved speech, better oral hygiene, patient comfort, and an earlier return to the workplace. The technique of rigid internal fixation was developed by AO/ASIF in Europe in the 1970s. The basic principles of the AO call for primary bone healing under conditions of absolute stability. This is accomplished by interfragmentary compression plates. An inferior border plate is used to counter compression forces, and a superior border plate or arch bars can be used to counter traction or tension forces at the superior border.

The subcondylar fracture poses a different and more complicated set of questions. Most practitioners agree that most subcondylar fractures can be treated in a closed fashion. Closed treatment implies control of the occlusion, aggressive physical therapy, and close follow-up. Additionally, children should generally be treated with closed reduction. Absolute indications for open treatment of subcondylar fractures are as follows: dislocation into the middle cranial fossa or external auditory canal, lateral extracapsular displacement, inability to obtain adequate occlusion, or open joint wound with foreign body or gross contamination.

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112. An 18-year-old woman who underwent repair of cleft lip and palate during infancy is scheduled to undergo maxillary advancement surgery. Which of the following factors favors distraction osteogenesis over traditional orthognathic advancement?

- A) Anticipated advancement of 5 mm
- B) Anticipated advancement of 14 mm
- C) Need for simultaneous alveolar cleft bone grafting
- D) Need for simultaneous palatal expansion

The correct response is Option B.

Children with cleft lip often develop maxillary hypoplasia and Class III malocclusion. Traditional orthognathic advancement is limited by the tension of the soft-tissue envelope. Greater tension is associated with scarring, advancement distances of greater than 1 cm, and past pharyngeal surgical procedures. Any of these issues will limit the advancement and increase the relapse rate over the subsequent years.

Distraction osteogenesis allows the soft tissues to be expanded as the bone is advanced.

Palatal expansion requires horizontal movement. Distraction in multiple directions is difficult to control.

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113. Which of the following facial anomalies is most common in patients with craniofacial microsomia?

- A) Facial nerve palsy
- B) Mandibular hypoplasia
- C) Maxillary hypoplasia
- D) Microtia
- E) Parotid gland hypoplasia

The correct response is Option B.

Craniofacial microsomia represents the second most common congenital anomaly affecting the head and neck behind cleft of the lip and/or palate. Multiple craniofacial and other anomalies are commonly seen as part of the constellation of findings. The most common anomalies are those affecting the mandible (89% to 100%) and ear (66% to 99%). Less common associations that must be sought involve the vertebrae and ribs (16% to 60%), ipsilateral facial nerve (10% to 45%), and genitourinary structures (4% to 15%), among others.

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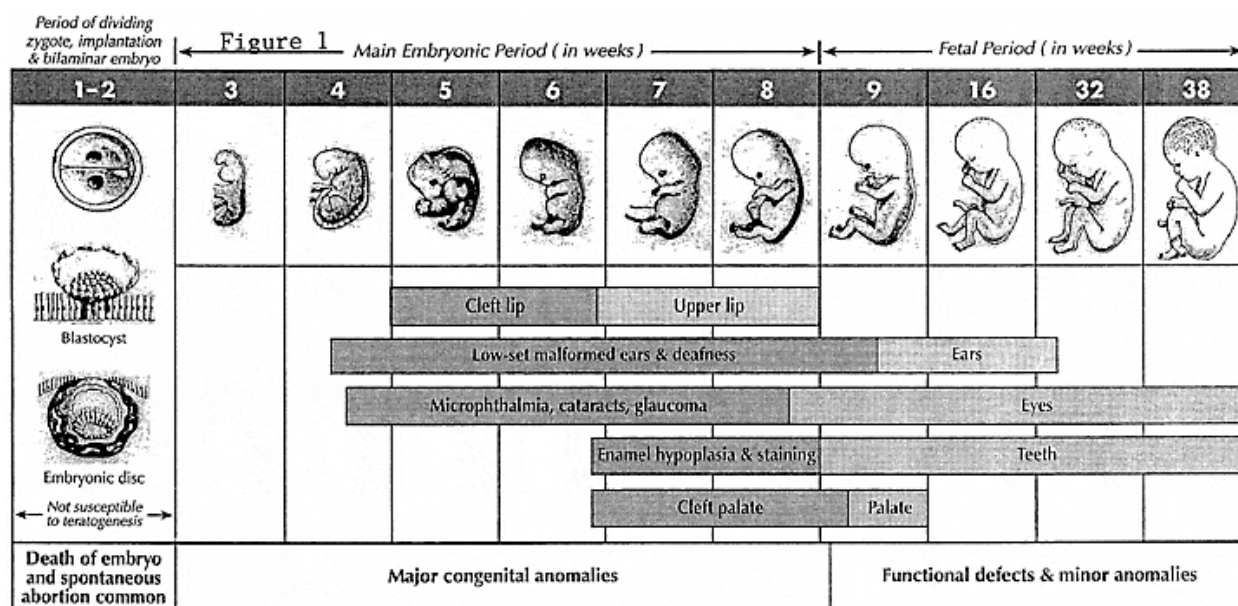
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114. Cleft palate occurs during which of the following weeks of fetal development?

- A) 1–2
- B) 3–4
- C) 5–6
- D) 7–8
- E) 9–10

The correct response is Option D.



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Errors occurring during the main embryonic period are responsible for major craniofacial anomalies. Cleft palate, which results from a failure of the palatine shelves to fuse, occurs primarily during weeks 7 to 8. Errors during weeks 1 to 2 result in death of the embryo. Clefting of the lip occurs during weeks 5 to 6. Ear and eye abnormalities occur during weeks 10 to 12.

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115. A 38-year-old man sustains panfacial fractures in a motor vehicle collision. During surgical reduction, which of the following structures is most appropriate to restore the transverse dimension of the facial skeleton?

- A) Condyle and posterior mandibular ramus
- B) Mandibular arch
- C) Nasomaxillary buttress
- D) Pterygomaxillary buttress
- E) Zygomaticomaxillary buttress

The correct response is Option B.

The buttresses of the face allow more precise reduction of facial fractures in both the transverse and vertical dimensions. The vertical buttresses include the nasomaxillary, zygomaticomaxillary, and pterygomaxillary buttresses. The condyle and posterior mandibular ramus make up yet another buttress establishing posterior facial height. The horizontal buttresses, also known as anterior-posterior buttresses, allow precise restoration of facial depth. They include the frontal, zygomatic, maxillary, and mandibular buttresses. The mandibular buttress is composed of the mandibular arch.

Of the options listed, the mandibular arch is the only structure that defines the horizontal buttress of the face.

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116. An 18-year-old man who was born with a bilateral cleft lip and palate, which were repaired in infancy, has completed orthodontic care and treatment. Maxillary advancement is planned. Which of the following is the most likely dental relationship in this patient?

- A) Negative overbite
- B) Positive overbite
- C) Negative overjet
- D) Positive overjet

The correct response is Option C.

Both overbite and overjet describe the relationship of the maxillary incisors to the mandibular incisors. Cephalometric angles are frequently used to analyze the relationship of the teeth to the maxilla and mandible.

Overbite is a vertical measure of the overlapping of the upper incisors to the lower incisors. It is calculated by measuring in millimeters the vertical relationship of the perpendicular plane to the occlusal plane. This value is positive when overlap is present and negative when there is no overlap (as in the anterior open bite of Apert syndrome).

Overjet is a horizontal measure of the position of the upper and lower incisors in the anteroposterior plane. Overjet is also measured in millimeters from the labial portion of the incisal edge of the upper incisor to the labial edge of the lower incisor. This number is positive if the maxillary teeth are forward of the mandibular teeth and negative if the lower teeth are forward of the upper teeth.

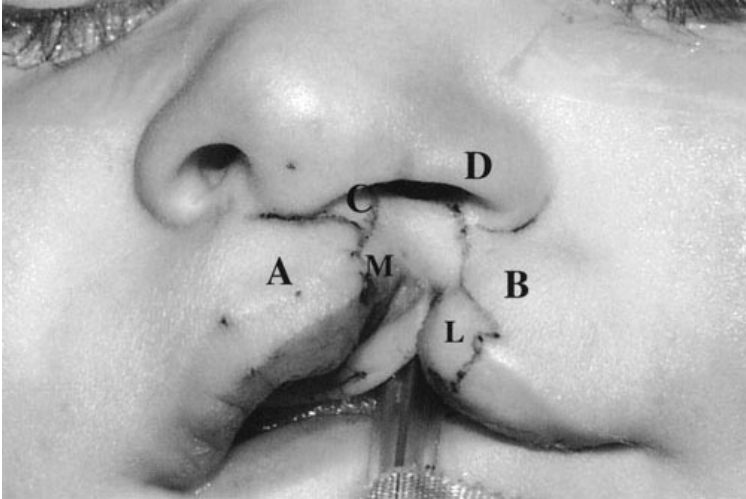
For the patient with a Class III dental relationship, in which the maxilla is retrusive, overbite is unaffected and the overjet is most likely negative.

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For the preoperatively marked rotation-advancement repair shown, select the corresponding labeled flap (A–D).



117. Rotation

118. Advancement

The correct response for Item 117 is Option A and for Item 118 is Option B.

The A flap is marked on the medial lip element and is the rotation flap. This flap is designed as a gentle curve from the height of Cupid's bow on the cleft side of the medial cleft element to the junction of the philtrum and columella. This incision approaches the normal philtral collum as much as needed to derotate and level Cupid's bow. If more rotation is needed to level Cupid's bow, a back-cut is made, but the normal philtral collum is not violated. This incision is used in philtral subunit reconstruction and leveling Cupid's bow.

The B flap is made on the non-cleft, lateral lip element and is the advancement flap. This flap is the “wedge” that is placed in the defect created above the rotation flap as the medial lip element is derotated to level Cupid's bow. This flap is marked by first finding the point on the white roll that will correspond to the height of Cupid's bow on the medial cleft element. This point is found where the fullness of the lateral lip element begins to fade. A line is drawn from this point cephalad and is the same length as the normal philtral collum as well as the marked edge of the A (rotation) flap.

The C flap or columellar flap is made from the tissue medial to the A-flap incision. This small flap is rotated into the columella, lengthening the cleft side of the columella. It is also sewn to the

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D flap (alar base flap).

The D flap or alar base flap is cut along the alar-facial groove, and this incision corresponds to the cephalad portion of the edge of the B flap (advancement flap). This alar groove incision is made as small as possible and long enough to allow differential rotation of the D flap and the B flap.

The L flap is the leading edge of the lateral lip that can be used to fill the nasal lining defect. The M flap is the medially based flap from the rotation.

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119. A 9-year-old boy is brought to the office by his parents because he has not been able to chew and swallow properly since he fell while riding a bicycle and landed on his chin one week ago. Treatment in the emergency department immediately after the injury included repair of a laceration to the chin. Which of the following findings on physical examination indicates an undiagnosed bilateral fracture of the condylar necks?

- A) Class II malocclusion
- B) Class III malocclusion
- C) Positive overbite
- D) Anterior open bite
- E) Posterior open bite

The correct response is Option D.

The mechanism of injury in the patient described is likely to produce a bilateral condylar neck fracture, which can be easily missed in the emergency department. As with the condylar neck fractures, there is a loss of vertical ramus height. Consequently, the mandible itself rotates and, with motion, the posterior molars will contact first. The anterior teeth will remain open—anterior open bite. A posterior open bite occurs when the central incisors contact and prevent the molars from occluding.

The Angle classification of dental occlusion was developed in 1890. It is based on the position of the maxillary first molar in relationship to the first mandibular molar. In class I relation, the mesiobuccal cusp of the maxillary first molar occludes in the mesiobuccal groove of the mandibular first molar. In class II, the mandibular molar is displaced backward (distal) to the maxillary first molar, while in class III relation, it is forward (mesial) to the maxillary molar. This classification describes the anterior-posterior tooth relationship only.

Overbite describes the vertical relationship of the central mandibular and maxillary incisors. It is a measure of the overlap between the incisal edges. When an anterior open bite is present, there will also be a negative overbite.

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120. A 5-year-old boy with submucous cleft palate has velopharyngeal incompetence. Which of the following is the most likely underlying cause?

- A) Incorrectly positioned levator palatine muscles
- B) Incorrectly positioned palatoglossus muscles
- C) Incorrectly positioned palatopharyngeal muscles
- D) Incorrectly positioned tensor palatine muscles
- E) Short soft palate

The correct response is Option A.

By definition, a submucous cleft palate involves the anomalous insertion of the levator palatine muscles onto the posterior aspect of the hard palate. In normal anatomy, these muscles would be oriented in a transverse fashion. When contracting, the palate then is forced to elevate in a V-shaped fashion and shorten to some degree. Nevertheless, not all children will develop speech difficulty or velopharyngeal incompetence.

The tensor palatine muscles and posterior tonsillar pillars (the palatopharyngeal muscles) are in relatively normal location. Their function is impacted by the incorrectly positioned levator.

Children with a submucous cleft have normal palate length.

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121. A 37-year-old man comes to the emergency department one hour after he was struck in the left side of the face by a baseball bat. Radiographs show a fracture of the left mandibular condyle, with anterior and medial displacement of the condyle. The most likely cause of the displacement is a pulling force originating in which of the following muscles?

- A) Lateral pterygoid
- B) Levator veli palatine
- C) Masseter
- D) Temporalis
- E) Tensor veli palatini

The correct response is Option A.

The lateral pterygoid muscle inserts on two places: the neck of the mandibular condyle and medial aspect of the articular disk. Its insertion on the condyle serves to pull the mandible superiorly, anteriorly, and medially. The medial pterygoid inserts on the medial border of the ramus and also pulls the mandible superiorly, anteriorly, and medially. The masseter inserts on the lateral border of the mandible and coronoid and acts as an elevator. The temporalis inserts on the coronoid process of the mandible rather than the condyle. The tensor veli palatini inserts in the midline of the soft palate and has no role in mandibular excursion.

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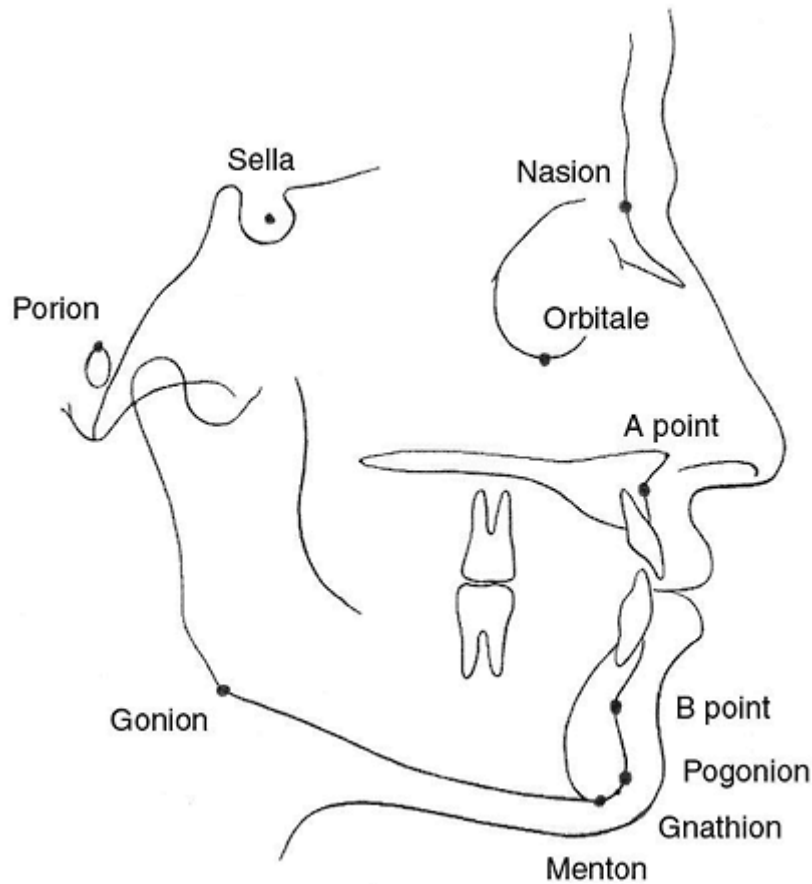
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122. The Frankfort horizontal line is formed by connecting which of the following two points on a standard cephalogram?

- A) A point and B point
- B) B point and menton
- C) Nasion and porion
- D) Orbitale and porion
- E) Sella and orbitale

The correct response is Option D.

A line joining the porion and the orbitale forms the Frankfort horizontal line (see cephalogram below). The porion is the superior aspect of the external auditory meatus. The orbitale is the most inferior point around the orbital rim. The Frankfort horizontal line is used to determine other reference measurements in the facial skeleton, such as the facial plane angle. The A point is the most posterior point of the anterior surface of the maxilla. The B point is the most posterior point on the anterior surface of the mandible. The menton is the most inferior point on the lower border of the mandible. The nasion is the junction of the frontal bone and the nasal bones. The sella is the midportion of the sella turcica. Lines and angles other than the Frankfort horizontal line utilize these points to determine anomalous cranial skeletal structure.



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123. A 25-year-old man is brought to the emergency department 30 minutes after sustaining severe trauma to the head and face during a motor vehicle collision. Examination shows clear-fluid rhinorrhea, indicating leakage of cerebrospinal fluid. This patient has most likely sustained an injury to which of the following structures?

- A) Anterior ethmoidal air cells
- B) Cribriform plate
- C) Frontonasal duct
- D) Orbital portion of frontal bone
- E) Superior nasal concha

The correct response is Option B.

The cribriform plate (the horizontal component of the ethmoid bone) has many foramina that act as passageways for olfactory (I) nerves and is in intimate contact with the meninges. Therefore, injury to the cribriform plate may cause tearing of the meninges, allowing leakage of cerebrospinal fluid via intact or fractured foramina. The other components of the ethmoid bone are the vertical portion and the lateral masses.

Because of their location, the other structures listed are not likely to be involved with leakage of cerebrospinal fluid. The lateral masses of the ethmoid bone extend from the periphery of the cribriform plate, contain the anterior ethmoid air cells, and articulate with the orbital portion of the frontal bone. The crista galli is a midline prominence that serves as a point of attachment for intracranial soft tissue and that centers the cribriform plate. The frontonasal duct communicates the frontal sinus of the nasal cavity. The superior nasal conchae are bony prominences located on the medial side of each lateral mass and facing the nasal cavity.

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124. In the United States, occurrence of encephaloceles is most common in which of the following anatomic regions?

- A) Frontoethmoidal
- B) Occipital
- C) Parietal
- D) Sphenoidal

The correct response is Option B.

In the United States, encephaloceles are most common in the occipital location. In Asia, they are more common in the frontoethmoidal region. The prognosis with these malformations depends upon the presence or absence of herniated brain tissue in the encephalocele.

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125. A 20-year-old man who sustained a naso-orbital-ethmoid fracture undergoes transnasal wire canthopexy. Which of the following vectors, relative to the position of the insertion of the medial canthal tendon, is most appropriate for placement of the primary wire?

- A) Anterior and inferior
- B) Anterior and superior
- C) Posterior and inferior
- D) Posterior and superior

The correct response is Option D.

Transnasal key wire must be positioned posterior and superior to the insertion of the medial canthal tendons, behind and above the lacrimal fossa (see diagram below). The fractures are exposed via coronal approach and may require temporary removal of nasal bones for complete access. The vector provided with this location of wire positioning allows optimal relationship between the eyelid tissue and the globes. The canthal tendon is rarely completely detached from the bone and usually has fibers to the anterior and posterior lacrimal crests. However, in cases of tendon avulsion, the same principle applies, so the tendon must be transfixed posterior and superior to the lacrimal fossa. The bony intercanthal distance should be between 16 and 23 mm.

