American Society of Plastic Surgeons
In-Service Examination

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

Material released March 2023.

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The In-Service Examination is comprised of a question and answer examination, individual score sheet, norm table and syllabus which includes questions, answers and references. The materials have been compiled by the ASPS In-Service Examination Committee along with National Board of Medical Examiners professional staff. All questions were reviewed and found to be objective and supported by appropriate review of the literature and align with evidence-based research. Content in this educational activity has been reviewed by peers and professionals to determine that the content is fair, balanced and unbiased.

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for the

In-Service Examination

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Section 1: Comprehensive

1. A 23-year-old woman presents for consultation for augmentation mammaplasty. She wants smooth, round silicone gel implants. Which of the following best aligns with the current U.S. Food and Drug Administration recommendations for implant rupture screening?

A) Mammography starting 3 years after surgery, then yearly

B) Mammography starting 5 years after surgery, then yearly

C) MRI starting 3 years after surgery, then every 2 years

D) MRI starting 5 years after surgery, then every 2 years

E) Ultrasound starting 3 years after surgery, then every 3 years

The correct response is Option D.

The updated U.S. Food and Drug Administration (FDA) guidelines recommend that women with silicone implants undergo surveillance for rupture starting 5 to 6 years after implantation, then every 2 to 3 years. It is recommended that surgeons discuss this guideline with patients prior to surgery. This can be either MRI or ultrasound.

The prior recommendation was first MRI at 3 years, then every 2 years.

Mammography is not recommended by the FDA for screening for implant rupture.

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1. Lacerda Macedo AC, Carvalho G, Uggioni MLR, et al. Accuracy of ultrasonography in breast implant rupture diagnosis: systematic review and meta-analysis. *Plast Reconstr Surg*. 2021;148(5):939-947. doi: 10.1097/PRS.0000000000008408
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2. A 25-year-old ambulatory man is evaluated because of a recurrent sacral wound. One year ago, the patient had a prolonged hospitalization from coronavirus disease 2019 (COVID-19). During his hospitalization, he developed a sacral pressure ulcer that was treated using bone debridement and bilateral gluteal fasciocutaneous flaps that healed uneventfully. On examination today, the wound probes to bone, and healthy granulation tissue is visible. Which of the following is the most likely cause of this patient's wound recurrence?

A) Malignancy

B) Malnutrition

C) Ongoing pressure

D) Osteomyelitis

E) Poor flap vascularity

The correct response is Option D.

Pressure ulcers, as their name implies, result from excess unaddressed pressure at sites of bony prominence. Pressure ulcers are a common problem with an acute care facility prevalence of nearly 15% in 1999. This clinical entity alone has a cost burden estimated between 11 and 26.8 billion dollars in the United States. Despite being common, healing a pressure ulcer is a difficult endeavor, requiring optimization of many factors. Wound recurrence is the most important outcome measure, with a widely reported range from 15 to 100%. Paraplegic patients have generally higher recurrence rates (up to 82% at 18 months) due to the lack of sensory awareness of ongoing pressure and greater difficulty in mobility.

Osteomyelitis is a common issue complicating ulcer care both in terms of local wound care and reconstructive surgical success. MRI is the diagnostic imaging modality of choice, with bone biopsy and culture serving as the gold standard for diagnosis. Proper control of osteomyelitis through bony debridement and culture-driven antibiotics is paramount in successful treatment. This is the most likely cause of recurrence in this clinical scenario given the patient’s ambulatory status, excellent nutrition and health, low incidence of malignancy overall in this setting, and delayed occurrence.

Ongoing pressure is another common reason for wound recurrence after reconstruction, but it is less likely in this clinical scenario given the initial use of a pressure offloading mattress,

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ambulatory status, and lack of prior ulcer.

Malnutrition is another important cause of ongoing wound-healing difficulty, yet it is also unlikely in this scenario. The patient has a normal albumin concentration, satisfactory protein intake, and normal BMI, all consistent with a lack of protein malnutrition.

Malignancy can occur in areas of chronic inflammation, including chronic wounds. Termed a "Marjolin ulcer," malignant transformation of a chronic injury site has been rarely reported. These tumors are typically squamous cell carcinoma and aggressive, and they have a poor prognosis. They are most often associated with prior burn sites but have been reported in regions of chronic osteomyelitis.

Vascularity of the flaps chosen for reconstruction are an important concern. Poor vascularity will lead to compromised healing in the acute postoperative period. Recurrence that occurs many months after healing is not typically the result of a poorly vascularized flap.

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1. Padula WV, Delarmente BA. The national cost of hospital-acquired pressure injuries in the United States. *Int Wound J*. 2019;16(3):634-640. doi:10.1111/iwj.13071
2. Ricci JA, Bayer LR, Orgill DP. Evidence-based medicine: the evaluation and treatment of pressure injuries. *Plast Reconstr Surg*. 2017;139(1):275e-286e. doi:10.1097/PRS.0000000000002850
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3. A 34-year-old right-hand–dominant man presents after traumatic amputation of the right upper extremity at the mid forearm level. He undergoes replantation after 5 hours of warm ischemia. Which of the following types of tissue is most sensitive to warm ischemia time?

A) Adipose

B) Bone

C) Muscle

D) Skin

E) Tendon

The correct response is Option C.

Muscle tissue is the most sensitive to ischemia of the tissues given, and it shows irreversible changes at 4 to 6 hours of warm ischemia time. Skin, subcutaneous tissue, and bone all tolerate longer ischemia time than muscle does.

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1. Prucz RB, Friedrich JB. Upper extremity replantation: current concepts. *Plast Reconstr Surg*. 2014;133(2):333-342. doi: 10.1097/01.prs.0000437254.93574.a8
2. Dragu A, Schnürer S, Surmann-Schmitt C, Unglaub F, Kneser U, Horch RE. Expression of HIF-1α in ischemia and reperfusion in human microsurgical free muscle tissue transfer. *Plast Reconstr Surg*. 2011;127(6):2293-2300. doi: 10.1097/PRS.0b013e318213a01f

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4. An otherwise healthy, 25-year-old transgender man (assigned female at birth) meets World Professional Association for Transgender Health guidelines for gender-affirming genital surgery. He chooses to undergo phalloplasty to achieve the ability to urinate while standing and also maintain a chance of penetrative intercourse. However, he would like to avoid a stigmatizing scar along the forearm. Therefore, he undergoes combination flap phalloplasty using anterolateral thigh tissue for penile shaft reconstruction and groin tissue for urethral reconstruction. A photograph is shown. Which of the following is the most likely vascular pedicle that will be dissected for harvesting the groin flap?

A) Deep external pudendal vessels

B) Deep inferior epigastric vessels

C) Lateral circumflex femoral vessels

D) Superficial circumflex iliac vessels

E) Superficial external pudendal vessels

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The correct response is Option D.

The most likely vascular pedicle that will perfuse the groin flap territory is the superficial circumflex iliac vessels as they emerge from the femoral system and course laterally across the groin, superficial to the sartorius muscle. A large and thin hairless skin flap may be harvested based on these vessels to reconstruct the urethral component of the phalloplasty. Perforators from the superficial branch of the superficial circumflex iliac vessels are located more medially, while perforators from the deep branch of the superficial circumflex iliac vessels are located more laterally along a line drawn from the groin crease to the anterior superior iliac spine.

The deep inferior epigastric vessels originate from the external iliac system and run deep to the rectus abdominis muscle and sprout perforators that supply abdominal tissue, commonly used for breast reconstruction.

Superficial and deep external pudendal vessels do not supply the groin territory as they emerge from the femoral system and course medially towards the perineum.

The lateral circumflex femoral vessels and its descending branch are the basis for the anterolateral thigh flap, which in this case is used for reconstruction of the shaft portion of the phalloplasty.

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5. A 65-year-old woman undergoes segmental mandibulectomy of the parasymphysis and left body for treatment of oral squamous cell carcinoma. The defect is reconstructed with an osteocutaneous free fibula flap. The flap is monitored with implantable venous Doppler and pencil Doppler. The day after surgery, the nurse reports that the implantable Doppler probe has become dislodged. On evaluation, the flap has a multiphasic transcutaneous arterial Doppler signal, dark coloration, and brisk capillary refill. Which of the following is the most appropriate next step in management?

A) Initiate heparin therapy

B) Initiate leech therapy

C) Perform bedside indocyanine green angiography

D) Perform serial physical examinations

E) Perform surgical exploration

The correct response is Option E.

This patient has signs of venous compromise, and the potential dislodgement of the Doppler probe may be misleading. The best course of action is to re-explore in surgery.

Serial examination is inappropriate as it will result in delay in treatment and does not address the obvious venous insufficiency.

Initiation of heparin or leech therapy does not address the likely venous pedicle compromise for a flap of this size. Indocyanine green angiography is not a therapeutic modality and will be less specific for early venous insufficiency.

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6. A 70-year-old woman who is obese and has type 2 diabetes is evaluated because of a very painful violaceous plaque on the abdomen that has developed into a black eschar. The eschar is located at the site where the patient injects insulin. History also includes end-stage renal disease. Examination of a specimen obtained on biopsy at the border of the lesion shows calcification of small- and medium-sized vessels, microvascular thromboses, extravascular soft-tissue calcification, and panniculitis. Administration of which of the following is the most appropriate management for this condition?

A) Calcium carbonate

B) Corticosteroids

C) Iron infusion

D) Sodium thiosulfate

E) Warfarin

The correct response is Option D.

This patient has calciphylaxis. This condition causes extremely painful ischemic skin lesions due to calcification of small- and medium-sized vessels and microvascular thromboses. The majority of patients have end-stage renal disease, although it can develop in patients with normal kidney function. Female sex and obesity are other risk factors. The diagnosis is based on clinical features in uremic patients. Pain out of proportion to physical findings is a prominent feature of the disease and may precede cutaneous lesions. Violaceous plaques, nodules, or skin erosions may progress to ulcers or eschars. Clinical diagnosis may not be straightforward in nonuremic patients and frequently requires a skin biopsy. Histologic features of calciphylaxis include intimal hyperplasia, calcification of small- and medium-sized vessels, vascular thrombosis, extravascular soft-tissue calcification, panniculitis, epidermal necrosis, ulceration, and dermal necrosis. Laboratory tests may disclose hypercalcemia, hypo- or hyperphosphatemia, or increased parathyroid hormone concentrations, although these are frequently normal.

Debridement of nonviable tissue and pain control are the mainstay of treatment. Sodium thiosulfate has been shown to result in improvement or resolution of calciphylaxis in patients with renal failure, according to a recent meta-analysis. Sodium thiosulfate has chelating and vasodilatory properties. Thiosulfate is administered intravenously in the last 30 to 60 minutes of hemodialysis. It is not effective for nonuremic calciphylaxis. Using calcium-based

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phosphate binders, such as calcium carbonate, for management of hyperphosphatemia should be avoided since they cause a positive calcium load, which increases tissue calcification. Corticosteroids, due to their effect on mineral metabolism, have been identified as a risk factor for calciphylaxis progression. Vitamin K, through its actions on matrix proteins, is an inhibitor of calcification in vessel walls. Warfarin is a vitamin K antagonist and should therefore be stopped and replaced with a non-vitamin K oral anticoagulant. Iron therapy is thought to be a risk factor for calciphylaxis. Iron deposits have been found in areas of microvascular calcification in biopsy specimens taken from patients with calciphylaxis.

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7. A 35-year-old transgender man (assigned female at birth) comes to the office to discuss top surgery for a masculine chest appearance. On examination, the patient has D-cup breasts and Grade III ptosis. Which of the following is the most appropriate surgical option for this patient?

A) Circumvertical reduction mammaplasty

B) Liposuction only

C) Mastectomy with free nipple graft

D) Nipple-sparing mastectomy

E) Wise-pattern reduction mammaplasty

The correct response is Option C.

The most appropriate surgical procedure in this patient is a subcutaneous mastectomy with free nipple graft due to breast size and ptosis. Top surgery, or excision of the female breast tissue and shaping of the male chest, is often the first surgical procedure for female-to-male transgender patients. This marks the beginning of the patient's surgical transition into a masculine phenotype and is associated with profound and impactful psychological and aesthetic benefits for the individual. The goal of top surgery is to produce a normal-appearing male chest. This is achieved by removing the breast parenchyma, obliterating the inframammary fold, decreasing the areolar size, and moving the nipple-areola complex into the appropriate position.

There are numerous studies demonstrating excellent results and high patient satisfaction with subcutaneous mastectomy and free nipple grafts in patients with large and ptotic breasts. Additionally, patients with a BMI over 27 kg/m^2 and a distance from nipple to inframammary fold greater than 7 cm demonstrate better outcomes with fewer complications. Nipple-sparing mastectomy is inappropriate due to the degree of breast ptosis and the amount of skin that needs to be removed.

Liposuction alone will not achieve the goals above and will result in residual breast tissue and excess skin. Additionally, liposuction will not address areolar size or position. Liposuction is useful when combined with other techniques to help feather tissue thickness and contour the edges of the chest. Both Wise-pattern and circumvertical reduction mammaplasties will leave behind too much breast tissue and will not create the desired masculine chest appearance.

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8. A 3-year-old boy is brought by his parents for evaluation of a unilateral lesion that overlays the angle of his jaw and extends onto the neck. The boy's parents state that the lesion has been present since birth and grown gradually, and they are concerned it may become more problematic as he ages. On examination, the lesion is easily noticeable, soft in nature, and translucent with a pen light. The patient is referred to interventional radiology for sclerotherapy. Use of which of the following sclerosing agents is most likely to put this patient at increased risk for skin necrosis?

A) Bleomycin

B) Doxycycline

C) Ethanol

D) OK-432

E) Sodium tetradecyl sulfate

The correct response is Option C.

All of the options listed are appropriate for sclerotherapy, but ethanol has the highest complication rate. Treatment of lymphatic malformations (LMs) is dependent on multiple factors including size, anatomic location, cosmesis, pain, cystic type, and recurrent infections. For small and microcystic lesions where the entire LM can be excised, surgical resection is a good option, but for large, macrocystic, or cosmetically sensitive areas, sclerotherapy is considered first-line due to superior efficacy and lower complication rates. Sclerotherapy is performed by first aspirating the cyst(s) and then infusing a sclerosing agent. Each agent works through different mechanisms, but the end result is induction of an inflammatory process and collapse and scarring of the cyst walls, thus decreasing the size of the lesion. Complications, including skin necrosis and nerve injury, are highest with ethanol at 18% on systematic review, compared to below 6% for the other agents.

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9. An otherwise healthy 45-year-old woman is diagnosed with recurrent anal cancer. History includes a course of radiation therapy to the perianal region for the original treatment of her cancer. Abdominoperineal resection (APR) is planned with soft-tissue reconstruction of the perineal region using a pedicled anterolateral thigh flap at the time of extirpation. The surgeon must pass the flap under which of the following muscles to achieve a tensionless inset of the flap?

A) Adductor longus and gracilis

B) Adductor longus and sartorius

C) Rectus femoris and gracilis

D) Rectus femoris and sartorius

E) Sartorius and gracilis

The correct response is Option D.

The muscles under which the flap must pass include the rectus femoris and sartorius.

The anterolateral thigh (ALT) flap is most commonly raised as a fasciocutaneous flap, though it may be raised as a musculocutaneous flap if the vastus lateralis is included. It is supplied by the descending branch of the lateral circumflex vessel, originating from the profunda femoris system. It is used either as a pedicled flap for regional reconstructions or as a free flap. To reach the perineal region, one usually needs to tunnel the flap under the rectus femoris as well as the sartorius muscles. One must take great care not to injure the femoral vessels since they travel just deep to the sartorius muscle in the territory where one is dissecting. The other potential danger to be mindful of is traction of the delicate perforators of the ALT flap as one passes the flap through these tunnels to get to the perineum.

The adductor longus and gracilis muscles need not be lifted to successfully pass the ALT flap to the perineum.

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10. A 4-month-old male infant is brought to the clinic with melanocytic nevi. He has 30 satellite nevi involving the extremities and a giant nevus in the midline covering the majority of the back and posterior scalp. Which of the following is the most appropriate imaging study to order next?

A) CT scan of the brain and spine

B) CT scan of the chest

C) Liver ultrasonography

D) MRI of the brain and spine

E) Renal ultrasonography

The correct response is Option D.

This presence of more than 20 satellite nevi and midline involvement of the trunk and scalp increases the likelihood of neurocutaneous melanosis. Screening at age 4 to 6 months before normal brain myelination improves visualization of these abnormal melanin deposits. While many remain asymptomatic, there are two peaks in melanosis: age 2 to 3 years with increased intracranial pressure (ICP), hydrocephalus, or developmental delay, and age 20 to 30 years with space-occupying lesions, increased ICP, or spinal cord compression. Symptomatic neurocutaneous melanosis has a high mortality within 2 to 3 years, so these patients need careful observation and screening.

There is no association between a giant congenital melanocytic nevus and abnormalities of the liver or kidneys. CT scan of the chest is not indicated since the lesion is not malignant and does not involve the lungs. CT scan of the brain and spine is inadequate, and MRI is more sensitive in detecting these smaller lesions.

Treatment options include serial excisions (with or without tissue expanders) and even free tissue transfer to improve the cosmesis. These patients should be referred to pediatric dermatology for careful monitoring so any suspicious satellite lesions can be biopsied for possible malignant transformation. However, aggressive treatment is not indicated in patients with systemic melanosis due to the high mortality.

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11. A 25-year-old Caucasian man presents with a self-inflicted gunshot wound to the face resulting in significant soft-tissue and bony injuries. Following initial stabilization and debridement, there is a 12-cm mandibular defect extending from the right angle to the left parasymphysis. Which of the following is the most appropriate bony reconstruction for this defect?

A) Fibula osteocutaneous flap

B) Iliac crest bone graft

C) Medial femoral condyle osteocutaneous flap

D) Parascapular osteocutaneous flap

E) Radial forearm osteocutaneous flap

The correct response is Option A.

The fibula flap provides the greatest bony length for reconstruction which is necessary for this large defect. While leaving the proximal and distal 5-6 cm is critical to preservation of donor site function, often a 20+ cm flap can be harvested. The fibula is also able to tolerate multiple osteotomies to reconstruct the mandibular contour as well as adequate bone stock for subsequent dental implant rehabilitation.

The parascapular, radial forearm, and medial femoral condyle flaps do not provide adequate bony length for this defect. The parascapular flap is a versatile flap which can be harvested with large volume for soft tissue reconstruction as well as bone from the scapular tip. However, this bone is relatively small and thin, therefore not easily amenable to dental implants. Chimeric flaps containing skin, muscle, and bone can be also harvested on the pedicle for extensive defects. Unfortunately, the flap is typically harvested either in a lateral decubitus or prone position, which often requires patient repositioning during the reconstruction. The radial forearm flap is another common flap used in head and neck reconstruction, but the amount of bone that can be harvested is limited due to concerns for donor site morbidity (fracture of the residual radius). The radial forearm osteocutaneous flap is rarely used. The medial femoral condyle flap is a popular source for vascularized bone defects, but it also only provides a small block of corticocancellous bone and therefore is more popular in hand surgery or smaller defects. An iliac crest bone graft is nonvascularized and more commonly reserved for smaller defects (less than 4 to 5 cm). Large nonvascularized bone is likely to result in bony absorption and non-union. The fibula flap provides the greatest

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bony length for reconstruction, which is necessary for this large defect.

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12. A 29-year-old woman presents after sustaining a traumatic avulsion of the scalp. A photograph is shown. She undergoes replantation after 5.5 hours of warm ischemia time. Which of the following cytokines is most likely to foster reperfusion injury?

A) Fibroblast growth factor 3

B) Interleukin-2

C) Transforming growth factor beta

D) Tumor necrosis factor alpha

E) Vascular endothelial growth factor

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The correct response is Option D.

Tumor necrosis factor alpha is a key cytokine in reperfusion injury. This cytokine is proinflammatory and plays a role in mediating vasodilation, edema, and oxidative stress after restoration of perfusion.

Interleukin-2 is also proinflammatory, but it is not central to reperfusion injury. The other cytokines are growth-mediating cytokines.

Transforming growth factor beta and vascular endothelial growth factor are involved with vascular growth. Fibroblast growth factor 3 is involved with cellular growth and wound-healing.

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13. A 36-year-old man undergoes wide local resection of a malignancy on his right lower extremity, resulting in an exposed tendon. Which of the following flaps is most likely to require minimal subcutaneous undermining?

A) Bilobed

B) Bipedicled

C) Keystone

D) Propeller

E) Rhomboid

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The correct response is Option C.

A keystone flap does not require significant undermining. Wide undermining would compromise flap perfusion. Various modifications exist, but one standard keystone flap marking includes lines drawn 90 degrees from the superior and inferior edges of a lenticular defect with a width equivalent to that of the defect (X in the photographs). Closure of the donor site is essentially a double V to Y. The other flaps listed require wide undermining to appropriately transpose the flap. A propeller flap is a perforator flap that involves two limbs centered around a perforator. The flap is undermined completely, although the tissue is centered about the perforator. The limb most distal from the defect is rotated 180 degrees to the defect. Rhomboid flaps and bilobed flaps also require undermining and rely on random dermal perfusion. A bipedicled flap is random with a dual dermal blood supply and requires wide undermining.

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14. A 48-year-old transgender woman (assigned male at birth) is evaluated by an endocrinologist for hormone therapy to induce breast development. History is significant for factor V Leiden mutation. Which of the following hormone therapies would put this patient at greatest risk for developing deep venous thrombosis?

A) Oral ethinyl estradiol

B) Oral progesterone

C) Oral tamoxifen

D) Subcutaneous testosterone

E) Transdermal estradiol

The correct response is Option A.

An aim of estrogen therapy in transgender women is to induce feminization through breast formation. Estrogen is responsible for breast tissue proliferation, whereas progesterone causes differentiation in female breast development. No evidence exists that the addition of progesterone improves breast development among male-to-female (MtF) patients.

Estrogen is a prothrombotic hormone. The patient's underlying venous thromboembolic risk profile should be evaluated prior to initiating estrogen therapy. Both oral estradiol and ethinyl estradiol exert an increased prothrombotic risk due to hepatic first-pass metabolism. Compared with oral estradiol, the unique molecular structure of ethinyl estradiol is associated with greater prevalence of venous thromboembolism (VTE) in MtF patients. Transdermal estradiol is associated with the lowest VTE risk in transgender women.

Testosterone therapy induces virilization in female-to-male transgender persons, including development of male physical contours, reduction of breast glandular tissue, and increase in muscle mass and body fat redistribution. Subcutaneous administration of testosterone is the preferred route of treatment by transgender men as compared with intramuscular administration. Testosterone therapy is not associated with venous thromboembolism, but long-term testosterone undecanoate has a potential risk for oil pulmonary embolism. Venous thromboembolism is a complication generally only observed in male-to-female transgender persons on estrogen therapy.

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Oral tamoxifen is not a therapy used to induce breast development. It is used for breast cancer risk reduction.

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15. An otherwise healthy 30-year-old woman undergoes bilateral reduction mammaplasty. Intravenous ketorolac is administered postoperatively in the recovery room for pain management. Compared with a patient who does not receive this medication, which of the following clinical outcomes is most likely in this patient?

A) Equal hematoma risk and decreased opioid requirement

B) Equal hematoma risk and equal opioid requirement

C) Increased hematoma risk and decreased opioid requirement

D) Increased hematoma risk and equal opioid requirement

The correct response is Option A.

The most likely clinical outcome is an equal hematoma risk and decreased opioid requirement.

There has been a longstanding theoretical concern that nonsteroidal anti-inflammatory drugs, such as ketorolac, may in fact lead to a higher incidence of hematomas. Earlier, weaker studies suggested such beliefs. However, more recently, higher quality studies have refuted that notion. There is no evidence to suggest that perioperative ketorolac use has any clinically significant increased risk for hematoma formation. Additionally, studies also show that regular use of ketorolac lowers the need for perioperative opioids and also decreases postoperative nausea and vomiting. Patients with normal kidney function are good candidates for such perioperative pain-reducing therapies.

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16. A 38-year-old man is brought to the emergency department after he sustained a Gustilo Type IIIB injury to the distal left lower extremity in a motor vehicle collision. Photographs and an x-ray are shown. A free flap is planned for soft-tissue coverage, and a temporary antibiotic bone cement spacer is placed in the 5-cm bone gap. Which of the following is the optimal time for using this induction membrane technique to perform the second-stage bone graft?

A) 1 week

B) 3 weeks

C) 6 weeks

D) 12 weeks

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The correct response is Option C.

The Masquelet technique (induction membrane technique) is an effective two-stage technique for managing large bone gaps (even greater than 20 cm). After appropriate debridement and soft-tissue coverage, the first stage involves meticulous debridement of the nonviable bone with placement of an antibiotic cement spacer to promote the creation of an organized pseudosynovial membrane rich in inductive molecules. During the second stage, the membrane is incised and cancellous bone graft is placed. The optimal time between the two stages is 4 weeks, but if delays are anticipated (especially with compromised vascularity or soft-tissues), the second stage can be performed at 6 to 8 weeks. The three largest published clinical series used 6 to 8 weeks for the second stage. At 1 to 2 weeks, the membrane has not formed adequately. Levels of growth factor release are lower before 4 weeks. After 4 weeks, the osteogenic capacity begins to decrease, so waiting 8 to 12 weeks has no advantage and may increase the risk for failure or nonunion.

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17. A 35-year-old transgender man (assigned female at birth) meets World Professional Association for Transgender Health guidelines for gender-affirming genital surgery. He chooses to undergo radial forearm flap phalloplasty. During flap harvest, the plastic surgeon identifies the cutaneous nerve near the cephalic vein; the nerve is later coapted to the ilioinguinal and dorsal clitoral nerves for sensory reconstruction. This cutaneous nerve originated from which of the following more proximal nerves?

A) Axillary

B) Median

C) Musculocutaneous

D) Radial

E) Ulnar

The correct response is Option C.

The nerve in question is the lateral antebrachial cutaneous nerve, which originates from the musculocutaneous nerve. The musculocutaneous nerve innervates the coracobrachialis, biceps brachii, and brachialis muscles before terminating as the lateral antebrachial cutaneous nerve in the forearm. The lateral antebrachial cutaneous nerve is usually coapted to the ilioinguinal nerve for protective sensation, given the proximity of the two nerves to the radial forearm flap vascular pedicle and its anastomoses.

Another cutaneous nerve of the forearm that is routinely harvested during radial forearm flap phalloplasty is the medial antebrachial cutaneous nerve. This nerve originates from the medial cord of the brachial plexus, which also gives off the medial brachial cutaneous nerve as well. The medial antebrachial cutaneous nerve is usually coapted to the dorsal clitoral nerve for erogenous sensation, given the proximity of the two nerves once the ulnar urethral component of the radial forearm flap is inset.

The radial nerve gives off the posterior antebrachial cutaneous nerve, which is usually not involved in the sensory reconstruction of free radial forearm phalloplasty. Axillary and ulnar nerves do not give off cutaneous nerves in the proximal forearm.

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18. A 69-year-old woman is evaluated for a pigmented lesion on the lateral cheek which has been present for 3 years. Physical examination shows a 3.7-mm–wide asymmetric lesion with irregular borders. Excisional biopsy shows a 2.2-mm–thick superficial spreading malignant melanoma. Which of the following is the most appropriate wide local excision margin for this lesion?

A) 0.5 cm

B) 1.0 cm

C) 1.5 cm

D) 2.0 cm

E) 3.0 cm

The correct response is Option D.

Malignant melanomas are managed with wide local excision. Additionally, sentinel lymph node biopsy procedures are indicated in melanomas with greater thickness.

Historically, excision margins of up to 5 cm were proposed for deeper melanomas. Over the past several decades, there have been multiple prospective, randomized trials performed that indicate the safety of more conservative excision margins for melanomas with thicknesses greater than 2 mm. Current best practice guidelines support wide local excision of resectable melanomas with horizontal excision margins extending from the edge of the lesion up to, but not exceeding, 2 cm. The resection should go down vertically to, but not include, the underlying fascia. The specific excision margins are dictated by the thickness of the melanoma lesion. Margins greater than 2 cm have been shown to contribute to increased rates of surgical dehiscence and disfigurement.

Melanoma in situ, Tis stage, is best excised with a 0.5- to 1-cm margin.

Melanomas less than or equal to 1.0-mm thickness, T1 stage, are best excised with a 1.0-cm margin.

Melanomas between 1.0- and 2.0-mm thickness, T2 stage, are best excised with a 1.0- to 2.0-cm margin.

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Melanomas between 2.0- and 4.0-mm thickness, T3 stage, are best excised with a 2.0-cm margin.

Melanomas with a thickness greater than 4.0 mm, T4 stage, are best excised with a 2.0-cm margin.

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19. A 44-year-old woman comes to the clinic because of chronic intermittent infection, pain, and drainage of the right axilla. History is significant for obesity, type 2 diabetes, and smoking, as well as multiple courses of antibiotic therapy and abscess drainage. A photograph is shown. Which of the following skin appendages is most likely involved in the disease process in the photograph?

A) Apocrine glands

B) Eccrine glands

C) Hair follicles

D) Sebaceous glands

E) Stratum spinosum

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The correct response is Option A.

This patient has hidradenitis suppurativa, which is an inflammatory disease that arises in the apocrine glands. Apocrine sweat glands are primarily located in the axilla, perineum, groin, and inframammary region. These glands produce a viscid, lipid-rich, milky fluid that functions primarily as a pheromone and produces body odor. Occlusion of the glands results in inflammation and subcutaneous abscess formation with resultant odor, pain, and drainage. Early disease is typically treated with antibiotic therapy, local and systemic steroids, antiandrogen therapy, and botulinum toxin injections. More severe cases may benefit from tumor necrosis factor alpha inhibitors, such as infliximab or etanercept. Surgical treatment is common and may range from simple drainage of the abscess to wide excision with skin graft or flap reconstruction.

Eccrine glands are found throughout the body and are responsible for thermoregulation by secretion of a thin, clear, hypotonic fluid during sweating. There is some recent data that suggests hair follicle occlusion and folliculitis may lead to apocrine occlusion; however, hair follicles are found throughout the body without evidence of clinical hidradenitis in those locations. Sebaceous glands are found throughout the skin except for the palms and soles and produce sebum, which is an oily substance that lubricates skin and hair follicles. These glands are particularly abundant in the head and neck region. The stratum spinosum is a layer of the epidermis located between the stratum granulosum and stratum basale.

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20. A 9-year-old boy is brought by his parents to the clinic for evaluation of a lesion on the right cheek. The lesion has steadily grown since it first appeared 6 months ago. On examination, the lesion has overlying bluish skin discoloration with an associated mobile, firm, and well-defined subcutaneous mass. Excisional biopsy is performed, and pathology results show a calcified benign mass. Which of the following is the most likely diagnosis?

A) Lipoma

B) Nevus sebaceous

C) Pilar cyst

D) Pilomatrixoma

E) Sebaceous cyst

The correct response is Option D.

Pilomatrixomas, also known as calcifying epitheliomas, are benign adnexal tumors arising from the hair follicle matrix cells. They are common in the pediatric population and often arise in the mid face region of the head and neck. They are typically nonresolving lesions that slowly grow and are firmer in comparison with inclusion or sebaceous-type cysts. Excisional biopsy is the preferred treatment with low recurrence rates (1.5%). Spontaneous regression has not been reported.

A nevus sebaceous is a skin lesion without a mass component that is classically salmon in color. These lesions are epidermal in origin and have the potential to become basal cell carcinomas. Sebaceous cysts are common cystic lesions associated with sebum collecting within a cystic mass. They slowly grow and often do not resolve, but they lack the calcified, firm component seen in pilomatrixoma.

Lipomas are benign hypertrophy of adipose cells. They are typically well-defined subcutaneous masses without overlying skin changes. They are spongy, soft tumors that are typically present for 1 or more years before presentation. Pilar cysts are firm, mobile masses that typically present in the hair-bearing scalp. They often have an inflamed overlying skin component with red discoloration. They also arise from the hair shaft and appear as firm, smooth, white nodules. Also known as trichilemmal cysts, pilar cysts are differentiated from pilomatrixoma by their homogenous firm appearance, presence in the scalp, and lack of a calcified component.

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21. A 29-year-old woman who is a professional violinist comes to a tertiary care center 45 minutes after sustaining an amputation through the base of the fingernail of the left middle finger while chopping vegetables. The amputated digit is wrapped in saline-moistened gauze and separately placed over a bag of ice slurry. Which of the following surgical treatment options is most likely to result in the best outcome for this patient?

A) Coverage with a thenar flap

B) Local wound care

C) Replantation with Kirschner wire fixation and neurovascular microanastomosis

D) Revision amputation

E) Use amputated remnant as a composite graft

The correct response is Option C.

Preoperative assessment of the patient's mechanism of injury, occupation, and reconstructive goals permit the reconstructive surgeon to select the best treatment course. Absolute indications for distal finger replantation may include children, individuals concerned with the aesthetic appearance of their hands, and individuals for whom full-length restoration is beneficial, as is the case for musicians. A professional violinist will not only need preservation of finger length but also recovery of function and sensibility. These treatment goals are not met following revision amputation, thenar flap coverage of the distal finger amputation wound, and replantation with only skin closure with resultant replant necrosis without revascularization.

Finger amputation is most often described using Tamai's classification. Digital amputations are separated into five zones. Fingertip amputations are separated into Tamai Zone 1 (from the fingertip to the base of the nail) and Tamai Zone 2 (from the base of the nail to the distal interphalangeal joint). The flexor digitorum profundus tendon inserts at the base of the distal phalanx in Tamai Zone 2.

The violinist sustained a distal finger injury at the base of the nailbed and would be classified with a Tamai Zone 1 amputation injury. At this level, successful microanastomosis of the central digital artery and digital vein are possible after phalangeal Kirschner wire fixation.

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Local wound care is contraindicated as preservation of length is critical due to her profession and presence of exposed bone.

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22. A 63-year-old woman who underwent gastric bypass surgery is treated with a circumferential lower body lift. Four weeks postoperatively, she presents with unilateral leg swelling and is diagnosed with a deep venous thrombosis on venous duplex. She is started on a pharmacologic agent with indirect inhibition of factor Xa as the primary mechanism of action. Which of the following agents did she most likely receive?

A) Apixaban

B) Dabigatran

C) Enoxaparin

D) Fondaparinux

E) Warfarin

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

The correct response is Option D.

Fondaparinux is an indirect factor Xa (thrombin) inhibitor that is administered by subcutaneous injection. It has been demonstrated to be efficacious for prophylaxis or treatment of venous thromboembolisms.

Dabigatran and apixaban are direct thrombin inhibitors. Warfarin is a vitamin K antagonist. Enoxaparin is a direct factor Xa inhibitor.

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23. An otherwise healthy 50-year-old woman with right-sided breast cancer undergoes autologous breast reconstruction. Which of the following free flaps has the highest risk for loss secondary to vascular thrombosis?

A) Deep inferior epigastric perforator

B) Gluteal artery perforator

C) Muscle-sparing transverse rectus abdominis myocutaneous

D) Superficial inferior epigastric artery

E) Transverse rectus abdominis musculocutaneous

The correct response is Option D.

The free flap that has the highest risk for vascular thrombosis is the superficial inferior epigastric artery (SIEA) flap.

There are numerous autologous free flap options for breast reconstruction. The most commonly performed is the deep inferior epigastric perforator flap. Others include variations of the transverse rectus abdominis musculocutaneous (TRAM) flap (standard TRAM or muscle-sparing TRAM), the SIEA flap, the gluteal artery perforator flap, lumbar artery perforator flap, and a number of thigh-based free flaps, like the gracilis musculocutaneous flap variations (transverse upper gracilis, vertical upper gracilis, diagonal upper gracilis), and the profunda artery perforator flap.

The SIEA flap has the advantage of being the only abdominally based flap that does not violate the rectus sheath, and thus has the lowest abdominal wall morbidity in terms of weakness, bulges, or hernias. However, due to its smaller vessel caliber, shorter pedicle length, and higher propensity for spasm, as well as the location of the vessel in the subcutaneous plane and at the edge of the flap, it has been shown to have a higher rate of vascular thrombosis and overall flap loss. Studies suggest the rate is as high as 17% and 7%, respectively, compared with less than 1% for the other options.

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24. A 28-year-old woman is evaluated to discuss treatment options for a chronic history of bilateral axillary purulent drainage from multiple sinus tracts. History includes acne. She has smoked 1 pack of cigarettes daily for 10 years. BMI is 25.1 kg/m^2. Which of the following factors in this patient is most commonly associated with increased severity of symptoms of her condition?

A) Age

B) BMI

C) Duration of disease

D) Sex

E) Smoking

The correct response is Option E.

Tobacco smoking is known to have negative effects on the integument, including premature skin aging, abnormal wound healing, and exacerbation of chronic dermatoses, such as hidradenitis suppurativa (HS), psoriasis, and cutaneous lupus erythematosus.

HS is a debilitating chronic inflammatory disease of the folliculopilosebaceous units of the apocrine gland-bearing areas of the skin. The disease is characterized by physical discomfort and malodorous drainage from nodules, abscesses, scars, and sinus tracts in the axillae, groin, perineum, buttocks, and inframammary areas. HS presents most commonly in the third and fourth decades of life, with greater prevalence among women (3:1 female-to-male ratio) and patients of African descent. The severity of HS is not linked to the sex of the patient or duration of HS disease. Risk factors for HS are obesity, autoimmune diseases, and smoking.

A significant association has been established between smoking and HS. Smoking has also been associated with a dose-response relationship to clinical HS disease severity. The pathophysiologic mechanism of smoking on HS arises from modification in the skin microflora, and nicotine-related increased activity of sweat glands and hyperplasia of epidermal and follicular occlusion.

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25. A 58-year-old woman with type 2 diabetes and hypertension is scheduled to undergo pelvic exenteration for recurrent anorectal cancer previously treated with chemotherapy and radiation. Her only prior abdominal surgery was an abdominoplasty at age 33 years. There is a large soft-tissue defect in the pelvis, as well as a large skin defect. Which of the following is the most appropriate reconstructive option for this patient?

A) Bilateral gracilis muscle flaps

B) Bilateral pudendal thigh fasciocutaneous flaps

C) Omentum and musculocutaneous gracilis flaps

D) Unilateral pudendal thigh fasciocutaneous flap

E) Vertical rectus abdominis musculocutaneous flap

The correct response is Option C.

In this patient with a history of abdominoplasty, a large soft-tissue defect, and a large external skin defect, the best surgical option listed is to proceed with omentum and musculocutaneous gracilis flaps. Since the patient has never had intra-abdominal surgery, the omentum should be available to fill in the large internal soft-tissue defect. The musculocutaneous gracilis flap is a modification of the standard gracilis musculocutaneous flap that allows harvest of a larger skin paddle. Unilateral or bilateral pudendal thigh fasciocutaneous (Singapore) flaps are useful for external skin defects and small soft-tissue defects, but they are not adequate for a large internal soft-tissue defect resulting from pelvic exenteration, unless combined with another flap such as the omentum flap. The vertical rectus abdominis musculocutaneous flap is the "workhorse" flap for reconstruction of large perineal defects, with better outcomes than thigh-based flaps; however, it is unavailable in this patient, who has had an abdominoplasty. As such, a muscle-only rectus abdominis flap would be an option if combined with another flap to address the external skin defect. Bilateral gracilis muscle flaps could be used for moderate-sized soft-tissue defects but do not address the large external skin defect in this patient.

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26. A 29-year-old transgender man (assigned female at birth) wishes to undergo gender affirmation surgery. Which of the following techniques is associated with the highest rate of urethral strictures?

A) Belgrade one-stage metoidioplasty

B) Flap prelamination with a skin graft

C) Second flap for urethral reconstruction

D) Tube-in-tube flap

The correct response is Option B.

The most common complications of genital surgery for female-to-male gender affirmation are urethral strictures and fistulas. Metoidioplasty consists of the creation of a neophallus from the clitoris, which has been enlarged with hormone therapy. Four techniques have been described: the Hage technique, the Belgrade technique, labial ring flap, and extensive metoidioplasty. The Belgrade technique has been most commonly reported in literature, with an overall urethral stricture rate of 3% according to a recent meta-analysis. Phalloplasty consists of the creation of a neophallus with flaps. The urethra can be created by prelamination of the flap with a graft, a single-flap tube-in-tube construct, or the use of a second flap for urethral reconstruction. A recent meta-analysis reported an overall urethral stricture and fistula rate of 48.9%. The highest rate of strictures was in the prelaminated group at 40.7%. The tube-in-tube group and second flap group had stricture rates of 15.5% and 18.3%, respectively.

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27. A 35-year-old woman comes to the clinic for evaluation because of a painful, pruritic scar following left shoulder surgery. Examination shows a 3 × 4-cm, firm, elevated, well-defined keloid scar on the left shoulder. Which of the following treatments has the lowest rate of recurrence for this lesion?

A) Carbon dioxide laser therapy

B) Excision and intralesional corticosteroid therapy

C) Excision and radiation therapy

D) Intralesional corticosteroid therapy

E) Topical 5-fluorouracil therapy

The correct response is Option C.

The lesion of concern is most consistent with a keloid scar. Keloids are a form of abnormal wound healing characterized by excess disorganized collagen proliferation beyond the boundaries of the original scar. Keloids are a benign fibroproliferative tumor of the skin and do not have malignant potential, despite their growth. The lesion described in this scenario is scarlike and measures larger than the scar of origin. The cause of keloid formation remains unknown, and there is no reliable animal model for study. Multiple treatment options have been described, with varying levels of success.

Each option has been described in the setting of keloid treatment. Recent reviews have documented the relative success rates of various treatment modalities in treating keloids. Success is often defined as absence of recurrent keloid formation. Multimodal therapy has been documented to have greater success than excision of the lesion alone. Excision alone is generally not a favorable approach, with recurrence rates between 45 and 100%. A commonly used first-line therapy is excision with serial intralesional corticosteroids. Success rates consistently exceed 80%. Excision followed by low-dose radiation therapy has been shown to have consistently high success rates ranging from 85 to 91%. Given the adverse effects of radiation therapy, this modality is typically reserved for refractory lesions.

Intralesional injections, topical agents, and laser therapy have each been shown to have higher recurrence rates when used alone, compared with multimodal therapies. Intralesional corticosteroids have a long history of use in keloid treatment. Triamcinolone is commonly used with an average of 50% recurrence when used as a monotherapy. Intralesional 5-

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fluorouracil has been shown as a successful treatment with rates of recurrence ranging from 19 to 47%, but no studies have looked at the use of topical 5-fluorouracil therapy for keloid scars. Ablative laser therapy (such as carbon dioxide laser therapy) has been shown to have recurrence rates of 74 to 100% when used alone.

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28. An 18-year-old transgender man (assigned female at birth) presents for an initial consultation to plastic surgery to discuss top surgery. He has been taking testosterone shots for the past year. The patient wants to know the preoperative requirements for gender affirmation surgery. Which of the following best describes the 7th Edition World Professional Association for Transgender Health (WPATH) criteria for top surgery?

A) The patient must be at least 16 years of age to provide informed consent

B) The patient must be on hormone therapy for one year prior to surgery

C) The patient must have persistent, well-documented gender dysphoria

D) The patient must not have any other mental health concerns

The correct response is Option C.

The 7th Edition World Professional Association for Transgender Health (WPATH) criteria for top surgery is that the patient must have persistent, well-documented gender dysphoria. The WPATH guidelines for female-to-male top surgery also require that the patient has the capacity to make a fully informed decision and consent for treatment and is the age of majority in a given country. Additionally, if significant medical or mental health concerns are present, they must be reasonably well-controlled.

Hormone therapy is not a prerequisite for female-to-male top surgery. Though many patients do take hormone therapy before surgery, it is not required to undergo surgery. The age of majority varies from country to country to provide informed consent. In the United States, 18 years of age is considered the age of majority. Many patients with gender dysphoria have other mental health concerns. As long as comorbid conditions are well-controlled, such patients are still acceptable candidates for surgery.

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29. A 42-year-old man who works at an aquarium is evaluated because of a 9-month history of a painless, nonhealing, 1-cm solitary papulonodular cutaneous lesion on the right hand. Medical history is unremarkable. Examination of the hand shows no other abnormalities. Tissue histopathology demonstrates granulomatous inflammatory infiltrates. Microscopy and staining demonstrate a nonmotile, true-branching, acid-fast bacillus. Cultures are positive after several weeks' incubation at 30.0°C (86.0°F). Which of the following is the most appropriate management?

A) Cefazolin therapy for 1 week

B) Doxycycline therapy for 3 months

C) Excision

D) Multi-antimicrobial therapy

E) Observation

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

The correct response is Option B.

Mycobacterium marinum is a slow-growing nontuberculous mycobacterium (NTM) with an average incubation period of 3 weeks. Skin and soft-tissue infections (SSTI) secondary to *M. marinum* primarily occur in immunocompetent patients with minor trauma and exposure to fresh- or salt-water occupations or hobbies related to marine settings or aquatic animals (eg, fish, shells, aquariums). The most common cutaneous manifestation is a painless, solitary papulonodular lesion on a finger or hand, and it may appear in sporotrichoid form when spreading along the lymphatic vessels to the regional lymph nodes. There is often a several-month delay between the onset of the lesion and seeking medical care.

Diagnosing an infection caused by *M. marinum* requires a high index of suspicion, attentive exposure history assessment, and knowledge of pathogenic characteristics for timely management for NTM SSTI. *M. marinum* infections are localized primarily to the skin due to optimal growth at 30.0°C (86.0°F). Clinical microscopy and culture are often negative because culture growth requires several-week incubation at a low temperature of 30.0°C (86.0°F).

Patients with *M. marinum* skin infections are usually treated with cycline antibiotic monotherapy for 3 months (clarithromycin, doxycycline, minocycline, or trimethoprim-sulfamethoxazole).

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Severe infections or complicated infections involving deep structures such as tendon sheaths, bursae, bones, and joints are treated with a combination of rifampin and ethambutol. Surgical treatment is not usually recommended and is reserved for deeper infections.

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30. A 20-year-old woman presents to the clinic with bilateral lower extremity edema. The edema developed 3 years ago. She is a recent immigrant from India. Which of the following is the most likely cause of this patient's lymphedema?

A) Abnormal development of lymphatic vessels

B) Destruction of lymph nodes and lymphatics

C) Lymphatic dysfunction due to increased amounts of adipose tissue

D) Obstruction of lymphatic vessels

E) Subendothelial lymphatic edema

The correct response is Option D.

The most common cause of lymphedema worldwide is filariasis. It is an infection caused by the roundworm (*Wuchereria bancrofti*). The infection is transmitted by mosquito bite, which deposits larvae on the skin. The larvae migrate into the lymphatics and cause lymphatic blockage. The disease is endemic in India and sub-Saharan Africa. The lower extremities are most commonly affected.

Primary lymphedema is a developmental hypoplasia of the lymphatic system. It is a rare condition affecting 1 in 100,000 people. It is classified according to the time of onset: congenital lymphedema presents at or around birth, lymphedema praecox presents at or shortly after puberty, and lymphedema tarda presents after age 35 years. Mutation of vascular endothelial growth factor C has been identified in approximately 30% of primary lymphedema patients.

The most common cause of lymphedema in the United States is secondary to oncologic therapy. Lymphadenectomy results in impairment of normal lymphatic flow. Irradiation results in destruction of lymphatics and may also impair their regeneration. Breast cancer treatment is the most common cause, with upper extremity lymphedema developing in 4 to 49% of patients undergoing axillary lymphadenectomy and 5 to 7% of patients undergoing axillary sentinel lymph node biopsy. The incidence of lymphedema in patients undergoing treatment for upper extremity melanoma is 5% and lower extremity melanoma is 28%.

Podoconiosis is the second most common cause of tropical lymphedema. The etiology is chronic exposure in barefoot walkers to soil containing high concentrations of silica. The silica

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particles are absorbed by the skin and collect in lymphatic vessels. This results in subendothelial lymphatic edema, which gradually progresses to fibrosis and obstruction. The lower extremity lymphedema is ascending and bilateral, although it is usually asymmetric. The disease is seen in Africa, Central America, and India. Individuals afflicted with the disease have a genetic susceptibility to silica-induced lymphatic inflammation.

Morbid obesity can cause lymphedema by obstruction of lymphatics by the high amounts of adipose tissue. Individuals with BMI greater than 60 kg/m^2 are at high risk. Lipedema is abnormal subcutaneous accumulation of fat and is frequently mistaken with lymphedema. It occurs in women, with onset in the second and third decades, and is thought to have a genetic component. It involves the buttocks, thighs and legs, and spares the ankles and feet, resulting in a characteristic "cuff sign." Patients also have tenderness and easy bruising of the affected areas. Lipedema can progress to lower extremity venous hypertension and lymphatic dysfunction.

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31. A 5-year-old girl with a history of a myelomeningocele with primary repair during infancy undergoes a tethered cord repair. One week later, she returns to the hospital with cerebrospinal fluid leaking from the wound and a 4-cm^2 area of wound dehiscence centrally. Which of the following methods is most appropriate for reconstruction of the wound?

A) Coverage with a local fascial flap

B) Gluteal muscle flap advancement

C) Placement of an acellular dermal matrix

D) Split-thickness skin grafting

E) Tissue expansion

The correct response is Option A.

Tethered cord syndrome affects 30% of patients with myelomeningocele. This patient has an open wound over the spinal cord with leaking cerebrospinal fluid. The most appropriate method to reconstruct the wound is a local fascial flap, which will provide vascularized soft-tissue coverage over the dural repair. Typically, the fascia overlying the paraspinous muscles can be turned over bilaterally to cover the dura; this bolsters the dural repair and also protects the repair from skin bacteria. A regional muscle flap, such as the gluteal muscle flap, is not the first-line option if the paraspinous muscles/fascia are available and can increase the risk for ambulatory problems. Placement of acellular dermal matrix is incorrect, since this is nonvascularized and will not allow for healing across the wound bed in the setting of leakage from the spinal cord. Similarly, a split-thickness skin graft directly over the dura/spinal cord would be unstable and less protective than a local fascial flap. Tissue expansion in the setting of an open wound with cerebrospinal fluid would be contraindicated.

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32. A 72-year-old man is evaluated because of a 1 × 1-cm skin defect on the lateral nose following Mohs micrographic excision of a basal cell carcinoma. On examination, the defect is located just superior to the ala, and the perichondrium is intact at the base of the wound. The patient wishes to have the best aesthetic outcome possible but prefers that any necessary interventions be completed in a single stage. Which of the following is the most appropriate treatment for this patient?

A) Bilobed flap reconstruction

B) Composite grafting

C) Healing by secondary intention

D) Paramedian forehead flap reconstruction

E) Split-thickness skin grafting

The correct response is Option A.

A bilobed flap offers single-stage reconstruction and is particularly suitable for nasal defects on the lateral sidewall that are 1 cm or less in diameter. Since the procedure involves local tissue rearrangement, the color and skin thickness match offers a good aesthetic result. Healing by secondary intention is possible, but it can result in significant scarring and is not a good option for this patient, since he would like a single-stage procedure. A split-thickness skin graft can cover the wound in a single procedure but will not result in good color or skin thickness match with the surrounding tissue. The use of a full-thickness skin graft may be possible, and the benefits of a full-thickness graft versus a bilobed flap remain equivocal. A composite graft is often used for alar rim reconstruction but is not indicated for a skin and subcutaneous tissue-only defect. A paramedian forehead flap is not necessary for this small of a defect and could not be completed in a single stage for this patient.

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33. An otherwise healthy 45-year-old man with paraplegia is evaluated because of a clean, slow-healing ischial pressure ulcer. Closure of the ulcer with a proximally based posterior thigh fasciocutaneous transposition flap is planned. The axial blood flow to this flap is supplied by a branch of which of the following arteries?

A) Inferior gluteal

B) Lateral circumflex femoral

C) Profunda femoris

D) Superficial femoral

E) Superior gluteal

The correct response is Option A.

The axial blood flow to the posterior thigh fasciocutaneous flap is provided by the descending branch of the inferior gluteal artery.

This vessel runs axially along the posterior thigh, along a course from the midpoint between the ischial tuberosity and the greater trochanter proximally, and the popliteal fossa distally. The vessel runs alongside the posterior cutaneous nerve of the thigh. The posterior thigh skin also has contributions from perforators from the profunda system, through the underlying thigh musculature, which is the main blood flow of the hamstring muscle/musculocutaneous flaps. However, in a true proximally based posterior thigh fasciocutaneous flap, those perforators are transected when the flap is raised.

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34. A 15-year-old girl is brought to the office for management of facial asymmetry. Over the past 2 years, the patient has progressively developed atrophy of the soft tissues of the left side of her face. She reports that the asymmetry is getting worse. Physical examination shows marked soft-tissue atrophy of the left mid face and lower face with a slight upward occlusal cant. Which of the following therapies is the most appropriate treatment for this patient's condition?

A) Calcium carbonate

B) Clindamycin

C) Methotrexate

D) Sodium thiosulfate

E) Warfarin

The correct response is Option C.

This patient has progressive hemifacial atrophy (Parry-Romberg syndrome). This condition is characterized by atrophy of the hemi face typically in the mid and lower face (cranial nerve V_2 and V_3 distribution), although the forehead may also be involved. The skin and subcutaneous tissue are most frequently involved, although it can also affect muscle, cartilage, and bone. Onset is in the first two decades of life in the majority of cases. The disease progresses for 2 to 10 years before it stabilizes ("burns out"). Parry-Romberg syndrome is thought to be an immune-mediated disease. There is currently no cure for the condition. Methotrexate is considered one of the first-line medical treatments to halt disease progression. It is frequently combined with prednisone for the first 3 months since methotrexate has a delayed effect on inflammation and fibrosis. Current evidence suggests that methotrexate therapy be administered for 12 to 24 months to induce prolonged remission. Methotrexate is administered in oral or intravenous form, at a dosage of 0.3 to 1 mg/kg/week with a maximum dose of 25 mg/week. Immunosuppressive drugs, like cyclosporine, mycophenolate mofetil, and cyclophosphamide, have been reported as treatments in isolated case reports. Other treatments that have been described are antimalarial, retinoids, penicillamine, tetracycline, and topical steroids with variable success.