Additional pull-out transnasal soft-tissue bolsters should be applied anteriorly to assist with contouring of soft tissue against bone.

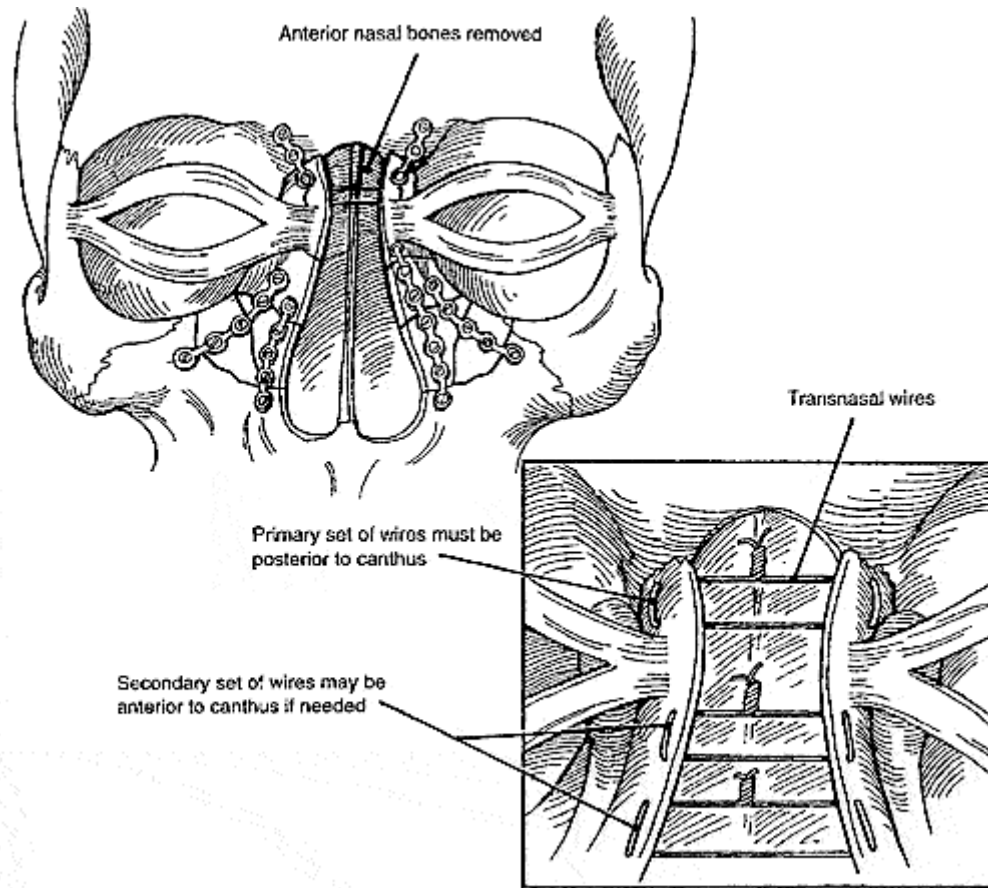


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126. A 60-year-old man is diagnosed with melanoma of the forehead. In addition to wide local excision, in which of the following tumor stages is sentinel lymph node biopsy indicated?
- A) Tis N0 M0
 - B) T2a N1 M0
 - C) T2b N0 M0
 - D) T3b N1 M0
 - E) T4a N0 M1

The correct response is Option C.

Sentinel lymph node biopsy (SLNB) is the standard of care for intermediate-thickness melanoma of the trunk and extremities and is recommended when possible for intermediate melanoma of the head and neck, such as those staged T1b N0 M0. SLNB is more complicated in the head and neck because of greater variation in the lymphatic drainage systems in those areas and because of the close proximity of the primary tumor to first-echelon lymph nodes. However, prospective studies have reported no false negatives, and SLNB results are of great prognostic value and may be used to guide adjuvant systemic protocols. Positive sentinel lymph nodes are identified in 15% to 21% of patients, and then complete nodal dissection yields additional positive nodes in up to 20% of patients. The effect of elective lymph node dissection on patient survival rates has not been determined. Nor has local or regional control in the clinically negative neck among patients with stage I and II melanoma.

SLNB is indicated in intermediate melanoma with lymph nodes that are clinically negative. Intermediate melanoma in the head and neck includes stages IB and II. In these stages, tumor characteristics include T1b (Breslow thickness of less than 1 mm with ulceration, or Clark level of IV or V), T2 (Breslow thickness of 1.01 to 2 mm), and T3 (Breslow thickness of 2.01 to 4 mm).

A T1a tumor is a thin, less aggressive melanoma with a Breslow thickness of less than 1 mm without ulceration or a Clark level below III. Because it is not yet intermediate, this tumor is not appropriate for SLNB. A patient with an N1 tumor has a clinically positive neck, which prohibits SLNB. A T4 tumor is a deep melanoma, with a Breslow thickness of more than 4 mm. Because it is no longer intermediate, it is not appropriate for SLNB.

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

127. A 4-year-old boy is brought to the office by his parents for follow-up evaluation of inability to fully open the mouth. Six weeks of physical therapy has resulted in no change in the patient's condition. On physical examination, maximal incisal opening is 12 mm. A three-dimensional CT scan is shown. Which of the following is the most likely diagnosis?

- A) Bony ankylosis of the temporomandibular joints
- B) Fibrous ankylosis of the temporomandibular joints
- C) Hypertrophy of the coronoid processes
- D) Möbius syndrome

The correct response is Option C.

Hyperplasia of the coronoid processes is a relatively rare condition that typically results in a slow and progressive reduction in mandibular opening. The limited mouth opening is due to mechanical impingement of the enlarged coronoid process against the posterior surface of the zygoma. The differential diagnosis includes all causes of ankylosis and pseudoankylosis of the temporomandibular joints. Radiographic imaging is necessary to identify hyperplasia of the coronoid process and CT scan can most accurately demonstrate the pathology. Surgical correction consisting of coronoidectomy via an intraoral approach with postoperative physical therapy is the recommended method of treatment.

Bony ankylosis of the temporomandibular joints will be seen as osseous fusion of the condyle with the glenoid fossa on CT. Fibrous ankylosis or pseudoankylosis of the temporomandibular joints is due to fibrosis of the periarticular or paramandibular soft tissues and typically will not show any bony pathology of the temporomandibular joints on CT. The coronoid processes would be expected to be normal in both conditions. Möbius syndrome is characterized by a congenital

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paralysis of cranial nerve VII, usually bilateral, with or without a combination of other cranial nerve palsies. The coronoid process would be expected to be normal.

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128. Which of the following is the most common parotid mass in a 1-year-old child?

- A) Acinic cell carcinoma
- B) Hemangioma
- C) Lymphoma
- D) Pleomorphic adenoma
- E) Warthin tumor

The correct response is Option B.

The most common parotid mass presenting in children is hemangioma. The history is usually one of identification and rapid enlargement in the first few months of life, with gradual involution over the next five to six years. Treatment is conservative observation of regression.

Acinic cell carcinoma and lymphoma are malignant tumors of the parotid gland. Acinic cell carcinoma is a malignant tumor, often multifocal, with aggressive propensity for local invasion of adjacent structures. Treatment is aggressive surgical resection. It is radiotherapy resistant. Lymphoma arises as a local manifestation of systemic disease. Treatment is by removal of the affected lymph node and systemic lymphoma treatment with chemotherapy.

Pleomorphic adenoma, a benign mixed tumor, is the most common tumor of salivary glands in adults. This tumor is treated by resection and in rare cases (recurrence) can transform into malignant mixed tumor.

Warthin tumor is a benign tumor and is the second most common tumor (in adults) of the parotid. It is frequently bilateral (10%) and is most commonly found in men aged 50 to 60 years. Treatment is removal of the tumor with only minimal margins needed.

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129. In a 20-year-old man, examination of the occlusion shows that the mesial buccal cusp of the maxillary first molar articulates between the first and second mandibular molars. Cephalometric analysis shows SNA angle of 70 degrees (normal 80 to 82 degrees) and SNB angle of 79 degrees (normal 79 to 80 degrees). Which of the following is the most likely diagnosis?

- A) Long face syndrome
- B) Maxillary deficiency
- C) Maxillary excess
- D) Retrognathia
- E) True prognathism

The correct response is Option B.

In a Class III mesiocclusion, the mesial buccal cusp of the maxillary first molar articulates between the first and second mandibular molars. The mandible is mesially placed or prognathic compared to the maxilla. This type of malocclusion may result from maxillary deficiency, mandibular overgrowth, or a combination of both.

Long face syndrome results from vertical maxillary excess. Physical findings include excessive gingival and upper incisor show at rest and during smiling, a long vertical face, and a retrognathic mandible caused by backward autorotation or true retrognathism.

At rest, normal incisor show is approximately 2 to 3 mm. Decreased incisor show usually indicates maxillary hypoplasia. Excessive gingival show indicates excess maxillary growth.

This patient has a normal SNB angle, indicating that he does not have true prognathism but that it only appears excessive because the maxilla is retrusive. The SNA angle (normally 82 degrees) relates the maxilla to the cranial base. The SNB angle (normally 79 degrees) relates the mandible to the cranial base.

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130. The 27-year-old woman shown above comes to the office for evaluation because she has had diplopia for the past 18 months. Physical examination shows orbital dystopia, enophthalmos, and malar flattening on the right. On the basis of the current findings, this patient's prior injury was most likely which of the following fractures?

- A) Le Fort II fracture
- B) Le Fort III fracture
- C) Orbital floor blow-out fracture
- D) Orbital roof fracture
- E) Orbitozygomatic complex fracture

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The correct response is Option E.

The clinical findings of orbital dystopia, enophthalmos, and malar flattening on the patient's right side are typical for orbitozygomatic fractures. With the downward pull of the muscles, the zygoma rotates and the orbital volume is increased. This results in enophthalmos and possible dystopia, depending on the degree of displacement. The rotation of the zygoma causes loss of malar projection. This patient had only her orbital floor repaired with synthetic mesh. This repair was inadequate for her type of fracture, and stresses the importance of correct diagnosis and treatment in order to prevent secondary post-traumatic deformities.

Orbital floor or roof fractures would not result in malar flattening. Le Fort II and III fractures would cause a malocclusion, which is not present in this patient.

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2. Longaker MT, Kawamoto HK. Evolving thoughts on correcting posttraumatic enophthalmos. *Plast Reconstr Surg.* 1998;101:899-906.

131. A 4-month-old boy is brought to the emergency department by his parents for evaluation after he had a seizure for the first time. Physical examination shows low nasal bridge and short neck. On laboratory studies, serum calcium level is 6.0 mg/dL (normal = 9.0–10.5 mg/dL) and serum phosphate level is 7.0 mg/dL (normal = 2.5–4.5 mg/dL). Which of the following is the most likely diagnosis?
- A) Albright syndrome
 - B) Binder syndrome
 - C) Carpenter syndrome
 - D) Down syndrome
 - E) Ectodermal dysplasia

The correct response is Option A.

Albright syndrome is the only syndrome listed that affects calcium and phosphate metabolism. It is caused by an autosomal-dominant mutation affecting receptor binding to adenylate cyclase. The resultant craniofacial malformations include a low nasal bridge and a short neck. Binder syndrome is manifested by maxillary hypoplasia and midface retrusion. Carpenter syndrome is a rare autosomal-recessive condition that results in brachycephaly due to variable synostoses, in addition to defects of the cardiovascular, musculoskeletal, and genital systems. Down syndrome is caused by trisomy of the 21st chromosome. Craniofacial manifestations include brachycephaly, a low nasal bridge, and inner epicanthal folds. Ectodermal dysplasia is an X-linked recessive syndrome that results in hypoplastic skin and sparse dermal appendages.

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2. Braccini F, Bacciu A, Bruzzo M, et al. Craniofacial fibrous dysplasia associated with primary hyperparathyroidism. *Acta Biomed Ateneo Parmense*. 1999;70:5-11.

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132. A 28-year-old man comes to the office six months after he sustained partial amputation of the left ear due to a human bite (shown). For successful reconstruction, which of the following anatomic areas of the ear must be addressed?

- A) Antihelix and triangular fossa
- B) Antitragus and intertragic notch
- C) Concha and scaphoid fossa
- D) Crus of helix and tubercle
- E) Helix and lobule

The correct response is Option E.

Even though the upper helix is still present, the middle helix below the auricular tubercle and the lower helix in continuity with the lobule are absent. Precise understanding of the anatomy of the ear is important in the planning of reconstruction regarding framework and soft-tissue requirements.

The antihelix is intact and represents the border of the defect. Inferiorly, the antihelix ends in the antitragus; superiorly, it divides into two crura. The triangular fossa separates the superior crus from the inferior crus. The intertragic notch is located between the tragus and antitragus. The concha constitutes the bowl-shaped area in the center of the ear from which the root or crus of the helix arises. The scaphoid fossa is the groove between the upper helix and the superior crus

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of the antihelix. The auricular tubercle is a thickening in the helix located between the upper and middle thirds of the helix.

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133. An 8-month-old girl is brought to the office for evaluation of the skull asymmetry shown. Physical examination shows posterior plagiocephaly with flattening of the right occipital area and an ipsilateral mastoid bulge. CT scan is shown. Which of the following is the most appropriate management for correction of this deformity?
- A) No treatment
 - B) Modification of sleep position
 - C) Molding helmet therapy
 - D) Remodeling of the posterior vault
 - E) Bilateral fronto-orbital advancement and remodeling

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The correct response is Option D.

This infant has premature obliteration of her right lambdoid suture (lambdoid synostosis), resulting in posterior plagiocephaly. Lambdoid synostosis is treated with posterior vault expansion and remodeling. Without treatment, increased intracranial pressure can occur. Modification of the infant's sleep position and use of molding helmet therapy are appropriate treatments for plagiocephaly caused by deformation forces, but not for plagiocephaly caused by lambdoid synostosis. Bilateral fronto-orbital advancement and remodeling is not appropriate for managing lambdoid synostosis because the synostosis and skull asymmetry are of the posterior vault.

Management of posterior plagiocephaly requires differentiation of occipitoparietal flattening caused by lambdoid synostosis from that caused by deformation forces because deformational plagiocephaly does not require surgical correction. However, the two entities are often difficult to distinguish. Lambdoid synostosis causes a more trapezium-shaped skull with occipitoparietal flattening and an ipsilateral mastoid bulge. The ipsilateral ear is posteriorly positioned in relation to the other ear. Deformational plagiocephaly causes a parallelogram-shaped skull and displaces the ipsilateral ear anteriorly.

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134. A 45-year-old man with microgenia is evaluated before undergoing augmentation genioplasty using an alloplastic prosthesis. A lateral cephalogram shows horizontal deficiency of 5 mm. A prosthesis of which of the following thicknesses is most appropriate for correction of this patient's deformity?

- A) 3 mm
- B) 6 mm
- C) 9 mm
- D) 12 mm

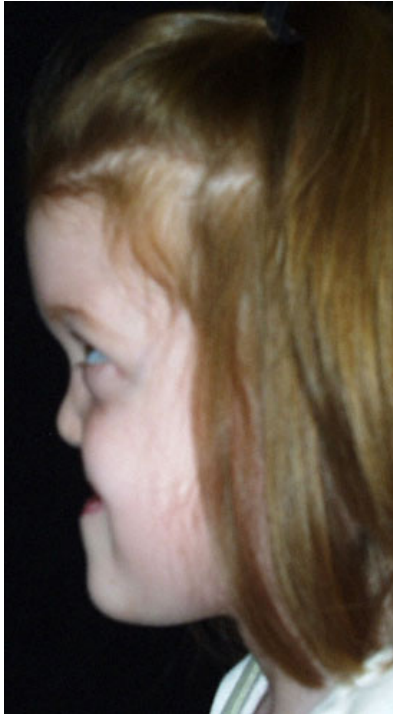
The correct response is Option B.

The ratio of soft-tissue response to augmentation genioplasty is approximately 0.8 to 1.0. Therefore, a 5-mm deficiency would best be corrected with a slightly thicker, 6-mm implant.

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

135. A 7-year-old girl is brought to the office for consultation regarding the congenital malformation shown. Which of the following anatomic structures is absent in this patient?

- A) Anterior nasal spine
- B) Dentoalveolus
- C) Hard palate
- D) Maxilla
- E) Nasal bones

The correct response is Option A.

The anterior nasal spine is absent in patients with Binder syndrome. In 1962, Von Binder described a form of nasomaxillary hypoplasia that included nasomaxillary hypoplasia, a convex lip, a vertically short nose, a flat frontonasal angle, an absent anterior nasal spine, limited nasal mucosa, and hypoplastic frontal sinuses. It is believed to be caused by a disturbance of the prosencephalic induction center at a critical phase in development.

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136. A 7-year-old boy is brought to the emergency department after sustaining trauma to the face. He has nausea and vomiting but is alert and oriented to time and place. Pulse rate is 48/min. Physical examination shows right periorbital ecchymosis, diplopia, and limited vertical gaze. Visual acuity is within normal limits. Which of the following is the most likely finding on CT scan of the head and craniofacial skeleton?
- A) Compression of the optic nerve
 - B) Displaced fracture of the zygoma
 - C) Large (greater than 3 cm) displaced fracture of the orbital floor
 - D) Minimally displaced fracture of the orbital floor

The correct response is Option D.

Based on the patient's age, signs, and symptoms, a CT scan is most likely to show a minimally displaced fracture of the orbital floor, suggesting a trapdoor fracture of the orbital floor. This type of fracture allows herniation of the orbital contents, which are then entrapped. It most commonly occurs in children, possibly because of the relative elasticity of their bones, which allows them to snap back into position after tissue herniates through the fracture. As in this patient, a trapdoor fracture of the orbital floor can cause an oculocardiac reflex, which produces bradycardia, nausea, and syncope.

A CT scan is not likely to show compression of the optic nerve because the patient does not have a relative afferent pupillary defect. A CT scan also is unlikely to show a displaced fracture of the zygoma because this type of fracture usually occurs in older patients. This study should not disclose a large displaced fracture of the orbital floor because this type of fracture does not typically cause oculocardiac reflex. Because the patient's mental status is intact, a CT scan is not likely to show a subarachnoid hemorrhage.

In a trapdoor fracture of the orbital floor, the muscles most likely to be entrapped are the inferior rectus and inferior oblique muscles. If entrapment restricts ocular movement, immediate surgery is recommended to prevent irreversible ischemia and fibrosis of the entrapped contents.

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137. Formation of the primary palate begins during which of the following weeks of gestation?

- A) First
- B) Third
- C) Fifth
- D) Eighth
- E) Eleventh

The correct response is Option C.

Formation of the primary palate begins during the fifth week of gestation and is completed by the end of the sixth week of gestation. Anatomically, it is located anterior to the incisive foramen. The premaxilla only contains the central and lateral incisors.

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138. A 25-year-old man comes to the office because he has numbness of the tip of the nose six weeks after he sustained a naso-orbital-ethmoid fracture during a motor vehicle collision. The most likely cause of the numbness is damage to which of the following nerves?

- A) Anterior ethmoidal
- B) Infraorbital
- C) Infratrochlear
- D) Nasopalatine
- E) Pterygopalatine

The correct response is Option A.

The anterior ethmoidal nerve innervates the nasal tip. The infratrochlear and infraorbital nerves innervate the sidewalls and dorsum. The lateral branch of the pterygopalatine nerve supplies the upper and middle turbinates, whereas the medial branch supplies the septum.

The nasopalatine nerve, which is the terminal branch of the pterygopalatine nerve, innervates the maxillary incisor teeth, gingiva, and palate.

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139. A 64-year-old man comes to the office for evaluation because of a lesion in the mouth and numbness of the chin. Examination shows a 3-cm ulcerative lesion on the anterior floor of the mouth that is fixed to the periosteum of the lingual mandible. A 4-cm mobile node is seen in the right submandibular triangle. Biopsy of the lesion shows squamous cell carcinoma. Distant metastases are not apparent. Which of the following is the most accurate TNM staging of this tumor?
- A) T2 N2b M0
 - B) T3 N1 M0
 - C) T4 N1 M0
 - D) T4 N1 M1
 - E) T4 N2a M0

The correct response is Option E.

Tumors of the oral cavity are staged according to the TNM (Tumor, Node, Metastasis) system. Chin numbness and fixation to the periosteum indicate invasion of the tumor into the mandible and involvement of the inferior alveolar nerve. Therefore, the T stage of this tumor would be a T4. A single 4-cm, mobile node would stage this tumor as an N2a. Absent distant metastases stage this tumor as an M0.

Oral Cavity:

T1	Tumor <2 cm
T2	Tumor >2 but <4 cm
T3	Tumor >4 cm
T4	Tumor invades adjacent structures such as cortical bone, tongue, skin, or soft tissues of the neck
N1	One ipsilateral node <3 cm
N2a	One ipsilateral node >3 and <6 cm
N2b	Multiple ipsilateral nodes <6 cm
N2c	Bilateral contralateral nodes <6 cm
N3	Any nodes >6 cm
M0	No distal metastasis
M1	Distal metastasis

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140. The 2-year-old boy shown has features typical of which of the following syndromes?

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

The correct response is Option E.

The appearance of the patient shown demonstrates Treacher Collins syndrome, characterized by bilaterally symmetrical abnormalities of structures within the first and second branchial arches. Features include a convex facial profile with a retrusive lower jaw and chin, anti-mongoloid slant of the palpebral fissures, lower lid colobomas, partial absence of eyelid cilia, absent or malformed external ears, hypoplasia of the malar bones, and variable cleft palate.

Binder syndrome is characterized by nasomaxillary hypoplasia. Apert, Crouzon, and Pfeiffer

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syndromes are all craniosynostotic syndromes that result in midfacial hypoplasia and a concave facial profile of varying degrees.

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141. In a patient with fracture of the frontal sinus, laboratory analysis of which of the following is most reliable to confirm cerebrospinal rhinorrhea?

- A) Albumin
- B) Beta-2 transferrin
- C) Glucose
- D) Glutamine
- E) Lactic acid

The correct response is Option B.

Initially described for the detection of cerebrospinal fluid (CSF) in 1979, beta-2 transferrin is currently accepted as the most reliable method of laboratory testing in determining the presence of CSF in rhinorrhea and otorrhea. It has been reported to have a sensitivity near 100% and a specificity near 95%. Beta-2 transferrin is a carbohydrate-free (desialylated) isoform of transferrin that is almost exclusively found in CSF. It is also found in perilymph in the cochlea and the aqueous and vitreous humor of the eye, but in lower concentrations. It is not present in blood, nasal mucus, tears, or mucosal discharge. Its presence is identified using immunofixation electrophoreses. Glucose testing of rhinorrhea or otorrhea was commonly used in the past, but interpretation of the studies was confounded by contamination of glucose containing fluid (tears, nasal mucus, blood in nasal mucus) or low CSF glucose levels (as seen in meningitis). Glucose testing of CSF has been found to have an unacceptably high rate of false-positive results.

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For each structure of the neck, choose the fascial plane in which it is enveloped (A–C).

- A. Pretracheal fascia
- B. Prevertebral fascia
- C. Superficial fascia

142. Trapezius muscle

143. Anterior scalene muscle

The correct response for Item 142 is Option C and for Item 143 is Option B.

The superficial fascia envelops the sternocleidomastoid, the trapezius, and the suprahyoid muscles. The prevertebral fascia incorporates all of the scalene and paravertebral muscles. The pretracheal fascia incorporates the thyroid and trachea.

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144. A 6-month-old boy is referred by a pediatrician for evaluation of asymmetric shape of the skull. Physical examination shows flattening of the right posterior skull, prominence of the right side of the forehead and zygomatic complex, and forward advancement of the right ear. Which of the following is NOT an option in the management of this patient's condition?
- A) Observation
 - B) Frequent repositioning exercises
 - C) Helmet-molding therapy
 - D) Three-dimensional CT scan of the head
 - E) Surgical remodeling of the cranial vault

The correct response is Option E.

Surgical management of plagiocephaly is not indicated at this young age.

Since the “back-to-sleep” campaign began recommending that young children be placed on their backs to sleep in an effort to limit the incidence of sudden infant death syndrome (SIDS), many children have been referred for evaluation of plagiocephaly. Physical examination continues to be the diagnostic method for separating plagiocephaly as a result of positional molding (ie, external pressures) from synostotic plagiocephaly.

Positional plagiocephaly results from external pressure on the skull—in this case, the right posterior skull. As the brain grows, it pushes the ipsilateral structures forward, including the zygomatic complex, forehead, and ear. From a vertex view, the skull takes on the appearance of a parallelogram.

In contrast, when a growth suture is fused as in craniosynostosis, growth is restricted perpendicular to the suture and accelerated parallel to that suture (Virchow’s Law). In cases of suspected lambdoid synostosis, the growth of the contralateral forehead is accelerated and the contralateral structures (such as the ear) are advanced. From the vertex, the skull becomes trapezoid in appearance. Similarly from a posterior view, there is ipsilateral mastoid bossing and the tilt.

A CT scan may be obtained for many reasons but is not necessary to establish the diagnosis in this patient. Physical examination should be adequate to diagnose positional plagiocephaly.

Treatment of positional plagiocephaly initially involves behavioral changes and frequent repositioning of the infant. Prone playtime activities are encouraged. Sometimes physical therapy

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is required. Custom helmet molding therapy is recommended for severe skull asymmetry or for patients with other developmental issues that would complicate behavioral modifications or repositioning techniques. In this child, poor muscle tone and slight developmental delay lead us to recommend helmet therapy. It is not unusual for the posterior fontanelle to be closed at this time.

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2. Huang M, Gruss JS, Clarren SK, et al. The differential diagnosis of posterior plagiocephaly: true lambdoid synostosis versus positional molding. *Plast Reconstr Surg*. 1996;98:765-774.
3. Teichgraeber JF, Seymour-Dempsey K, Baumgartner JE, et al. Molding helmet therapy in the treatment of brachycephaly and plagiocephaly. *J Craniofac Surg*. 2004;15:118-123.

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145. A fracture in which of the following locations is most likely to cause disruption of mandibular growth?

- A) Angle
- B) Body
- C) Condyle
- D) Ramus
- E) Symphysis

The correct response is Option C.

The area most commonly associated with growth disturbances in pediatric patients with mandibular fractures is the condyle. The incidence of facial fractures in the pediatric patient population is as high as 15% of all maxillofacial traumas; the most common location is the mandible. The condyle in the pediatric patient, which is the growth center of the mandible, is the most common site for fracture in this patient population as well. Conservative therapy is used in nondisplaced fractures with no malocclusion. Displaced fractures are managed with closed reduction and immobilization when possible, deferring open reduction to only the most severe cases.

The angle, body, ramus, and symphysis are not growth centers. Fractures in these locations would not cause disruption of mandibular growth.

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1. Demianczuk A, Verchere C, Phillips J. The effect on facial growth of pediatric mandibular fractures. *J Craniofacial Surg.* 1999;10:323-328.
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146. In distraction osteogenesis of the mandible, which of the following is a disadvantage of an external device compared with an internal device?

- A) Ability to alter the vector of distraction
- B) Ability to manipulate the bony regenerate
- C) Greater expansion length
- D) Shorter moment arm at the device–bone interface

The correct response is Option D.

Distraction osteogenesis of the mandible may be performed using external devices or internal devices. External devices are secured to the bony segments via percutaneous pins. Internal devices are placed subperiosteally, typically via an intraoral incision, and are anchored to the bone with screws passing through foot plates.

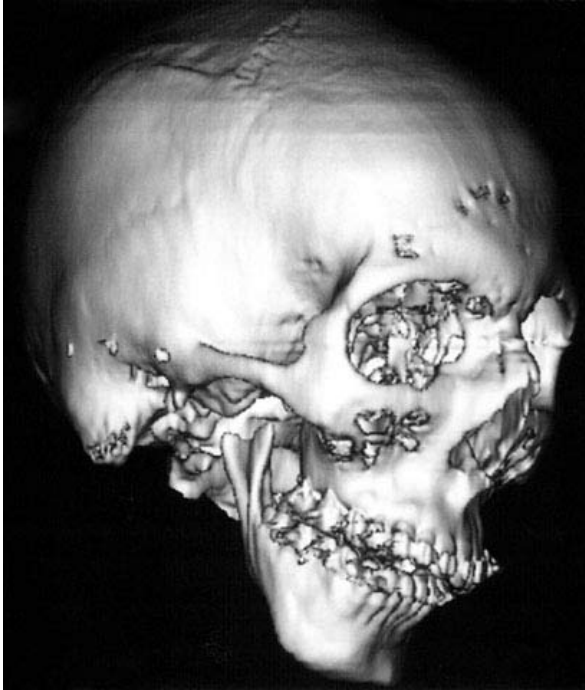
Advantages of external devices include the potential for three-dimensional distraction, the ability to “mold” the bony regenerate, adjust dental relationships prior to consolidation, a greater length of distraction, and greater ease of placement.

Disadvantages include creation of more prominent facial scars and an increased distance from the body of the distractor to the bone surface. The latter leads to a longer “moment arm” at the device–bone interface and an increased possibility of pin loosening. Internal devices avoid the creation of a significant facial scar, and are much more inconspicuous and cumbersome. They do not allow for alteration of the distraction vector after the device is placed and generally the length of distraction is less.

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147. If the 13-year-old boy whose CT scan is shown has an epibulbar dermoid, the most appropriate classification of his condition is which of the following syndromes?

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

The correct response is Option A.

The CT scan demonstrates a patient with the type IIb mandibular deformity of hemifacial or craniofacial microsomia. Patients with hemifacial microsomia with associated epibulbar dermoids and spinal or scapular deformities are classified as having Goldenhar syndrome.

Van der Woude syndrome is an autosomal-dominant cleft lip/palate syndrome. The defining feature in addition to cleft lip and/or palate is “lip pits.” These lip pits are often found on the lower lip and are accessory salivary glands.

Velocardiofacial syndrome (previously known as DiGeorge syndrome, conotruncal anomaly,

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Sphrintzen syndrome, Catch-22 syndrome, and 22 minus syndrome) is a syndrome diagnosed by the addition or deletion of the 22q.11 gene. Common findings include congenital heart anomalies, clefting and velopharyngeal insufficiency, and facies that include a broad nasal root and narrow alar bases, elongated face with low tone, low-set ears with folded helixes, malar flattening, and retrognathia. It is estimated that up to 8% to 10% of patients with isolated cleft palate carry the 22q.11 deletion/addition.

Treacher Collins syndrome or mandibulofacial dysostosis has three pathognomonic features: lower eyelid colobomas, zygomatic hypoplasia with hypoplastic or absent zygomas and inferolateral orbital rim clefting, and bilateral mandibular hypoplasia. Bilateral ear anomalies ranging from simple deformities to complete microtia are often additional findings.

Stickler syndrome is associated with Pierre Robin sequence (micrognathia, glossoptosis, respiratory distress, and possibly cleft palate) and includes possible skeletal anomalies as well as optical conditions such as myopia.

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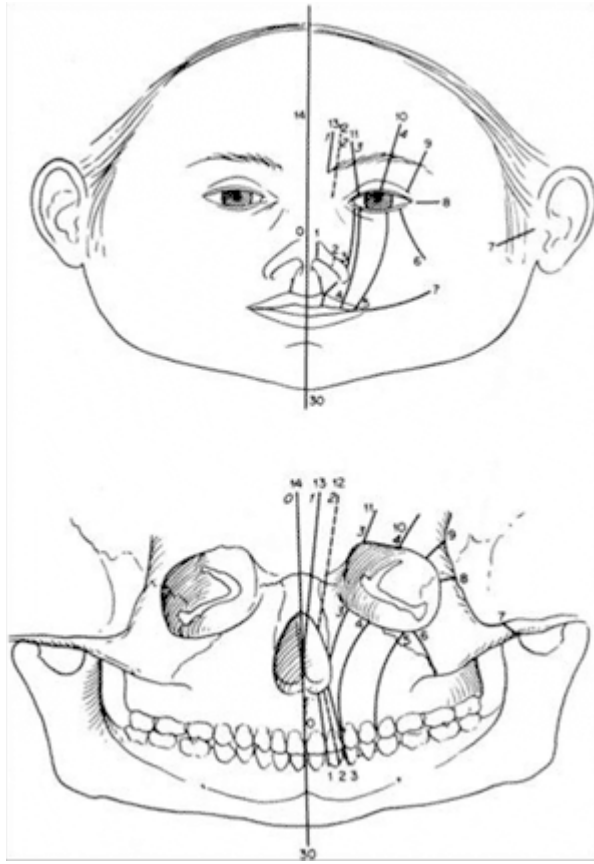
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148. In the Tessier system, which of the following classifications represents the most common facial cleft?

- A) Tessier No. 0
- B) Tessier No. 3
- C) Tessier No. 7
- D) Tessier No. 9
- E) Tessier No. 14

The correct response is Option C.

The most common facial cleft is a Tessier No. 7. This is a cleft that begins at the lateral oral commissure and extends laterally. From a soft-tissue standpoint, it creates macrostomia. A Tessier No. 0 cleft involves the midline of the upper lip and nose. The Tessier No. 14 cleft is the cranial extension of this. A Tessier No. 3 cleft involves the lateral nasal ala and the medial canthus of the eye. A Tessier No. 9 cleft is actually the least common cleft. It extends from the superolateral orbit into the temporal region.



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149. Cranialization is indicated for patients with which of the following conditions of the frontal sinus?

- A) Fracture of the anterior sinus wall
- B) Fracture of the nasofrontal duct
- C) Fracture of the posterior sinus wall
- D) Fracture of the sinus floor into orbital roof
- E) Post-traumatic frontal sinus mucocoele

The correct response is Option C.

Although cranialization is indicated for fractures of the posterior sinus wall, not all frontal sinus fractures involving the posterior wall require cranialization. Exceptions would be noted in cases of undisplaced fracture in which the dura is deemed intact by clinical observation and confirmatory testing. Even in patients with leakage of cerebrospinal fluid (CSF), many surgeons will allow up to 10 days for the CSF leak to resolve on its own before resorting to cranialization, as long as all fractures are undisplaced and the nasofrontal duct is patent. In addition, cases of posterior wall fracture with obstructed nasofrontal ducts can be addressed with sinus obliteration and not cranialization, as long as there is no brain injury and little or no comminution of the posterior wall. If there are other potential sources of a CSF leak, sorting out the cause can be done preoperatively with a metrizamide CT scan. The cranialization procedure consists of obliterating the nasofrontal duct and removing the sinus mucosa and posterior wall of the sinus, effectively incorporating the sinus space into the cranial cavity. This prevents future meningitis and brain abscess by sterilizing this connection.

Management of an anterior table fracture with an intact posterior table and an intact frontonasal duct should be addressed by plating the anterior table to restore forehead contour.

If the nasofrontal duct is obstructed, then obliteration of the frontal sinus is indicated.

When the sinus floor is fractured medial to the supraorbital foramen, there is a good chance that the nasofrontal duct is injured, in which case sinus obliteration is indicated. If it is not injured, then plating is indicated to restore the orbital roof if fracture lines are displaced.

Post-traumatic mucocoeles of the frontal sinus are managed by sinus obliteration. The exception is, however, that cranialization could be indicated in a few instances where the mucocoele has become extremely expanded and destructive on the posterior table.

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150. Which of the following muscles of the mouth is innervated by the mandibular branch of the facial (VII) nerve?

- A) Buccinator
- B) Depressor anguli oris
- C) Levator anguli oris
- D) Orbicularis oris
- E) Risorius

The correct response is Option B.

The other mimetic muscles innervated by the mandibular branch of the facial nerve include the depressor labii inferioris and the mentalis muscle. These muscles control movement of the lower lip to either pull it down and laterally or to protrude it. Paralysis of the nerve results in elevation of the angle of the mouth and of the lower lip on the affected side. This nerve is at risk for injury during rhytidectomy or neck lift procedures, parotidectomy, and neck dissection.

The buccinator, levator anguli oris, orbicularis oris, and risorius are all innervated by the buccal branch of the facial nerve. Anatomic variation may be encountered with the risorius muscle, which is rarely innervated by the mandibular branch.

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Section 4: Hand

151. Hematologic evaluation is indicated before surgical intervention for which of the following conditions?

- A) Atypical cleft hand
- B) Constriction band syndrome
- C) Radial hypoplasia
- D) Small finger polydactyly
- E) Thumb duplication

The correct response is Option C.

Radial aplasia and hypoplasia are associated with several syndromes including VACTERL (vertebral, anal, cardiac, tracheoesophageal, renal/radial, limb), Holt-Oram, TAR (thrombocytopenia-absent radius), and Fanconi anemia. Both TAR syndrome and Fanconi anemia are contraindications for early surgical intervention until the underlying hematologic abnormalities have stabilized or been corrected.

The other congenital disorders listed tend to occur sporadically or familially and are not associated with specific hematologic abnormalities.

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

152. A 57-year-old man is referred to the office by his primary care physician for management of contracture of the little finger (shown) that has been present for more than five years. Flexion of the digit has been increasing during the past year. Surgical management is planned via a transverse palmar approach with longitudinal incisions based over the contracted cord and later converted to the necessary V-Y advancement Z-plasties. Which of the following is the most likely long-term outcome in this patient?
- A) Anesthesia of the digit
 - B) Carpal tunnel syndrome
 - C) Complex regional pain syndrome type I
 - D) Cord recurrence
 - E) Vascular insufficiency

The correct response is Option D.

Complications of Dupuytren disease have been reported to be 17% overall. Nerve injuries can be a devastating complication after surgery for Dupuytren disease. The digital nerves are displaced medially by the spiral cord, making them more prone to injury. Fortunately, nerve transection is relatively rare, reported in only 1.5% of patients with Dupuytren disease. Complex regional pain syndrome (reflex sympathetic dystrophy) may occur after Dupuytren disease, but this is an uncommon complication (approximately 4% to 8%). It can be confused with flare reaction, which can intense vasodilation; however, there is no associated pain. Infection in patients with Dupuytren disease is not significantly greater than other similar surgeries. Arterial injuries occur

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in less than 1% of Dupuytren cases.

Recurrence after Dupuytren is significant; a recent study placed recurrence at 18% to 24%. Other studies, with 10-year follow-up, have noted that no patients were free of disease. Patients should have realistic expectations on the possible complications and recurrence risks prior to surgery.

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153. A 17-year-old boy is referred to the office by his primary care physician for consultation regarding lack of active flexion of the distal interphalangeal joint of the ring finger of the dominant right hand. Six weeks ago, he sustained an injury to the hand while practicing with his high school football team. Immediately after the injury, the team's trainer initiated alternating application of hot and cold packs to the hand and gave the patient a finger splint, which he wore intermittently for five weeks. Current physical examination shows a tender mass at the distal interphalangeal joint of the ring finger. A radiograph is shown. Which of the following is the most appropriate next step?
- A) Fusion of the distal interphalangeal joint
 - B) Fusion of the proximal interphalangeal joint
 - C) Reduction and fixation
 - D) Tendon repair with single-stage tendon grafting
 - E) Two-stage tendon reconstruction with implantation of a silicone rod

The correct response is Option C.