The other choices are not medications used for this condition.

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35. An 18-year-old woman with congenital vaginal agenesis undergoes reconstruction with bilateral pudendal fasciocutaneous thigh flaps. Which of the following is the sensory innervation of these flaps?

A) Genitofemoral nerve

B) Lateral femoral cutaneous nerve

C) Obturator nerve

D) Pudendal nerve

E) Saphenous nerve

The correct response is Option D.

The pudendal thigh flap (also known as a Singapore flap) is a local fasciocutaneous flap used for vaginoplasty. It can be sensate with innervation from the posterior labial nerve branches of the pudendal nerve. The blood supply is terminal branches of the superficial perineal artery. The lateral femoral cutaneous nerve can provide sensory innervation to the anterolateral thigh flap. The obturator nerve supplies the gracilis muscle. The saphenous nerve is a cutaneous branch of the femoral nerve that provides sensation to the medial leg. The genitofemoral nerve supplies the upper thigh, mons pubis, labia majora, and anterior scrotum.

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36. A 38-year-old man presents with a large midline abdominal ventral hernia following colectomy. Physical examination shows a 16 × 9-cm midline fascial defect. Posterior component separation repair with transversus abdominis release and retrorectus mesh placement is planned. To maintain innervation to the rectus abdominis muscles, identification and preservation of which of the following nerves during dissection is most appropriate?

A) Iliohypogastric

B) Ilioinguinal

C) Intercostal

D) Lateral cutaneous

E) Subcostal

The correct response is Option C.

Component separation repair of abdominal wall hernias can be performed via both the classic anterior component separation technique and the posterior component separation technique. The posterior component separation repair is based on the Rives-Stoppa retrorectus technique. This technique uses mesh placement in the 6- to 8-cm–wide space between the posterior rectus sheath and the rectus muscle. This plane for mesh placement has been found to have the lowest risk for hernia recurrence.

Extending the dissection lateral to the lateral border of the posterior rectus sheath via a transversus abdominis release allows for tension-free repair of larger defects. Hernia recurrence rates as low as 3 to 6% have been documented with this technique.

A key maneuver during this dissection is the identification of the intercostal nerves, which innervate the rectus abdominis muscles. They should be identified and preserved as they enter the posterior aspect of the rectus muscle just medial to the linea semilunaris.

The lateral cutaneous nerves innervate the skin overlying the bilateral hypogastric regions.

The ilioinguinal nerve extends from the inferior branch of the anterior ramus of L1. It travels through the inguinal canal. If this nerve is damaged during inguinal hernia repairs, it could lead to loss of sensation in the inguinal region, mons pubis, medial thigh, and the anterior scrotum or labia majora.

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The iliohypogastric nerve is the continuation of the superior branch of the anterior ramus of L1. It innervates the transversus abdominis and internal oblique muscles. It is also responsible for the sensation of the skin overlying the iliac crest, superior inguinal canal, and hypogastric regions.

The subcostal nerve travels along the border of the twelfth rib until it passes into the abdominal wall and runs through the second and third muscular layers. The subcostal nerve innervates the inferior portion of the external oblique muscle, skin, region superior to the inguinal crest, and the region inferior to the umbilicus. The subcostal nerve does not innervate the rectus abdominis muscle.

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37. A 47-year-old woman with a history of abdominoplasty presents for discussion of delayed unilateral right breast reconstruction following mastectomy. The patient is interested in autologous options. After discussion with the patient, the plastic surgeon elects to use a horizontally oriented profunda artery perforator flap from the upper posterior thigh. In this area, the dominant perforator most commonly courses through which of the following muscles?

A) Adductor brevis

B) Adductor longus

C) Adductor magnus

D) Gracilis

E) Rectus femoris

The correct response is Option C.

The profunda femoris artery gives off multiple musculocutaneous and septocutaneous perforators to supply the thigh. In the area of a horizontally oriented profunda artery perforator flap, the dominant perforator travels through the adductor magnus muscle and enters the subcutaneous region of the flap skin and subcutaneous tissue posterior to the gracilis muscle. The perforator does not usually course through the other muscles listed.

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38. A 20-year-old woman is scheduled to undergo open rhinoplasty and bilateral lateral nasal osteotomies. Administration of which of the following agents is most appropriate to limit perioperative blood loss in this patient?

A) Ketorolac

B) Methylprednisolone

C) Thromboxane

D) Tranexamic acid

E) Vitamin K

The correct response is Option D.

Tranexamic acid (TXA) is an antifibrinolytic drug that has been used in other specialties to limit perioperative bleeding. Within plastic surgery, TXA has been evaluated for use in rhinoplasty, where multiple studies have demonstrated significant decreases in perioperative blood loss and have suggested improvements in periorbital edema and ecchymosis as well. Thromboxane is a vasoconstrictor and a potent hypertensive agent, and it facilitates platelet aggregation. Thromboxane administration has not been evaluated with surgical procedures. Vitamin K is used for reversal of warfarin but has no effect in a non-anticoagulated patient. Ketorolac is a nonsteroidal anti-inflammatory drug. Previous studies have not demonstrated that it significantly affects perioperative blood loss. Methylprednisolone is a steroid, which may limit postoperative edema but has not been shown to limit perioperative blood loss.

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39. A 40-year-old man comes to the office with bilateral lower extremity swelling. The swelling has occurred over the course of the past few years. He reports no history of cardiac or renal dysfunction, no prior surgeries, and no travel outside the United States. BMI is 58 kg/m^2. Physical examination shows bilateral lower extremity pitting edema and a positive Stemmer sign. There are no signs of venous insufficiency. Lymphoscintigraphy shows dermal back flow in both lower extremities. Which of the following is the most appropriate surgical treatment for this condition?

A) Bariatric surgery

B) Charles operation

C) Lymphovenous anastomosis

D) Suction lipectomy

E) Vascularized lymph node transfer

The correct response is Option A.

This patient has obesity-induced lymphedema (OIL). This condition is caused by lymphatic dysfunction, which occurs in the lower extremities in patients with a BMI above 50 kg/m^2. The exact cause is unknown; proposed causes are excess lymphatic fluid production by a large volume of adipose cells, impaired lymphatic drainage caused by compression of lymphatics, and inflammatory damage of lymphatic vessels. Diagnosis is clinically made after other causes of primary and secondary lymphedema as well as conditions that can cause lower extremity swelling (cardiorenal dysfunction, venous insufficiency) have been ruled out. The condition is associated with the onset of obesity, with patients with a BMI greater than 50 kg/m^2 at risk. Stemmer sign, the inability to pinch the dorsum of the foot, is indicative of lymphedema. However, the test is not very specific and false positives can occur. Definitive diagnosis is made via lymphoscintigraphy, showing delayed transit, dermal back flow, and/or tortuous collateral lymphatic channels. The primary treatment of this condition is weight loss. Patients with morbid obesity may be referred for bariatric surgery. Weight loss can reverse the lymphedema. Excisional procedures may be performed after weight has stabilized, which is typically at least 1 year after bariatric surgery. Physiologic procedures like lymphovenous anastomosis and vascularized lymph node transfer are not treatments for this condition as the primary cause is excess fat in the extremities.

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An important differential for OIL is lipedema, which is lymphatic dysfunction caused by fat hypertrophy in the lower extremities. It occurs exclusively in women, with onset most commonly in the second and third decades of life. Weight loss does not result in improvement of symptoms.

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40. A 52-year-old woman is evaluated because of an 18-month history of right upper extremity swelling and pain. History includes a right modified radical mastectomy for breast cancer 3 years ago. BMI is 25 kg/m^2. The patient has tried 9 months of physical therapy, compression, and lymphatic massage with minimal improvement of symptoms. Which of the following is the most appropriate next step in management?

A) Initiate oral diuretic therapy

B) Perform liposuction

C) Perform vascularized lymph node transfer

D) Recommend weight loss

E) Refer for magnetic resonance lymphangiography

The correct response is Option E.

This patient has developed lymphedema following mastectomy for breast cancer. The most appropriate next step is magnetic resonance lymphangiography to work up the lymphedema.

Weight loss is incorrect since the patient has a normal BMI. The patient has already tried 9 months of conservative management with physical therapy, compression, and lymphatic massage without improvement. Oral diuretic therapy, such as furosemide, is not a mainstay of lymphedema treatment. Before surgical intervention is performed, diagnostic testing such as magnetic resonance lymphangiography or radioisotope lymphoscintigraphy can be used to confirm the diagnosis, stage the disease, and plan for appropriate surgical intervention. Surgical interventions such as liposuction, lymphovenous bypass, or vascularized lymph node transfer can be considered after staging the disease.

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41. A 21-month-old boy with Treacher Collins syndrome is scheduled to undergo mandibular distraction osteogenesis. Which of the following is the primary mechanism by which new bone will form for the mandibular lengthening associated with this procedure?

A) Endochondral ossification

B) Intramembranous ossification

C) Osteoconduction

D) Osteogenesis

E) Osteoinduction

The correct response is Option B.

Distraction osteogenesis is a technique in which an osteotomy is first performed, and then distraction of the surrounding vascularized bone segments is performed with a mechanical device. The hallmark of this process is formation of new bone within the distraction gap. This technique is commonly used for reconstruction of certain bony defects in the craniofacial skeleton.

New bone is formed during distraction osteogenesis via the process of intramembranous ossification. The key is that the new bone is spontaneously formed without a cartilaginous intermediate. In addition to distraction osteogenesis, intramembranous ossification occurs during fetal development with the formation of the flat bones. It also occurs with primary bone healing.

Osteogenesis is the primary mechanism for healing of a vascularized bone graft. Osteoblasts that survive the bone graft transfer procedure and osteoblasts at the native recipient bone both participate in the formation of new bone to heal the bony interface.

Osteoconduction is the primary process for healing of cortical bone grafts. Blood vessels and cells from the recipient wound bed grow into the cortical bone graft, which functions as a template for the deposition of new bone.

Endochondral ossification involves formation of new bone via a cartilaginous intermediate. This process is seen during fetal long bone development and during bony fracture healing via a cartilaginous callus.

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Osteoinduction, which is seen in healing of cancellous bone grafts, involves bone morphogenetic protein stimulating mesenchymal cells at the recipient site to differentiate into osteoprogenitor cells.

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42. An 18-year-old woman presents to the clinic with absence of menses and reports her concern for vaginal agenesis. She is diagnosed with Mayer-Rokitansky-Küster-Hauser syndrome. The patient is interested in reconstruction of the vagina. Which of the following has the highest chance of restenosis?

A) Colonic interposition vaginoplasty

B) Reconstruction with pudendal thigh flaps

C) Serial dilation of the rudimentary vaginal pouch

D) Split-thickness skin grafting over a vaginal mold

E) Vulvovaginoplasty

The correct response is Option C.

Serial dilation of the rudimentary vaginal pouch is the method that has the highest rate of restenosis due to inadequate patient compliance; the dilation must be performed several times per day over a period of months to years. The Abbè-McIndoe procedure is a common form of reconstruction and involves the use of a split-thickness skin graft secured over a vaginal mold; this is then placed between the rectum and the bladder to create a neovagina. Vulvovaginoplasty avoids dissection in the rectovaginal space and uses a horseshoe incision along the border of the labia majora and the minora to create the neovagina. The neurovascular pudendal thigh flap, or Singapore flap, can be used bilaterally for total vaginal reconstruction for vaginal agenesis. Finally, colonic interposition vaginoplasty is commonly used in pediatric patients or in gender-affirming surgery and can allow for adequate vaginal length and width maintained over time.

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43. A 58-year-old woman presents with a 2-cm, raised, red ulcerative lesion on the left central cheek that has been growing for 2 years. Examination of a specimen obtained on biopsy discloses nodular basal cell carcinoma. Elliptical excision and complex closure is planned. Which of the following is the optimal surgical margin?

A) 1 to 2 mm

B) 4 to 6 mm

C) 10 to 12 mm

D) 2 cm

E) 3 cm

The correct response is Option B.

The adequate margin listed for a 2-cm basal cell carcinoma is 4 to 6 mm. The traditional recommendation for margins is 4 mm for most basal cell carcinomas. The literature is conflicting regarding the safety of 3-mm margins for small, well-demarcated, low-risk lesions. Very few studies support 1- to 2-mm margins unless the lesion is in a very cosmetically/functionally sensitive area and close follow-up is an option. Some studies suggest a 5-mm or more margin for large (greater than 2 cm) and/or high-risk tumors. Because 4- to 6-mm margins result in very low recurrence rates, larger margins, such as 2 and 3 cm, are not necessary and would cause considerable morbidity, especially on the face.

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44. A 28-year-old man comes to the emergency department 2 hours after sustaining a sharp genital self-mutilation amputation at the base of his penis. The patient undergoes replantation and revascularization. In addition to anastomosis of the dorsal penile artery, reanastomosis of which of the following additional arteries is recommended in order to provide optimal blood flow to the penile skin?

A) Cavernosal

B) External iliac

C) Inferior external pudendal

D) Urethral

The correct response is Option C.

Genital self-amputation is a rare surgical and psychiatric emergency. Initial evaluation and resuscitation should follow ATLS guidelines. Then an opportunity for replantation is offered to a patient who is receiving acute psychiatric care to decrease physical limitations and psychosocial sequelae of penile amputation.

This patient meets criteria for penile replantation and revascularization since cold ischemia time from time of injury is 2 hours, the injury mechanism is a sharp amputation, and a microvascular replantation specialist is available.

Following irrigation and debridement of nonviable tissues, the corpus cavernosum is re-approximated followed by urethral reconstruction over a foley catheter. Microvascular anastomoses of the deep and superficial dorsal veins, dorsal artery, and nerves should be performed by a surgeon with advanced microsurgical training. The replantation is completed after layered closure of the Buck fascia, dartos fascia, and skin.

The most common complication of penile replantation is skin necrosis (54.8%). Penile skin necrosis is still reported despite dorsal artery anastomosis and an additional number of vascular anastomoses. The internal pudendal artery is the proximal branch of the dorsal artery, cavernosal artery, and urethral artery that vascularizes the deep structures of the penis. Penile skin is mainly supplied by the inferior external pudendal artery, and it should be routinely considered for microanastomosis to limit penile skin necrosis.

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45. A 5-year-old girl presents to the clinic with a right temporoparietal cranial defect. History is significant for a nonaccidental trauma requiring a decompressive craniectomy 2 years ago. The initial bone flap was replaced but has resorbed due to a prior infection. The residual defect measures 10 × 8 cm. Which of the following materials is most appropriate for reconstruction of this defect?

A) Demineralized bone

B) Hydroxyapatite cement

C) Methyl methacrylate

D) Porous polyethylene

E) Split calvarial bone

The correct response is Option E.

The most appropriate method of cranial reconstruction in the case of this pediatric patient is split calvarial bone graft.

Autologous split calvarial bone is the most appropriate material due to the large size of the defect, the age of the patient, and the prior history of infection. Calvarial bone can be split as early as age 3 years, when the diploic space has developed. The other materials have been used in pediatric patients but have some limitations. Demineralized bone has been shown to be osteoinductive, but the large size of the bone gap makes this method costly, and there is a higher risk for not completely ossifying the gap. Hydroxyapatite cement has a similar crystalline structure to the mineral phase of human bone and can be remodeled over time; however, this material is expensive, prone to fracture, and has a higher complication rate with regards to osseointegration, infection, and extrusion. Methyl methacrylate is an acrylic that is often used in nonautologous adult cranioplasties since it is biocompatible and has similar hardness to natural bone; however, the risk for infection is much higher and it causes a highly exothermic reaction during the setting process that can lead to complications. Porous polyethylene is a ceramic that can also be used for large defects, but it is more expensive, is not protective against infection, and will not grow with the patient.

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46. A 64-year-old man undergoes pharyngectomy with anterolateral thigh free flap reconstruction. Blood loss is minimal and surgery is proceeding smoothly. The anesthesiologist reports persistent mild hypotension and would like to initiate vasopressor infusion. Vasopressor use would most likely have which of the following outcomes in this patient?

A) Decreased flap loss

B) Increased flap loss

C) Increased risk for adverse cardiac events

D) No effect on flap survival

The correct response is Option D.

During routine microsurgical head and neck reconstruction, or any microvascular reconstruction, the use of vasopressors has been shown to be safe with no adverse effects on flap outcomes. For decades, plastic surgeons have been taught that vasopressors should be avoided during microvascular surgery. This was due to the logical fear that vasoconstriction would increase the risk for thrombosis. However, in clinical practice, multiple studies have shown that the use of vasopressors does not increase the risk for thrombotic events, reoperation, or surgical complications. Therefore, it is best to tell the anesthesiology team to do what is best for the individual patient, according to that patient's comorbidities and physiologic status.

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47. A 16-year-old boy comes to the clinic for follow-up 1 year after sustaining third-degree burns to the scalp in a house fire. He lost about 30% of the scalp vertex because of the burn injuries and now has alopecia in this region. Initial treatment included debridement and split-thickness skin grafting of the scalp. Reconstruction of the scalp with staged tissue expansion to correct the skin graft alopecia is planned. Which of the following factors is most commonly associated with premature removal of the expander in this scenario?

A) Location of the tissue expander

B) Patient age

C) Sex of the patient

D) Use of multiple expanders

The correct response is Option D.

Placement of a higher number of tissue expanders at the time of the initial operation is most associated with premature removal of the expander, usually due to infection or expander extrusion.

Tissue expansion of the scalp in pediatric patients is commonly used for burn reconstruction, removal of congenital nevi, and scalp avulsion injuries. Premature removal of the expander is common in the setting of infection and/or expander extrusion, with rates reaching 10 to 20%. The odds of premature removal are increased with younger age of patient, greater number of expanders placed at the initial operation, and expander placement in the lower extremity. Patient sex does not appear to affect this risk. The number of rounds of serial expansion and the indications for surgery do not appear to have a significant impact either.

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48. A 5-month-old infant presents with a raised, rubbery, bright red tumor. History shows that the lesion began as an area of telangiectasia at around eight weeks of age. Which of the following is most likely to be a characteristic of this lesion?

A) Decreased number of mastocytes

B) GLUT-1 positive immunohistochemistry

C) Growth proportionate with the child's growth

D) Normal basement membrane

E) Normal endothelial cell cycle

The correct response is Option B.

The classification and the terminologies used for various vascular lesions have been very confusing, despite the fact that a biological classification was first published in 1982 by Mulliken and Glowacki. This classification was later adopted by the International Society for the Study of Vascular Anomalies (ISSVA) in their first workshop held in Rome during June of 1996. This continuing workshop now takes place every 2 years in various countries around the world.

Mulliken and Glowacki described a biological classification based on endothelial cell characteristics, physical findings, and natural history that differentiates vascular lesions with endothelial cell proliferation (eg, hemangioma) from lesions with structural anomalies (eg, vascular malformations). The ISSVA modified it in their continuing workshops, differentiating vascular tumors from vascular malformations on the basis of their clinical appearance, radiological features, pathological features, and biological behavior.

Infantile hemangiomas, like the one exhibited by this patient, have a proliferative phase during early childhood for 6 to 12 months and grow into a raised, rubbery, bright red tumor (resembling a strawberry, hence the outdated term strawberry hemangioma).

Features of hemangiomas that distinguish them from vascular malformations include GLUT-1 positive immunohistochemistry, increased endothelial cell proliferation, thick basement membrane, a 5:1 female prevalence, rapid growth out of proportion to the child's growth, and increased number of mastocytes.

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49. A 42-year-old woman is scheduled for an abdominoplasty with flank liposuction. A regional anesthetic block is planned to decrease postoperative pain and minimize the need for narcotics. The anesthetic should be placed between which of the following anatomic structures?

A) External oblique muscle and internal oblique muscle

B) Internal oblique muscle and transversus abdominis muscle

C) Skin and external oblique muscle

D) Transversus abdominis muscle and transversalis fascia

E) Transversalis fascia and peritoneum

The correct response is Option B.

The transversus abdominis plane (TAP) block is a regional anesthetic that blocks sensory afferent nerve fibers that supply the anterior/lateral abdominal wall dermatomes of T6-L1. These sensory nerves travel below the internal oblique muscle in the plane above the transversus abdominis muscle. Traditionally, the technique is performed blindly by placing a needle through the triangle of Petit posteriorly until the needle reaches the TAP. Once in the appropriate plane, 20 mL of a long-acting local anesthetic, such as bupivacaine, are injected.

More recent modifications include the use of ultrasound guidance to optimize precise placement and the use of diluted long-acting multivesicular liposomal bupivacaine (Exparel). Several studies have demonstrated the benefits of a TAP block during abdominal surgery. These benefits include decreased pain, opioid use, and nausea/vomiting, as well as faster return of bowel function. Complications include potential systemic toxicity due to the dose of anesthetic delivered/inadvertent intravascular injection and intraperitoneal injection with possible injury to intra-abdominal organs such as the liver or spleen.

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50. A 38-year-old man undergoes reconstruction of a lower extremity wound with a muscle flap and skin graft. Which of the following best describes the immediate mechanism for skin graft survival after placement onto the recipient wound?

A) Dermal contraction

B) Encapsulation

C) Inosculation

D) Plasmatic imbibition

E) Revascularization

The correct response is Option D.

Plasmatic imbibition describes the earliest stage of skin graft healing. Immediately after placement onto the wound, the graft becomes edematous and may increase its volume by 30 to 40%. Plasma leaks from recipient bed capillaries and venules and fills the space between the wound bed and the graft. Fibrinogen within the plasma settles out and forms a fibrin bond which helps anchor the graft to the wound. The graft passively absorbs nutrients from the underlying serum by diffusion during the first 48 hours. Metabolism within the graft becomes anaerobic and the pH level falls to 6.8. The metabolic demands of the graft also fall, with adenosine triphosphate concentrations falling 70% and glucose concentrations falling 80%.

Revascularization and inosculation describe the second stage of skin graft healing. These processes begin shortly after graft placement, but it takes approximately 4 to 5 days for the graft to become vascularized, with maximal blood flow developing by day 29. Revascularization refers to direct ingrowth of new blood vessels into the graft from the underlying wound bed. Inosculation describes a process by which blood vessels from the underlying wound bed connect with existing vessels in the skin graft. More recent evidence suggests that both processes play a role in the development of vascularization within the skin graft. Existing vasculature within the skin graft undergoes some level of degeneration; however, the acellular basal lamina persists and provides a conduit for the ingrowth of a new vascular tree from the host wound bed.

Primary contraction of a skin graft occurs immediately after harvest and is caused by the recoil of elastic fibers within the dermis. Grafts with a larger amount of included dermis (eg, full-thickness grafts) have greater primary contraction. Secondary contraction refers to

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contraction after the wound heals. This process is mediated by myofibroblasts and occurs more frequently in grafts with a thinner dermal component (eg, split-thickness grafts). A larger dermal component appears to suppress proliferation of myofibroblasts within the wound. Encapsulation refers to the development of a fibrous scar capsule around a foreign device, such as a breast implant.

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Section 2: Hand and Lower Extremity

51. A 19-year-old woman is evaluated 2 hours after jamming her finger while playing basketball. She has pain with resisted extension and a 20-degree extensor lag at the proximal interphalangeal (PIP) joint, but she is able to actively flex and extend the joint. On physical examination, she demonstrates active extension at the distal interphalangeal joint with the PIP joint held in 90 degrees of flexion. Which of the following structures is most likely injured in this patient?

A) Central slip

B) Lateral bands

C) PIP collateral ligaments

D) Terminal tendon

E) Volar plate

The correct response is Option A.

A central slip avulsion will often lead to attenuation of the triangular ligament and volar migration of the lateral bands, which become proximal interphalangeal (PIP) joint flexors. This leads to a boutonnière deformity. However, this may take days to weeks to occur, and acutely, the lateral bands may remain able to weakly extend the PIP joint. The Elson test is useful to determine the integrity of the central slip in this acute stage.

This examination shows a positive Elson test, by which the patient is able to actively extend the distal interphalangeal (DIP) joint as a result of disruption of the central slip. An uninjured finger will not actively extend at the DIP joint with the PIP joint held in flexion, but with injury to the central slip, the lateral bands dissociate and extend the DIP with the PIP joint in flexion.

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52. An 18-month-old male infant is brought to the office for evaluation of a Blauth Type II hypoplastic thumb deformity. Physical examination of the right hand shows a narrow first web space and weak opposition. Valgus stress testing shows instability of the metacarpophalangeal (MCP) joint of the thumb. Which of the following is the most appropriate treatment to address the MCP joint instability in this patient?

A) Arthrodesis

B) Extensor indicis proprius tendon transfer

C) Pollicization of the index finger

D) Serial splinting

E) Ulnar collateral ligament reconstruction

The correct response is Option E.

A Blauth Type II hypoplastic thumb deformity includes a narrow first web space, thenar muscle insufficiency, and metacarpophalangeal (MCP) joint instability. Surgical management should attempt to address all of the deficiencies at the same time. The flexor digitorum superficialis tendon of the ring finger can be used to perform an opponensplasty and a ulnar collateral ligament (UCL) reconstruction since the tendon length is typically long enough to perform both simultaneously. The narrow first web space can be addressed by various web space deepening procedures, such as a four-flap Z-plasty.

In the case of multi-directional MCP joint instability or degenerative changes, arthrodesis is a reasonable option. With this patient's unidirectional valgus instability, however, ligament reconstruction is the preferable option. Index finger pollicization is an option for Blauth Type IIIB through V thumbs, which demonstrate carpometacarpal joint instability. Therapy and serial splinting are components of postoperative management and rehabilitation, but they cannot solve the inherent UCL deficiency. Patients with Blauth Type II thumbs can sometimes also present with a clasped thumb deformity from an absent extensor pollicis brevis tendon. This can be addressed with an extensor indicis proprius tendon transfer.

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53. Which of the following best describes the primary functions of the tibialis anterior muscle?

A) Ankle dorsiflexion and eversion

B) Ankle dorsiflexion and inversion

C) Ankle plantarflexion and eversion

D) Ankle plantarflexion and inversion

The correct response is Option B.

The tibialis anterior muscle is located in the anterior compartment of the leg and is the primary motor involved in dorsiflexion of the foot and ankle. It is innervated by branches of the deep peroneal nerve. It inserts into the medial cuneiform bone in the foot, and as such is primarily responsible for dorsiflexion and inversion of the foot. Loss of function of the tibialis anterior muscle may result in a foot drop, although other muscles involved in dorsiflexion (such as the extensor hallucis longus or toe extensors) can compensate for loss of tibialis anterior function. The tibialis anterior muscle is not responsible for eversion (which is controlled by the peroneus longus and brevis muscles).

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54. A 50-year-old, right-hand–dominant woman presents because of insidious onset, ulnar-sided wrist pain that has been present for the past 10 years. Ulnar impaction syndrome is suspected. Which of the following x-ray images shown is most appropriate for measurement of ulnar variance in this patient?

A) Carpal tunnel view

B) Clenched fist view

C) Lateral view

D) Oblique view

E) Ulnar deviated view

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The correct response is Option C.

The most appropriate x-ray for measurement of ulnar variance is the lateral view. Cadaver studies have shown that the most accurate and reproducible method of measurement is achieved on the lateral wrist film. Many clinicians use the posteroanterior (PA) wrist x-ray for measurement of ulnar variance. There are several described methodologies for this measurement including concentric circles, perpendiculars, and project-a-line techniques. However, studies have shown that variability in the thickness of the forearm tissue may lead to inaccuracy in measurements on this view. The PA x-ray is taken with the patient's shoulder abducted, elbow at 90 degrees, and palm flat on the cassette. In this position, the radius is at maximal length relative to the ulna. The ulnar styloid is visible at the most ulnar aspect of the distal ulna on the PA view. In contrast to the PA view, the anteroposterior (AP) x-ray is taken with the patient's palm up and the dorsum of the hand against the cassette. In this position, the radius is crossed over the ulna and will appear shorter, making it unsuitable for measurement of ulnar variance. The ulnar styloid is visible in the center of the distal ulna on the AP view. The oblique view is not appropriate for measurement of ulnar variation. The ulnar deviated view is used to more completely visualize the scaphoid and is also not appropriate for measurement of ulnar variation. Clenched fist or grip views have been shown to relatively increase the ulnar variance and therefore are not suitable for measurement. The carpal tunnel view is inappropriate for measurement of ulnar variance since the radius and ulna are not visualized on this view.

Plain x-rays have been shown to have good accuracy when compared with more precise measurements obtained on MRI. On PA films, the common approach is to use the method of perpendiculars. A line is drawn perpendicular to the long axis of the radius at the level of the volar ulnar cortical rim of the lunate facet. A second line parallel to the first at the most distal ulnar articular cortical rim is drawn, and the distance between these two lines is measured as the ulnar variance. On lateral films, ulnar variance is measured between the most proximal point of the lunate fossa and the most distal articulation of the ulnar head, and studies have shown that this is the most accurate x-ray method of estimating ulnar variance.

Ulnar variance, or the relative difference in length of the ulna compared with the radius, has been implicated in a number of pathologic processes. Positive ulnar variance has been associated with tears of the triangular fibrocartilage complex and ulnar impaction syndrome. Negative ulnar variance has been associated with Kienböck disease and carpal instability.

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55. An 81-year-old woman comes to the office because of pain and dysfunction in the left hand. She reports that after washing her hands, she shook off excess water and felt sharp pain in the metacarpophalangeal joint region of the middle finger of the left hand. On examination, the patient has no difficulty making a fist with her left hand, but on extending her fingers, the middle finger does not have full active extension. The middle finger can be easily extended passively, and she is then able to hold it in a fully extended position without difficulty. Which of the following structures is most likely injured in this patient?

A) Extensor digitorum communis tendon

B) Juncturae tendinum

C) Lateral band

D) Sagittal band

E) Terminal tendon

The correct response is Option D.

Sagittal band injury, especially involving the middle finger, may present in older patients after seemingly insignificant trauma. Classically, these patients present with painful snapping of the extensor tendon as it dislocates/relocates from its position atop the metacarpophalangeal (MCP) joint. They can also present with difficulty with finger extension because of the extensor tendon displacement into the intermetacarpal space.

Patients who have deficits in full active MCP extension from a flexed position, but are able to maintain extension once passively extended, almost certainly have a sagittal band injury. Injury to the extensor digitorum communis tendon would leave a patient unable to maintain full extension once passively brought into that position.

Symptomatic injury of the juncturae tendinum is rare. Division of juncturae, usually because of iatrogenic damage during surgical exposures to the dorsal hand, do not lead to this clinical scenario. In fact, intact juncturae are implicated in masking tendinous injury, since they may potentiate extensor function even when extensor digitorum communis tendon has been damaged to a given finger.

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Disruption of the lateral band may affect extension of the interphalangeal joints but not the MCP joint. Likewise, injury of the terminal tendon could lead to a mallet finger, with loss of distal interphalangeal extension, but would not affect the MCP joint.

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56. A 27-year-old man comes to the office because of pain that developed in the left hand while rock climbing, during which he experienced a loud pop in the hand. He also reports loss of flexion strength. Physical examination shows bruising and swelling over the palmar aspect of the ring finger. The patient is able to bend the proximal interphalangeal (PIP) and distal interphalangeal joints of the ring finger, and he is able to flex the digit with the remaining fingers held in extension. The PIP and metacarpophalangeal joints are stable and pain-free to stress. X-ray studies do not show fracture or dislocation. Which of the following is the most likely diagnosis?

A) Avulsion of the flexor digitorum profundus

B) Lumbrical muscle tear

C) Midsubstance tear of the flexor digitorum superficialis

D) Pulley rupture

E) Volar plate injury

The correct response is Option D.

This patient exhibits symptoms consistent with flexor tendon pulley rupture. With the increasing popularity of rock climbing, injuries to the flexor tendon pulleys have become more common. Closed traumatic ruptures of the pulleys are typically rare in the general population but are more likely in rock climbers. These injuries typically present with an acute onset of pain and sometimes with a loud popping noise, along with swelling and possibly hematoma. Bowstringing may occur in cases of multiple pulley ruptures, when flexing against resistance.

The flexor tendons travel through a series of fibro-osseous tunnels in the fingers, comprised of five annular pulleys (A1-A5) and three cruciate pulleys (C1-C3). The A2 and A4 pulleys are the strongest and most biomechanically important, since they hold the tendons to the bone and prevent bowstringing.

Pulley injuries to the middle and ring fingers are the most common, with rupture of A2 and A4 pulleys occurring because of the forces placed on them as a result of the force demands in rock climbing. In the crimp position, which is used to maintain hold on a narrow ledge, the distal interphalangeal (DIP) joints are extended and the proximal interphalangeal (PIP) joints are flexed. This puts significant forces on the flexor tendons and pulleys, with biomechanical

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studies showing that the forces acting in the crimp position are 287 newtons (N) at the A2 pulley and 226 N at the A4 pulley. The highest tension is on the A2 pulley, which may experience forces three to four times greater than at the fingertip. A sudden slip and resultant loading of the finger can create additional demand and exceed the maximum tear load of the pulley, which is believed to be on the order of 400 N at the A2, leading to pulley rupture.

Pulley injuries can be confirmed by imaging using ultrasonography or MRI. Treatment may be conservative in less severe injuries, or surgical reconstruction may be performed in cases of multiple closed pulley ruptures.

An avulsion of the flexor digitorum profundus may present with pain and swelling in the volar finger or palm, but it would result in an inability to flex the DIP joint.

A lumbrical muscle tear can also occur in rock climbing, but it would be less likely in this clinical scenario.

A tear of the flexor digitorum superficialis tendon would result in decreased flexor function at the PIP joint, but it would yield an inability to flex the PIP joint in isolation when the remaining fingers are extended.

A volar plate injury would not typically affect flexor force, and it is ruled out because the metacarpophalangeal and PIP joints are stable and pain-free to stress.

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57. A 70-year-old man is evaluated because of progressively worsening leg pain with ambulation and a nonhealing wound of the lower leg. Physical examination shows a 2-cm dry, necrotic ulcer on the anterior aspect of the leg. In addition to referral to a vascular surgeon, which of the following is the most appropriate next step in management?

A) Ankle-brachial index test

B) Arteriography

C) Biopsy

D) Culture

E) Debridement

The correct response is Option A.

This is the typical presentation of an older patient with peripheral vascular disease and likely another large vessel arteriosclerotic disease. Any kind of surgery prior to revascularization of the lower extremities is likely to increase the size of the wound due to the lack of blood flow causing poor wound healing. A culture would not be helpful since the wound is dry and has no appearance of infection. Arteriography may be needed, but it's invasive and carries some risk. The first step would be an ankle-brachial index (ABI) test since it is the most sensitive for evaluating the distal vasculature, with values less than 0.7 indicative of peripheral vascular disease and likely coronary disease. Extremities with lower ABI values can be further investigated with color Doppler studies to measure the extent of disease. Doing a biopsy of the wound would likely extend the size of the wound and not provide any helpful information. However, a biopsy may be indicated for a long-standing chronic wound to rule out malignancy.

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58. An 82-year-old man who is a retired welder comes to the office with an 18-month history of intermittent pain in the right hand. Physical examination shows warm and well-perfused fingers with tiny discolorations in the nail beds. Photographs are shown. Vascular studies disclose a thrombosed ulnar artery and an aneurysm with digital brachial indices in the 0.9 to 1.0 range. Which of the following treatments is most likely to alleviate the symptoms in this patient?

A) Activity modification

B) Aneurysm excision

C) Daily full-dose aspirin therapy

D) Guyon canal decompression

E) Thrombectomy

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The correct response is Option B.

This patient presents with symptoms and signs (ie, splinter hemorrhages) related to intermittent vascular compromise, likely because of microemboli from the thrombosed ulnar artery, as well as possible intermittent vasospastic episodes. Surgical isolation or excision of the ulnar artery aneurysm is indicated to decrease the chance of future emboli. Aneurysm excision also provides an effective Leriche sympathectomy to the vascular tree at this location, which can improve perfusion. Reconstruction with vein grafting is not required in the setting of normal digital brachial indices.

Lifestyle modification and nonoperative treatment, including calcium-channel blockers and botulinum toxin A, have a smaller chance of relieving symptoms. Even in patients whose vein graft did not remain patent long-term, surgical intervention leads to sustained improvements superior to nonoperative therapy.

Thrombectomy has not been proposed as a surgical intervention for a chronically thrombosed ulnar artery aneurysm.

While decompression of the Guyon canal might be required during operative exposure in this case, this decompression alone will not alleviate the vascular symptoms present.

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59. A 24-year-old man sustains a degloving injury to the dorsal foot. The surgeon uses a free temporoparietal fascia flap and split-thickness skin graft to provide thin coverage with a gliding surface. Which of the following complications is most likely to occur at the flap donor site in this patient?

A) Injury to the temporal branch of the facial nerve

B) Injury to the trigeminal nerve

C) Loss of ability to actively move the ears

D) Temporal alopecia

E) Temporal hollowing

The correct response is Option D.

The free temporoparietal fascia flap is a thin, pliable flap ideal for dorsal hand coverage when paired with a skin graft. It is supplied and drained by the superficial temporal vessels. The flap undersurface consists of a smooth areolar connective tissue layer allowing an excellent gliding surface for tendons.

While this flap has a generally hidden donor site, dissection may lead to iatrogenic alopecia, which may be most visible in patients with shorter hairstyles.

While the temporal branch of the facial nerve may sustain neuropraxia, significant injury is rare. The trigeminal nerve is far from the flap harvest site and not injured in this operation.

Temporal hollowing may be associated with temporoparietal muscle flap harvest or injury to the temporal branch of the fascial nerve which supplies it, but not with facial harvest alone. Hollowing is also often seen after craniotomy incisions when the muscle is cut across, leaving a denervated superior segment of muscle.

Motion of the ear is possible in some individuals using their auricular muscles. These are supplied by the temporal branch of the facial nerve. As noted previously, this is rarely injured.

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60. A 55-year-old woman is referred to the office because of a slow-growing, painless soft-tissue mass on the volar aspect of the right forearm. She does not report any history of trauma. Physical examination shows a 3-cm firm mass at the volar midline of the distal forearm that is mobile in the transverse direction. The mass does not transilluminate. Percussion of the mass elicits a Tinel sign in the median nerve distribution. MRI demonstrates an eccentric mass of the median nerve that is homogeneously hypointense centrally with peripheral hyperintensity. Which of the following is the most likely diagnosis?

A) Dermatofibrosarcoma protuberans

B) Epidermal inclusion cyst

C) Schwannoma

D) Tenosynovial giant cell tumor

E) Volar ganglion cyst

The correct response is Option C.

The history and physical examination findings in conjunction with the MRI findings indicate that the most likely diagnosis is a schwannoma. Schwannomas (neurilemomas) are benign nerve sheath tumors of Schwann cell origin and are the most common peripheral nerve tumor of the upper extremity. They are usually solitary and typically present as a slow-growing, painless soft-tissue mass on the flexor surface of the forearm or hand. Schwannomas are often mobile in the transverse direction but not longitudinally, where they may be tethered in line with a peripheral nerve. A positive Tinel sign may be present over the mass. Excision of this benign tumor is not always necessary; however, excision can be considered if the patient is symptomatic (ie, pain, neurologic deficit). These lesions are usually well-encapsulated and eccentrically located on the nerve, and they can be shelled out with a small risk for postoperative neurologic deficit (5–15%).

Ganglion cysts are the most common soft-tissue masses of the hand. Volar ganglion cysts are the second most common type of ganglion (second to dorsal ganglion cysts), and they are typically located on the volar radial aspect of the wrist and may arise from the radiocarpal joint or scaphotrapezial joint. Ganglion cysts contain mucin and transilluminate. The findings on this patient's physical examination, including the absence of transillumination, and the MRI findings make the diagnosis of ganglion cyst less likely.

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Dermatofibrosarcoma protuberans (DFSP) is an uncommon low-grade malignant skin tumor that arises in the dermis and may be located in the forearm, but rarely in the hand. It usually presents as a painless plaque or nodule with a red-brown or violet color. DFSPs grow slowly over several months to years. They have tendency to recur, even after wide local excision.

Tenosynovial giant cell tumors, which include giant cell tumors of the tendon sheath and pigmented villonodular synovitis, are benign soft-tissue tumors. They are the second most common tumor in the hand. These tumors generally occur on the volar surface of the fingers and hand. They present as a firm, nodular, nontender mass commonly located on the three radial fingers.

An epidermal inclusion cyst is believed to result from a penetrating, traumatic injury causing implantation of epithelial cells into the underlying soft tissue. These cells grow over time to become a firm, painless mass, which is most commonly located in the fingertip.

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61. A 40-year-old man comes to the clinic because of difficulty with the use of his right hand. Six weeks ago, he was treated at the emergency department after sustaining multiple stab wounds to the right upper extremity. At that time, the wounds were irrigated and closed. Physical examination shows clawing of the small and ring fingers and hyperextension of the metacarpophalangeal joint of the thumb. Sensation is decreased over the palm but normal over the dorsum of the hand. Injury to which of the following nerves is the most likely explanation for these findings?

A) High median

B) High ulnar

C) Low median

D) Low ulnar

E) Radial

The correct response is Option D.

In low ulnar nerve injuries, the nerve is damaged distal to the motor branch of the flexor carpi ulnaris and motor branch to the flexor digitorum profundus (FDP) of the ring and little fingers. In low injuries, sensation over the palmar ulnar aspect of hand is lost and paralysis occurs, usually to all interosseous muscles, the two ulnar lumbrical muscles, the three hypothenar muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle. Sensation over the dorsum of the hand may be intact if the lesion has occurred distal to the takeoff of the dorsal ulnar sensory nerve, which takes off approximately 5 to 6 cm proximal to the ulnar styloid. The loss of intrinsic muscle function results in an inability to flex at the metacarpophalangeal (MCP) joints and extend the interphalangeal (IP) joints. This results in the development of the intrinsic-minus or claw posture of the ring and little fingers, where there is hyperextension at the MCP joints and flexion at the IP joints (Duchenne sign). The development of clawing does require the presence of intact extrinsic extensor and flexor tendon function; therefore, a high ulnar nerve injury results in less claw hand deformity because of the loss of FDP function.

In addition, intrinsic weakness leads to decreased pinch and grip strength, a result of paralysis of the adductor pollicis, deep head of the flexor pollicis brevis, and first dorsal interosseus muscles. Thumb pulp to index pulp pinch leads to excessive flexor pollicis longus contraction

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and development of the Froment paper sign.

Median nerve sensation is intact, as is the function of the median innervated forearm and hand muscles. A high or low median nerve injury would not explain this patient's symptoms. In low median nerve injuries, patients present with thenar wasting, weak thumb abduction and opposition, and decreased sensation of the volar thumb, index, and middle fingers. Patients with a high median nerve injury will have these same findings, as well as loss of FDP and flexor digitorum superficialis function to the index and middle fingers and loss of flexor pollicis longus function. They will also have weakness of the flexor carpi radialis muscle.

Distal to the elbow, the radial nerve divides into a deep branch and a superficial branch. The deep branch supplies motor function to the extensor carpi radialis brevis and supinator muscles. The deep motor branch continues as the posterior interosseous nerve, which supplies motor function to the abductor pollicis longus, extensor carpi ulnaris, extensor digiti minimi, extensor digitorum communis, extensor indicis proprius, extensor pollicis brevis, and extensor pollicis longus muscles. The superficial branch of the radial nerve supplies sensation to the dorsal radial hand, as well as dorsal sensation to the thumb, index finger, middle finger, and the radial side of the ring finger. Depending on the location and specific branches involved, radial nerve injury can result in loss of wrist, thumb, and finger extension, as well as dorsal radial hand and finger sensation.

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62. A 25-year-old man presents with the hook nail deformity shown in the photograph. Which of the following techniques will best address the deformity in this patient?

A) Ablation of the germinal matrix

B) Amputation at the distal phalanx level

C) Placement of an allograft under the nail bed

D) Reconstruction of the eponychium with a local island flap

E) Revision of the distal sterile matrix

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The correct response is Option E.

A hook nail develops when an amputation to the fingertip occurs and the nail bed is not supported by bone because part of the distal phalanx is removed proximal to the distal end of the sterile matrix. As a result, the nail grows volarly over the tip. Trimming the distal aspect of the sterile matrix to match the length of the distal phalanx would stop the growth of the nail in the volar direction to repair the deformity.

Removal of the germinal matrix would stop further nail growth and result in a tip without a nail. The eponychium is the proximal aspect of the nail and would be normal in this scenario. Placing an allograft under the nail bed has been described for treating a trumpet nail. Amputation of the entire distal phalanx is not indicated and would decrease grip and hand function.

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63. A 40-year-old woman presents with a pigmented streak in the nail of the thumb. Which of the following is the strongest indication for biopsy of the lesion?

A) History of trauma to the thumb

B) Hypertrophic nail growth

C) Petechial hyperpigmentation

D) Presence of pigmentation for 2 weeks

E) Streak crosses the eponychial fold

The correct response is Option E.

Subungual melanoma typically presents with a melanotic streak beneath the nail. However, delays in diagnosis and misdiagnosis are common and portend a significantly worse survival rate with subungual melanoma relative to other sites, with 5-year survival being reported as anywhere between 16 and 80%.

A full-thickness biopsy (punch or excision) is the key to diagnosis, allowing both diagnosis and evaluation of the depth of the lesion, which is helpful in determining treatment and prognosis.

Several features help to differentiate a subungual melanoma from other causes of pigmentation (ie, benign striae melanonychia, trauma, onychomycosis). Worrying signs include irregular borders, ulceration, increasing size, lifting of the nail plate, and extension beyond the nail plate. The finding of pigmentation including the surrounding skin (such as crossing the eponychial fold, ie, Hutchinson sign) is highly suggestive of subungual melanoma.

A history of trauma, short time to presentation (less than 4 to 6 weeks), regular borders, and multiple melanotic streaks are less cause for concern.

Hypertrophic nail growth with splitting of the nail is more suggestive of onychomycosis. Petechiae-like hyperpigmented lesions in multiple nail beds are suggestive of Peutz-Jeghers syndrome.

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64. A 28-year-old man who is a carpenter is evaluated after sustaining a complete amputation of the thumb of the nondominant left hand when using a table saw. The injury resulted in destruction of the carpometacarpal joint. Replantation was attempted but not successful. Pollicization of the uninjured index finger is planned for reconstruction. Which of the following joints of the index finger will best function as the carpometacarpal joint of the reconstructed thumb after pollicization?

A) Carpometacarpal

B) Distal interphalangeal

C) Metacarpophalangeal

D) Proximal interphalangeal

The correct response is Option C.

Thumb amputations that involve loss of the carpometacarpal joint of the thumb further complicate reconstruction and limit reconstructive options. Pollicization of the index finger involves pedicled neurovascular transfer of the index finger into the thumb position. The new carpometacarpal joint of the thumb is constructed by preserving the metacarpophalangeal joint of the index finger which is fixed into hyperextension to avoid a hyperextension deformity of the new carpometacarpal joint. The index metacarpal is positioned in abduction and pronation.

The proximal interphalangeal joint of the index finger functions as the metacarpophalangeal joint of the new thumb following pollicization. The distal interphalangeal joint of the index finger will function as the interphalangeal joint of the new thumb. The index carpometacarpal joint would not be transferred in this scenario.

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65. A 25-year-old man comes to the office because of pain in the right hand sustained after striking a wall. Physical examination shows swelling, tenderness, and a bony deformity at the dorsal ulnar aspect of the hand. X-ray studies show dorsal fracture-dislocations of the fourth and fifth carpometacarpal joints. In addition to an axially directed load, which of the following forced movements is the most likely mechanism of injury in this patient?

A) Extension of the wrist

B) Flexion of the wrist

C) Metacarpophalangeal joint extension

D) Pronation of the wrist

E) Radial deviation of the wrist

The correct response is Option B.

Fourth and/or fifth carpometacarpal (CMC) joint dislocations and fracture dislocations are a relatively uncommon group of injuries. The fourth and fifth CMC joints are more mobile compared with the second and third CMC joints. This increased range of motion of the ulnar-sided CMC joints contributes to grip strength; however, this increased mobility predisposes these joints to instability with a direct blow.

The mechanism of injury typically involves an axially directed load and forced flexion of the wrist along with an extended arm. This may occur with a clenched fist punching a firm surface or a fall. This axially directed load across a flexed CMC joint causes the metacarpal base to be directed dorsally, resulting in a dislocation or fracture-dislocation. There is dorsal and proximal displacement of the metacarpal with disruption of the dorsal CMC ligaments and sometimes a hamate fracture. These are unstable injuries and often require reduction and fixation.

The other options listed do not best describe the most common mechanism for this injury.

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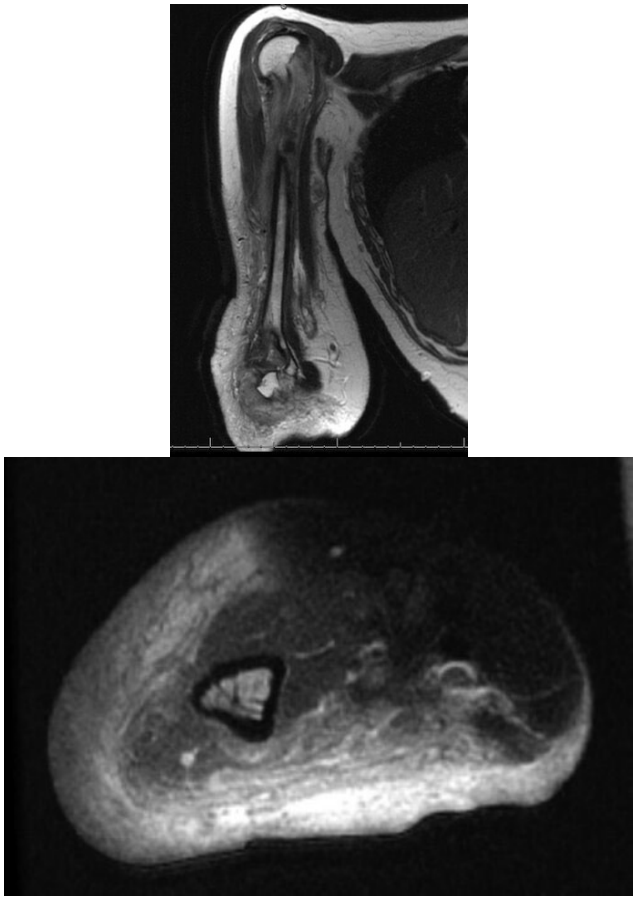

66. A 25-year-old woman comes to the office because of a slow-growing upper extremity mass. Physical examination also shows numerous smaller lesions and masses scattered over the patient's body. She reports that her mother has similar lesions. MRI images are shown. Which of the following is the most likely diagnosis?

A) Glomus tumor

B) Hemangioma

C) Lymphatic malformation

D) Plexiform neurofibroma

E) Venous malformation

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The correct response is Option D.

The patient is presenting with neurofibromatosis. The T2-weighted MRI image shows skin thickening and hypertrophy of the subcutaneous tissues consistent with a cutaneous plexiform neurofibroma. The T1-weighted MRI image shows a muscle split fat sign where the mass displaced the fat. Crescent-shaped fatty rinds are more frequently seen in peripheral nerve sheath tumors while circumferential fatty rinds are more commonly seen in hemangiomas. In the case of hemangiomas, this scenario does not fit the typical presentation of a hemangioma, since there is often a proliferation phase followed by involution in childhood. The split fat sign is more often seen in benign lesions or low-malignancy-grade tumors. It has been suggested that neurofibromatosis 1 tumors arise from the neurovascular bundles that are surrounded by fat and maintain the fat in the periphery as they grow.

Neurofibromatosis can be seen in 1/3000 people and is highly variable. Up to half of the cases can be familial. It can affect the skin, central nervous system, musculoskeletal system, and cardiovascular system. Neurofibromatosis can be benign or malignant.

Neither image shows abnormal vascularity, so venous malformation, hemangioma, and lymphatic malformation are less likely. Hemangiomas tend to show intravascular thrombi, vascular aneurysms, and venous components.

Glomus tumors are small masses that can be extremely painful with temperature change and typically affect the distal nail bed or palm. They would not have the presentation seen in this scenario.

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67. A 54-year-old man is evaluated after sustaining a traumatic ulnar nerve laceration with no intrinsic muscle function. On examination, a Froment sign is noted. Which of the following muscles most likely compensates for the thumb adduction that caused the deformity?

A) Abductor pollicis brevis

B) Abductor pollicis longus

C) Extensor pollicis longus

D) Flexor pollicis brevis

E) Flexor pollicis longus

The correct response is Option E.

Ulnar nerve injuries have significant sensory and motor functional consequences. When injuries occur proximal to the elbow, the expected motor deficits are in the following muscles: flexor carpi ulnaris, flexor digitorum profundus to the ring and small fingers, hypothenar (opponens digiti minimi, abductor digiti minimi, flexor digiti minimi brevis), third and fourth lumbrical, dorsal and palmar interosseous, adductor pollicis, and deep head of the flexor pollicis brevis.

A Froment sign is observed when the patient attempts to pinch between the thumb and index finger but is unable to activate the adductor pollicis muscle (ulnar innervated) and compensates by activating the flexor pollicis longus muscle by flexing the interphalangeal joint (median nerve innervated). None of the other muscles listed cause adduction of the thumb to help with pinch between the thumb and index finger and therefore do not contribute to the deformity.