The patient described has an avulsion of the flexor digitorum profundus (FDP) tendon from the distal phalanx, otherwise known as a jersey finger. This injury most commonly involves the ring finger. Leddy has classified these injuries into three types to direct treatment. In type 1 injuries, the proximal FDP retracts to the palm. These injuries must be repaired within two weeks to avoid

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a tendon graft. In Type 2 injuries, the tendon retracts to the level of the proximal interphalangeal (PIP), where it is usually maintained by a distal phalanx bone fragment by the A3 pulley. Type 2 injuries can usually be repaired without the need for a graft if treated within three months. However, over time, type 2 injuries can convert to type 1 injuries with proximal migration of the tendon to the palm. In Type 3 injuries, the bone fragment prevents tendon retraction proximal to the A4 pulley. Type 3 injuries can usually be repaired without a tendon graft, at any time, even after three months. Both type 2 and 3 injuries can be confirmed by radiography, which will demonstrate the small bone piece in the finger. Critical to the outcome of profundus avulsion injuries is early identification of the injury.

References

1. Leddy JP. Avulsions of the flexor digitorum profundus. *Hand Clin.* 1985;1:77.
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154. A 23-year-old man comes to the emergency department immediately after he sustained an injury to the tip and nail bed of the index finger of the right hand. Physical examination shows avulsion of the nail bed and nail plate. Ninety percent of the sterile matrix is missing and cannot be located on the underside of the nail plate. Which of the following is the most appropriate intervention for repair of the missing nail bed?
- A) Application of regenerative dermal matrix (Alloderm)
 - B) Grafting of the sterile matrix from the great toe
 - C) Grafting of the sterile matrix from the injured nail bed
 - D) Healing by secondary intention
 - E) Skin grafting from the hypothenar area

The correct response is Option B.

If the area of loss of sterile matrix is significant, grafting with sterile matrix provides the best outcome. More than half of the sterile matrix is missing from the injured nail bed of the patient described, which is not enough to provide for coverage of the defect. Therefore, use of sterile matrix from the great toe as the donor site is the most appropriate intervention in the scenario described.

Regenerative dermal matrix is not sterile matrix and application of it would not reconstruct either the germinal or sterile matrix.

Allowing the nail bed injury of the patient described to heal by secondary intention would result in nail nonadherence and risk bony infection.

The sterile matrix should not be reconstructed with a standard skin graft because this would also result in nail nonadherence and risk frequent infection.

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155. A 35-year-old woman who underwent above-the-knee amputation of the left leg for soft-tissue sarcoma 20 years ago comes to the office because she has had constant stabbing pain in the left thigh for the past year. Medical history includes weight loss of 50 lb through diet and exercise over the past two years. Physical examination shows a 3 × 2-cm mass in the posterior aspect of the left thigh, just proximal to the amputation scar. Extreme tenderness is noted on palpation of the mass. Which of the following diagnostic studies is most appropriate?
- A) Electromyography
 - B) Local anesthetic nerve block
 - C) Magnetic resonance angiography
 - D) Positron emission tomography
 - E) Three-phase bone scanning

The correct response is Option B.

The history and physical examination described is most consistent with a neuroma in a lower limb above-the-knee amputation. After a nerve is cut, nerve cell bodies start to adapt, sending out branches to the distal nerve in an attempt to reach the distal end organs. An irregular mass of tissue, clinically known as a neuroma, forms at the end of the proximal stump. If the neuroma is superficial, painful symptoms can result. The Tinel sign, which is provoked pain on percussion of the nerve, is useful for identifying a neuroma. Diagnosis of the neuroma (shown) can be achieved by performing a diagnostic nerve block. The nerve proximal to the neuroma is blocked with an anesthetic solution. If the pain resolves, a definitive diagnosis can often be made.

Electromyography is of little help in diagnosing neuroma, which is usually a clinical diagnosis. There is no clinical indication for magnetic resonance angiography or positron emission tomography. This scenario does not point to arterial disease or recurrent tumor. A three-phase bone scan is sometimes used but does not have adequate predictive value.



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156. A 25-year-old firefighter is transferred to the burn unit for management of burns to the hands 10 days after he sustained burns to 85% of the total body surface area (TBSA). His condition is stable, and vital signs are within normal limits. He has undergone multiple excision and grafting procedures. Current physical examination shows large areas of exposed tendon over the dorsum of both hands after excision of the burned skin. Partial-thickness burns of adjacent tissue are noted. Because of the extent of this patient's TBSA burns, regional and free tissue flaps are precluded. The most appropriate intervention for wound coverage is application of which of the following?

- A) Allograft skin graft
- B) Dermal regeneration template (Integra)
- C) Expansion of adjacent tissue
- D) Porcine xenografts
- E) Temporary biosynthetic skin substitute (Biobrane)

The correct response is Option B.

The patient described requires wound coverage with dermal regeneration template (Integra). Exposure of the extensor tendons precludes the use of skin grafts and no local flaps are available in this patient's burned hands because of adjacent scarring. Allograft skin would have similar problems of adherence to the exposed tendons and would require overly epidermal autografts. Regional and free flaps are also unavailable.

The use of tissue expansion to increase the size of full-thickness grafts and to improve the availability of local flaps while decreasing donor site morbidity has been suggested. The patient described is not a candidate for this procedure because of the local partial-thickness burns. Even if the local tissue was uninjured and could be expanded, the presence of exposed tendons does not allow for the protracted time associated with expander reconstruction. Expanders in the upper extremity have also been associated with a high rate of complications such as infection and extrusion.

Temporary biosynthetic skin substitute (Biobrane) consists of a collagen gel dermal analog and a Silastic silicone rubber epidermal analog. It is indistinguishable from porcine xenograft in terms of pliability, wound adherence, and formation of granulation tissue. Both Biobrane and porcine xenograft may be used for coverage of partial-thickness burns. Both allow wound re-epithelialization, at which point the Biobrane or allograft can be peeled off.

Bilaminar skin substitutes such as Integra (collagen-glycosaminoglycan dermis/Silastic

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epidermis) and Alloderm regenerative tissue matrix (autologous-allogeneic dermis) plus a split-thickness skin graft emulate the desirable properties of dermis and epidermis, particularly with respect to pore size. The outer membrane requires a small pore size to act as a barrier to microorganisms while allowing water vapor permeability. The inner layer requires a larger pore size to permit ingrowth of granulation tissue from the wound bed. Use of Integra and Alloderm for full-thickness wound coverage has been associated with less scarring than with conventional skin grafts. This decreased scarring may in turn minimize secondary contracture and improve outcome, particularly in the hand. Both require thin epidermal grafts for coverage, though only Alloderm is able to support immediate skin grafting.

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157. A 35-year-old man comes to the emergency department 30 minutes after he sustained a knife wound to the right hand during an altercation. Medical history includes end-stage renal disease, for which the patient undergoes dialysis through an arteriovenous fistula in the right upper arm. Physical examination of the hand shows Zone II lacerations of the volar aspect of the index, long, ring, and small fingers. Both tendons and digital nerves are lacerated. The estimated duration of surgical repair is three hours. Which of the following is the most appropriate use of a tourniquet during this procedure?
- A) Apply the tourniquet to the right distal forearm, and use reperfusion breaks every 90 minutes
 - B) Apply the tourniquet to the right upper arm for the first two hours only
 - C) Cool the right extremity for 30 minutes, then apply the tourniquet to the upper arm for as long as needed
 - D) Do not use a tourniquet because of the possibility of causing thrombosis of the arteriovenous shunt
 - E) Urgently schedule creation of an arteriovenous shunt in the left arm by a vascular surgeon and perform the procedure on the right hand with use of an upper arm tourniquet with reperfusion breaks every 60 minutes

The correct response is Option A.

The tourniquet provides the hand surgeon with a bloodless field, which is essential to perform the exacting technique required in hand surgery. Any time a tourniquet is applied proximal to an arteriovenous shunt for dialysis, there is a chance that the shunt may clot while the tourniquet is inflated. In a review of 14 dialysis patients on whom upper arm tourniquets were used, 2 of 14 patients experienced shunt thrombosis and required fistula repair. The hand surgeon can minimize this possibility by applying the tourniquet distal to the shunt rather than on the upper arm. A forearm tourniquet can be used safely and effectively. The recommended inflation pressure is 75 to 100 mmHg above systolic pressure. Higher pressures will increase the incidence of complications such as nerve compression injuries. There is no universally accepted safe tourniquet time; however, two hours is the generally accepted time limit. When tourniquet times are longer than two hours, most surgeons will deflate the tourniquet for reperfusion breaks. The reperfusion time is related to the duration of inflation (see the table below, adapted from reference 2). The reperfusion times in the table are based on the time required for venous pH to return to normal after deflation of the tourniquet.

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Duration of Tourniquet Inflation (min)	Recommended Reperfusion Times Before Reinflation (min)
30	3–5
60	5–10
90	10–15
120	15–20

Applying the tourniquet to the right upper arm for the first two hours only is not appropriate for the procedure described because the tourniquet is applied proximal to the shunt, and then the operation is completed without the tourniquet, which sacrifices the bloodless field.

Cooling the right extremity and then applying the tourniquet to the upper arm is not appropriate because the tourniquet is applied proximal to the shunt. This method also brings up the concept of decreasing ischemic injury with hypothermia. Although this technique theoretically can lengthen acceptable tourniquet times, it is cumbersome and more complex than reperfusion breaks. Not using a tourniquet is not appropriate for the procedure described because it does not provide the necessary bloodless field. Scheduling creation of a second shunt is unnecessary with a forearm tourniquet.

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158. A 62-year-old woman with symptomatic carpometacarpal arthritis of the thumb is scheduled to undergo resection of the trapezium for relief of pain and swelling. Which of the following additional steps in management of this patient's condition is critical to the successful outcome of the surgical procedure?

- A) Fluoroscopic assessment of the trapezial resection
- B) Postoperative immobilization of the thumb in a spica splint
- C) Reconstruction of the suspending ligament
- D) Resection of the trapezial space
- E) Temporary fixation of the metacarpal base with Kirschner wires

The correct response is Option B.

Osteoarthritis of the carpometacarpal joint of the thumb is frequently seen by hand surgeons and often requires surgical reconstruction. Classical teaching by Eaton and Littler supports the technique of ligament reconstruction and tendon interposition arthroplasty. Reported results using this technique are very good, with more than 80% relief of symptoms. Several authors have recently reported that trapezium excision and cast immobilization may be just as effective in relieving symptoms as the more extensive placement of a soft-tissue spacer and ligament reconstruction. Although the other management options are effective, they are not as essential to successful outcome as the simple act of cast or splint immobilization for four to six weeks in the postoperative period.

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159. A 28-year-old man is brought to the emergency department 30 minutes after he sustained avulsion injuries to the nondominant left hand when it became caught in a motor vehicle fanbelt. Physical examination shows amputation of the index finger at the level of the proximal interphalangeal joint as well as a 2 x 1-cm area of soft-tissue loss. Replantation of the amputated digit is performed, and the resulting 2 x 1-cm soft-tissue avulsion volar defect is covered with an arterialized venous flow-through flap with overlying skin interposed as a vein graft in the arterial repair. Which of the following is the most likely early complication of this flap procedure?
- A) Arterial thrombosis
 - B) Congestion of the flap
 - C) Failure of the replantation
 - D) Hematoma from vessel leak
 - E) Loss of flap due to infection

The correct response is Option B.

Venous flow-through flaps (VFTFs) are unusual but are gaining acceptance for certain kinds of hand and finger wounds. The ideal site for coverage with a VFTF is a long and narrow defect needing thin soft tissue. VFTFs typically become congested in the first week and then decongest over the following two weeks as they revascularize from the wound bed. VFTFs cannot reliably transfer composite tissue such as bone and tendon or cover a wide defect such as an entire palm. Because VFTFs do not bring in vascularization to the wound bed as well as classic flaps, they are not indicated in radiated or potentially infected wound beds. A small defect such as the 2-cm defect needing coverage during the replantation of the finger in the scenario described is the ideal candidate for this flap.

When compared with simple vein grafts, VFTFs are not associated with increased rates of arterial thrombosis, failure of replantation, or hematoma. Although VFTFs are more susceptible to infection than typical flaps, congestion of the flap with superior epidermolysis is a much more likely complication.

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160. A 55-year-old man with well-controlled type 1 diabetes mellitus and a history of kidney transplantation comes to the clinic because he has had increasing pain, swelling, and redness of the right index finger over the past four days. Five days ago, he sustained an injury to the finger when a thorn became lodged under the skin while he was gardening. Medical records show that hemoglobin A_{1c} was 12% three weeks ago. Temperature is 37.9°C (100.2°F). On laboratory studies, white blood cell count is 16,000/mm³ and serum glucose level is 495 mg/dL. Examination of the right hand shows severe flexor tenosynovitis of the index finger. Which of the following factors in this patient increases his risk of amputation of the digit?
- A) Hemoglobin A_{1c} greater than 10%
 - B) History of kidney transplantation
 - C) Insulin dependence
 - D) Serum glucose level greater than 450 mg/dL
 - E) White blood cell count greater than 14,000/mm³

The correct response is Option B.

History of renal failure or kidney transplantation is associated with the highest risk of amputation in diabetic patients with hand infections. Amputation rates in this population range from 75% to 100%.

Multiple studies have shown that diabetes mellitus negatively impacts the prognosis of hand infections. Hand infections in patients with diabetes take longer to resolve and are more likely to require multiple debridements than infections in patients without diabetes. In addition, initiation of treatment is more likely to be delayed in patients with diabetes. In 50% of cases, the initial surgical procedure does not control the infection adequately. Amputation rates for hand infections in patients with diabetes range from 7% to 63%. In up to 28% of patients undergoing amputation, a repeat procedure at a more proximal level is required.

Insulin dependence, history of poorly controlled diabetes (as indicated by elevated hemoglobin A_{1c}), white blood cell count greater than 14,000/mm³, and serum glucose level greater than 450 mg/dL have not been shown to significantly increase the risk of amputation in diabetic patients with hand infections.

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161. A 73-year-old man is referred to the office by his primary care physician for evaluation of discoloration of the nail of the left thumb (shown), which has been present for the past seven years. The patient says the appearance of the nail has not changed recently. Biopsy of the nail matrix shows malignant melanoma of indeterminate depth. Which of the following surgical procedures is the most appropriate management?
- A) Elective lymph node dissection and amputation at the metacarpophalangeal joint
 - B) Elective lymph node dissection and nail ablation
 - C) Sentinel node biopsy and amputation at the level of the interphalangeal joint
 - D) Sentinel node biopsy and excision of skin with 1-cm margins
 - E) Sentinel node biopsy and ray amputation of the carpometacarpal joint

The correct response is Option C.

The annual incidence of melanoma has increased significantly from a lifetime risk of 1:1500 in 1900 to the current risk of 1:35. Nail apparatus melanomas, and specifically subungual melanomas, pose a difficult problem because they are often diagnosed late. Late diagnosis correlates with thicker melanomas and greater risk of metastasis. Approximately 20% to 25% of subungual melanomas may be amelanotic. Sentinel node biopsy has become the standard of care, and since its advent, elective lymph node dissection is no longer recommended.

Because of the proximity of the nail matrix to the periosteum and bone, adequate resection margins are not achieved with standard wide excision of 1 to 2 cm, and recommendation for

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excision is at the distal interphalangeal joint of the finger or interphalangeal joint of the thumb. Melanoma can track along the neurovascular bundles. Amputation at a more proximal level is not needed and does not improve prognosis. More proximal amputation also results in a critical loss of function, particularly concerning the thumb.

The presence of pigment in the paronychia area (Hutchinson sign) is shown in the photograph. An area of pigmentation in the eponychium is almost pathognomonic for subungual malignant melanoma.

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162. A 28-year-old professional baseball player comes to the emergency department one hour after he sustained injuries to the index finger of the dominant right hand during a game. A radiograph is shown. Which of the following is the most appropriate management?
- A) Buddy taping the index and long fingers for three weeks
 - B) Closed reduction, splinting, and repeat radiography at four weeks
 - C) Extension block splinting with early protected motion
 - D) Open reduction with rigid screw fixation with early protected motion
 - E) Skeletal dynamic traction splinting for three weeks

The correct response is Option D.

Condylar fractures of the proximal phalanx are inherently unstable. The patient described has a displaced condylar fracture. The standard of care is open reduction and internal fixation with either screws or Kirschner wire. Screw fixation allows for early active range of motion. Percutaneous pinning or fixation with cannulated screws under C-arm control is a reasonable approach; however, it can be more difficult to obtain reduction using these techniques.

Nondisplaced condylar fractures can be treated with splinting alone. However, displacement is likely and radiographs must be taken frequently to monitor for displacement. Similarly, closed reduction can be performed, but frequent follow-up radiographs are needed.

Buddy taping is not appropriate because the intrinsic instability of condylar fractures of the proximal phalanx is ignored. A displacement of 2 mm also requires open reduction and internal fixation. Skeletal dynamic traction splinting is appropriate for severely comminuted proximal interphalangeal (PIP) joint fractures such as those seen with pylon-type injuries.

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163. A 64-year-old woman with a four-year history of symptomatic Dupuytren contracture of the ring and small fingers of the nondominant left hand undergoes palmar and digital fasciectomy with local infiltration of 1% Xylocaine and 1:100,000 epinephrine. Four hours after completion of the procedure, circulation to the ring finger is inadequate. The most appropriate management at this time is local injection of which of the following?

- A) Hyaluronidase
- B) 1% Lidocaine
- C) Nitroglycerin solution
- D) Papaverine
- E) Phentolamine

The correct response is Option E.

Recent trials have demonstrated that it is unlikely that Xylocaine with 1:100,000 epinephrine can cause irreversible finger ischemia. More likely causes of the finger ischemia in the patient described are underlying vascular disease, iatrogenic injury, or splinting in extension placing too much stretch on the foreshortened vessels. However, if it is believed that arterial inflow may be compromised by the infiltration of epinephrine, then the treatment of choice is phentolamine rescue by local infiltration at the site of vasoconstriction. Phentolamine in experimental studies “consistently and reliably reverses adrenaline vasoconstriction in the finger in an average of 1 hour and 25 minutes.”

Phentolamine is an alpha-adrenergic blocking agent and, as such, is useful in cases of epinephrine-induced vasospasm. It is of no benefit in cases of arterial ischemia from organic stenosis, such as in atherosclerotic disease.

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164. A 20-year-old man comes to the office after he sustained transection of the ulnar nerve of the left arm during a rollover motor vehicle accident. Physical examination shows a 5-cm transverse laceration in the proximal ulnar aspect of his left forearm. A photograph of the laceration after suture removal is shown. Microscope-assisted epineural repair of the transection is performed. As function is restored over time, which of the following movements will most likely be last to return?
- A) Abduction of the small finger
 - B) Adduction of the thumb
 - C) Flexion of the metacarpophalangeal joint of the small finger
 - D) Flexion of the proximal interphalangeal joint of the small finger
 - E) Ulnar-sided flexion of the wrist

The correct response is Option B.

The ulnar nerve is the terminal portion of the medial cord of the brachial plexus, after the medial head of the median nerve has separated from it, with fibers from C8–T1. It initially lies medial to the axillary artery and then to the brachial artery as it travels distally in the upper arm. It pierces the intermuscular septum and then follows the medial head of the triceps muscle to the groove between the olecranon process and the medial epicondyle. It gives off no branches in the arm. After the ulnar nerve passes through the cubital tunnel, it gives off articular branches and branches to the flexor carpi ulnaris (FCU) and the medial half of the flexor digitorum profundus (FDP). It travels between the two heads of the FCU and continues into the forearm between this muscle and the FDP.

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In the distal half of the forearm, it is joined on its lateral side by the ulnar artery. Proximal to the wrist, the nerve gives off the dorsal sensory branch, providing sensation to the dorsal wrist and ulnar aspect of the hand. The ulnar nerve continues into the hand via Guyon's canal, where it splits into a superficial sensory branch and a deep motor branch. The superficial branch supplies the palmaris brevis and the skin of the hypothenar eminence and digital nerves to the small and ulnar side of the ring finger. The motor branch passes between the abductor digiti minimi (ADM) and the flexor digiti minimi (FDM), with the deep branch of the ulnar artery, perforates the opponens digiti minimi and follows the deep volar arch across the interossei, and finally innervates the adductor pollicis (AD) and the deep head of the flexor pollicis brevis.

Based on its path, ulnar-sided flexion of the wrist (FCU) would be expected early, followed by abduction of the small finger (ADM) and flexion of the metacarpophalangeal joint (FDM). Interosseus muscle function would manifest as ability to abduct and adduct the fingers, followed last by adduction of the thumb (AD). Flexion of the proximal interphalangeal joints of the fingers is a function of the flexor digitorum superficialis, which is innervated by the median nerve.

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165. A 57-year-old man has a painless mass on the right wrist that has been enlarging gradually over the past two years. Physical examination shows a 4-cm mass at the wrist level deep to the flexor carpi ulnaris. The mass is smooth and firm, is nonadherent to surrounding structures, and is not bony. Tinel sign is present at the site of the mass, but no ulnar nerve sensory or motor deficits are noted. Plain-film radiographs show no abnormalities. MRI shows a homogeneous mass within the ulnar nerve. Which of the following is the most likely diagnosis?
- A) Aneurysm of the ulnar artery
 - B) Enchondroma
 - C) Epidermal inclusion cyst
 - D) Giant cell tumor of the tendon sheath
 - E) Schwannoma

The correct response is Option E.

The most likely pathology of this mass is a schwannoma of the ulnar nerve. These benign nerve tumors are typically painless proximal to the wrist. Schwannomas of the digits tend to be painful. A Tinel sign can often be demonstrated. Nerve function typically is not disturbed. Because of the size and location, MRI is effective in characterizing and localizing the mass. With magnification, marginal excision of schwannomas is easily performed because they are almost self-extruding from the nerve. Compared with neurofibromas, schwannomas are noninfiltrative. The recurrence rate is approximately 4%. The risk of nerve deficit is higher for excision after recurrence.

An aneurysm of the ulnar artery presents as a pulsatile mass. Vasospastic or thromboembolic findings may be present. The ulnar nerve may be compressed by the aneurysm. Surgery will preclude thromboembolic events. If the digital brachial index is <0.7 , arterial reconstruction is required.

An epidermal inclusion cyst results from implantation of epithelial cells into the underlying soft tissue or bone after an injury. Involvement of the thumb or index finger is most common. The cyst can abscess and require drainage. Otherwise, the cyst can be marginally excised from surrounding soft tissue or curettaged from bone. Interestingly, imaging of bony involvement can demonstrate cortical erosion or bone destruction that is more typical for malignancy.

A giant cell tumor of the tendon sheath is a rubbery mass that is more common along the flexor surfaces of the digits. The slowly enlarging tumor can compress or splay adjacent digital nerves and arteries. Recurrence is minimized with a complete marginal excision and bipolar cauterization of the tumor bed. The recurrence rate is reported to be 5% to 50%.

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166. A 35-year-old man comes to the emergency department immediately after he sustained an injury to the long finger of the dominant right hand while using a table saw. Physical examination shows a segmental injury to the extensor tendon. Sensation and vascular supply are intact along both sides of the finger. Radiographs show a severely comminuted proximal interphalangeal (PIP) joint with loss of bone. Arthrodesis of the PIP joint is performed using a tension band technique. Soft-tissue coverage is adequate. Which of the following is the most likely complication of this procedure?
- A) Decreased two-point discrimination
 - B) Lumbrical plus deformity
 - C) Malunion
 - D) Nonunion
 - E) Quadriga effect

The correct response is Option E.

A proximal interphalangeal (PIP) fusion will result in a limitation in long finger profundus excursion. Any action that prevents the full excursion of the profundus tendon of one finger will affect the other fingers and produce some component of quadriga. “Quadriga” refers to the global limitation in profundus excursion resulting from injury or limitations in motion occurring at a single finger profundus tendon. Amputations are a common cause of quadriga. After finger amputations, spontaneous adhesions of the resected profundus tendon may occur in the finger stump or palm. Because of the normal interconnections of the profundus tendons, such adhesions can block the excursion of the profundus tendons to intact fingers, resulting in the quadriga syndrome, or profundus tendon blockage. This causes a decrease in the power and range of movement of the terminal joints of the uninjured fingers when they are fully flexed. PIP fusion is often well tolerated in the index finger, because the relatively independent profundus function of the index finger does not impose a significant quadriga effect on the other fingers during power grasp. PIP fusion of the long finger, however, has been shown to decrease the excursion of all profundus tendons, reducing grip strength. PIP fusion restricts profundus excursion to a greater extent than distal interphalangeal (DIP) or metacarpophalangeal (MP) fusion.

A change in two-point discrimination will occur if there has been a significant injury to one or both of the digital nerves.

The lumbrical plus deformity produces paradoxical extension of the PIP joint when the finger is flexed at the MP and is caused by retraction of the profundus tendon and tightening of the lumbricals following amputation.

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Malunion and nonunion are complications that may occur following any fusion procedure but are unlikely if proper surgical technique is followed.

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167. A 40-year-old woman who is a pitcher on a softball team has had swelling and discomfort of the ring finger of the dominant right hand since she sustained an injury during a game five days ago. She is concerned because she is not able to grip a softball and has several games scheduled over the next few months. Physical examination is limited because of edema and pain. The lateral radiograph is shown. Which of the following interventions is the most appropriate initial management of this patient's finger?

- A) Buddy taping of the ring and long fingers
- B) Extension block splinting of the proximal interphalangeal joint
- C) Forearm-based intrinsic plus splinting
- D) Hyperextension splinting of the distal interphalangeal joint
- E) Injection of a corticosteroid into the proximal interphalangeal joint

The correct response is Option B.

The patient described has a fracture dislocation of the proximal interphalangeal (PIP) joint, which is a frequent sports injury. The most common pattern involves the volar lip of the middle phalanx. With the stability of the PIP joint disrupted, the finger subluxes or dislocates dorsally. Early identification of the injury pattern and severity is critical to successful outcome. After evaluation and radiography, the injury should be splinted in a protected position. A dorsal semiflexed splint should protect the PIP joint in a stable, reduced position. The dorsal splint, which blocks extension, protects the injured joint from further complications.

An injection of a corticosteroid will alleviate pain and swelling but is not indicated for a

fracture-dislocation injury. Buddy taping is useful for PIP joint collateral ligament injury. Hyperextension casting of the distal interphalangeal joint is indicated for a mallet injury or terminal tendon disruption. An intrinsic plus splint is useful for many soft tissue and bony injuries. However, the injury in the patient described requires specific positioning of the PIP joint.

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168. A 48-year-old woman is referred to the office by her primary care physician for evaluation of a painless ulcer on the tip of the index finger of the right hand that has been present for the past three months. Medical history includes scleroderma with thin, tight, fibrotic skin on the face and perioral region. On physical examination, dry eschar and visible bone are noted at the tip of the index finger. The skin of the other digits is thin and shiny. No flexion contractures of the interphalangeal joints are noted. Radiographs of the index finger show mild resorption of the tuft. Which of the following is the most appropriate management at this time?
- A) Amputation of the distal phalanx and direct closure of the stump at the level of the distal interphalangeal joint
 - B) Conservative debridement of the soft tissue of the tip of the finger and resection of exposed bone
 - C) Ray amputation of the digit and primary closure
 - D) Resection of the distal phalanx to the level of the distal interphalangeal joint and soft-tissue healing by secondary intention
 - E) Urgent digital sympathectomy and debridement of eschar

The correct response is Option B.

Scleroderma is an autoimmune disease that includes a disorder of the connective tissue and small blood vessels. This disease can affect the skin, hands, gastrointestinal tract, heart, lungs, and kidneys. The sclerosis or fibrosis is commonly seen in the skin of the face and perioral area. This sclerosis of the face gives the patient a mask-type appearance characteristic of scleroderma. The CREST symptom complex has been used to describe the most common findings of systemic sclerosis: calcinosis, Raynaud phenomenon, esophageal dysfunction, sclerodactyly, and telangiectasia. Ulceration at the fingertips is a common finding secondary to poor circulation. Skin breakdown can also occur at the proximal interphalangeal (PIP) and metacarpophalangeal (MP) joints caused by bony joint deformities as well as poor circulation.

Tip ulcerations are common because of the poor circulation associated with scleroderma. Many of these ulcerations will successfully heal over time without surgery. An initial conservative approach should therefore be taken. This approach includes conservative debridement, topical antibiotics (eg, silver sulfadiazine), and limited resection of exposed bone. If active infection is present, antibiotics should be administered.

If ulceration and pain fail to respond to conservative treatment, more aggressive intervention is required, including amputation and possible digital sympathectomy. Unfortunately, many

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patients who undergo digital sympathectomy continue to have pain and suffer recurrent ulceration.

Calcinosis is the deposition of calcium within the dermis or subcutaneously. These deposits can cause pain, spontaneously cause skin breakdown, and drain calcific material. Symptomatic lesions require excision or partial removal to alleviate symptoms.

Amputation, digital sympathectomy, and resection of the distal phalanx with secondary healing are not appropriate because conservative therapy should be attempted first.

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169. A 35-year-old highway construction worker is brought to the emergency department after he sustained injuries to the right leg when he was struck by a passing vehicle. The patient's condition is stable and vital signs are within normal limits. Physical examination shows a Gustilo Class IIIB open fracture of the tibia. No other serious injuries are noted. Irrigation and debridement performed in the operating room result in a large soft-tissue defect of the upper third of the anterior leg and an underlying tibial defect of 11 cm. Which of the following interventions is most appropriate for wound closure and healing in this patient?
- A) Application of hydroxyapatite crystals under a vascularized muscle flap
 - B) Cross-leg flap over an ipsilateral fibula transfer flap
 - C) Free muscle flap and a traditional tricortical iliac bone graft
 - D) Rotation pedicle muscle flap over a contralateral free fibula graft
 - E) Vacuum-assisted closure (VAC) therapy and bone lengthening with the Ilizarov apparatus

The correct response is Option D.

Classifications of open fractures of the tibia allow for grouping based on severity. These classifications can then be used to determine the most appropriate treatment and its prognosis. Gustilo Class IIIB is an open fracture with extensive soft-tissue damage and exposed bone and requires soft-tissue coverage. The goal of treatment is wound closure and bone healing to allow ambulation. The first step of treatment is early and adequate debridement in concert with bone stabilization. This treatment is followed by vascularized soft-tissue coverage and bone reconstruction.

In bone defects greater than 6–8 cm, a vascularized fibular graft is the treatment of choice. A free fibula graft can be taken with a skin island; however, if the defect is large, a second flap is required.

In the scenario described, a rotation pedicle muscle flap over a contralateral free fibula graft is most appropriate for wound closure and healing because it provides for vascularized soft-tissue coverage. A gastrocnemius flap is a reasonable choice in the upper third of the tibia.

Application of hydroxyapatite crystals under a vascularized muscle flap is inappropriate because this defect is too large for cancellous bone grafting or hydroxyapatite.

A cross-leg flap is only indicated if the other methods listed are not available. An ipsilateral fibula pedicled bone graft is possible; however, with both tibia and fibula fractures, transfer of the fibula can aggravate instability.

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Free muscle flap and a traditional tricortical iliac bone graft provides for soft-tissue coverage; however, the defect size of 11 cm is too large for a traditional iliac bone graft. A vascularized iliac crest free flap will have significant curvature as well as inadequate length.

A vacuum-assisted closure (VAC) system applies negative pressure to the wound to decrease the edema and reduce wound size. This process is slow and does not provide bone coverage in a high-energy injury. The Ilizarov bone-lengthening technique is a long and arduous process of distracting the debrided bone ends. It is less successful in injuries with significant soft-tissue injury and scarring.

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170. A 37-year-old man comes to the emergency department because he has pain and swelling of the right hand as well as numbness of the fingertips two hours after undergoing CT scan of the abdomen because of abdominal pain. Physical examination shows lack of full active extension of the fingers and exquisite tenderness on passive adduction and abduction of the fingers. Pulses are intact. High-pressure infiltration of intravenous radiographic contrast medium into the hand is suspected. Which of the following is the most appropriate management?
- A) Administration of nonsteroidal anti-inflammatory drugs and follow-up evaluation in the office
 - B) Elevation of the arm, application of ice, and re-evaluation in six hours
 - C) Emergency fasciotomy
 - D) Initiation of heparin therapy for anticoagulation
 - E) Subcutaneous injection of calcium gluconate into the arm

The correct response is Option C.

The condition described is clearly a developing compartment syndrome that should be emergently decompressed in the operating room. The diagnosis should not be delayed until pulses are absent because absence of pulses is a late finding. Re-evaluation in six hours is not appropriate for the patient described because, by that time, irreversible muscle necrosis may occur, resulting in potential long-term disability. Similarly, having the patient follow up in the office is not appropriate. Initiation of heparin therapy for anticoagulation may be indicated in an ischemic event but is not appropriate in this scenario given the history and findings of the patient described. Subcutaneous injection of calcium gluconate is the treatment of choice for hydrofluoric acid burns, not for intravenous contrast infiltration.

In the case of a “nonalert” patient, compartment pressures may be measured using an intracompartmental pressure monitor. Such devices are commercially available or may be fabricated. Interstitial compartment pressures of > 30 mmHg are consistent with compartment syndrome.

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171. A 21-year-old man comes to the office because he has had absence of sensation of the right thumb since he underwent repair of the digital nerve on the opposition side of the digit one year ago. On physical examination, Tinel sign is absent at the surgical scar. After surgical exploration and debridement of the thumb, a 3-cm nerve gap is noted. Which of the following is the most appropriate method of digital reconstruction?

- A) Mobilization of the free nerve ends and primary repair
- B) Polyglycolic acid tube conduit
- C) Posterior interosseous nerve grafts
- D) Radial central nerve grafts
- E) Vein conduit

The correct response is Option C.

Repair or reconstruction of a digital nerve requires a tensionless technique. With tension, repair of the nerve will cause scarring and form a neuroma. If the gap is too large, a graft or conduit is required for a tensionless reconstruction. The terminal posterior interosseous nerve graft is ideal because it provides a nerve with similar caliber for the repair. Harvesting of this nerve avoids a donor deficit because at the level of the distal forearm wrist it only provides for wrist sensation.

Large nerve defects should not be reconstructed with vein or polyglycolic acid tube conduits. The radial sensory nerve is too large in diameter. Additionally, the sensory loss would be more problematic and would risk a painful neuroma.

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172. A 72-year-old man is referred to the hand clinic because he has had paronychia of the left thumb for the past three months. Treatment by the patient's primary care physician, including warm soaks and antifungal therapy, resulted in no change in his condition. Physical examination of the finger shows a 0.3 x 0.6-cm erythematous lesion extending from the lunula to the eponychial fold and involving the nail bed. No palpable lymph nodes are noted. Radiography shows no bony involvement. Biopsy of the lesion shows moderately differentiated squamous cell carcinoma. Which of the following is the most appropriate management?
- A) Amputation of the entire distal phalanx
 - B) Complete ablation of the nail matrix
 - C) Excision of the lesion with 2-mm margins
 - D) Excision of the lesion with 15-mm margins
 - E) Ray amputation

The correct response is Option A.

The condition of the patient described requires amputation of the entire distal phalanx.

Chronic paronychia is usually caused by a candidal infection. Failure of medical treatment with antifungals requires culture, radiographic evaluation to exclude bony involvement, and biopsy to exclude malignancy, particularly squamous cell carcinoma.

Squamous cell carcinoma is the most common primary malignancy of the hand. Lesions not involving the nail bed require excision with 1-cm margins; 2-mm margins are inadequate for squamous cell carcinoma. Tumors involving the nail bed or bone necessitate amputation of the entire distal phalanx.

Ray amputation of the thumb results in excessive functional loss of the extremity and does not improve long-term survival.

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173. A 29-year-old woman is referred to the office because she has flu-like symptoms as well as pain and stiffness in the joints of the hands. The pain keeps her awake at night and the stiffness occurs in the morning and lasts approximately two hours. The patient was evaluated for these symptoms in the emergency department two weeks ago. Analysis of aspirate from the affected joints was negative for white blood cells and organisms. A one-week course of cephalexin was initiated at that time. Current temperature is 38.1°C (100.6°F). Examination of the hands shows inflammation, swelling, and tenderness of the proximal interphalangeal joints of the index and long fingers. Which of the following is the most likely diagnosis?
- A) Gout
 - B) Osteoarthritis
 - C) Pseudogout
 - D) Rheumatoid arthritis
 - E) Septic arthritis

The correct response is Option D.

The patient described has the hallmarks of rheumatoid arthritis, the diagnosis of which is made on clinical grounds. The criteria for diagnosis were published in 1988; these criteria are the gold standard for diagnosis. Patients with the following symptoms for six or more weeks are suspected to have rheumatoid arthritis: morning stiffness; soft tissue swelling; swelling of the proximal interphalangeal, metacarpophalangeal, and/or wrist joints; and symmetric arthritis. They may also have subcutaneous nodules, a positive rheumatoid factor, and positive findings on plain radiographs.

Although the other diagnoses (gout, osteoarthritis, pseudogout, and septic arthritis) should not be ruled out, the clinical findings described make rheumatoid arthritis the most likely diagnosis. A complete blood count, erythrocyte sedimentation rate, serum rheumatoid factor, and antinuclear antibodies, although not adequate for making a conclusive diagnosis, will make diagnosis more conclusive when combined with plain radiographs and clinical findings.

Gout would be indicated by an elevated serum uric acid level or uric acid crystals in the joint aspirate. Calcium pyrophosphate crystals would be found in the joint aspirate in pseudogout. Leukocytes and pathogens would be noted in the aspirate in septic arthritis.

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

174. A 42-year-old man comes to the office for initial consultation regarding an injury to the small finger of the right hand for which he was treated at an outside hospital one week ago. No medical records or radiographs related to the injury are available. The device on the patient's finger (shown) was most likely placed for correction of which of the following conditions?
- A) Central slip avulsion
 - B) Fracture dislocation of the proximal interphalangeal joint
 - C) Fracture of the middle phalangeal shaft
 - D) Laceration of the flexor tendon
 - E) Mallet finger deformity

The correct response is Option B.

Operative treatment of a fracture dislocation of the proximal interphalangeal (PIP) joint is generally indicated when more than 30% to 40% of the volar articular surface is involved. With this fragment volume, the PIP joint is unstable and displaced. Treatment options include open reduction and internal fixation, extension block pinning, or use of a dynamic traction device. Several manufactured devices are on the market; however, the simple device pictured has been shown to be very effective and can be made using easily available Kirschner wires. The technique relies on the fact that distraction of the finger will reliably reduce the fracture and restore the joint anatomy. It also allows the patient to move the joint during fracture healing,

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decreasing the incidence of PIP stiffness.