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68. A 72-year-old woman with advanced rheumatoid arthritis comes to the office because of a sudden inability to extend the small and ring fingers. On physical examination, she is able to extend the wrist, thumb, and index finger independently. Passive wrist flexion with tenodesis shows no passive extension of the small and ring fingers. Her fingers can be passively placed in extension without difficulty, but she cannot maintain them in that position. Which of the following is the most likely cause of these findings?

A) Radial nerve palsy

B) Sagittal band rupture

C) Subluxation of the metacarpophalangeal joints

D) Trigger finger

E) Vaughan-Jackson syndrome with caput ulnae

The correct response is Option E.

This patient has rheumatoid arthritis and has developed rupture of the extensor tendons to the ring and small fingers. An inability to extend the fingers at the metacarpophalangeal (MCP) joint can be caused by radial nerve dysfunction, subluxation of the extensor tendons at the MCP joint with sagittal band incompetence, a trigger finger, or extensor tendon rupture. This patient is able to extend the wrist, thumb, and index finger; therefore, the radial nerve is functioning. If the finger can be positioned in extension and maintained by the patient, then the sagittal band is likely ruptured. If the patient had a trigger finger severe enough to prevent active extension of the fingers, it would not be easy to passively reposition them in extension. If tenodesis with wrist flexion does not result in finger extension, the extensor tendons are likely not in continuity. In patients with rheumatoid arthritis, prominence of the distal aspect of the ulna (ie, caput ulnae) is the most common cause of tendon rupture, and the ulnar to radial progression of tendon rupture is termed Vaughan-Jackson syndrome.

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69. A 5-year-old boy is evaluated because of the deformity of the left hand shown in the photograph. Three months ago, the boy fell from a chair, and his parents report that he has been unable to extend his thumb. X-ray studies obtained by his pediatrician showed no fracture or dislocation. Physical examination today discloses a palpable mass at the volar aspect of the metacarpophalangeal joint flexion crease. Which of the following is the most appropriate treatment for this patient?

A) Corticosteroid injections

B) Extensor tendon repair

C) Manipulation with anesthesia

D) Percutaneous transection

E) Surgical incision

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The correct response is Option E.

The cause of a pediatric trigger thumb is considered congenital by some and acquired by others. Because children hold their thumb in the palm naturally, the flexed position of the interphalangeal joint is often not observed by the family until after a fall or injury that prompts a closer evaluation. The Notta nodule is often mistaken for a bony mass.

Although some authors have recommended a period of splinting or observation, the majority of pediatric trigger thumbs presenting as locked in flexion require surgical release since the rate of spontaneous resolution is low. For those cases that did resolve with splinting and therapy or observation alone, it took many months to years to achieve resolution.

Open surgical intervention is performed with release of the A1 pulley and sometimes a portion of the oblique pulley. The Notta nodule at the time of surgical release is shown in the photograph.

Percutaneous release, although used with success in adult trigger fingers, is not appropriate for children because of the close proximity of the neurovascular structures.

There is no literature addressing the treatment of pediatric trigger thumb with steroid injections; therefore, it is not recommended.

Manipulation with anesthesia might be an appropriate treatment for a dislocation, which this child does not have.

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The extensor tendon is not injured or involved in this pathology, and it does not need to be repaired.

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70. A 13-year-old boy is evaluated after undergoing debridement of calcaneal osteomyelitis by the orthopedic team. A photograph is shown. Reconstruction with a sensate anterolateral thigh flap is planned. Which of the following best describes the path of the nerve that should be harvested with this flap?

A) It arises from the common peroneal nerve

B) It branches from the tibial nerve

C) It descends through the fibers of the psoas muscle

D) It passes under the lateral aspect of the inguinal ligament

E) It pierces the gastrocnemius muscle

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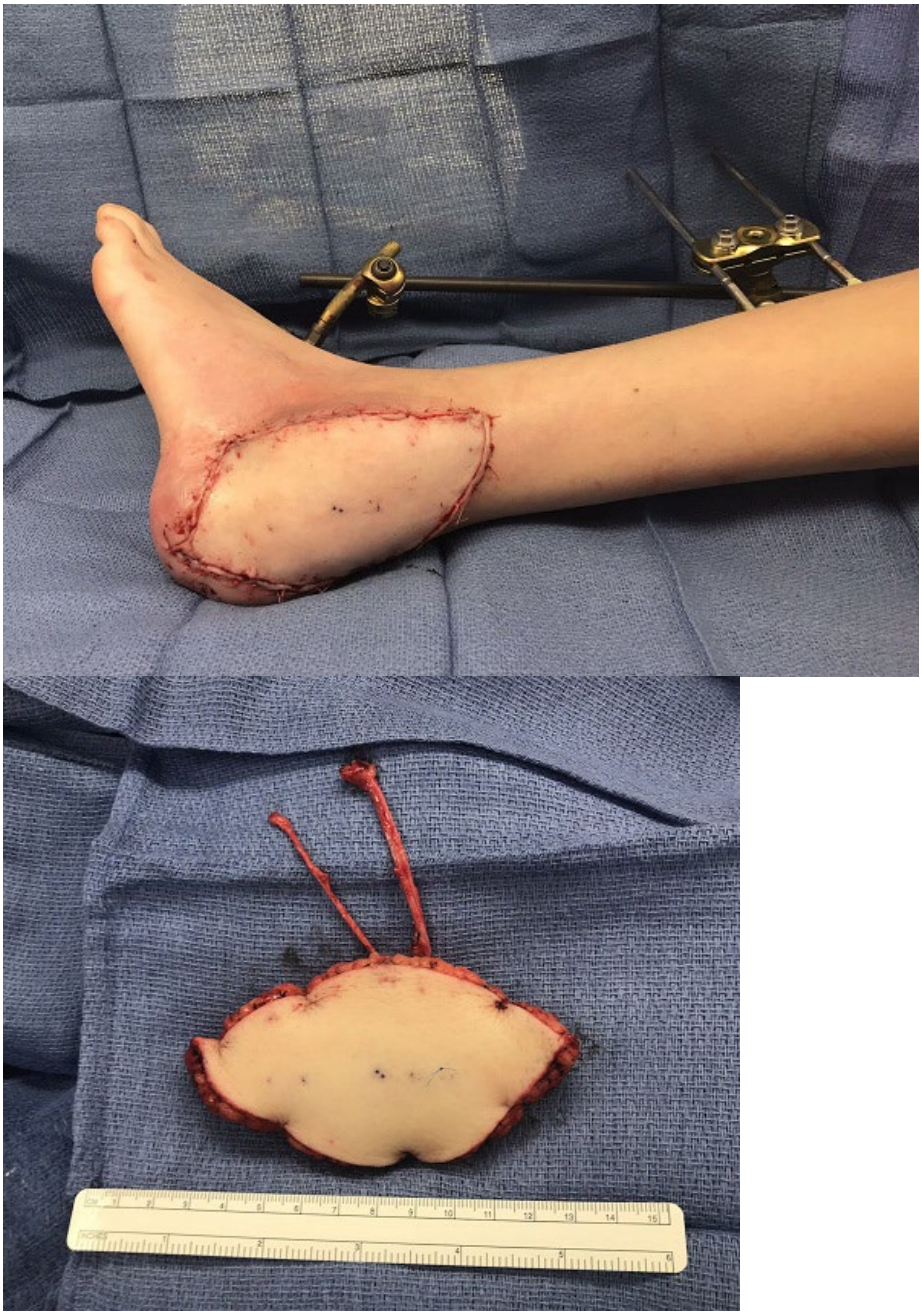

The correct response is Option D.

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The lateral femoral cutaneous nerve (LFCN) of the thigh can be used to make an anterolateral thigh flap sensate. This flap is a good choice for a wound requiring some filling of dead space. In this patient, the LFCN was coapted to the sural nerve for sensory reconstruction. Photographs are shown. The anatomy of the LFCN is also important to understand when treating patients with meralgia paresthetica, or compression of the LFCN. The LFCN passes under the inguinal ligament, which can be a site of compression.

The gracilis muscle receives motor (not sensory) innervation from the obturator nerve, which descends through the fibers of the psoas muscle.

The sural nerve pierces the gastrocnemius muscle in the distal third. This is a commonly used nerve donor for graft reconstruction of nerve defects. It is also an important pedicle for the reverse sural flap (a nonsensate flap since the proximal nerve is divided in the harvest). It arises from the tibial nerve and the common peroneal nerve at the level of the knee.

The gastrocnemius muscle is commonly used for pedicled reconstruction of proximal third defects. This muscle receives motor (not sensory) innervation from branches of the tibial nerve.

The medial plantar artery flap can be harvested as a sensate flap, innervated by cutaneous branches of the tibial nerve. This flap is useful for small defects and would not be suitable for such a large wound.

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71. Which of the following reconstructive techniques best improves the aesthetics of toe syndactyly repair by decreasing the visibility of the interdigital skin grafts on the dorsal aspect of the foot?

A) Harvesting skin grafts from the antecubital fossa

B) Harvesting skin grafts from the groin

C) Resurfacing the web space with a large dorsal flap

D) Resurfacing the web space with a plantar flap

E) Using larger Z-plasty flaps on the dorsal toes

The correct response is Option D.

Treatment of toe syndactyly tends to emphasize the aesthetic outcomes heavily, since there is not often a significant functional deficit that needs to be addressed. When toe syndactyly is treated with a large dorsal flap, or large dorsal Z-plasty flaps, there is typically a significant dorsal skin deficit that requires grafting. Regardless of the donor site (groin, antecubital fossa, or other site), these grafts are often a poor match, since the dorsum of the foot tends to be several shades darker than the sole of the foot, especially in patients with darker skin. The one exception might be the use of glabrous skin grafts, but although they might be a better color match, visibility of the scars may still be an issue.

A couple of different techniques have been developed to decrease the visibility of the skin grafts on the dorsal aspect of the foot. These techniques use a plantar flap to create the floor of the web space and/or resurface some of the interdigital deficits, without using large dorsal web space flaps or Z-plasty flaps, so that the dorsal skin is largely undisturbed.

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72. A 36-year-old woman comes to the office because of a painless soft-tissue mass on the ulnar aspect of the palm that has grown rapidly during the past 6 weeks. MRI shows a 2-cm heterogenous soft-tissue tumor that is bright on T1 sequences and does not suppress on fat suppression sequences. Thickened irregular septations are seen within the mass, which abuts the metacarpal bones. Examination of a specimen obtained on biopsy shows liposarcoma. Which of the following is the most appropriate next step for this patient?

A) Amputation below the elbow

B) Chemotherapy

C) Double ray resection

D) Marginal excision

E) Radiation

The correct response is Option C.

This patient has a tumor with characteristics of a liposarcoma. Although most masses in the hand are benign, some signs indicative of malignancy are the history of rapid growth, heterogeneous nature of the tumor, and the lack of suppression on fat suppression sequences. On MRI, benign lipomas have all the appearances of fat, appearing bright on T1 sequences and showing suppression on fat suppression sequences. Benign lipomas should also appear homogeneous. The history of rapid growth adds to the index of suspicion for malignancy in this case.

Wide surgical excision with clear margins is the most important primary goal in the treatment of soft-tissue sarcomas. In this case, double ray resection would allow removal of the tumor while preserving some hand function.

Amputation below the elbow would resect the tumor, but it is more extensive than required, since preservation of the thumb and radial aspect of the hand is possible in this scenario.

Chemotherapy may be used as an adjunctive technique for soft-tissue sarcomas but does not take the place of surgical excision. When used in an adjuvant setting, it may have some overall benefit, but this is typically recommended for high-grade and large (greater than 5 cm) sarcomas.

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Marginal excision would not clear the tumor adequately and would not be recommended in the case of malignant disease. Marginal excision would be appropriate for the excision of benign lipomas.

Radiation may be used for local control after surgical resection but not as a primary modality in treatment. Radiation may help decrease local recurrence rates, but it does not have a significant effect on long-term survival. Typically radiation is advised for larger and high-grade lesions.

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73. A 2-year-old boy with Type IV hypoplasia of the thumb undergoes index finger pollicization. The extensor digitorum communis and extensor indicis proprius tendons of the index finger will most likely be used to reconstruct which of the following two tendons in the thumb of this patient?

A) Abductor pollicis longus and extensor pollicis longus

B) Abductor pollicis longus and flexor pollicis longus

C) Extensor pollicis brevis and abductor pollicis longus

D) Extensor pollicis brevis and flexor pollicis longus

E) Flexor pollicis longus and extensor pollicis longus

The correct response is Option A.

During pollicization, the extensor tendons of the index finger are used to reconstruct the extensor tendons of the reconstructed thumb. The extensor digitorum communis is shortened and attached to the proximal phalanx to act as the abductor pollicis longus. The extensor indicis proprius is shortened and repaired and acts as the extensor pollicis longus. There is no need to reconstruct both the extensor pollicis brevis and the abductor pollicis longus since they both will act as abductors of the thumb. The flexor pollicis longus is reconstructed with a flexor tendon from the index finger, specifically the flexor digitorum profundus.

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74. A 42-year-old man who sustained an amputation immediately distal to the elbow is scheduled to undergo a targeted muscle reinnervation procedure for improved prosthetic control and function. Which of the following nerve transfers is most likely to provide a "hand-close" signal in this patient?

A) Medial antebrachial cutaneous nerve to the brachioradialis muscle

B) Median nerve to the short head of the biceps

C) Musculocutaneous nerve to the pectoralis major muscle

D) Radial nerve to the lateral head of the triceps

E) Ulnar nerve to the brachialis muscle

The correct response is Option B.

Targeted muscle reinnervation techniques allow options for improved prosthetic function and nerve pain management in patients after traumatic amputations. The options available are determined by the available donor nerve remnants and muscle targets. A patient with a transhumeral amputation has an intact elbow joint but unusable forearm muscle targets. In such a patient, the intact elbow allows for maintenance of flexion and extension by preservation of musculocutaneous innervation of the long head of the biceps and radial innervation of the long head of the triceps. To provide "hand-close" prosthetic function, transfer of the median nerve remnant to the motor nerve of the short head of the biceps can be accomplished.

Transfer of the radial nerve remnant to the motor nerve of the lateral head of the triceps allows for prosthetic "hand-open" control. If available, an ulnar nerve remnant can be transferred to the nerve of the brachialis to provide prosthetic wrist control. Musculocutaneous nerve remnant transfer to the nerve of the pectoralis major is an option for patients with "shoulder disarticulation" amputations. Transfer of the medial antebrachial cutaneous nerve to the brachioradialis is an option for a patient with residual limb pain following a distal forearm amputation.

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75. A 42-year-old man undergoes open reduction and internal fixation of an olecranon fracture complicated by wound dehiscence. Coverage of the soft-tissue defect of the posterior aspect of the elbow with a pedicled lateral arm flap is planned. When used to cover the defect in this patient, this pedicled flap is most likely to be supplied by which of the following arteries?

A) Circumflex humeral

B) Interosseous

C) Lateral thoracic

D) Radial recurrent

E) Ulnar

The correct response is Option D.

The distally based pedicled lateral arm flap is used for coverage of elbow defects following traumatic injuries. When used as a pedicled, distally based flap, the dominant arterial inflow is from the radial recurrent artery, which has communication with the posterior radial collateral artery. The primary pedicle to the anterograde lateral arm flap is the posterior radial collateral artery, which is most commonly used as a free flap. The other arteries do not provide perfusion to the reverse lateral arm flap.

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76. A 45-year-old man is evaluated because of an enlarging fluctuant mass over the posterior hip. Four months ago, he sustained injuries in a snowmobile accident. At that time, he received treatment for sacral and pubic rami fractures, but no skin injury was noted. The initial CT image is shown. Which of the following is the most likely cause of the deformity in this patient?

A) Fat necrosis

B) Hemorrhage

C) Lymphatic disruption

D) Postoperative seroma

E) Sarcoma

The correct response is Option C.

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This is a Morel-Lavallée lesion (MLL), which can result from a shearing injury but also from other forms of trauma. It occurs when the fascia is sheared away from the superficial subcutaneous tissues. This creates a prefascial plane which allows for a potential space to be filled from the leaking disrupted lymphatic vessels and capillaries.

The CT scan at time of injury shows the space filled with a hematoma. Although the blood typically resolves, the lymphatic fluid can continue to leak, causing surface damage and skin necrosis.

Fat necrosis would not worsen over time, although it can be present with this type of injury and can calcify. A hemorrhage, which would be present, would resolve over time, and it would not likely be the cause of skin necrosis or worsening this far out.

MLL can be confused with a postoperative seroma, but seromas generally don't enlarge months after the procedure. MLL is also often seen with pelvic fractures, as in this patient.

MLL can also be confused with sarcomas, but they would be more fixed in nature and not fluctuant. There is no evidence of a tumor on the CT scan of the initial injury; the scan shows a large hematoma and shearing injury to the right hip. Although the blood has likely resorbed by now, the leaking lymphatic vessels would be the most likely cause of the increasing fluid collection.

The treatment of MLL varies, with aspiration and more conservative measures early on, followed by surgical excision of more recalcitrant lesions.

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77. A 24-year-old woman presents with a severe first web space contracture due to scarring from a complex injury sustained 12 months ago. During management of the initial injury, the patient's superficial palmar arch was noted to be incomplete. The scar tissue involves 50% of the dorsal aspect of the hand. After contracture release, the pedicle between which of the following structures will provide the best blood supply for reconstruction?

A) Brachioradialis and abductor pollicis longus muscles

B) Extensor carpi ulnaris and extensor digiti minimi muscles

C) Extensor pollicis longus and extensor indicis proprius muscles

D) First and second metacarpal bones

E) Vastus lateralis and vastus intermedius muscles

The correct response is Option B.

The best option for this reconstruction is a posterior interosseus artery flap, which has a pedicle between the extensor carpi ulnaris and the extensor digiti minimi muscles. A reverse radial forearm would be a suitable option, but the pedicle is located between the brachioradialis and the flexor carpi radialis muscles. The first and second dorsal metacarpal artery flaps are not good options in this patient because of the location and extent of contracture. A free flap using the anterolateral thigh would also be an option, but its pedicle is between the vastus lateralis and the rectus femoris muscles.

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78. Which of the following types of graft is most appropriate for reconstruction of a bony defect in the forearm when using the induced membrane (Masquelet) technique?

A) Cancellous allograft

B) Cancellous autograft

C) Cortical allograft

D) Cortical autograft

E) Membranous autograft

The correct response is Option B.

The classic induced membrane (Masquelet) technique for reconstruction of a bony defect involves the following key steps:

- Thorough debridement and stable external fixation
- Placement of a spacer (usually antibiotic-impregnated bone cement) into the bone defect
- Allowing healing around the spacer for 4 to 6 weeks to generate a "membrane" around the spacer
- Returning to the operating room to incise the membrane and remove the spacer
- Filling the defect with a cancellous autograft, most often obtained from the femur or iliac crest

The technique has not been described with cortical bone, nor would allografts be expected to give the same results.

Membranous bones include parts of the skull and facial bones, as well as the clavicle. These are not practical sources of autograft bone.

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79. A 64-year-old man recently underwent total knee arthroplasty in the setting of infection, and the plastic surgeon is consulted regarding coverage. After debridement, there is a 4 × 5-cm soft-tissue defect over the tibial tuberosity with exposed hardware. Which of the following is the most appropriate reconstructive option?

A) Medial gastrocnemius flap

B) Negative pressure wound therapy

C) Rectus femoris flap

D) Skin graft

E) Soleus flap

The correct response is Option A.

The gastrocnemius flap is an excellent reconstructive option for defects of the proximal third of the leg. The medial head is longer and the muscle extends more distally, and it provides more reliable coverage around the knee than the lateral gastrocnemius flap. The soleus flap is the preferred option for middle third defects.

Negative pressure wound therapy would not be effective over hardware since this cannot granulate. Similarly, a skin graft cannot take over hardware.

A soleus flap is useful for coverage over the middle third of the lower leg but cannot reach the knee.

A rectus femoris flap may be used for inguinal reconstruction but is not typically used for knee coverage.

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80. A 45-year-old man comes to the emergency department 3 days after sustaining a puncture wound to the palmar skin overlying the index ray of the right hand. He has type 1 diabetes that is poorly controlled. On examination, the right index finger has fusiform swelling, a semi-flexed posture, and pain over the flexor sheath. There is also substantial dorsal and palmar hand swelling, and the thumb appears widely abducted. Passive adduction of the thumb causes significant pain. In addition to irrigation of the index finger flexor sheath, which of the following spaces requires exploration and drainage?

A) Dorsal subaponeurotic

B) Hypothenar

C) Midpalmar

D) Parona

E) Thenar

The correct response is Option E.

Deep hand space infections occur in anatomically defined spaces in the hand and include the thenar, midpalmar, hypothenar, interdigital, Parona, and dorsal subaponeurotic spaces. Infections may be a result of direct inoculation/penetrating trauma or from spread from an adjacent infection.

This patient has a thenar space infection that resulted from the proximal spread of index finger flexor tenosynovitis. The thenar space is bordered dorsally by the adductor pollicis muscle and the index and long metacarpals, palmarly by the index finger flexor tendon and palmar fascia, ulnarly by the midpalmar oblique septum, and radially by the adductor insertion and thenar muscle fascia.

The hypothenar space is not in communication with flexor sheaths and therefore would not be a likely area of adjacent spread from an index finger infection. Patients would be expected to present with swelling and tenderness along the hypothenar eminence.

Midpalmar infections can occur secondary to spread from the long, ring, or small flexor sheath infections. Patients will present with swelling of the palm and dorsal hand; involved fingers are usually flexed and if passively extended will elicit pain.

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The Parona space can become infected from an abscess that spreads proximally from the radial or ulnar bursa. Patients traditionally present with signs of flexor tenosynovitis of the thumb or small finger and swelling and tenderness in the volar wrist. There may be median nerve compression symptoms as well.

Infections of the dorsal subaponeurotic space are usually due to direct inoculation of this space. Patients will have dorsal hand swelling and erythema and may have difficulty with finger extension.

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81. The superolateral border of the popliteal fossa is formed by which of the following muscles?

A) Biceps femoris

B) Lateral head of the gastrocnemius

C) Medial head of the gastrocnemius

D) Plantaris

E) Semimembranosus

The correct response is Option A.

Because of its location and contents, the popliteal fossa remains a challenging region for both reconstructive and elective procedures. Important structures contained in the popliteal fossa include the popliteal artery, the popliteal vein (continuation of the small saphenous vein), the tibial nerve, the common peroneal nerve, the medial sural cutaneous nerve, the lateral sural cutaneous nerve, and the takeoffs of the motor branches to the medial gastrocnemius, lateral gastrocnemius, and soleus muscles.

The region is outlined by muscular borders. The medial head of the gastrocnemius muscle forms the inferomedial border and the semimembranosus muscle forms the superomedial border. The inferolateral border is formed by the lateral head of the gastrocnemius muscle and the plantaris muscle. The biceps femoris forms the superolateral border. Knowledge and familiarity with the anatomy are important for safely performing reconstructive and cosmetic procedures in this delicate region.

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82. A 30-year-old man comes to the office after sustaining an injury to the tip of the middle finger of the right hand when it got caught in a car door. On examination, the finger is well-perfused and sensation is intact. There is an approximately 90% subungual hematoma with poor adherence of the nail margins and laceration of the nail plate. Flexion and extension at the distal interphalangeal joint are intact. X-ray studies show a transverse, displaced tuft fracture of the distal phalanx. Which of the following is the most appropriate management for this patient's injury?

A) Amputation of the fingertip with total nail bed excision

B) Full-thickness nail bed grafting

C) Primary repair of the nail bed

D) Trephination of the nail plate

E) Observation

The correct response is Option C.

Given the presence of a large subungual hematoma with poor adherence and laceration of the nail plate and a displaced tuft fracture, nail plate removal and primary repair of the nail bed is the most appropriate management. The nail plate should be carefully removed, taking care to avoid further traumatizing the underlying nail bed. A Freer elevator or iris scissors with the sharp tips pointed up against the nail plate can be used. Following nail plate removal, the nail bed can be visualized using loupe magnification and examined for lacerations. Radial incisions in the eponychium at 90-degree angles can be performed to facilitate exposure of germinal matrix lacerations. Minimal (if any) debridement of the nail bed is necessary since excessive tension on the repair can cause scarring. Repair can be accomplished with fine chromic gut sutures or octyl-2-cyanoacrylate. Various measures have been described for stenting the eponychial fold, including the use of the nail plate, sterile foil, nonadherent gauze, or silicone sheeting.

Observation is not the best management strategy in this clinical scenario where there is a high likelihood of nail bed laceration.

The opinion on nail plate removal in the setting of a subungual hematoma has evolved over the past several years. Currently, many surgeons favor trephination of the nail plate even in the setting of a larger subungual hematoma if there is an intact nail margin and an adherent

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nail plate that is not broken. Trephination is not the best treatment in this scenario since the nail plate is poorly adherent and damaged, signifying an increased likelihood of underlying nail bed injury.

Full-thickness nail bed grafting would be more appropriate for germinal matrix avulsion injuries with loss of germinal matrix that cannot be closed by bipedicled advancement. In the current scenario, this would not likely be required.

Fingertip amputation with total nail bed excision would not be appropriate in the setting of a well-perfused, sensate finger and a displaced tuft fracture.

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83. A 25-year-old man presents with pain over the dorsal aspect of the forearm 4.5 cm proximal to the Lister tubercle. The pain worsens when he rows for exercise. Physical examination shows focal swelling and tenderness over the affected area, as well as crepitus with wrist and thumb extension. Which of the following is the most likely diagnosis?

A) de Quervain disease

B) Extensor carpi ulnaris tenosynovitis

C) Intersection syndrome

D) Radial tunnel syndrome

E) Wartenberg disease

The correct response is Option C.

Intersection syndrome (IS) occurs at the intersection of the extensor carpi radialis longus (ECRL) and extensor carpi radialis brevis (ECRB) muscles in the second extensor compartment (SEC) as they pass under the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) muscle bellies. IS occurs about 4 cm proximal to the Lister tubercle. There is inflammation of the SEC synovium with subsequent stenosing tenosynovitis or friction from the overlying muscle bellies, with associated pain and swelling of the APL and EPB muscle bellies that overlie the SEC in this region. IS is most commonly seen in athletes, more often in rowers or weightlifters, as well as in young patients working as manual laborers. Patients frequently have swelling 4 to 5 cm proximal to the wrist with focal tenderness, often with crepitus with thumb and wrist extension. Pain worsens with wrist flexion/extension but can also be exacerbated with active thumb motion. Ultrasound or MRI can help confirm the diagnosis but are not necessary. A thumb spica splint can help treatment, as well as activity modification and steroid injection to the SEC. Surgical management includes SEC release.

De Quervain disease is inflammation of the first extensor compartment (FEC) tendons (APL and EPB). Symptoms can be similar to IS, but IS symptoms are worse with wrist flexion/extension, while patients with de Quervain disease typically have more notable pain on the radial aspect of the wrist over the FEC. Pain in de Quervain disease typically worsens with motion of the thumb, such as lifting, twisting, or gripping. Focal swelling and tenderness are seen over the radial styloid region.