A simple central slip avulsion can be treated with extension splinting. The device shown would not stabilize a fracture of the phalangeal shaft. An unstable shaft fracture could be managed by pinning or plate fixation. Repair of the flexor tendon would not be helped by a dynamic intradigital traction device. A mallet injury would be treated with hyperextension splinting.

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175. A 43-year-old man who works as an electrical lineman is brought to the emergency department one hour after he sustained a high-voltage electrical injury. Physical examination shows a 1.5×2 -cm area of eschar on the palmar aspect of the right hand and an area of charred tissue on the right foot that is presumed to be the exit wound. Pulses in all extremities are within normal limits. Evaluation of the hand shows absence of sensation and muscle weakness. Which of the following diagnostic studies is most appropriate to evaluate the extent of muscle damage in the patient's hand?

- A) Angiography
- B) CT
- C) Electromyography
- D) MRI
- E) Technetium-99m scanning

The correct response is Option D.

High-voltage electrical injuries (greater than 1000 volts) to the extremities present a difficult diagnostic dilemma. Often, the injury is significantly more extensive than indicated by the cutaneous examination. Muscle necrosis may be present under normal skin. Electrical injuries often involve deep structures and subfascial edema may occur, leading to further muscle necrosis. Various studies have been used to evaluate the burned extremity when there is no need for urgent escharotomy. MRI is the most appropriate choice because it is the most sensitive of the tests listed. MR images do not demonstrate tissue edema.

In patients who have sustained high-voltage electrical injuries, observation is appropriate. In electrical burns, sensation often cannot be used as an adequate judge because paresthesia is common because of the low resistance of the nerve to electric current. Myoglobinuria is associated with significant muscle damage and may predict the need for fasciotomies.

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176. A 62-year-old man who is a practicing orthodontist comes to the office because he has had pain in the thumb of the dominant left hand at the level of the trapeziometacarpal (TM) joint for the past year. He has no symptoms in the right hand. On physical examination, grind test of the left thumb is positive. Radiographs of both thumbs are shown. Which of the following interventions involving the left thumb is most appropriate at this time?

- A) Injection of a corticosteroid followed by splinting of the TM joint
- B) Metacarpal extension osteotomy of the TM joint
- C) Partial excision of the trapezium and tissue interposition arthroplasty
- D) Resection of the trapezium followed by silicone implant arthroplasty
- E) Splinting of the TM joint and application of a bone stimulator

The correct response is Option A.

The trapeziometacarpal (TM) joint is frequently affected with osteoarthritis. Arthritis of the trapezium can affect five articulations: TM, trapezium-second metacarpal, trapezium-trapezoid,

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scaphotrapezial, and scaphotrapezoidal. When all of these surfaces are involved, the condition is called pantrapezial arthritis. This complex of trapezial articulations is referred to as the basal joint of the thumb.

The key to the scenario described is twofold. The first important fact is that radiographic staging may not relate to symptoms. The second important tenet is that conservative nonoperative therapy such as splinting and injection of corticosteroids should be tried first. If conservative therapy is unsuccessful, then arthroplasty is indicated. The patient described has pantrapezial arthritis in the right basilar joint, but he has no symptoms. Therefore, no intervention is needed. The left basilar joint (the patient's dominant hand) is symptomatic, and an initial trial of conservative therapy is indicated. One study found that 70% of patients undergoing conservative therapy were able to avoid surgery in the long term.

The grind test is performed by holding the thumb metacarpal and applying axial compression while rotating the metacarpal in a circular motion. Pain and crepitance indicate a positive result.

Early stages of basal arthritis can be treated with ligament reconstruction. The goal of this operation is reconstruction of the volar beak ligament of the thumb metacarpal and reinforcement of the dorsal ligaments. Metacarpal extension osteotomy is an alternative operation for early basal arthritis. The goal of this operation is to unload the palmar joint surfaces. More advanced stages of basal arthritis require either partial or complete resection of the trapezium. Silicone implant arthroplasty has fallen out of favor because of long-term complications such as implant wear, implant fracture, and subluxation. The most common treatment for advanced pantrapezial arthritis is excision of the trapezium with ligament reconstruction and metacarpal suspension. Hematoma and distraction arthroplasty is excision of the trapezium without tendon interposition. In this technique, Kirschner wires are placed for six weeks to maintain the trapezial space. Bone stimulation does not play a role in the treatment of basilar joint arthritis.

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

177. A 3-month-old infant is brought to the office for consultation regarding deformity of the right hand (shown). The infant is otherwise healthy and has no other abnormalities. On physical examination, no abnormalities other than those of the right hand are noted. Radiographs show no bony syndactyly. The most appropriate management of this patient's deformity is release of the syndactyly and which of the following?

- A) Amputation of the digits
- B) First dorsal interosseus flap
- C) Full-thickness skin grafting
- D) Radial artery flap
- E) Split-thickness skin grafting

The correct response is Option C.

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Syndactyly is the second most common congenital hand abnormality after polydactyly, occurring in 1 in 2000 live births. Syndactyly can be described as complete, when the interdigital web extends to the full length of the digit, or incomplete. Although there have been reports of the use of skin flaps or primary closure after radical subcutaneous tissue debulking, skin grafts are almost always necessary. Full-thickness skin grafting is the appropriate management of syndactyly in a child. Effective grafts for this procedure include the lateral groin crease, plantar foot, antecubital fossa, inner arm, or wrist flexion crease.

Amputation of the digits is almost never required for a simple syndactyly.

Pedicle flaps such as a dorsal interosseus flap or radial artery flap are not required because tissue can be closed with adjacent flaps and skin grafts alone.

A split-thickness skin graft is a poor choice in a young child because it is difficult to obtain and has a significant amount of contracture.

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178. A 30-year-old man comes to the emergency department 30 minutes after he sustained traumatic avulsion amputation of the thumb at the level of the interphalangeal joint. The amputated digit was wrapped in a wet towel immediately after the injury and has been kept on ice since that time. Physical examination shows complete avulsions of the extensor pollicis longus and flexor pollicis longus tendons from their muscle bellies. Which of the following is the most appropriate management of this patient's injury?
- A) Replantation and tendon repair
 - B) Replantation of the amputated digit and immediate fusion of the interphalangeal joint
 - C) Revision amputation and delayed pollicization
 - D) Revision amputation and subsequent transfer of the great toe
 - E) Revision amputation, immediate shortening of the bone, and closure of the skin

The correct response is Option B.

Because the extensor pollicis longus (EPL) and flexor pollicis longus (FPL) tendons are avulsed, repair or reconstruction of their function is difficult. When these tendons are reinserted, there is a risk of infection. The main contribution of the thumb to overall hand function is through its length and ability to oppose the fingers to grab and hold objects. The critical length of the thumb is the level of the interphalangeal (IP) joint. It is optimal to preserve the length of the thumb to at least the IP level. Thumb length is more important than motion. Considerable motion can be preserved through the metacarpophalangeal and carpometacarpal joints of the thumb. Therefore, thumb function is not significantly altered with fusion of the IP joint. Furthermore, fusion of the IP joint can allow for less tension across the microvascular repairs. This has been shown to improve survival rates for thumb replantations as well as produce reliable recovery of two-point discrimination through nerve repairs that are not under tension. Furthermore, shortening of the thumb allows for avoidance of the potential need for grafts to repair the artery or nerves. If the IP joint of the thumb is fused, there is no need to repair the FPL tendon. Revision amputation with closure, pollicization, or toe transfer would not yield the functional outcome of a successful replantation. Specifically, transfer of the great toe is not needed if thumb length is at the IP level.

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179. A 44-year-old man comes to the emergency department immediately after he sustained an injury to the tip of the left thumb while working with a table saw. Physical examination shows a 1.5 × 1.5-cm wound involving the volar tip of the thumb with bone visible within the base of the wound. Which of the following is the most appropriate management?
- A) Cross-finger flap
 - B) Island Moberg flap
 - C) Secondary healing
 - D) Skin grafting
 - E) Thenar flap

The correct response is Option B.

The Moberg flap is the most effective intervention for thumb tip defects of 1.5 cm or smaller. Some of the tactics that have been described to facilitate distal advancement of the flap include flexion of the thumb interphalangeal crease, extension of the lateral incisions proximal to the metaphalangeal crease, and islandization of the flap by releasing the skin at the base of the flap and skin grafting the donor wound.

The cross-finger flap can be used for the thumb but is best suited for fingers of younger patients because of the risk of flexion contractures when used in older patients. Secondary healing is inappropriate in the case described because of the large size of the wound. Skin grafting is not appropriate for the patient described because bone is exposed. The thenar flap is harvested from the thumb and, therefore, is not used to reconstruct the thumb.

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180. A 67-year-old woman comes to the office because she is unable to extend the distal phalanx of the right thumb eight weeks after sustaining a fracture of the right distal radius. At the time of the injury, she was seen in the emergency department and the fracture was treated with closed reduction and casting for eight weeks. Which of the following is the most appropriate next step in management?
- A) Direct repair of the extensor pollicis longus tendon
 - B) Fusion of the interphalangeal joint of the thumb
 - C) Splinting of the thumb in extension for six weeks
 - D) Tenolysis of the extensor pollicis longus tendon
 - E) Transfer of extensor indicis proprius to extensor pollicis longus tendon

The correct response is Option E.

Minimally or nondisplaced fractures of the distal radius may be associated with significant complications, including nonunion, malunion, stiffness, and tendon ruptures. The extensor pollicis longus (EPL) and the extensor digitorum communis tendons are the most frequently ruptured tendons after distal radius fracture. Rupture of the EPL tendon is more common in minimally or nondisplaced fractures of the distal radius. The management of EPL ruptures is surgical exploration and transfer of the extensor indicis proprius tendon to the distal stump of the EPL tendon. This tendon transfer is a simple procedure that retains the extensor function of the index finger.

Generally, EPL rupture occurs late. A zone of relative ischemia within the tendon weakens the EPL until rupture occurs. With rupture of the EPL tendon, the proximal muscle and tendon retracts. Direct repair is not possible or would place excessive tension on the repair. Grafting of the gap lays the tendon graft in a scarred bed and motors the muscle-tendon unit with a contracted muscle. Fusion of the interphalangeal joint of the thumb would not be optimal treatment because a simple tendon transfer exists; however, it may serve to be a viable option if there are multiple tendon ruptures and no sufficient transfers exist. Splinting will not restore tendon function. Tenolysis is indicated for tendon adhesions but has no role in the management of a tendon rupture. Interphalangeal joint arthrodesis is a more reasonable option with a similarly ruptured flexor pollicis longus where the flexor sheath is scarred.

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181. A 21-year-old woman who rows regularly with her university's crew rowing club comes to the office because she has had pain on movement of the right thumb as well as pain and swelling of the distal forearm for the past month. She has not sustained trauma to the hand or arm. Physical examination shows tenderness and crepitus 4 cm proximal to the wrist and over the distal and radial aspects of the forearm. Slight discomfort is noted on ulnar deviation of the wrist with the thumb clasped in the palm. No grinding or crepitation of the thumb carpometacarpal joint is noted. Which of the following is the most appropriate initial step in management of this patient's condition?
- A) Injection of a corticosteroid into the first dorsal compartment
 - B) Injection of a corticosteroid into the third dorsal compartment
 - C) Splinting of the carpometacarpal joint of the thumb
 - D) Splinting of the wrist in extension
 - E) Observation

The correct response is Option D.

The patient described has findings consistent with intersection syndrome, a tenosynovitis of the second dorsal compartment (common radial wrist extensors) associated with pain and swelling of the muscle bellies of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB), 4 cm proximal to the wrist joint (ie, where the muscle bellies of APL and EPB cross extensor carpi radialis longus and extensor carpi radialis brevis). As in other stenotic conditions of the hand and wrist, it is associated with repetitive motions of the wrist and is frequently seen in athletes, especially rowers and weightlifters. Initial nonoperative treatment consists of rest, nonsteroidal anti-inflammatory drugs (NSAIDs), splinting of the wrist in 15 degrees of extension, and, in some patients, injection of a corticosteroid into the second dorsal compartment. For those with persistent pain, surgical release of the second dorsal compartment beginning at the wrist and extending proximal to the area of swelling may be necessary.

De Quervain disease, a tenosynovitis of the first dorsal compartment, presents with wrist pain on the radial side aggravated by movement of the thumb, most often in women aged 40–60 years. Local tenderness and swelling 1 to 2 cm proximal to the radial styloid and knifelike pain on Finklestein test (clasped thumb in palm while wrist is ulnarly deviated) is diagnostic. In mild cases, rest, NSAIDs, and splinting of the wrist in gentle extension and the thumb widely abducted may be successful. Injection of a corticosteroid into the first dorsal compartment may be successful in 50%–80% of patients following one or two injections. If nonsurgical modalities are unsuccessful, then surgical release of the first dorsal compartment is successful, if variations of this compartment are appreciated and addressed.

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Tenosynovitis of the extensor pollicis longus (third dorsal compartment) is rare but requires early diagnosis and urgent operative treatment to prevent tendon rupture, a complication rarely seen with de Quervain disease, trigger finger, or trigger thumb. It presents with pain, swelling, tenderness, and often crepitus at Lister's tubercle. Surgical treatment consists of third dorsal compartment release and tendon transposition radial to Lister's tubercle. Injection of a corticosteroid is rarely indicated.

Degenerative arthritis of the thumb most frequently affects the carpometacarpal joint. Diagnosis can be made by a positive grind test (ie, crepitations elicited with axial loading combined with the rotation of the thumb metacarpal), and confirmed with radiographs that show destruction of the articular surface and joint space. Early-stage disease may be treated with rest, splinting, NSAIDs, and thenar strengthening. If this fails to relieve pain, then ligament reconstruction may be performed, based on the extent of joint surface destruction. As the patient progresses to end-stage degeneration of the carpometacarpal joint, carpometacarpal arthrodesis, trapezium hemiprosthesis, ligament reconstruction-tendon interposition arthroplasty, or hemi- or complete trapeziectomy may be appropriate management.

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182. A 25-year-old man comes to the clinic for follow-up examination six months after undergoing open reduction and internal fixation of a grade IIIB fracture of the distal third of the tibia and soft-tissue coverage with a neuroadipofascial flap. On physical examination, turbid fluid is draining from the flap. The surrounding skin is erythematous and edematous. Radiographs show evidence of osteomyelitis. Debridement of the involved tibia is performed, resulting in a 15-cm bony defect, and the leg is placed in an external fixator. Which of the following interventions is most appropriate for reconstruction of bone in this patient?
- A) Free fibula flap
 - B) Iliac crest bone flap
 - C) Iliac crest bone grafting
 - D) Ilizarov bone lengthening
 - E) Open cancellous bone grafting

The correct response is Option A.

The most appropriate choice for management of this large bony defect is a free fibula flap. This flap can provide up to 26 cm of vascularized bone in an adult. Other options for free vascularized bone include the scapula and iliac crest, both of which can provide up to 12 cm in length. Not only are these flaps of insufficient length to adequately treat this patient, but the scapula lacks the tubular width and depth of the fibula and the iliac crest has excessive curvature. For bone defects smaller than 6–8 cm, bone grafts are sufficient when placed in a well-vascularized soft-tissue pocket. Larger bony defects require vascularized bone.

The Ilizarov bone lengthening technique is not optimal in a patient who requires such a long bone segment, although longer defects have been documented in the literature. With this technique, a corticotomy is made through healthy bone distant from the defect. The intercalary segment is pulled through the limb with wires until the defect is closed, with new bone formation in the widening distraction gap. Treatment time of 1.9 months in fixation for each centimeter of defect reconstructed requires a highly motivated and compliant patient.

Open cancellous bone grafting to open granulating skeletal defects, also known as the Papineau technique, is limited to 6-cm defects. Larger deficiencies require multiple donor sites, adding to donor site morbidity and discomfort.

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183. The most appropriate intervention to achieve a bloodless field during hand surgery is application of a tourniquet to the upper arm at which of the following pressures?

- A) Equal to diastolic blood pressure
- B) Equal to systolic blood pressure
- C) 30 mmHg greater than diastolic blood pressure
- D) 50 mmHg greater than mean arterial blood pressure
- E) 100 mmHg greater than systolic blood pressure

The correct response is Option E.

For surgical procedures involving the hand, the tourniquet pressure should be based on the patient's preoperative systolic blood pressure.

Tourniquets have been used in extremity surgery for hundreds of years. In 1873, Johann Friedrich August von Esmarch first introduced a bandage to exsanguinate the extremity before applying a tourniquet. Tourniquets are used to achieve a bloodless field during surgery, allowing greater visualization of the structures. The safe duration of tourniquet time ranges from 45 minutes to four hours; a duration of two hours is most widely accepted by hand surgeons. Tourniquet pressure is related to both the pressure generated by the machine and the width of the cuff. The cuff should be properly fitted to the arm. A rough guideline is use of a cuff width equal to the diameter of the upper arm. Tourniquet pressure has been widely debated, with standard pressures ranging from 250 to 300 mmHg.

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184. A 26-year-old man comes to the office because he has worsening pain and erythema in the thumb and small finger of the dominant right hand two days after he punctured the thumb with a wood splinter. The most appropriate initial step is exploration of the thumb, small finger, and which of the following?

- A) Dorsum of the hand
- B) Midpalmar space
- C) Parona space
- D) Posterior adductor space
- E) Ring finger

The correct response is Option C.

The radial and ulnar bursas are connected through the Parona space, which lies between the pronator quadratus fascia and the flexor digitorum profundus tendon sheath. The flexor tendon sheath of the small finger often connects with the ulna bursa, which extends proximal to the transverse carpal ligament. This connection can give rise to a “horseshoe abscess.” This abscess results when an infection starting in the thumb or small finger progresses proximal through the wrist and then into the opposite flexor tendon sheath through the Parona space. The Parona space can be explored by performing an extended carpal tunnel release.

Another potential space in the hand is the thenar space, which is bordered ulnarly by the vertical septum between the flexor sheath and metacarpal of the long finger, dorsally by the fascia of the adductor pollicis, and radially by the thenar muscle fascia. It should be noted that this space does not include the thenar muscles.

The midpalmar space is bordered radially by the vertical septum between the flexor sheath and metacarpal of the long finger, dorsally by the fascia over the interossei of the third and fourth web spaces, ulnarly by the fascia over the hypothenar muscles, and volarly by the flexor tendons.

The posterior adductor space is defined as the space dorsal to the adductor pollicis and volar to the first dorsal interosseous.

The dorsum of the hand contains the posterior interosseous space, which is dorsal to the first dorsal interosseous.

The ring finger would be explored if the patient had displayed signs of tenosynovitis of this digit.

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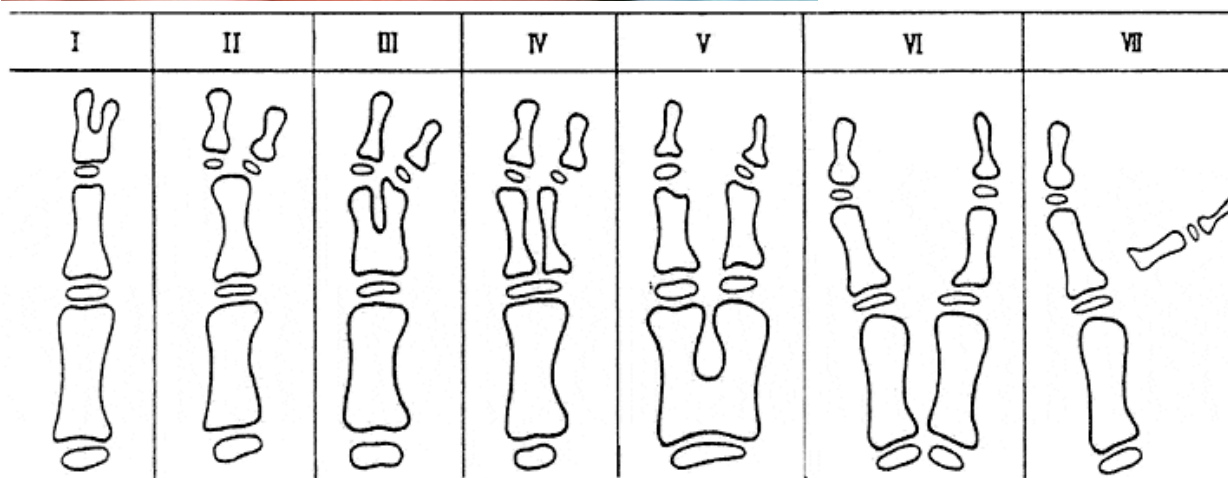
185. A 2-year-old boy is referred to the office by a pediatrician for surgical correction of a deformity of the right hand. Physical examination shows Wassel Type 4 duplication of the thumb. In surgical management of this patient's condition, which of the following is the most critical point?

- A) Amputation of the ulnar duplication
- B) Maintenance of the ulnar collateral ligament at the metacarpophalangeal joint
- C) Reattachment of the abductor pollicis brevis
- D) Repair of the flexor pollicis longus tendon
- E) Repair of the nail bed

The correct response is Option B.

There are seven classes of thumb duplication as described by Wassel. Type 4 is the most common. Type 1 involves a duplication of the distal phalanx in which the two are connected at the base. Type 2 duplications occur when the two distal phalanges are separate. Type 3 duplications are of the proximal phalanx and are connected at the base. Type 4 duplications are of the distal and proximal phalanges when there are four distal and proximal phalanges. Type 5 are duplications of the distal and proximal phalanges with a duplication of the metacarpal still fused at the base. Type 6 duplications result in six separate bones, two distal phalanges, two proximal phalanges, and two metacarpals that are separate.

In the correction of Type 4 duplications, it is most critical to preserve the ulnar collateral ligament to stabilize pinch. Typically, the radial thumb is less functional and less developed. The radial collateral ligament (RCL) is reconstructed with a ligament-periosteal flap. The abductor pollicis brevis is included in this RCL reconstruction. Most often, the flexor pollicis longus in the ulnar element is intact and does not require repair or reconstruction. As seen in the photograph of the thumb duplication in the patient described, the nail complex does not require intervention.



Wassel classification. Reproduced with permission from Kemnitz S, De Smet L.
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186. A 48-year-old man comes to the office for consultation regarding a draining sinus tract in the pretibial area of the left leg that developed approximately one week ago. He has not had fever, chills, or recent trauma to the leg. Medical history includes an open fracture of the tibia six years ago treated with an external fixator. Which of the following diagnostic studies is the most appropriate initial step?

- A) Arteriography
- B) CT
- C) MRI
- D) Plain radiography
- E) Three-phase bone scan

The correct response is Option D.

After examination of the patient, plain-film radiography is the most appropriate next step in the case of the patient described.

Chronic osteomyelitis may present months to years after the initiating trauma. Contaminated fractures may heal but continue to harbor sequestrum and devitalized bone. Once the diagnosis of osteomyelitis is suspected, an accurate culture is obtained through a bone biopsy and all necrotic bone must be removed. Bone is best obtained for cultures and pathology during open debridement. Cultures of the sinus tract and biopsies of the skin are inadequate to characterize bone pathogens. Cultures must be obtained prior to initiation of treatment with antibiotics. Culture-specific antibiotics are administered for six weeks after the final debridement.

Arteriography may be considered for later reconstructive options for the patient described.

Radiographs, CT, MRI, or bone scan will not identify the pathogen.

Dressing changes fail to address the underlying etiology of this patient's problem.

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187. A 58-year-old woman who is a pianist comes to the office because she has had increasing clumsiness of the right hand for the past four months. She says the awkward movement of her hand makes it difficult for her to play the piano. Physical examination shows marked atrophy of the first dorsal interosseous muscle. Two-point discrimination is 3 to 4 mm in all fingers. The most likely cause of these findings is nerve compression at which of the following sites?
- A) Arcade of Struthers
 - B) Carpal tunnel
 - C) Guyon canal
 - D) Ligament of Struthers
 - E) Osborne ligament

The correct response is Option C.

Isolated intrinsic motor weakness is most often a result of compression of the motor branch of the ulnar nerve with the ulnar tunnel, also referred to as the Guyon canal. The ulnar tunnel is divided into three zones. Within zone 2 of the ulnar tunnel, the deep motor branch passes around the hook of the hamate and between the pisohamate ligament and the fibrous arch of the flexor digiti minimi. The motor branch goes on to innervate the abductor digiti minimi, the flexor digiti minimi, the opponens digiti minimi, the small and ring lumbricals, the palmar and dorsal interosseous muscles, the adductor pollicis, and the deep head of the flexor pollicis brevis muscle. The terminal portion of the nerve innervates the first dorsal interosseous muscle. Causes for compression include ganglion, hamate hook fracture, lipoma, and hypothenar hammer syndrome.

Although isolated motor nerve compression can occur, the ulnar nerve is most commonly compressed at the level of the elbow, which is referred to as cubital tunnel syndrome. Cubital tunnel syndrome classically presents with sensory changes within the small and ring finger followed by weakness in the intrinsic muscles and, in severe cases, weakness of the profundus tendon to the small and ring finger. Surgical release in cases of cubital tunnel syndrome involves release of the Osborne ligament as well as the arcade of Struthers.

The carpal tunnel is the most common site of median nerve compression and is not the most common site of compression in this scenario. The ligament of Struthers may be involved in median nerve compression at the level of the elbow.

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188. A 22-year-old man has undergone multiple debridements of a wound of the right hand since he sustained a gunshot wound six days ago. Physical examination shows a significant soft-tissue defect and a 4-cm segment of bone loss from the third metacarpal. A radial forearm osteofasciocutaneous flap procedure for simultaneous reconstruction of the soft-tissue and skeletal defects is planned. Which of the following portions of the radius is the most appropriate site for harvesting the cortical bone graft?
- A) Radial aspect, between the brachioradialis and pronator teres insertions
 - B) Radial aspect, between the brachioradialis insertion and flexor pollicis longus origin
 - C) Radial aspect, between the pronator teres insertion and flexor pollicis longus origin
 - D) Ulnar aspect, between the brachioradialis and pronator teres insertions
 - E) Ulnar aspect, between the pronator teres insertion and flexor pollicis longus origin

The correct response is Option A.

When raising a radial forearm osteofasciocutaneous flap, cortical bone should be harvested from the radial aspect of the radius between the brachioradialis and pronator teres muscle insertions. A cuff of the flexor pollicis longus to the radius is maintained to preserve the periosteal vessels. A small cuff of periosteum is maintained on both sides of the radial vessels. All of the other optional donor sites are anatomically not appropriate. A segment up to 10 cm in length and up to 40% of the cross-sectional area of the radius may be harvested. The superficial branch of the radial nerve, running adjacent to the brachioradialis, is at risk and is sometimes sacrificed.

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189. A 65-year-old man who plays golf three times weekly has severe Dupuytren contracture of the small finger of the dominant right hand. The dense cord extends along the ulnar aspect of the hand and digit. The contracture of the metacarpophalangeal joint is 60 degrees, and the contracture of the proximal interphalangeal joint is 95 degrees. Which of the following is the most likely origin of the ulnar cord?
- A) Abductor digiti minimi
 - B) Abductor pollicis brevis
 - C) Antebrachial fascia
 - D) Cleland ligament
 - E) Volar carpal ligament

The correct response is Option A.

In the small finger, the ulnar cord typically originates from the musculotendinous junction of the abductor digiti minimi. From this location, the pretendinous band, spiral band, lateral digital sheath, and Grayson ligament can become involved, which can result in significant contractures at the metacarpophalangeal and proximal interphalangeal joints.

The other structures listed are not typically involved in Dupuytren contracture. The abductor pollicis brevis is the most radial thenar muscle and does not affect the ulnar cord. The antebrachial fascia is the superficial forearm fascia and is not related to Dupuytren contracture. The contractile cords involve Grayson ligaments and not Cleland ligaments. The Cleland ligament is dorsal to the neurovascular bundle. The volar carpal ligament covers the Guyon canal.

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190. A 13-year-old boy is brought to the office by his parents for removal of a cast that was applied to the right arm in the emergency department four weeks ago. The long arm cast was applied with the wrist in flexion after closed reduction of a fracture of the radius. On physical examination after removal of the cast, the patient is unable to extend the long finger with the wrist in extension or in neutral position. Full active range of motion of the long finger is noted with the wrist in flexion. Which of the following is the most likely cause of these findings?

- A) Entrapment of the flexor tendon
- B) Injury to the median nerve
- C) Ischemic necrosis of the flexor bellies
- D) Posterior interosseous nerve palsy
- E) Quadriga effect

The correct response is Option A.

Flexor tendon entrapment or adhesion in a fracture of the forearm is an unusual complication. It has usually been described in children and adolescents. All patients exhibit the tenodesis effect—that is, lack of extension of the involved digit with a neutral or extended wrist and full range of motion with the wrist flexed.

A patient who had sustained an injury to the median nerve would present with numbness of the fingers innervated by the median nerve and finger extension would not be affected. Ischemic necrosis of the muscle bellies is unlikely in the patient described because active motion is normal with the wrist flexed and there are no other symptoms to suggest a compartment syndrome. Posterior interosseous nerve palsy usually affects all the fingers rather than just one. Quadriga effect typically occurs after excessive shortening of a common flexor tendon or repairing a flexor tendon end to a terminal extensor tendon.

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191. An otherwise healthy 55-year-old woman who works as a secretary comes to the office because she has had increasing pain in the left wrist as well as loss of mobility and impaired function for the past year. Physical examination shows tenderness over the dorsoradial wrist, anatomic snuff box, and scaphoid tuberosity. A radiograph is shown. Which of the following is the most appropriate management?
- A) Dexamethasone injection into the radiocarpal joint and splint
 - B) Radioscaphoid arthrodesis
 - C) Scapho-trapezio-trapezoid arthrodesis
 - D) Scaphoidectomy and four-corner fusion
 - E) Total wrist arthrodesis

The correct response is Option D.

The patient described has scapholunate advanced collapse (SLAC wrist). Components of a SLAC wrist include radioscaphoid, capitolunate, and scaphocapitate arthritis. The capitate wedges itself between the scaphoid and lunate as it slides off the ulnar articular surface of the scaphoid. Typically, the articulation of the lunate with the distal radius is preserved, although there are advanced degenerative changes elsewhere in the wrist.

In the radiograph shown, the radiolunate and the scapho-trapezio-trapezoid (STT) joints appear preserved. The STT joint is unlikely to be the source of pain considering the clinical history and the radiographic appearance. Therefore, STT arthrodesis is incorrect. Radioscaphoid arthrodesis is unlikely to relieve all symptoms in this patient because of the presence of multiple other arthritic joints. Injection of dexamethasone into the wrist may provide some relief; however, this is not a long-term solution. Total wrist arthrodesis is excellent for control of pain caused by

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advanced osteoarthritis; however, this pain control comes at the expense of loss of mobility. Because of the preservation of the radiolunate joint, a limited wrist arthrodesis (scaphoidectomy and four-corner fusion) is a superior alternative. This is because the arthritic joints can be fused or eliminated while preserving wrist motion. Therefore, total wrist arthrodesis is not the best option.

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192. A 50-year-old woman who is obese undergoes carpal tunnel release using a lidocaine Bier block for anesthesia. During the procedure, the patient becomes restless and complains of a metallic taste in her mouth and ringing in her ears. As the tourniquet is rechecked, the patient begins having seizures. Which of the following interventions is the most appropriate next step?

- A) Administer intravenous fluids
- B) Administer intravenous lidocaine
- C) Administer intravenous thiopental
- D) Establish an airway
- E) Hyperventilate with oxygen

The correct response is Option D.

The patient described has experienced a cuff leak leading to local anesthetic toxicity. At lower doses, most toxic reactions involve the central nervous system in a biphasic fashion. Initially there is an excitatory phase that manifests as muscle twitching in the face and distal extremities, followed by tremors and progressing to generalized tonic-clonic seizures. With further increases in anesthetic, a depression phase follows with drowsiness, unconsciousness, and respiratory arrest.

Treatment of patients who demonstrate systemic toxicity with convulsions first requires the establishment of a secure airway, followed by hyperventilation with oxygen. This often terminates the seizures by reducing arterial CO₂, preventing the cycle of acidosis, increased local anesthetic uptake by the central nervous system, and lowered seizure threshold. If seizures continue, 50 to 100 mg of intravenous sodium thiopental may also terminate the convulsions.

Cardiovascular toxicity usually occurs at higher anesthetic blood levels. If there is hypotension, however, intravenous fluids, elevation of the legs, and vasopressor support should correct it. If bupivacaine was used for the block, bupivacaine-induced arrhythmias are not extremely responsive to intravenous lidocaine. Because of its recognized cardiotoxicity and reports of several deaths following its use, bupivacaine is no longer recommended for use in Bier blocks.

Obesity, particularly in patients with funnel-shaped arms, may complicate the establishment of good tourniquet occlusion in Bier block anesthesia. Thus, selecting another method of anesthesia in obese patients may be prudent to avoid potential local anesthetic toxicity associated with tourniquet leak.

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193. A 37-year-old woman has had intermittent pain in the tip of the long finger of the dominant right hand during the past three years. She says the pain is excruciating and occurs randomly. She has extreme sensitivity to cold in the finger. Physical examination shows extreme tenderness of the central matrix of the long finger. Loupe magnification of the nail complex and finger pad shows no abnormalities. Which of the following is the most likely diagnosis?

- A) Buerger disease
- B) Epidermal inclusion cyst
- C) Glomus tumor
- D) Hemangiopericytoma
- E) Kaposi sarcoma

The correct response is Option C.

Glomus tumors occur most frequently in the fingertip. In the digit, most glomus tumors occur subungually. The digital pulp is a less common location. Symptoms of glomus tumors typically include pain, sensitivity to cold, and tenderness on palpation. On close evaluation, a blue-purple mass can sometimes be observed. The Love sign is extreme pain on direct, focal pressure. The Hildreth sign is ablation of pain with proximal tourniquet inflation. MRI can localize the glomus tumor.

The surgical approach is either direct transungual or lateral subperiosteal. Complete excision results in rapid resolution of symptoms. Recurrence varies from 6.6% to 33%. Incidence of nail deformity with the transungual approach is 3.3% to 10%.

Buerger disease or thromboangiitis obliterans (TAO) is an inflammatory, occlusive, and nonatherosclerotic vascular disease. The angiitis most commonly affects the small and medium-sized arteries, veins, and nerves. Tobacco use and development and progression of TAO are clearly linked. The precise etiology of TAO is unknown. The arteriographic findings include normal proximal arteries, absent atherosclerosis or emboli, and focal and multifocal distal segmental occlusions of small and medium-sized vessels, interspersed with normal-appearing segments. Irregular stenosis with corkscrew appearance is the classic arteriographic finding. Cessation of tobacco use is the critical first step in successful treatment.

An epidermal inclusion cyst develops after an injury traps epithelial cells in the underlying soft tissue or bone. These cysts slowly enlarge and typically are not painful. However, an epidermal inclusion cyst can abscess and require drainage.

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Hemangiopericytoma is a rare tumor that can involve soft tissue or bone. Approximately 30% to 50% of cases develop in the limbs. It derives from vascular Zimmermann pericytes. These differ from glomus tumor and hemangioma. Biopsy is critical to diagnosis, and treatment involves functional wide local excision. The tumor can recur locally, and malignant forms can metastasize, primarily to the lung and skeleton.

There are several clinical types of Kaposi sarcoma (KS). Classic KS runs an indolent course over 10 to 15 years. Most cases are seen in elderly men of Italian or Eastern European Jewish ancestry. However, HIV-associated KS has a fulminant, disseminated, and most often fatal course. Other clinical forms of KS occur in recipients of renal allotransplantation, patients undergoing immunosuppressive therapy, prepubescent children, or young black African men. Recently, a gamma herpes virus—human herpes virus type 8 (HHV-8)—was identified in KS tissue from patients with classic, African, transplantation-related, and AIDS-associated KS.

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194. A 25-year-old police officer is brought to the emergency department 30 minutes after he sustained amputation injuries to the dominant right hand. Physical examination shows guillotine-type amputation of the thumb at the level of the metacarpophalangeal (MP) joint and index finger at the proximal interphalangeal (PIP) joint. The amputated parts were wrapped in moist gauze and placed in a plastic bag immediately after the injury. Transfer of the patient to a replantation facility will not be possible for at least 18 to 24 hours because a hurricane in the region has disabled all ground and air emergency transport. The emergency department physician has experience suturing minor lacerations of the hand but has no microscopic surgical experience. He contacts the replantation facility by telephone for consultation with a plastic surgeon. Which of the following is the most appropriate instruction regarding management of the patient's condition until transport to a replantation facility is possible?
- A) Debride and close the wounds
 - B) Dermabrade the epidermis of the amputated parts and insert them under the skin of the abdomen through two separate incisions
 - C) Reattach the amputated parts with sutures as a composite graft and apply splints to the involved digits
 - D) Replant the amputated parts with step-by-step guidance of the plastic surgeon via telephone
 - E) Wrap the amputated parts in saline-soaked gauze and place them in a plastic bag on a bed of ice

The correct response is Option E.

The time interval between amputation and replantation can change a replantable situation to an unreplantable one. There are no strict guidelines for ischemia times. There have been case reports of a successful hand replantation performed after 54 hours of cold ischemia and a successful digit replantation after 42 hours of warm ischemia. Acceptable ischemia time is dependent on the amount of muscle in the amputated part: the more muscle, the shorter the acceptable ischemia time. General guidelines are that if warm ischemia time is greater than 6 hours for amputations proximal to the carpus or 12 hours for the digits, replantation is usually not recommended. Cold ischemia can double these acceptable time limitations. The patient discussed is a young police officer with an amputation of the thumb and index finger. The thumb is the only opposable digit and, as such, is critical for hand function. Thumb amputation is a strong indication for replantation. The dangerous weather in the scenario described precludes quick transfer; however, the cold ischemia time would be approximately 24 hours in a digit with no muscle. This time frame is within the limits for a successful outcome. Therefore, the most appropriate management in the scenario described is to wrap the amputated parts in saline-

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soaked gauze and place them on ice.

Debriding and closing the wounds is not appropriate because this would treat the cold ischemia time as a contraindication for replantation and commit this patient to late reconstruction.

Reattaching the amputated parts with sutures as a composite graft and applying splints to the involved digits is not appropriate because of the size of the amputated digit. Small composite grafts can survive; however, this applies to young children with distal tip amputations. Furthermore, suturing the parts back on will create a condition of warm ischemia instead of cold ischemia. In situations of near-complete amputations, the attached digits can be placed in an ice saline slurry. Dermabrading the epidermis of the amputated parts and inserting them under the skin of the abdomen through two separate incisions will not work for similar reasons.