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Radial tunnel syndrome is a compression neuropathy of the posterior interosseus nerve, a branch of the radial nerve. It innervates the supinator and all extensors of the forearm except the ECRL muscle and variably the ECRB muscle. Patients typically have pain and aching at the dorsoradial forearm proximally, often starting at the lateral epicondyle and radiating distally. Maximal pain is often palpated at the radial tunnel 3 to 5 cm distal to the lateral epicondyle. Pain frequently worsens with repetitive forearm pronation and wrist and elbow extension.

Extensor carpi ulnaris (ECU) tenosynovitis is a common tendinopathy and cause of ulnar wrist pain. The ECU tendon pain occurs at the dorsoulnar wrist. Patients frequently have intermittent or constant ulnar wrist pain that worsens with wrist and forearm motion. The tendon is present at the sixth extensor compartment, and the sheath floor forms part of the triangular fibrocartilage complex, helping stabilize the distal radioulnar joint. ECU tenosynovitis can occur secondary to overuse injuries, such as repetitive motions in golfing and weightlifting. Injury secondary to abrupt twisting of the wrist can lead to an avulsion or tear of the tendon's ulnar sheath, with subsequent instability of the ECU especially with forearm motion.

Wartenberg disease is a nerve compression of the superficial branch of the radial nerve (SBRN). Patients present with pain and paresthesias of the radial aspect of the dorsal hand, with no motor deficits because this is a sensory nerve branch. The SBRN travels under the brachioradialis (BR) muscle, proximally passing between the BR and ECRL muscles into a subcutaneous position about 9 cm proximal to the radial styloid. The SBRN can become compressed between the BR and ECRL muscles in pronation where the ECRL tendon passes under the BR tendon; in supination the SBRN tends to lie between the two tendons without compression. Repetitive forearm motion such as pronosupination may elicit symptoms. Patients may report previous compression or trauma to the area. A positive Tinel sign will be at the BR-ECRL transition without tenderness at the FEC.

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84. A 24-year-old man presents with an injury to the thumb of his dominant hand that he sustained while skiing. In which of the following positions should the metacarpophalangeal joint be tested to assess for integrity of the proper ulnar collateral ligament?

	Degrees of flexion	Direction of stress
A)	-10	ulnar
B)	0	radial
C)	0	ulnar
D)	30	radial
E)	30	ulnar

The correct response is Option D.

Thumb metacarpophalangeal (MCP) collateral ligament injuries are some of the most common hand injuries, particularly in athletes, so much so that an acute ulnar collateral ligament (UCL) injury is termed a "skier's thumb." This is in contrast to a chronic attritional rupture of the UCL, which is termed a "gamekeeper's thumb."

The UCL and radial collateral ligament (RCL) include both a proper and accessory component. The UCL is injured around 10 times more commonly than the RCL. UCL injuries occur through hyperabduction and hyperextension.

The static stabilizers of the thumb MCP joint include the bony anatomy, UCL and RCL, volar plate, and dorsal capsule. Dynamic stabilizers include the extrinsic and intrinsic muscles that cross the MCP joint.

The proper collateral ligament runs about 30 degrees in a dorsal to volar direction, inserting at the base of the proximal phalanx. In contrast, the accessory collateral ligament is volar to the proper collateral ligament, inserting on the volar aspect of the proximal phalanx and volar plate at a 90-degree angle from its origin.

The proper collateral ligament is under maximal tension (and therefore provides maximal stability) with the MCP joint in 30 degrees of flexion. This is the optimal position to test its integrity. The accessory collateral ligament is in maximal tension with the joint in full extension.

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On examination, 10 to 15 degrees of radial laxity may be considered normal for an ulnar collateral ligament. Complete tears are indicated by more than 30 degrees of coronal plane deviation and greater than 15 degrees relative to the contralateral uninjured side.

Grading for UCL injuries is as follows: grade 1 demonstrates pain without laxity to stress, grade 2 shows asymmetric laxity with a firm end point, and grade 3 shows increased laxity with no clear endpoint. Grade 1 and 2 injuries may be treated with immobilization for at least 4 weeks. Grade 3 injuries, especially with a Stener lesion and avulsion fractures involving greater than 30% of the articular surface, are typically treated with surgery.

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85. A 6-month-old female infant is brought to the office because of cleft-type symbrachydactyly affecting the left hand. X-ray studies are shown. Which of the following is the most appropriate recommendation regarding a prosthesis for this patient?

A) The child currently has no functional need for a prosthesis

B) Fit the child with an activity-specific prosthesis immediately

C) Fit the child with an articulating finger prosthesis immediately

D) Schedule the child for skeletal augmentation prior to fitting for a prosthesis

E) Schedule the child for targeted muscle reinnervation prior to fitting for a prosthesis

The correct response is Option A.

In contrast to traumatically injured patients, children with upper limb differences use prosthetics more for social purposes than functional ones. This is because the prosthesis effectively covers up the sensation of the terminal limb and, in effect, interferes with the child's use of the limb. Furthermore, the prosthetic socket, by blocking sensory feedback, may limit the development of functional strategies. For this reason, the rejection rate is high and there is no functional difference seen in patients who use a prosthesis versus patients who do not use one. For children and families who choose to use a prosthesis, the key timeline for fitting is to provide a passive (not activity-specific or articulating) prosthesis when the child has obtained the ability to sit balanced, usually at 9 months of age. Children fitted after 2 years of age have an even higher rate of rejection of the prosthesis.
Skeletal augmentation is not required for this patient to be eligible for a prosthetic. Some

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children may present with nonfunctional anatomy that can be removed, although families usually choose not to. The prosthetic fitting can be performed to accommodate these parts. If the child continues to use a prosthesis, nonfunctional parts can be removed later in life to allow for more advanced prosthetic fitting.

Targeted muscle reinnervation is a surgical technique used to enhance control of myoelectric prosthetics for patients after traumatic amputation. It is not an appropriate technique for a congenital limb difference.

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86. A 24-year-old man comes to the office after sustaining a flail upper extremity injury in a motorcycle collision 4 weeks ago. A severe brachial plexus injury is suspected. Which of the following evaluations will provide the most information to plan the best reconstruction for this patient?

A) CT myelography

B) Electromyography

C) MRI

D) Nerve conduction studies

E) Ultrasonography

The correct response is Option C.

Current MRI techniques have the ability to pick up root avulsions as well as other areas of nerve discontinuity. CT myelography has been used to determine the presence or absence of nerve root avulsion, but is not useful in identifying other nerve injuries. Ultrasonography can be useful to discern peripheral nerve anatomy but is not as sensitive as MRI. Nerve conduction studies and electromyography would not be useful until at least 6 weeks after injury.

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87. Ossification of the femur begins during which of the following weeks of gestation?

A) 4

B) 8

C) 12

D) 16

E) 20

The correct response is Option B.

The femur and the clavicle are the first long bones to ossify. The femur first appears during week 4 of gestation as mesenchymal tissue. Ossification begins in the shaft of the femur during week 8 of gestation. Condyles begin to form through a secondary ossification center between weeks 33 to 36 of gestation. The femoral head is entirely cartilaginous at birth and the trochanters ossify during childhood and adolescence.

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88. A 7-year-old boy who is a soccer goalie is brought to the emergency department because of right hand pain after being struck in the hand by the ball at practice. An x-ray study is shown. Attempts at reduction are unsuccessful. If this patient undergoes surgical intervention using a volar approach, which of the following structures has the greatest iatrogenic risk for injury?

A) Collateral ligament

B) Digital nerve

C) Flexor digitorum profundus tendon

D) Lumbrical muscle

E) Volar plate

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The correct response is Option B.

This patient has a dorsal metacarpophalangeal joint dislocation of the right index finger. These dislocations are commonly complex and unable to be reduced nonoperatively. Surgical intervention has been described from both the dorsal and volar approaches.

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The volar approach seems intuitive, since the metacarpal head is easily palpable in the palm and immediately accessible. On opening the skin, however, the radial digital nerve is quite often draped or tented across the metacarpal head and is at significant risk for injury during the initial exposure of the joint dislocation. Photographs are shown. After assuring the nerve is safe, the task of extricating the volar plate from behind the metacarpal head is often a daunting task, and one must take care to protect both the nerves as well as the vulnerable cartilage surface of the metacarpal head during this maneuver.

The dorsal approach avoids the increased risk for nerve injury, and some feel that the reduction is easier and that the surgery is therefore faster. After identifying the volar plate, this structure can simply be divided down its midline, allowing the split volar plate to fall to either side of the reducing metacarpal head as it relocates into position. Although the volar plate is then inaccessible for repair, this step is not felt to be required, since stability of these injuries is usually restored following reduction with very low risk for redislocation or long-term instability in the fingers.

The volar plate and collateral ligaments are often injured in dorsal dislocations and, as such, are not at risk in the surgical approach. The lumbrical muscle and flexor digitorum profundus tendon are adjacent to volar aspect of the metacarpal proximal phalanx, but they are not distorted by the dislocation to the degree of the radial digital nerve, putting them at less risk for inadvertent injury.

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89. An 18-year-old man who is a high school football player is brought to the emergency department immediately after sustaining an injury to the small finger of his dominant right hand when tackling an opponent. Physical examination shows no lacerations. There is an area of tenderness and swelling in the distal aspect of the palm. Active flexion at the proximal interphalangeal joint of the small finger is intact. The patient demonstrates no active flexion of the distal interphalangeal joint. X-ray studies of the small finger and hand show no abnormalities. Which of the following is the most appropriate next step in management?

A) Hand therapy for the distal interphalangeal joint

B) Reconstruction of the A4 pulley

C) Repair of the flexor digitorum profundus tendon

D) Splint immobilization of the distal interphalangeal joint

E) Two-stage flexor tendon reconstruction

The correct response is Option C.

The scenario is consistent with a flexor digitorum profundus (FDP) tendon Type I avulsion with retraction of the FDP tendon into the palm. Because of the proximal retraction into the palm, the vincular blood supply to the tendon has been disrupted. These injuries are best managed with urgent surgical repair to prevent muscle-tendon unit shortening and minimize tendon nutritional compromise. The retracted tendon is usually retrieved through a proximal incision and routed back through the tendon sheath to its distal location. The tendon stump is carefully debrided in preparation for reinsertion into the distal phalanx, which is also prepared. Different techniques have been described for tendon reinsertion, including suture anchors, transosseous tunnel sutures, and pull-out sutures tied over the nail plate dorsally.

Splint immobilization of the distal interphalangeal joint is incorrect in this scenario, in which there is a flexor tendon injury requiring repair. This treatment strategy would be more appropriate for a mallet finger.

Referral to hand therapy to begin range-of-motion exercises at the distal interphalangeal joint would not be appropriate in the setting of an unrepaired flexor digitorum profundus tendon avulsion.

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Reconstruction of the A4 pulley is incorrect since the scenario presented is not consistent with a pulley rupture.

Two-stage flexor tendon reconstruction is incorrect since this is an early tendon avulsion, so prompt exploration and primary tendon repair is the best option.

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90. A 22-year-old man comes to the emergency department with a sharp injury to the lateral cord of the brachial plexus sustained during an altercation. Which of the following examination findings is most likely present in this patient?

A) Intrinsic atrophy

B) Limited wrist extension

C) Loss of shoulder abduction

D) Numbness of the ulnar digits

E) Weak elbow flexion

The correct response is Option E.

The lateral cord of the brachial plexus contributes to the musculocutaneous nerve with its continuation of the lateral antebrachial cutaneous nerve, and it provides the sensory portion of the median nerve. Therefore, injury would affect elbow flexion as well as lateral forearm and median sensory innervation.

Loss of shoulder abduction (upper trunk, posterior cord), limited wrist extension (extended upper trunk, posterior cord), and ulnar numbness and intrinsic atrophy (lower trunk, medial cord) would be seen in other patterns of brachial plexus injury.

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91. A 24-year-old man presents with a nonulcerated pustule on the pulp of the index finger of the dominant hand after sustaining a minor cut 6 months ago. Results of culture show *Mycobacterium marinum*. Which of the following was most likely used for incubation?

A) Blood agar

B) Chocolate agar

C) Löwenstein-Jensen medium

D) Lysogeny broth

E) MacConkey agar

The correct response is Option C.

Mycobacterial infections of the hand are characterized by an indolent course with frequent diagnostic and treatment delays. Mycobacteria are a group of nonmotile obligate aerobic gram-positive bacilli that do not form spores. However, they have a characteristic hydrophobic cell wall which confers many of the characteristics of these bacteria, including the ineffectiveness of many antibiotics. Specific mycobacteria include *Mycobacterium tuberculosis*, *M. leprae*, *M. marinum*, *M. abscessus*, *M. terrae*, and *M. avium intracellulare*, among others. Treatment typically involves long-term antibiotics and surgical debridement.

Diagnosis of *Mycobacterium marinum* infection is confirmed through an acid-fast (Ziehl-Neelsen) stain, since they do not stain well with regular Gram stain methods. Staining may be negative in atypical mycobacterial infections in up to 30% of cases. Cultures are performed on Löwenstein-Jensen media, but due to prolonged incubation times and their fastidious nature, cultures may be positive in only 42% of cases. Additionally, nonspecific histology findings of noncaseating granulomas or polymerase chain reaction may be helpful in diagnosis.

MacConkey agar is used for growth of gram-negative bacteria. Chocolate agar is useful for growing fastidious respiratory bacteria. Blood agar is an enriched medium for fastidious organisms such as *Streptococci*. Lysogeny broth is an enriched liquid medium for bacterial growth often used in molecular biology.

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92. When harvesting the fibula osseous flap, the pedicle is located between which of the following two muscles?

A) Extensor hallucis longus and flexor hallucis longus

B) Flexor hallucis longus and tibialis posterior

C) Peroneus brevis and extensor digitorum longus

D) Peroneus longus and flexor hallucis longus

E) Tibialis posterior and extensor digitorum longus

The correct response is Option B.

The peroneal artery and vein, which act as the vascular pedicle for the fibula osseous flap, are located between the tibialis posterior muscle and the flexor hallucis longus muscle. During dissection of the flap, care must be taken to separate the pedicle from the flexor hallucis longus to preserve great toe flexion and prevent a contracture.

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93. A 48-year-old man presents with an isolated nerve injury 4 weeks after sustaining a stab wound to the axillary region. On physical examination, he is unable to cross the index and middle fingers over one another. Surgical exploration with nerve repair is planned. Which of the following nerve transfers is most appropriate for this patient?

A) Anterior interosseous to ulnar

B) Median to the posterior interosseous

C) Musculocutaneous to anterior interosseous

D) Radial to axillary

E) Spinal accessory to suprascapular

The correct response is Option A.

This patient has sustained a high ulnar nerve injury proximal to the elbow. The primary deficits for this patient include ulnar hand sensation, as well as intrinsic hand dysfunction. In an adult, it is very challenging to restore intrinsic motor function in the setting of a high ulnar nerve injury. Options include ulnar nerve repair or reconstruction alone, although this strategy is unlikely to restore native intrinsic hand function. In this case, the best option is an anterior interosseous nerve to ulnar motor nerve transfer, which has been described and popularized during the past decades for high ulnar nerve injuries and in patients with a minimal chance of intrinsic recovery. In the scenario presented, a high ulnar nerve injury in an adult, the injury is unlikely to recover using intrinsic reconstruction with ulnar nerve repair or reconstruction alone, and a nerve transfer is the recommended strategy for this patient.

The other nerve transfers described are not used for ulnar nerve injury. The radial to axillary transfer is a well-described transfer for restoration of deltoid function and shoulder abduction, and it would not be appropriate for this patient with an ulnar nerve injury. The musculocutaneous to anterior interosseous is not a described transfer, although for patients with high median nerve injury, radial nerve branches supplying the brachialis can be used to reinnervate the anterior interosseous nerve. The spinal accessory nerve can be transferred to the suprascapular nerve to reinnervate the supraspinatous and infraspinatous muscles to help restore external rotation for patients with brachial plexus injury. Lastly, the median to posterior interosseous nerve transfer uses the median nerve to restore radial nerve function and would not be appropriate for this patient.

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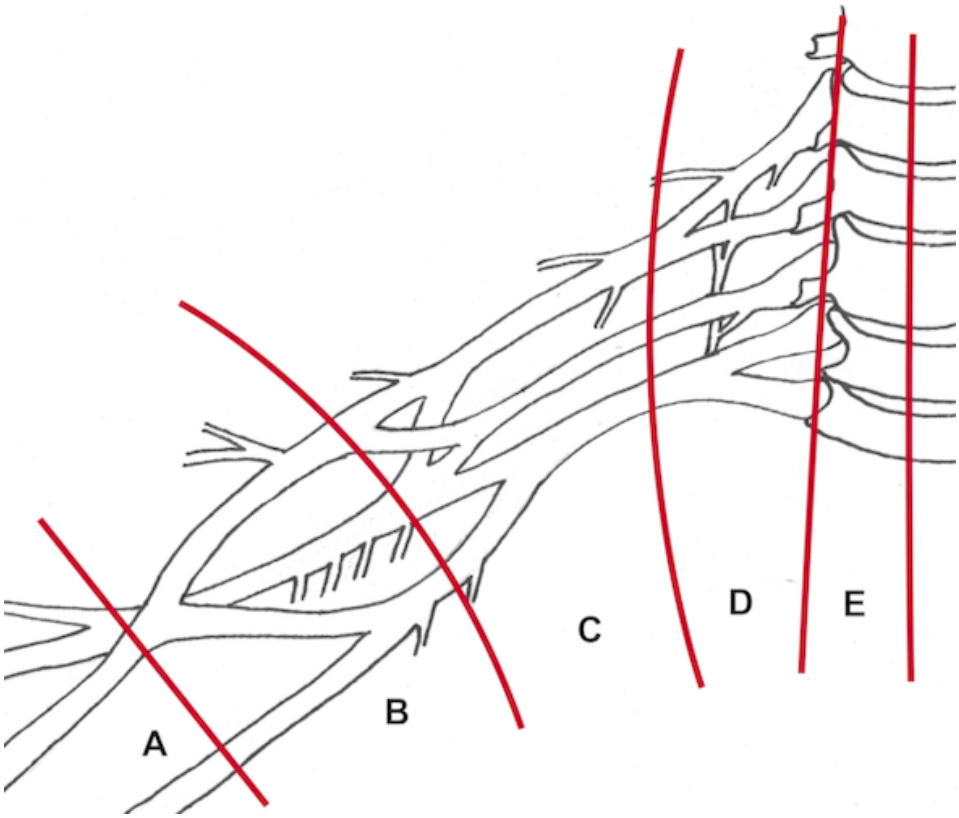
94. An 18-year-old man presents with severe weakness and sensory loss from his right shoulder to his hand. He was involved in a motorcycle collision 3 months ago. Physical examination shows scapular winging. X-ray study of the chest shows that the hemidiaphragm is raised. Electrodiagnostic study demonstrates preservation of sensory nerve action potentials. On the basis of the image shown, which of the following (A–E) is the most likely site of injury in this patient?



A)

B)

C)

D)

E)

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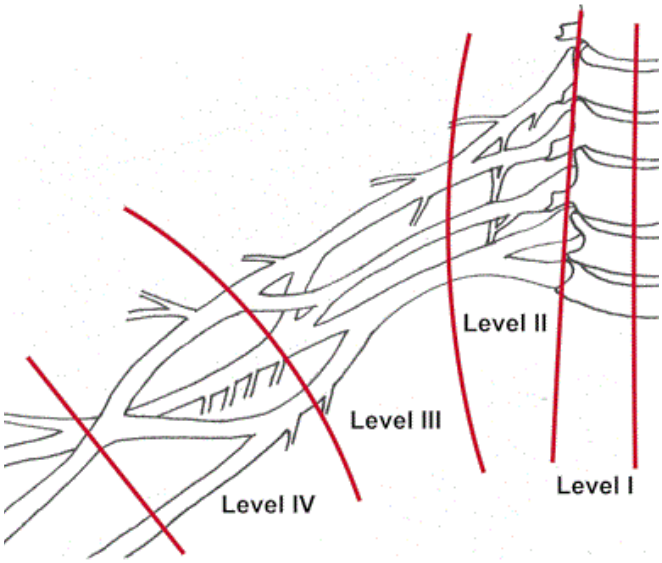

Level I Preganglionic root injury
Level II Postganglionic spinal nerve injury
Level III Pre-and retroclavicular injury (trunks and divisions injury)
Level IV infraclavicular injury (cords and terminal branches injury)

The correct response is Option E.

The ventral root (motor fibers) and dorsal root (sensory fibers) from the spinal cord converge to form each spinal nerve, which travel through the interscalene space between the anterior and middle scalene muscles. The dorsal roots carry sensory signals back to the spinal cord while the ventral roots carry motor signals to the muscles. The brachial plexus forms from the anterior primary rami of the C5-T1 spinal nerves. The brachial plexus provides motor innervation to the shoulder, including all chest muscles providing control for the glenohumeral joint, motor innervation to the upper extremity, and sensory innervation of the upper limb, except for a small area of the medial upper arm.
At the level of the anterior primary ramus, the nerve branch to the scalene muscles

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(C5-C8), the nerve branch to the longus colli muscle (C5-C8), the long thoracic nerve (C5-C7), a component of the phrenic nerve (C5 contribution), and component of the dorsal scapular nerve (C5 contribution) all arise.

Subsequent to the interscalene space, the spinal nerves converge to form the three trunks. Each trunk divides into anterior and posterior divisions under the clavicle. Below the clavicle, the anterior and posterior divisions intermix to form the cords: lateral, posterior, and medial. Their nomenclature is based on their position in relationship to the axillary artery. Intermixing the terminal branches of the cords leads to the peripheral nerves: median (from medial and lateral cords), musculocutaneous (lateral cord), ulnar (medial cord), axillary, and radial (posterior cord).

This patient has a Level I injury, which is a preganglionic root injury involving the spinal cord, rootlet, and root. Level I injuries occur in 70% of patients with brachial plexus injuries. Diaphragmatic elevation implies a C4-C5 injury at the level of the root/anterior ramus. Scapular winging implies injury at the level of the root/anterior ramus.

Sensory nerve action potentials (SNAPs) help determine whether a lesion is preganglionic or postganglionic. SNAPs will be preserved in lesions proximal to the dorsal root ganglia (DRG), which house the sensory nerve cell bodies. Sensory input from the periphery runs along sensory fibers and utilize the DRG to reach the brain, bypassing a preganglionic lesion. With preganglionic injuries, SNAPs are normal in an otherwise insensate dermatome and muscle action potentials are absent. SNAPs will be absent in a postganglionic lesion or in the combined pre- and postganglionic lesion.

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95. A 40-year-old man is brought to the emergency department after being found unconscious on the floor at home. The patient is currently alert, oriented, and answering questions appropriately. He reports using heroin the previous evening. He also reports pain in his right arm. On examination, the right forearm is tense and swollen with decreased sensation in the median innervated digits. Passive extension of the fingers causes pain. Which of the following is the most appropriate next step in management?

A) Admit the patient to the intensive care unit for serial examination

B) Obtain a CT scan to assess for gas formation

C) Obtain an electromyogram to rule out median nerve compression

D) Obtain an MRI to assess for muscle atrophy

E) Perform operative release of forearm compartments

The correct response is Option E.

This patient has compartment syndrome. He likely collapsed on his arm for an extended period of time, resulting in decreased blood flow. Once lifted off his arm, reperfusion of the upper extremity led to reperfusion injury and swelling, resulting in elevated compartment pressures. The treatment for compartment syndrome of the forearm is immediate four-compartment forearm fasciotomy release. Given that the patient already is demonstrating signs of worsening compartment syndrome, admission to the intensive care unit for serial examination puts the patient at risk for irreversible muscle damage and Volkmann contracture. Although the patient uses heroin, he has no evidence of infection on examination. If there was concern for a necrotizing infection, urgent operative debridement is the next step rather than further imaging. Electromyography will not diagnose compartment syndrome and would take too long to acquire in this urgent setting.

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96. A 56-year-old man presents for tendon grafting 3 months after undergoing silicone rod placement for flexor tendon reconstruction of multiple fingers. It is determined that at least 20 cm of tendon will be needed for grafting. Which of the following single autologous tendon donors in this patient is most likely to provide sufficient length?

A) Extensor digiti minimi

B) Extensor indicis proprius

C) Flexor digitorum longus

D) Palmaris longus

E) Plantaris

The correct response is Option E.

The plantaris tendon is the longest tendon in the human body, averaging 30 to 45 cm in length. It is present in 80% of legs. The palmaris longus, extensor digiti minimi, and extensor indicis proprius typically provide 12 to 15 cm of graft length and would be unlikely provide sufficient length individually for the need indicated. The flexor digitorum longus has been described for use in tendon grafting but typically provides less than 10 cm of length.

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97. Amelia develops primarily from an abnormality in which of the following?

A) Apical ectodermal ridge

B) Dorsal ectoderm

C) Sonic hedgehog protein

D) Ventral ectoderm

E) Zone of polarizing activity

The correct response is Option A.

Limb differences may be classified according to the Oberg-Manske-Tonkin (OMT) classification. These divide limb differences as malformations, deformations, dysplasia, and syndromes. Malformations may be of the entire limb or limited to the hand. Entire upper limb malformations may be proximodistal, radioulnar (anteroposterior), dorsoventral, or of unspecified axis. Proximodistal malformations are divided into brachymelia, symbrachydactyly spectrum, transverse deficiency, intersegmental deficiency, or whole limb duplication/triplication. Amelia is a transverse deficiency type of proximodistal entire-limb malformation.

The proximodistal axis develops through the apical ectodermal ridge. Signaling in this pathway occurs primarily via fibroblast growth factor and WNT proteins. The zone of polarizing activity is responsible for anteroposterior development, and sonic hedgehog protein is secreted from the zone of polarizing activity. Dorsal and ventral ectoderms are involved in dorsal-ventral differentiation.

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98. A 6-year-old boy is brought to the office by his parents because of Blauth Type IIIB hypoplasia of the thumb of the right hand. Which of the following procedures is the most appropriate recommendation to give this patient optimal function of the hand?

A) Ablation of the thumb and pollicization of the index finger

B) Free great toe transfer

C) Web space deepening and opponensplasty

D) Z-plasty of the web space and arthrodesis of the metacarpophalangeal joint

E) No procedure is indicated

The correct response is Option A.

Thumb hypoplasia is classified according to degree by the modified Blauth classification as follows:

- Type I – minor generalized hypoplasia
- Type II – intrinsic thenar muscles hypoplasia, first web space narrowing, and ulnar collateral ligament (UCL) insufficiency
- Type IIIa – similar to Type II, plus extrinsic muscle and tendon abnormalities with bone deficiency and stable trapeziometacarpal (TMC) joint
- Type IIIb – same as Type IIIa, except the TMC joint is unstable or missing
- Type IV – "pouce flottant" or floating thumb
- Type V – absent thumb

Reconstruction is planned according to the missing components. No treatment is generally needed for Type I. Type II usually requires opponensplasty with web space deepening and UCL stabilization. Type IIIa would necessitate extrinsic tendon transfer in addition to the procedures for Type II. Types IIIb, IV, and V are best treated with pollicization of the index finger after ablation of the residual thumb, if present.