Replanting the amputated parts with step-by-step guidance of the plastic surgeon via telephone is inappropriate because of the poor outcome associated with an inexperienced operator.

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195. A 27-year-old man who sustained complete transection of the median nerve at the level of the midforearm 18 months ago is scheduled to undergo opponensplasty for improvement of hand function. Transfer of which of the following tendons is most appropriate to restore the oppositional force of the thumb?

- A) Abductor digiti minimi
- B) Extensor carpi radialis brevis
- C) Extensor indicis proprius
- D) Flexor digitorum superficialis of the long finger
- E) Palmaris longus

The correct response is Option D.

Opponensplasty is the term used to describe the transfer of a muscle tendon unit to restore the oppositional force of the thumb that is often absent after an injury to the median nerve. The three major principles of tendon transfer are as follows: (1) the transferred muscle should be used to provide a single function only; (2) the transferred tendon must have an excursion sufficient to produce the desired movement; (3) the transferred muscle should be as strong as, if not stronger than, the muscle that is being reconstructed. Muscle power or strength is assessed by examining the cross-sectional area of the muscle, which directly correlates with power.

In a study by Cooney, cross-sectional area and analysis of moment arm were used to determine the best donor muscle for oppositional transfer. The flexor digitorum superficialis (FDS) of the long finger and the extensor carpi ulnaris (ECU) muscles closely approximated thenar muscle strength and potential excursion. Abduction from the palm was greatest after transfer of the FDS from the long and ring fingers and after ECU and extensor carpi radialis longus (ECRL) transfers. Pulley location was found to influence the motion and strength of transfers in both the flexion and abduction planes. Cooney stresses the importance of directing the force of the transfer toward the pisiform. Transfers distal to the pisiform, such as those using the extensor digitorum quinti or the abductor digitorum quinti, produce more flexion than abduction. Transfers proximal to the pisiform, such as the FDS using the flexor carpi ulnaris loop as a pulley, produce more abduction and less metacarpal flexion.

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196. A 36-year-old man is brought to the emergency department after he sustained an open, comminuted fracture of the proximal third of the tibia in a motorcycle collision. After the patient's condition has been stabilized, he is transferred to the operating room. Popliteal artery disruption is noted and warm ischemia time is six hours. Surgical exploration of the wound shows avulsion of the posterior tibial nerve. Which of the following is the most appropriate next step in management?
- A) Implantation of the end of the posterior tibial nerve into the muscles of the posterior compartment
 - B) Primary amputation of the leg
 - C) Vascular repair and coverage with a distally based anterolateral thigh flap
 - D) Vascular repair and coverage with a medial gastrocnemius flap
 - E) Vascular repair and repair of the posterior tibial nerve

The correct response is Option B.

Surgeons are always hesitant to amputate primarily, but in certain instances, it is the best option. Generally, two absolute criteria for primary amputation after open tibial fractures with vascular injury exist: anatomically complete disruption of the posterior tibial nerve in an adult, and crush injury with warm ischemia time of more than six hours.

Relative indications for amputation include serious associated polytrauma, severe ipsilateral foot trauma, and anticipated protracted course to obtain coverage and tibial reconstruction.

Several classification systems exist to determine salvage versus amputation, including MESI (Mangled Extremity Syndrome Index), PSI (Predictive Salvage Index), MESS (Mangled Extremity Severity Score), LSI (Limb Salvage Index), and NISSA (acronym for nerve injury, ischemia, soft-tissue contamination, skeletal injury, shock, and age).

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197. A 10-year-old boy is scheduled to undergo surgical treatment of spastic cerebral palsy. His function is limited by an internal rotation of the arm, flexion of the elbow, pronation of the forearm, flexion of the wrist, and flexed in palm thumb. Which of the following factors is the most significant predictor of the surgical outcome in this patient?

- A) Intelligence quotient
- B) Level of voluntary control
- C) Stereognosis
- D) Two-point discrimination
- E) Type of cerebral palsy

The correct response is Option B.

Cerebral palsy is a nonprogressive disorder of the central nervous system in children that primarily affects the motor system. Clinical evaluation review passive range of motion, sensibility, motor function, and functional classification. The most significant predictor of surgical outcome is preoperative level of voluntary control. Intelligence, stereognosis, two-point discrimination, and type of cerebral palsy do not have as much of an impact of postoperative functional outcome.

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For each clinical scenario, select the most appropriate pharmacologic agent (A–E).

- A. Acyclovir
- B. First-generation cephalosporin
- C. Prednisone
- D. Rifampin isoniazid
- E. Third-generation cephalosporin

198. A 45-year-old man has a two-day history of pain and swelling of the proximal interphalangeal joint of the right index finger. Physical examination shows pain on passive motion of the affected joint and erythema and tenderness extending into the right hand. Gram's stain of fluid aspirated from the joint shows gram-positive cocci.
199. A 19-year-old man has a seven-day history of swelling and pain on the volar surface of the left index finger. He has no history of trauma to the finger. Gram's stain of fluid aspirated from the joint shows gram-negative diplococci.

The correct response for Item 198 is Option B and for Item 199 is Option E.

Septic arthritis may result from extension of an adjacent subcutaneous abscess or by intra-articular contamination caused by a laceration or puncture wound. The joint is a poorly vascularized potential space, favoring colonization. Early diagnosis and drainage are crucial to treatment, as a joint infection can progress rapidly to destruction of articular cartilage.

The two most common organisms that cause hand infections are *Staphylococcus aureus* and B-hemolytic streptococci. Minor staphylococcal and streptococcal infections are treated with first-generation cephalosporins. More significant infections of the interphalangeal joint should be performed through a midaxial incision.

Neisseria gonorrhoeae usually manifests as a primary venereal infection. However, it can disseminate and sometimes present as a secondary hand infection, which is often confused with a purulent tenosynovitis or arthritis. It is important to distinguish gonococcal from pyogenic infection because, unlike a pyogenic infection, a gonococcal infection does not usually destroy tendon or articular cartilage. Therefore, incision, drainage, and debridement are unnecessary and should be avoided. Disseminated gonococcal infection is the most common cause of acute infectious arthritis in sexually active adults. A history or evidence of trauma are lacking. Fluid aspiration with Gram staining for gram-negative diplococci allows definitive diagnosis. Hospitalization and intravenous administration of a third-generation cephalosporin is recommended.

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Manifestations of Sweet syndrome can masquerade as acute hand infections. Sweet syndrome, originally described as an acute febrile neutrophilic dermatosis, belongs to a class of skin lesions that histologically have intense epidermal and/or dermal inflammatory infiltrate of neutrophils without evidence of infection or vasculitis. The lesions can erupt at sites of minor trauma. The clinical picture is consistent with infection initially. The unresponsiveness of these lesions to antimicrobial therapy and the lack of associated cellulitis is a clue to the diagnosis. The treatment of choice involves a tapering dose of corticosteroids.

Herpetic whitlows are often confused with paronychia or felon and are treated mistakenly as such. Initial signs include intense pain and erythema of the fingertip, followed by edema and tenderness. A Tzanck smear of vesicular fluid may show multinucleated giant cells. Primary herpes simplex infections typically resolve without treatment within three weeks. Incision and drainage of herpetic whitlow is contraindicated because surgical treatment converts a closed wound to open and may result in a secondary bacterial infection or viral superinfection. To date, there have been no controlled studies that assess the efficacy of acyclovir for the treatment of herpetic whitlow, but case reports suggest that it both suppresses and decreases the length and severity of recurrent infections when taken orally.

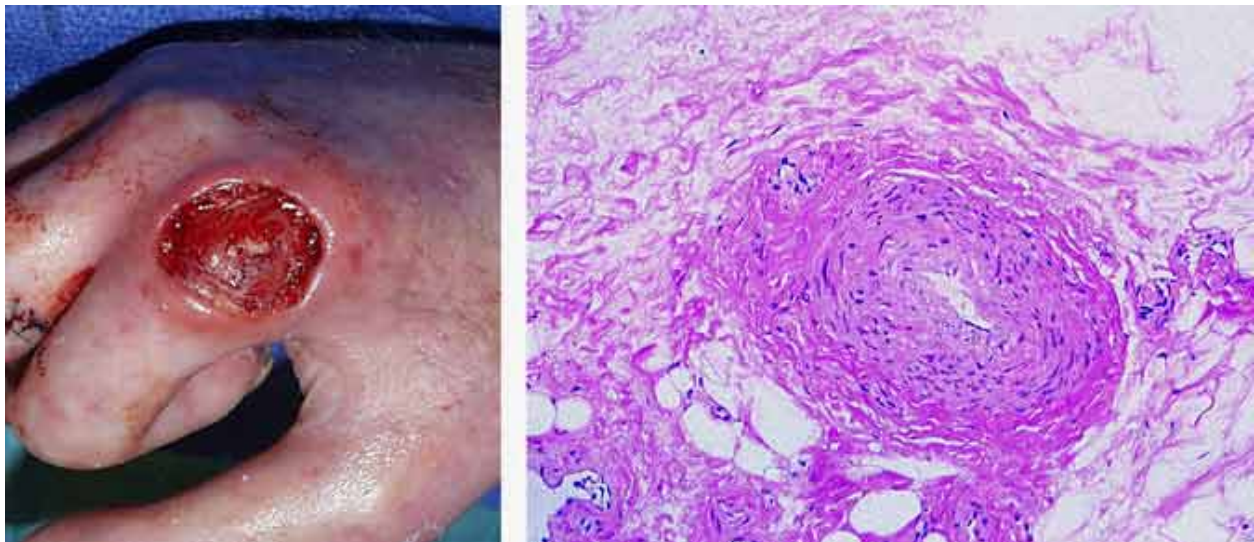
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200. A 43-year-old man with rapidly progressive scleroderma comes to the office for follow-up examination because of skin atrophy, sclerosis, and telangiectases resulting from his disease condition. On physical examination, multiple contractures and skin lesions are noted. The largest lesion is located on the dorsum of the metacarpophalangeal joint of the index finger of the right hand, with exposure of the dorsal joint capsule and dorsal bone surfaces. Which of the following is the most appropriate surgical procedure for correction of this deformity?

- A) Coverage with a local flap
- B) Cross-finger flap
- C) Full-thickness skin grafting
- D) Reconstruction with bilaminar neodermis
- E) Split-thickness skin grafting

The correct response is Option D.



In the scenario described, because one of the fingers is not contracted and still functional, salvage is important for rudimentary activities. This view, in surgery, shows the open metacarpophalangeal joint and degenerated bone at the base of the phalanx. These open structures required suitable coverage. Histology showed stenotic fibrotic arteries typical of

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immunopathic angiopathy, and impaired circulation made any surgery risky. Conventional options for closure, including topical care and skin grafts, are likely to fail. Sclerotic skin renders local flaps a technical impossibility, and amputation of the index finger is a more destructive option. The Integra healed the open bones and joint and preserved a functioning finger, shown below at six months. The material is compliant enough to allow full flexion. Threats to the finger are gone, and daily function is possible.



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Thank you for your participation.

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In-Service Examination

1	(A) (B) (C) (D) (E)	26	(A) (B) (C) (D) (E)	51	(A) (B) (C) (D) (E)	76	(A) (B) (C) (D) (E)
2	(A) (B) (C) (D) (E)	27	(A) (B) (C) (D) (E)	52	(A) (B) (C) (D) (E)	77	(A) (B) (C) (D) (E)
3	(A) (B) (C) (D) (E)	28	(A) (B) (C) (D) (E)	53	(A) (B) (C) (D) (E)	78	(A) (B) (C) (D) (E)
4	(A) (B) (C) (D) (E)	29	(A) (B) (C) (D) (E)	54	(A) (B) (C) (D) (E)	79	(A) (B) (C) (D) (E)
5	(A) (B) (C) (D) (E)	30	(A) (B) (C) (D) (E)	55	(A) (B) (C) (D) (E)	80	(A) (B) (C) (D) (E)
6	(A) (B) (C) (D) (E)	31	(A) (B) (C) (D) (E)	56	(A) (B) (C) (D) (E)	81	(A) (B) (C) (D) (E)
7	(A) (B) (C) (D) (E)	32	(A) (B) (C) (D) (E)	57	(A) (B) (C) (D) (E)	82	(A) (B) (C) (D) (E)
8	(A) (B) (C) (D) (E)	33	(A) (B) (C) (D) (E)	58	(A) (B) (C) (D) (E)	83	(A) (B) (C) (D) (E)
9	(A) (B) (C) (D) (E)	34	(A) (B) (C) (D) (E)	59	(A) (B) (C) (D) (E)	84	(A) (B) (C) (D) (E)
10	(A) (B) (C) (D) (E)	35	(A) (B) (C) (D) (E)	60	(A) (B) (C) (D) (E)	85	(A) (B) (C) (D) (E)
11	(A) (B) (C) (D) (E)	36	(A) (B) (C) (D) (E)	61	(A) (B) (C) (D) (E)	86	(A) (B) (C) (D) (E)
12	(A) (B) (C) (D) (E)	37	(A) (B) (C) (D) (E)	62	(A) (B) (C) (D) (E)	87	(A) (B) (C) (D) (E)
13	(A) (B) (C) (D) (E)	38	(A) (B) (C) (D) (E)	63	(A) (B) (C) (D) (E)	88	(A) (B) (C) (D) (E)
14	(A) (B) (C) (D) (E)	39	(A) (B) (C) (D) (E)	64	(A) (B) (C) (D) (E)	89	(A) (B) (C) (D) (E)
15	(A) (B) (C) (D) (E)	40	(A) (B) (C) (D) (E)	65	(A) (B) (C) (D) (E)	90	(A) (B) (C) (D) (E)
16	(A) (B) (C) (D) (E)	41	(A) (B) (C) (D) (E)	66	(A) (B) (C) (D) (E)	91	(A) (B) (C) (D) (E)
17	(A) (B) (C) (D) (E)	42	(A) (B) (C) (D) (E)	67	(A) (B) (C) (D) (E)	92	(A) (B) (C) (D) (E)
18	(A) (B) (C) (D) (E)	43	(A) (B) (C) (D) (E)	68	(A) (B) (C) (D) (E)	93	(A) (B) (C) (D) (E)
19	(A) (B) (C) (D) (E)	44	(A) (B) (C) (D) (E)	69	(A) (B) (C) (D) (E)	94	(A) (B) (C) (D) (E)
20	(A) (B) (C) (D) (E)	45	(A) (B) (C) (D) (E)	70	(A) (B) (C) (D) (E)	95	(A) (B) (C) (D) (E)
21	(A) (B) (C) (D) (E)	46	(A) (B) (C) (D) (E)	71	(A) (B) (C) (D) (E)	96	(A) (B) (C) (D) (E)
22	(A) (B) (C) (D) (E)	47	(A) (B) (C) (D) (E)	72	(A) (B) (C) (D) (E)	97	(A) (B) (C) (D) (E)
23	(A) (B) (C) (D) (E)	48	(A) (B) (C) (D) (E)	73	(A) (B) (C) (D) (E)	98	(A) (B) (C) (D) (E)
24	(A) (B) (C) (D) (E)	49	(A) (B) (C) (D) (E)	74	(A) (B) (C) (D) (E)	99	(A) (B) (C) (D) (E)
25	(A) (B) (C) (D) (E)	50	(A) (B) (C) (D) (E)	75	(A) (B) (C) (D) (E)	100	(A) (B) (C) (D) (E)

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In-Service Examination

101	(A) (B) (C) (D) (E)	126	(A) (B) (C) (D) (E)	151	(A) (B) (C) (D) (E)	176	(A) (B) (C) (D) (E)
102	(A) (B) (C) (D) (E)	127	(A) (B) (C) (D)	152	(A) (B) (C) (D) (E)	177	(A) (B) (C) (D) (E)
103	(A) (B) (C) (D) (E)	128	(A) (B) (C) (D) (E)	153	(A) (B) (C) (D) (E)	178	(A) (B) (C) (D) (E)
104	(A) (B) (C) (D)	129	(A) (B) (C) (D) (E)	154	(A) (B) (C) (D) (E)	179	(A) (B) (C) (D) (E)
105	(A) (B) (C) (D) (E)	130	(A) (B) (C) (D) (E)	155	(A) (B) (C) (D) (E)	180	(A) (B) (C) (D) (E)
106	(A) (B) (C) (D) (E)	131	(A) (B) (C) (D) (E)	156	(A) (B) (C) (D) (E)	181	(A) (B) (C) (D) (E)
107	(A) (B) (C) (D) (E)	132	(A) (B) (C) (D) (E)	157	(A) (B) (C) (D) (E)	182	(A) (B) (C) (D) (E)
108	(A) (B) (C) (D) (E)	133	(A) (B) (C) (D) (E)	158	(A) (B) (C) (D) (E)	183	(A) (B) (C) (D) (E)
109	(A) (B) (C) (D) (E)	134	(A) (B) (C) (D)	159	(A) (B) (C) (D) (E)	184	(A) (B) (C) (D) (E)
110	(A) (B) (C) (D) (E)	135	(A) (B) (C) (D) (E)	160	(A) (B) (C) (D) (E)	185	(A) (B) (C) (D) (E)
111	(A) (B) (C) (D)	136	(A) (B) (C) (D)	161	(A) (B) (C) (D) (E)	186	(A) (B) (C) (D) (E)
112	(A) (B) (C) (D)	137	(A) (B) (C) (D) (E)	162	(A) (B) (C) (D) (E)	187	(A) (B) (C) (D) (E)
113	(A) (B) (C) (D) (E)	138	(A) (B) (C) (D) (E)	163	(A) (B) (C) (D) (E)	188	(A) (B) (C) (D) (E)
114	(A) (B) (C) (D) (E)	139	(A) (B) (C) (D) (E)	164	(A) (B) (C) (D) (E)	189	(A) (B) (C) (D) (E)
115	(A) (B) (C) (D) (E)	140	(A) (B) (C) (D) (E)	165	(A) (B) (C) (D) (E)	190	(A) (B) (C) (D) (E)
116	(A) (B) (C) (D)	141	(A) (B) (C) (D) (E)	166	(A) (B) (C) (D) (E)	191	(A) (B) (C) (D) (E)
117	(A) (B) (C) (D)	142	(A) (B) (C)	167	(A) (B) (C) (D) (E)	192	(A) (B) (C) (D) (E)
118	(A) (B) (C) (D)	143	(A) (B) (C)	168	(A) (B) (C) (D) (E)	193	(A) (B) (C) (D) (E)
119	(A) (B) (C) (D) (E)	144	(A) (B) (C) (D) (E)	169	(A) (B) (C) (D) (E)	194	(A) (B) (C) (D) (E)
120	(A) (B) (C) (D) (E)	145	(A) (B) (C) (D) (E)	170	(A) (B) (C) (D) (E)	195	(A) (B) (C) (D) (E)
121	(A) (B) (C) (D) (E)	146	(A) (B) (C) (D)	171	(A) (B) (C) (D) (E)	196	(A) (B) (C) (D) (E)
122	(A) (B) (C) (D) (E)	147	(A) (B) (C) (D) (E)	172	(A) (B) (C) (D) (E)	197	(A) (B) (C) (D) (E)
123	(A) (B) (C) (D) (E)	148	(A) (B) (C) (D) (E)	173	(A) (B) (C) (D) (E)	198	(A) (B) (C) (D) (E)
124	(A) (B) (C) (D)	149	(A) (B) (C) (D) (E)	174	(A) (B) (C) (D) (E)	199	(A) (B) (C) (D) (E)
125	(A) (B) (C) (D)	150	(A) (B) (C) (D) (E)	175	(A) (B) (C) (D) (E)	200	(A) (B) (C) (D) (E)

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