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99. Which of the following percentages best represents the likelihood that a patient will have an extensor indicis proprius tendon present for use in a tendon transfer?

A) 30%

B) 50%

C) 75%

D) 95%

The correct response is Option D.

An extensor indicis proprius tendon transfer is frequently performed for restoration of extensor pollicis longus function when delayed presentation prevents direct repair of the extensor pollicis longus due to musculotendinous retraction. The extensor indicis proprius is an excellent donor because it is expendable (given the presence of the extensor digitorum communis tendon to the index finger), has a straight-line similar vector of pull to the extensor pollicis longus, has adequate excursion and strength, and is reliably present.

Studies have shown an overall prevalence greater than 96%, and greater than 90% prevalence in all ethnic groups studied. 92.6% of those with an extensor indicis proprius have a single slip with double and triple slips being 7.2% and 0.3%, respectively. Classically, the extensor indicis proprius is described as being found on the ulnar side of the extensor digitorum communis to the index, and this is the case in 98.3% of cases.

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100. A 72-year-old man presents with a traumatic injury to the right lower extremity sustained in a fall from standing. Physical examination shows an open fracture of the tibia with exposed bone and a 5-cm wound with no gross contamination. Initially, the lower leg is moderately cool to touch. After fracture reduction, distal pulses are palpable and angiography shows normal blood flow. Which of the following is the most appropriate Gustilo classification of this patient's injury?

A) Type I

B) Type II

C) Type IIIA

D) Type IIIB

E) Type IIIC

The correct response is Option B.

The Gustilo classification system is the most widely accepted system for characterizing open fractures of the lower extremity. Injuries are divided into three types. Type I open fractures involve soft-tissue lacerations smaller than 1 cm. Type II fractures include lacerations of 1 to 10 cm, with moderate soft-tissue damage. Type III fractures are greater than 10 cm and involve extensive soft-tissue damage. Type III fractures create difficulties with coverage of bone or hardware used in fixation.

Gustilo Type III fractures can be further subdivided into A, B, and C subtypes. In Type IIIA fractures, there is still sufficient soft tissue to provide for bony coverage. Type IIIB fractures involve periosteal stripping and extensive tissue damage, where local soft-tissue coverage is not possible. These typically arise from high-energy mechanisms, such as high-velocity gunshot or shotgun wounds, or significant crush injuries. Type IIIB fractures are the most common injuries for which plastic surgeons are consulted. Type IIIC fractures include vascular injuries that require repair. The presence of a vascular injury significantly increases the probability of amputation.

In this case, the open fracture with a 5-cm wound is a Gustilo Type II injury. If there was vascular trauma requiring repair, the injury would be considered Type IIIC, but the examination and angiography show normal blood flow in this case.

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Section 3: Craniomaxillofacial

101. A 45-year-old man comes to the emergency department because of new-onset left-sided facial weakness. Two days ago, the patient fell on the left side of his head. He sustained a 3-cm laceration of the left medial cheek near the nose that was repaired. After repair of the laceration, he had full facial (VII) nerve function. On examination today, the patient has normal facial symmetry at rest. When he is asked to animate, there is diminished function of all branches of the left facial nerve. CT scan of the head shows a transverse fracture of the petrous portion of the left temporal bone. Which of the following is the most appropriate next step in management?

A) Administration of high-dose corticosteroids and observation

B) Cross-facial nerve grafting using the sural nerve

C) Decompression of the facial nerve through a transmastoid approach

D) Immediate facial nerve exploration through the repaired laceration

E) Initiation of a 2- to 4-week course of ceftriaxone and observation

The correct response is Option A.

The patient is presenting with a delayed onset of left facial nerve palsy after a fall from elevation with associated medial cheek laceration and ipsilateral temporal bone fracture. His facial nerve palsy is not complete paralysis but rather moderate to severe with a House-Brackmann Grade of at least IV. The facial nerve injury is likely proximal due to symptoms of all thirds of the face and therefore associated with the temporal bone fracture. The medial cheek laceration is unlikely to be related, and exploration would risk further injury. The facial nerve travels through the petrous portion of the temporal bone before exiting the stylomastoid foramen and can be affected in 7 to 10% of temporal bone fractures. Within this subset, 38 to 50% of cases are associated with transverse fractures. Surgical exploration may be indicated in the setting of immediate complete paralysis, either through a middle cranial fossa and transmastoid approach, or a translabyrinthine approach, depending on the hearing function of the ear. Delayed paralysis or incomplete paresis should be treated conservatively with high-dose corticosteroids with anticipated good prognosis for recovery. Intravenous antibiotics

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would not be appropriate since the patient's facial nerve palsy is unlikely to be associated with Lyme disease. Cross-facial nerve grafting is reserved for settings where primary neurorrhaphy or interpositional nerve grafting are not feasible or have failed.

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102. A 6-year-old boy with right congenital corneal anesthesia and a history of multiple corneal abrasions and ulcerations is scheduled to undergo donor sural nerve grafting. Which of the following graft targets is most likely to provide the greatest improvement in corneal sensation?

A) Left supraorbital nerve to right corneal nerve

B) Left supraorbital nerve to right supraorbital nerve

C) Left supratrochlear nerve to right scleral limbus

D) Right frontal branch of facial (VII) nerve to right supratrochlear nerve

E) Right infraorbital nerve to right corneal nerve

The correct response is Option C.

The ipsilateral, supraorbital, and supratrochlear nerves provide sensation to the cornea. There are many causes for insensate cornea, including congenital and acquired conditions. Herpes infection is one of the leading causes. Chronic ulceration and injury can lead to corneal scarring that can lead to blindness. Corneal sensation is critical for protection of the cornea and sight. Reinnervation of the cornea may be possible with donor nerve grafts from the contralateral side to the sclera at the limbus. The fascicles can be divided and the individual fascicles distributed in a subconjunctival fashion to be sutures to the sclera at the edge of the cornea. Use of the ipsilateral, trochlear, or supraorbital nerve is not expected to regain innervation since these nerves themselves are involved. The infraorbital nerve and frontal branch do not provide sensation to the cornea.

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103. Which of the following factors is most predictive of a successful outcome when neonatal ear molding is used to correct congenital ear abnormalities?

A) Breastfeeding status of the mother

B) Duration of therapy

C) Hearing status

D) Type of ear anomaly

The correct response is Option D.

Neonatal ear molding has proven to be an effective nonsurgical treatment for congenital ear deformities. Circulating maternal estrogens lead to plasticity of the auricular cartilage, allowing molding and maintenance of shape changes. The average treatment duration is about 4 weeks.

When outcomes have been reviewed, the only factor that demonstrates significance in treatment success is the type of ear anomaly. Deformations such as Stahl ear deformity and lop ear deformity have high treatment success rates, and deformations such as constricted ear deformity have much lower success rates.

Age at initiation of therapy correlates with the need for additional length of treatment but not successful outcome. Duration of therapy is also not an independent predictor of success. The hearing status of the ear has no correlation with outcome, nor does the breastfeeding status of the mother.

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104. A 10-month-old male infant undergoes bilateral cleft palate repair using the two-flap palatoplasty with Z-plasty technique. His parents have expressed a goal of only having one palate surgery. The cleft is very wide, but the plastic surgeon achieves a satisfactory tension-free nasal lining repair. The oral closure is tenuous in the area of the hard-soft palate junction overlying the nasal lining transition. Which of the following is the most appropriate next step to achieve tension-free, watertight oral lining closure?

A) Fracture the hamulus

B) Mobilize and divide the greater palatine artery

C) Use a buccal myomucosal flap

D) Use a posterior pharyngeal flap

E) Use a tongue flap

The correct response is Option C.

The majority of cleft palates can be closed primarily in a tension-free manner. Mobilization of the periosteal flaps, freeing of the greater palatine artery, and relaxing incisions all aid in advancing the flaps medially for a tension-free oral closure after a tension-free nasal lining closure. Tension-free two-layer closure is the preferred method to reduce fistulas. In the event that the oral lining layer closure is tenuous, particularly overlying the transition zone of the soft and hard palate nasal lining, the cleft surgeon must consider the best options for a reliable closure. The buccal myomucosal flap has increased in popularity for the purpose of fortifying the hard-soft junction, for fistula closure, and for palatal lengthening. A posterior pharyngeal flap would not be appropriate at this age for primary palate closure and would not fortify the hard-soft junction. A tongue flap for fistulas is generally reserved for older children. The parents expressed a desire for one surgery; a tongue flap is a two-step surgery. Additionally, the child would not be able to bottle-feed after a tongue flap, so this is not an appropriate choice for this patient. Fracturing the hamulus is not expected to achieve added mobilization for a tension-free closure. The greater palatine artery is the only blood supply to the flap, and division would lead to necrosis and potentially a large fistula.

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105. A 6-year-old boy is brought to the emergency department with pain and malocclusion 1 hour after an unwitnessed fall from his bicycle. Physical examination shows a 1.5-cm laceration in the submental region and a deviation of the chin to the right with a left-sided posterior open bite. Which of the following is the most likely fracture pattern in this patient?

A) Bilateral condylar head fractures

B) Left angle fracture and symphyseal fracture

C) Left condylar neck fracture and right body fracture

D) Right condylar neck fracture and left parasymphyseal fracture

The correct response is Option D.

For a pediatric patient presenting with an unwitnessed fall, physical examination may provide ample information to establish the diagnosis of a mandible fracture. In this case, the patient presents with chin deviation toward the right side and a left posterior open bite. A right-sided condylar neck fracture will result in loss of height of the right ramus and premature contact of the right dentition. A right-sided crossbite and a left posterior open bite are also noted in this scenario. The other fracture patterns are not associated with loss of ramus height on the right side.

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106. A 25-year-old Asian man comes to the office for consultation regarding angle of jaw fullness. The patient reports no history of temporomandibular joint conditions, dental disease, or bruxism. Injection of 30 units of botulinum toxin type A is administered. On follow-up examination 3 weeks later, the patient reports an asymmetric smile. Unintentional diffusion of botulinum toxin into which of the following structures is most likely responsible for the asymmetry?

A) Masseter muscle

B) Orbicularis oris muscle

C) Parotid gland

D) Risorius muscle

E) Temporalis muscle

The correct response is Option D.

Masseter hypertrophy is a common benign condition seen in the Asian population. It is often also associated with aging and bruxism. Botulinum neurotoxin injections for masseter hypertrophy, while an off-label use, were reported as early as 1994. Complications are infrequent and include: local swelling, bruising, asymmetry, worsening jowling, paradoxical bulging, temporomandibular joint abnormalities, xerostomia, neurapraxia, and changes in facial expression.

The incidence rates for changes in facial expression vary between 1 to 27% after botulinum injection for masseter hypertrophy. This change is usually noted at 2 to 4 weeks' post injection and is thought to be caused by local muscle diffusion. A cadaver study found that the risorius muscle attaches to the anterior or middle part of the masseter muscle in greater than 95% of individuals and is thought to be the most likely cause due to its variability in location, and thus more challenging to prevent. Of the options listed, it is the best anatomic choice. A parotid diffusion is more likely to result in xerostomia, not facial asymmetry. Temporalis paralysis would result in weakened bite, not facial asymmetry. Orbicularis oris weakness would result in diminished pursing of the lips.

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107. Compared with adults, management of isolated condylar fractures in children in primary dentition is most likely to require which of the following?

A) Condylectomy

B) Nonoperative management

C) Open reduction and internal fixation using an endoscopic approach

D) Open reduction and internal fixation using a preauricular approach

E) Open reduction and internal fixation using a retroparotid approach

The correct response is Option B.

Nonoperative management for condylar fractures has demonstrated high success for healing and reducing ankylosis with better long-term growth compared with operative management for most fractures in children in primary dentition. For adults, operative management is more likely to be indicated with open reduction and internal fixation or maxillomandibular fixation depending on the fracture. Condylectomy is not a first-line treatment for condylar fracture for either children or adults.

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108. When evaluating a patient with velopharyngeal dysfunction, which of the following studies is most helpful for analysis of lateral pharyngeal wall motion?

A) Lateral view videofluoroscopy

B) Nasometry

C) Nasopharyngeal endoscopy

D) Speech analysis

E) Static MRI

The correct response is Option C.

Nasopharyngeal endoscopy is performed under the guidance of a speech pathologist; it allows for examination of the anatomy and function of the entire vocal tract, including the soft palate, pharyngeal walls, and posterior pharynx during speech production.

Comprehensive speech analysis is usually the first step in assessing speech and diagnosing velopharyngeal dysfunction but it does not analyze wall motion. Nasometry provides measurements of the modulation of the velopharyngeal opening area, but it does not identify the gap location. Lateral view videofluoroscopy helps analyze soft palate mobility. Static MRI allows for visualization of all velopharyngeal structures, but it does not assess function.

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109. An 18-month-old female infant is evaluated because of oral asymmetry. A photograph is shown. This patient's oral soft-tissue deficiency is best classified as which of the following Tessier cleft types?

A) No. 4

B) No. 5

C) No. 6

D) No. 7

E) No. 8

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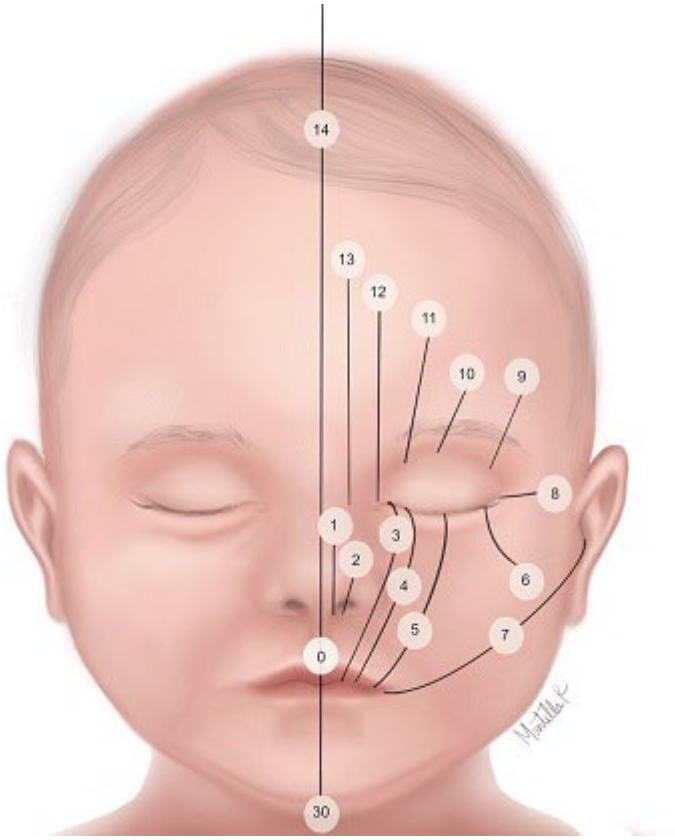

The correct response is Option D.

The Tessier classification provides a useful framework for defining rare soft tissue (shown in the illustration) and bony clefts of the face and craniofacial skeleton. Of these rare clefts, the Tessier No. 7 cleft is one of the more common and is often associated with craniofacial microsomia. Embryologically, it arises from failed fusion of the mandibular and maxillary prominences of the first branchial arch. The resultant soft-tissue defect can be quite variable, ranging from a subtle disruption of the oral commissure to a large open facial cleft extending from the oral cavity, across the cheek, and into the temporal region. Repair of the defect shown requires a multi-layered repair of the intraoral and commissure mucosa, all of the affected perioral musculature (especially the separated orbicularis oris muscle to establish oral continence), and the skin. Tessier No. 4 and No. 5 clefts extend from the upper lip to the lower eyelid, while the Tessier No. 6 cleft extends from the lateral lower eyelid into the ipsilateral cheek. Tessier No. 8 is a transverse cleft arising from the lateral canthal region.

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110. A 3-month-old male infant is evaluated because of a midline congenital nasal mass. To determine the diagnosis and most appropriate management, which of the following imaging modalities would be most helpful in detecting associated brain abnormalities?

A) CT scan

B) Lateral cephalography

C) MRI

D) Skull x-ray study series

E) Ultrasonography

The correct response is Option C.

Midline congenital skull masses are most commonly dermoid cysts, encephaloceles, or gliomas.

To plan surgical resection of these masses, imaging is required to delineate diagnosis and extension. Concerns include intracranial extension through a patent skull base as well as associated intracranial anomalies.

Skull x-ray study series, ultrasonography, and lateral cephalography would not provide the detail needed to exclude intracranial extension or associated brain abnormalities. CT scanning is a useful adjunct in surgical planning and diagnosis of these patients, providing bony detail above and beyond what is possible with MRI.

However, for the most accurate diagnosis of structural brain abnormalities, MRI is the imaging modality of choice.

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111. A 12-year-old boy presents for evaluation after facial injury. His mother reports that he was involved in a mountain bike accident 2 months ago in which he sustained road rash and facial lacerations that were repaired in the emergency department. He experienced episodes of cellulitis accompanied by drainage from the sites of the repaired lacerations that did not improve with penicillin-based antibiotic therapy. CT scan without contrast disclosed retained foreign body in the subcutaneous tissue of the left cheek. The patient was then placed on cephalosporin without improvement. Which of the following is the most appropriate next step in management?

A) Addition of broad-spectrum antibiotics

B) Expectant management

C) Repeat CT scan with contrast

D) Surgical exploration

The correct response is Option D.

CT scan with contrast will not provide any form of "treatment." Additional imaging may help with diagnostic factors, but given the patient's age and prior CT imaging results, exposure to additional radiation will not provide any therapeutic benefits. Watchful waiting is not indicated since the wound continues to worsen with the findings of debris and failure to respond to antibiotics. Broad-spectrum antibiotics would not be superior to surgical exploration for the most appropriate next step, since two trials of antibiotics have failed and the patient has no history of MRSA infection. Due to the foreign body present in the CT findings, it is likely that there are additional retained debris in the wound. Therefore, as stated in the supportive literature, wound exploration with washout and reapproximation is the most appropriate next step to treat this patient.

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112. A 2-year-old girl presents to the clinic preoperatively with an unrepaired cleft palate. The patient is meeting developmental milestones. Compared with a similar patient undergoing surgery at 1 year of age, this patient has an increased risk for which of the following?

A) Feeding difficulty

B) Fistula formation

C) Maxillary growth restriction

D) Postoperative airway complications

E) Velopharyngeal insufficiency

The correct response is Option E.

Age at palatoplasty is an important consideration in the comprehensive care of the patient with a cleft palate. While multiple factors are at play, including the overall health of the infant and comorbid conditions, the primary balance is between maxillary growth and speech outcomes.

Earlier repair is associated with increased risk for maxillary growth disturbance. Later repair (beyond approximately 18 months of age) has been associated with worse speech outcomes and a higher risk for velopharyngeal insufficiency, leading to higher rates of secondary speech surgery.

Age at repair is independent of fistula formation risk. Older age at repair is also not associated with increased airway complications nor with feeding difficulties.

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113. Which of the following best describes the order of permanent teeth eruption?

A) Lower premolar, upper incisor, upper canine, upper first molar

B) Upper canine, upper incisor, lower premolar, upper first molar

C) Upper first molar, upper incisor, lower premolar, upper canine

D) Upper first molar, upper incisor, upper canine, lower premolar

E) Upper incisor, upper canine, lower premolar, upper first molar

The correct response is Option C.

Mandibular incisors and canines erupt earlier than their maxillary counterparts. The first molar appears before the premolar and canine. The permanent canines are one of the last permanent teeth to erupt.

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114. A 6-month-old female infant with holoprosencephaly is brought by her parents to the clinic for follow-up. The patient has no history of seizures, and she has demonstrated successful weight gain and good oral intake. A photograph is shown. The patient's parents desire closure of the lip defect when appropriate. Which of the following treatments is most likely to result in the best outcome with minimal risk?

A) Closure with an Abbe flap

B) Closure with an Estlander flap

C) Closure with a Karapandzic flap

D) Primary lip adhesion

E) Single-stage local tissue arrangement

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The correct response is Option E.

Treatment of children with a midline facial cleft is challenging because the plastic surgeon must balance the safety of the procedure with the family's desire for treatment. Many of the children have severe brain deformities; due to seizures and metabolic issues, they are never surgical candidates and expire within the first year of life. A subset, now larger than previously recognized, do reasonably well and by 12 months of age are suitable surgical candidates. Because of their comorbidities, the plastic surgeon's planning must optimize seizure control, airway protection, and nutrition. The goal is to achieve three-dimensional closure of the lip and nasal defect while minimizing the number of procedures and anesthesia risk.

Of the options listed, lip adhesion and Karapandzic flap only address the lip and not the columella. The Abbe flap addresses the columella but necessitates two operations and, due to the decreased intraoral opening between the two procedures, increases airway and feeding risk. The three-in-one procedure as described by Zwahlen et al gets everything adequately closed in a single stage. An Abbe flap can always be performed later if warranted and if the child survives long enough to need it. While these deformities are rare, the need for a plastic surgeon to reconstruct these three-dimensional defects in this area is not. An Estlander flap is incorrect, as it is similar to a Karapandzic flap in that it does not address the nasal (columellar) defect.

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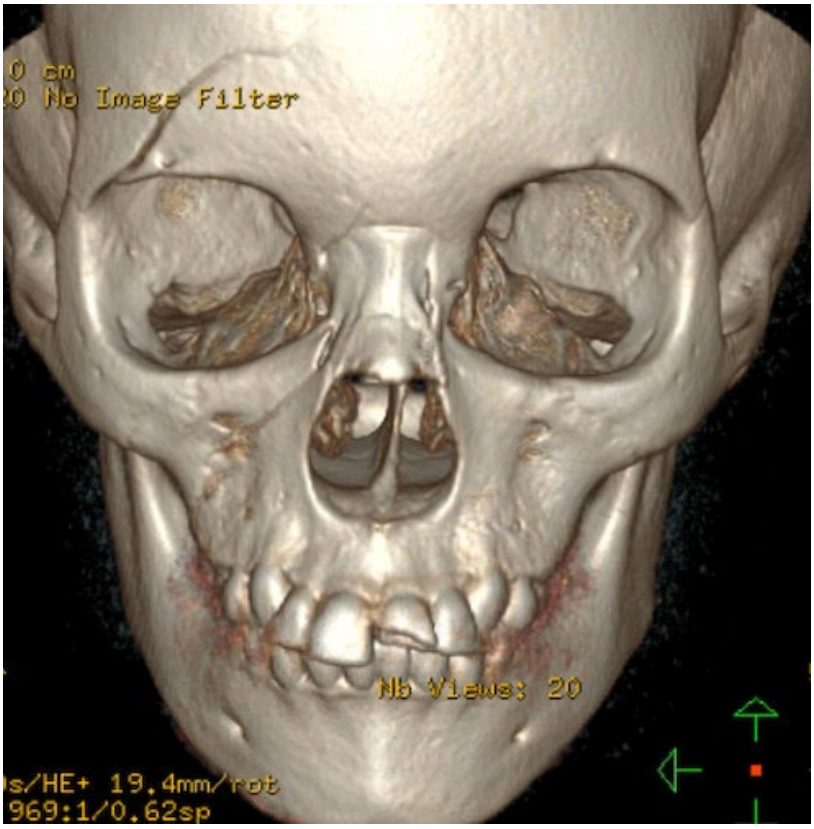

115. A 7-year-old girl is brought to the emergency department following a motor vehicle collision. The CT scan shown demonstrates fractures of the right orbital roof, inferior orbital rim, nasal bone, and left naso-orbital-ethmoid segment. There is no laxity of the medial canthal tendon with lateral traction on the upper eyelid (negative bowstring test). Surgical treatment is most strongly indicated for which of the following fractures?

A) Frontal bone

B) Inferior orbital rim

C) Nasal

D) Naso-orbital-ethmoid

E) None; surgery is not indicated

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The correct response is Option E.

Serious facial trauma in the pediatric population is uncommon, and the need for operative intervention is rare. Very young patients, like the 7-year-old in this scenario, heal quickly, and subsequent facial growth lends to rapid bone remodeling. Consequently, the requirement of anatomic or near anatomic reduction of all bony fractures is far less stringent than in adults, who have very limited bone remodeling potential. Moreover, surgical intervention, especially through open incisions and with the application of fixation, risks altering normal facial growth and should be reserved for injuries with significant bone displacement. All of these fractures are minimally displaced, and, in light of the patient's age, surgical intervention is not indicated.

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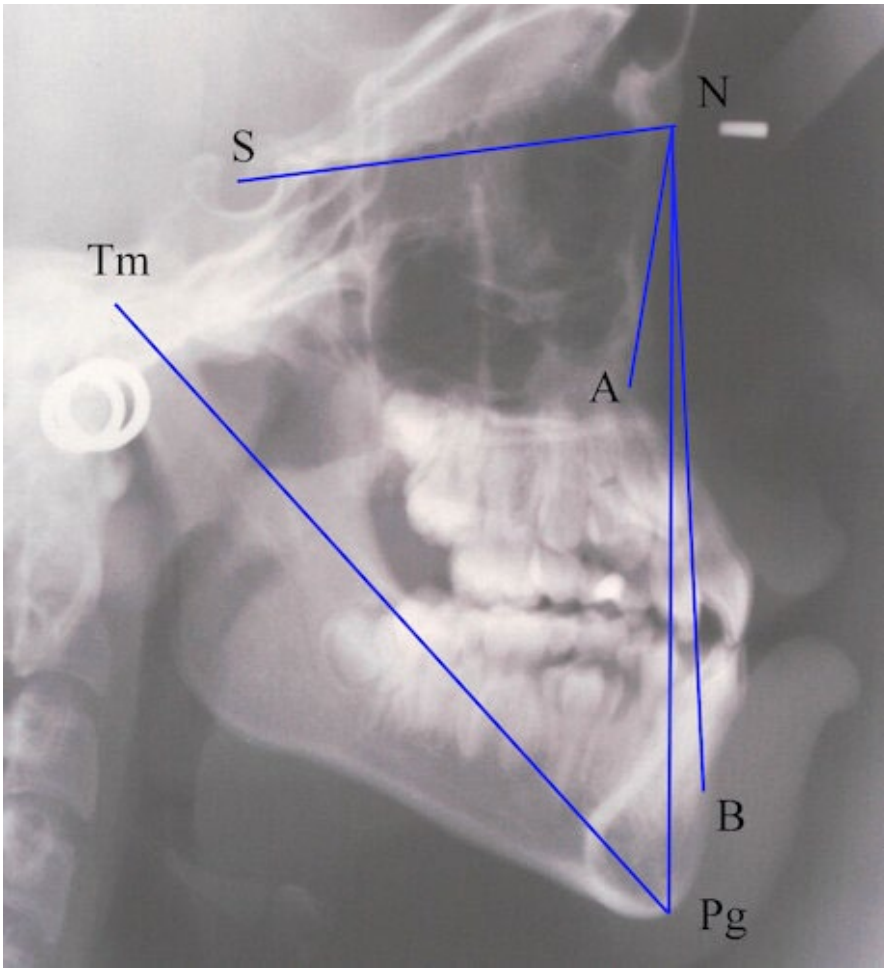

116. The lateral cephalogram shown has a normal SNB angle of 80 degrees. These cephalometric findings are most consistent with which of the following?

A) Angle class II malocclusion

B) Mandibular prognathia

C) Maxillary retrusion

D) Overjet

E) Vertical maxillary excess

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The correct response is Option C.

SNA, SNB, and ANB are standard measures taken on a lateral cephalogram to assess the absolute and comparative position of the mid face (point A, maxilla) and the lower jaw (point B, mandible) relative to the cranial base (SN, sella-nasion). The normal values for and relationship of these angular measurements are well-established and can vary with age, ethnicity, and other patient variables. In this cephalogram, SNB is given as normal and, thus, the mandibular position is not prognathic by definition. SNA is normally 2 to 3 degrees greater than SNB, but in this image, it is considerably less than SNB (negative ANB), indicating significant midfacial retrusion.

Overjet describes the relationship of the incisors wherein the top central incisors are anterior to the lower incisors in the sagittal plane; this is not seen in this image. The patient's incisors are positioned edge-to-edge or at slightly negative overjet. Class II malocclusion is defined by the relationship of the maxillary and mandibular first molars, ie, the mesiobuccal cusp of the maxillary first molar rests anterior to the buccal grove of the first mandibular molar in occlusion. This relationship is not found in this image. Lastly, vertical maxillary excess, also called long face syndrome, is excess vertical maxillary length. These patients often present with a gummy smile and an under-projected (recessed) chin point due to autorotation of the mandible. The maxilla in this patient is vertically undergrown.

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117. Which of the following options is most common as a cause of temporomandibular joint ankylosis in children?

A) Congenital

B) Infectious

C) Neoplastic

D) Radiation-induced

E) Rheumatic

The correct response is Option A.

Temporomandibular joint ankylosis is a rare pediatric diagnosis with symptoms including trismus, decreased interincisal opening, and pain with forced excursion. Congenital causes represent about one-third of cases and are often syndromic in nature.

The other choices are also acquired causes of temporomandibular joint dysfunction but are much less common than congenital ankylosis:

- Rheumatic: 3%
- Radiation-induced: 3%
- Infectious: 18%
- Neoplastic: 5%

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118. A 44-year-old woman is evaluated because of pain and clicking anterior to the tragus with mouth opening. In the more common form of internal derangement of the temporomandibular joint, the disc is most often located in which of the following positions?

A) Anterior and medial

B) Inferior and lateral

C) Posterior and lateral

D) Posterior and medial

E) Superior and medial

The correct response is Option A.

The most common position of the disc with internal derangement is anterior and medial relative to the condyle in the closed position. During attempted opening, the condyle translates forward and passes over the thickened posterior band of the disc, often creating a clicking noise. During closure, the condyle slips posteriorly and rests on the retrodiscal tissues, with the disc returning to the anterior, medially displaced position.

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119. When planning a mandibular reconstruction with a free fibula flap, the use of computer-aided design/manufacturing (CAD/CAM) is more advantageous than conventional surgical planning because of a decrease in which of the following?

A) Flap loss

B) Hardware failure rate

C) Ischemia time

D) Orocutaneous fistula rate

E) Overall cost

The correct response is Option C.

The only option that has been demonstrated to be statistically significant is ischemia time. All of the other options have not shown differences between the two approaches, with cost shown to be higher for computer-aided design/manufacturing in some studies.

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120. A 45-year-old woman presents with a nasal defect after undergoing Mohs micrographic resection of a recurrent basal cell carcinoma. One year ago, the patient underwent a smaller excision of a basal cell carcinoma in the same area, followed by single-stage reconstruction with a flap from the ipsilateral cheek. Examination shows a transmural defect extending into the nasal cavity. A photograph is shown. Reconstruction of the nasal lining using an interpolated septal flap is planned, along with autologous cartilage grafting to provide structural support. Which of the following is the most appropriate technique for cutaneous reconstruction in this patient?

A) Cervicofacial rotation advancement flap

B) Full-thickness skin graft

C) Ipsilateral interpolated nasolabial flap

D) Paramedian forehead flap

E) “Waltzing” tubed flap

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The correct response is Option D.

The patient has a full-thickness nasal defect in which a vascularized flap is used for nasal lining with overlying cartilage grafting. Cutaneous reconstruction will also require a vascularized flap as opposed to a graft due to the cartilage grafting. Given the size and location of the defect, an interpolated option would be best to preserve the alar facial sulcus, which would otherwise be obliterated by a cervicofacial rotation advancement flap or other adjacent tissue transfers. In the setting of a prior reconstruction with an ipsilateral cheek flap, it would be better to avoid an interpolated ipsilateral cheek flap, since the vascularity may be compromised. Although tubed flaps can be "waltzed" from distant sites to the nose, a paramedian forehead flap is the best option since it can be performed in the fewest number of stages.

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121. A 1-week-old female newborn who was born at term is evaluated because of respiratory distress. She has had apneic episodes and low oxygen saturation during sleep, which improves in the prone position. She also has had difficulty with weight gain. Which of the following is the most likely finding on physical examination?

A) Cleft palate

B) Eye colobomas

C) Low-set ears

D) Lower lip pits

E) Small tongue

The correct response is Option A.

The patient in the scenario described presents with airway obstruction that improves in prone position and poor weight gain. These findings are likely associated with Pierre Robin sequence, which includes micrognathia, glossoptosis, and airway compromise. Its incidence is around 1 in 10,000, and cleft palate is observed in approximately 80% of these patients. Lower lip pits are seen in Van der Woude syndrome. Small tongue, colobomas, and low-set ears can be associated with multiple syndromes, but they are not associated with Pierre Robin sequence.

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122. A 26-year-old woman is brought to the emergency department after sustaining injuries in a high-speed motor vehicle collision. Physical examination shows abnormal nasal bridge projection and telecanthus. This patient most likely has which of the following types of fracture?

A) Frontal bone

B) Le Fort III

C) Naso-orbital-ethmoid

D) Orbital floor

E) Zygomaticomaxillary complex

The correct response is Option C.

The deformity in the scenario described is commonly seen in naso-orbital-ethmoid fractures due to lateral displacement of the medial canthal tendon or central segment.

Patients with zygomaticomaxillary complex fractures present with malar flattening, lateral canthus malposition, and enophthalmos. Frontal bone fractures may be associated with forehead deformity. Patients with Le Fort III fractures present with hooding of the eyes, increased facial length, malocclusion, and enophthalmos. Orbital floor fractures are associated with enophthalmos and potential entrapment.

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123. Which of the following structures is formed from the same branchial arch as the levator veli palatini muscle of the soft palate?

A) Inferior parathyroid gland

B) Lesser horn of the hyoid bone

C) Maxillary artery

D) Styloid process

E) Superior laryngeal nerve

The correct response is Option E.

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

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

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

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

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

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124. A 23-year-old man presents with progressive left hemifacial atrophy that has been stable for the past 2 years. Physical examination shows deficiency of subcutaneous fat in the left mid face and the mandibular angle extending toward the menton region. Occlusion is normal, and smile is symmetric. Compared with single-stage structural fat grafting, which of the following is an advantage of reconstruction with a free adipofascial parascapular flap?

A) Decreased donor site morbidity

B) Decreased scar burden

C) Increased retained volume of transfer

D) Less operative time to achieve optimal results

The correct response is Option C.

Free adipofascial transfer with a parascapular flap has been popularized for the treatment of hemifacial atrophy. Recently, serial fat grafting has gained in prominence as an alternative to free tissue transfer. Compared with single-stage fat grafting, free flap reconstruction requires larger incisions and results in a larger scar burden, requires more total operative time, has significant donor site morbidity, and results in a higher volume transfer, often requiring revision liposuction/recontouring procedures.

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125. A 6-year-old girl is brought to the clinic by her mother for follow-up 2 weeks after undergoing posterior pharyngeal flap surgery for velopharyngeal insufficiency. Intraoral examination shows a hole in the palate at the insertion point of the posterior pharyngeal flap. Velopharyngeal insufficiency is noted, and the posterior pharyngeal flap is not visible. Which of the following is the most appropriate next step in management for this patient?

A) Closure with a buccal mucosal flap in 2 weeks

B) Immediate placement of an obturator

C) Referral for speech and swallow consultation

D) Observation

The correct response is Option D.

Observation and a soft diet is the most appropriate initial treatment. A speech and swallow consultation will not treat the anatomical defect that has occurred. Immediate placement of an obturator will create more stress on the acutely repaired palate. Buccal mucosal flap would not be the first-line treatment since the incident occurred acutely.

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126. A 30-year-old woman is referred by her dermatologist for evaluation of scar alopecia after undergoing excision of a nevus over the right eyebrow. Examination shows absence of one-third of the right eyebrow hair. The patient undergoes single-follicle hair transplantation to reconstruct the eyebrow. Preoperative and postoperative photographs are shown. Four weeks later, the patient returns to the clinic because all of the transplanted hair has fallen out. Which of the following is the most likely cause of this patient's hair loss?

A) Acute transplant rejection

B) Hair follicle shedding prior to regrowth

C) Inappropriate revascularization of scar tissue

D) Noncompliance with postoperative instructions

E) Postoperative cellulitis

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The correct response is Option B.

Single-unit hair follicle transplantation is a successful method of eyebrow reconstruction. Eyebrow hair generally grows as a single follicle, and therefore hair transplantation with single follicle replaces like with like. Burned skin and radiated skin have decreased blood supply, and therefore revascularization of the hair follicle is challenging. In these cases, vascularized hair flaps may be preferred. In simple scars, the take for hair transplantation is reasonable. Once the hair is transplanted, the hair will enter the telogen phase (resting) and then the exogen phase (shedding) before entering the anagen phase (regrowth). The hairs will shed and then regrow in the next several months.

Infection to the face is rare from a clean and sterile surgery, since the face is very vascular. Loss of hair to infection is very rare. Repeat hair transplantation may be required to improve density, but generally there is take at each hair transplantation event. Many women also use a brow pencil to improve the appearance of density.

Postoperative care is important to avoid trauma to the fragile hairs or avoid pressure to the site so they do not evacuate from their implantation sites. Assigning blame to the patient may harm the physician-patient relationship. Rejection does not occur with autologous transplants.

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127. A 5-month-old male infant is referred by neurosurgery for evaluation of a craniofacial dermoid cyst. Which of the following anatomic sites of a dermoid cyst is associated with the highest risk for intracranial extension?

A) Anterior fontanelle

B) Lateral brow

C) Lateral occiput

D) Medial canthus

E) Nasal tip

The correct response is Option A.

Dermoid cysts are a common congenital tumor of the head and neck. Imaging is often considered when evaluating these lesions. Based on a recent review of the literature, lesions located at the anterior fontanelle have the highest incidence of intracranial extension at 36.8%. Lateral brow, medial canthal, nasal tip, and occipital lesions were noted to have intracranial extension rates of 0.3%, 0%, 11.5%, and 16.3% respectively. Overland et al recommend imaging for any lesion located in the occipital, frontal, temporal, and midline nasal areas.

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128. A 6-year-old boy is evaluated because of a scalp lesion. The lesion was present at birth and has not changed in character or appearance. A photograph is shown. The boy's parents were told by their pediatrician that this lesion could become malignant. This patient has the highest risk for which of the following malignant tumors?

A) Basal cell carcinoma

B) Malignant melanoma

C) Merkel cell tumor

D) Pleomorphic dermal sarcoma

E) Squamous cell carcinoma

The correct response is Option A.

This is a nevus sebaceus (of Jadassohn), also known as an organoid nevus, a congenital malformation that arises from the pilosebaceous follicular units. It most commonly occurs in

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the scalp where it almost invariably presents as a flat, discolored plaque-like lesion with overlying alopecia. Over time, these lesions can thicken and transform into various benign tumors and malignant tumors. Benign tumors include syringocystadenoma papilliferum, trichoadenoma, and trichoblastoma, while the most common malignant tumor is basal cell carcinoma, followed a distant second by squamous cell carcinoma. While conventional wisdom once placed the rate of malignant transformation at 10 to 15%, current evidence suggests that the rate is significantly lower, especially in the pediatric population. Isolated nevus sebaceus should not be confused with nevus sebaceus syndrome, which is when a nevus sebaceus presents along with a more complex constellation of physical findings.

Malignant melanoma, pleomorphic dermal sarcoma, and Merkel cell tumor do not arise from nevus sebaceus.

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129. A 25-year-old man with a unilateral cleft lip and palate is scheduled to undergo placement of a dental implant in the region of the cleft alveolus to address a missing lateral incisor. Sixteen years ago, bone grafting was performed in mixed dentition. On examination today, the alveolar height is deficient when compared with the piriform height. Which of the following is the most appropriate next step in management?

A) Avoid any further surgery in the area

B) Perform maxillary distraction

C) Perform revision bone grafting

D) Place a bonded denture

E) Place a dental implant

The correct response is Option C.

Dental implants have been used for treatment of tooth loss in patients with and without cleft-related tooth loss. Patients treated with bone grafting to increase the height of the bone in the implant have improved capability of holding an implant. Adequate implant retention is possible after 3 months from a revision bone graft. Overall tooth restoration is reasonable, but deficient gingiva and soft tissue in the cleft region can affect overall aesthetic outcomes. The other options will not achieve the goal of an integrated implant.

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130. A 50-year-old man undergoes a total glossectomy for oral tongue cancer. A microvascular free flap reconstruction with a vertically oriented profunda artery perforator flap is planned. In dissection of this flap, the pedicle is found between which of the following muscles?

A) Adductor longus and gracilis

B) Gracilis and adductor magnus

C) Rectus femoris and vastus medialis

D) Vastus lateralis and rectus femoris

E) Vastus medialis and adductor longus

The correct response is Option B.

The profunda artery perforator flap can be used to provide reliable soft-tissue reconstruction for head and neck defects using skin and fat from the medial thigh. The flap is based on perforators arising from the profunda femoris artery with paired venae comitantes. The blood supply to this flap is found between the gracilis and adductor magnus muscles. The perforators are usually partially covered by a superficial layer of the adductor magnus, especially proximally. Some perforators may also travel between the adductor magnus and semimembranosus muscles.

The pedicle for the anterolateral thigh flap travels between the vastus lateralis and rectus femoris muscles. The pedicle for the anteromedial thigh flap travels between the rectus femoris and vastus medialis muscles, or it travels through the rectus femoris muscle. The pedicle for the gracilis flap travels between the adductor longus and gracilis muscles. A flap with a pedicle that travels between the vastus medialis and adductor longus muscles has not been described.

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131. A 55-year-old woman undergoes upper blepharoplasty for upper eyelid fullness. The upper eyelid soft tissue is resected and contoured. Two months after the procedure, the patient reports persistent unilateral dry eye, described as feeling like there is a foreign object in that eye. Which of the following is the mostly likely cause of this patient's symptoms?

A) Canalicular system injury

B) Frey syndrome

C) Horner syndrome

D) Lacrimal gland injury

E) Sicca

The correct response is Option D.

During blepharoplasty, reshaping of the upper eyelid can be achieved by judicious contouring of the upper eyelid fat pads, usually the nasal and central. Lateral fullness in some patients may be caused by lacrimal gland prolapse and should be recognized by the surgeon to avoid resecting the lacrimal gland, risking dry eye syndrome. The surgeon should recognize that the upper eyelid does not have a lateral fat pad, and that the lacrimal gland is firmer and paler than the preaponeurotic fat that is more billowy and more yellow. Lacrimal gland prolapse should be resuspended, rather than excised, to minimize the risk for dry eye syndrome.

Horner syndrome, Frey syndrome, and canalicular system injury are not related to dry eye syndrome. Sicca can have dry eyes; however, it is an autoimmune disease unrelated to blepharoplasty's postsurgical course.

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132. A 60-year-old man is evaluated because of a 6-week history of pain in the preauricular area without interlocking of the jaws. The pain is present at rest and with mastication. The patient reports that he's lost 10 lb (4.5 kg) during the past month. Physical examination shows nontender swelling on the left side of the preauricular area, and maximal incisal opening is 30 mm. Which of the following is the most appropriate next step in management?

A) Arthrography of the temporomandibular joint

B) Biopsy of the area of preauricular swelling

C) Botulinum toxin type A injection

D) NSAID therapy and soft diet

E) Physical therapy and cognitive behavioral therapy

The correct response is Option B.

Temporomandibular joint (TMJ) disorders present with pain in the TMJ and/or muscles of mastication. They may also present with clicking and/or popping with movement. Conservative treatments include wearing a mouth guard at night (if there is bruxism contributing to temporomandibular pain), analgesia, soft diet, and physical therapy. Botulinum toxin type A therapy has also been used with varied success. However, this patient's dramatic weight loss and unilateral swelling are not expected features of TMJ disorders and further diagnostic studies are necessary to rule out malignancies or inflammatory diseases. This can include imaging studies (such as CT scan or MRI) to rule out malignancies or needle biopsy of suspected masses.

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133. A 40-year-old man comes to the office because of an expanding painless mandibular mass. Physical examination shows a 5-cm mass of the mandible with local extension into the gingiva and inferior mandible border. Examination of a specimen obtained on biopsy confirms ameloblastoma. Which of the following is the most appropriate management?

A) Marginal mandible resection only

B) Marginal mandible resection with radical neck lymphadenectomy

C) Radical neck lymphadenectomy and radiation therapy

D) Segmental mandible resection only

E) Segmental mandible resection with radical neck lymphadenectomy

The correct response is Option D.

Ameloblastoma can be treated with segmental excision or marginal excision with preservation of the inferior border of the mandible based on size and the involvement of the inferior border and gingiva. Localized lesions toward the apex or opposite the inferior border can be treated with marginal resection and preservation of the inferior border. In this case, due to involvement of the inferior border and gingiva, segmental resection is indicated. Routine regional lymph node dissection is not recommended due to the low incidence of lymphatic spread with this type of mandible lesion. Resection margins of 1 cm at a minimum are recommended due to a histologic extension from the grossly visible lesion at a mean of 4.5 mm (range of 2.3 to 8 mm).

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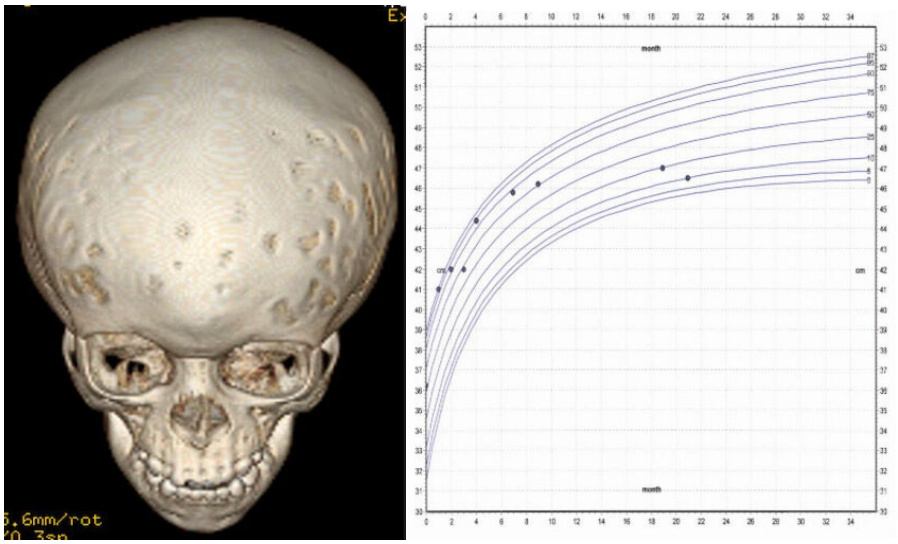

134. An otherwise healthy 21-month-old female infant is evaluated because of an insidious and progressive decline in head circumference percentile that began at age 6 months. Family history is significant for Crouzon syndrome. A head circumference chart and CT scan are shown. Which of the following best describes the findings on the CT scan?

A) Cloverleaf skull

B) Frontal lobe hypoplasia

C) Normal cranial shape

D) Patent cranial sutures

E) Turribrachycephaly

The correct response is Option C.

This patient has progressive postnatal pansynostosis (PPP), a relatively rare but important form of craniosynostosis that typically occurs in the first year of life. Unlike most other forms of craniosynostosis, affected patients have a normal head shape (often leading to a delay in diagnosis) and a slow unrelenting decline in head circumference percentile. This condition can occur in any child, but it is more common in patients with certain craniosynostosis

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syndromes, including but not limited to Crouzon syndrome. Because the sutures do not begin to fuse until after birth, the cranial shape typically remains normal (albeit smaller) and many of the common facial features seen with an associated craniosynostosis syndrome (eg, midfacial retrusion, exorbitism) may evolve in a delayed fashion once the sutures begin to close. The risk for intracranial pressure is quite high, greater than 75%, and cranial vault expansion is almost universally required. The age of onset of suture fusion correlates with the sudden decline in head circumference percentile, at age 6 to 8 months for this patient.

Patent cranial sutures would not adversely impact cranial growth unless there was a massive and acute cerebral event, which would impact the patient's development. Unlike PPP, cloverleaf skull occurs as a result of prenatal multi-suture fusion and is clearly evident at birth. Frontal lobe atrophy can result in a small head, but the head circumference percentile typically stays consistent with growth. Turribrachycephaly results from prenatal fusion of both coronal sutures and, while often seen in patients with Crouzon syndrome, it would be clinically obvious at or around birth and would not typically result in a sudden decline in head circumference percentile as observed in this scenario.

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135. A 65-year-old woman is scheduled to undergo concurrent upper eyelid blepharoplasty and levator advancement for correction of a superior visual field deficit. During dissection, the levator muscle and tendon are most likely to be located immediately deep to which of the following structures?

A) Capsulopalpebral fascia

B) Müller muscle

C) Orbicularis oculi

D) Orbital septum

E) Pre-aponeurotic fat

The correct response is Option E.

A levator advancement is performed to reinsert the tendon of the levator palpebrae superioris muscle into the tarsal plate to treat senile ptosis, and it can be performed concurrently with upper eyelid blepharoplasty. The levator muscle and tendon are located immediately deep to the pre-aponeurotic (central orbital) fat pad. The orbital septum serves as the intra- and extraorbital space. It is divided sharply before encountering the orbital fat. The capsulopalpebral fascia is the musculoaponeurotic structure responsible for retracting the lower eyelid tarsus and is analogous to the levator palpebrae. The Müller muscle is a parasympathetically innervated muscle that acts synergistically with the levator palpebrae and is located deep to it. The orbicularis oculi muscle of the eye is the sphincteric muscle responsible for eyelid closure. It is located in the anterior lamella of the eyelid superficial to the orbital septum.

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136. A 6-month-old male infant is referred to the multidisciplinary craniofacial clinic because of a congenital full-thickness defect of the lower eyelid. This condition is most commonly associated with which of the following craniofacial syndromes?

A) 22q11 deletion syndrome

B) Möbius syndrome

C) Opitz syndrome

D) Treacher Collins syndrome

E) Van der Woude syndrome

The correct response is Option D.

The child described was born with a coloboma of the lower eyelid, most commonly associated with Treacher Collins syndrome. In addition to colobomas, Treacher Collins syndrome is characterized by downward slanting palpebral fissures, malar hypoplasia, conductive deafness, microtia and atresia, and cleft palate.

Möbius syndrome is characterized by cranial nerve dysfunction, including facial paralysis. Other symptoms include retrognathia, cleft palate, and extremity abnormalities.

The common features of 22q11 deletion syndrome include cleft palate, hypertelorism, and short philtrum, as well as cardiac and immunologic abnormalities.

Opitz syndrome includes cleft lip and palate in 50% of cases, hypertelorism, a prominent forehead, and low-set ears.

Van der Woude syndrome, the most common cause of syndromic clefting, is characterized by the presence of lip pits.

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137. A 12-year-old girl comes to the clinic with concerns about the appearance of her ears. On examination, a bilateral prominent ear deformity is noted. Which of the following anomalies most commonly contributes to this condition?

A) Acute angle to nasal dorsum

B) Decreased auriculocephalic angle

C) Decreased conchal bowl height

D) Effaced helical rim

E) Loss of antihelical fold

The correct response is Option E.

While several pathologic components may be present with a prominent ear deformity, loss of the antihelical fold is most common. This may be managed in the 2- to 4-week-old infant with molding or in the older child with weakening of the anterior surface of the antihelical fold and placement of posterior mattress (Mustardé) sutures. Other components may be an increased auriculocephalic angle and an increased conchal bowl height. The angle to the nasal dorsum refers to the orientation of the ear rather than the prominence. Effacement of the helical fold would result in flattening of the ear contour and less perceived prominence.

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138. A 20-year-old man presents with significant malocclusion with the buccal groove of the mandibular first molar mesial to the mesiobuccal cusp of the maxillary first molar. Which of the following surgeries is most likely to correct this malocclusion?

A) Bilateral sagittal split osteotomy mandibular advancement

B) Le Fort I maxillary advancement

C) Sliding genioplasty advancement with interposition bone graft

D) Surgically assisted rapid palatal expansion

The correct response is Option B.

Normal class I occlusion was defined by Edward Angle as the mesiobuccal cusp of the maxillary first molar resting in the buccal groove of the mandibular first molar. When the mandibular first molar is mesial (toward the dental midline, or anterior) to the maxillary first molar, this is termed class III malocclusion, with the mandible more forward than the maxilla. Of the surgeries listed, only a Le Fort I maxillary advancement restores a normal maxilla-mandible relationship for this patient as described with class III malocclusion.

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139. A 3-month-old male infant is evaluated because of an abnormal head shape. Physical examination shows biparietal narrowing with a cephalic index of 62 (N 76–81). There is a palpable ridge spanning anterior to posterior in the cranial midline. No ridge is palpable on the forehead. Which of the following is the most appropriate treatment?

A) Cranial molding orthotics

B) Fronto-orbital advancement

C) Monobloc advancement

D) Posterior vault distraction osteogenesis

E) Suture craniectomy and cranial spring application

The correct response is Option E.

The patient is presenting with sagittal craniosynostosis and scaphocephaly on examination. Although the surgical correction of sagittal craniosynostosis is controversial, the accepted options include spring-assisted surgery (SAS), strip craniectomy followed by cranial molding orthosis, and open vault remodeling cranioplasty. SAS entails removal of the synostotic suture, application of cranial springs, and subsequent hardware removal as a separate surgery.

Posterior vault distraction osteogenesis is typically reserved for multi-suture synostosis or in syndromic synostosis with concerns for increased intracranial pressure. Fronto-orbital advancement is typically performed for metopic and/or coronal synostosis and not performed at 3 months of age. Monobloc advancement is performed in syndromic coronal synostosis and indicated in those patients with concomitant severe obstructive sleep apnea and exorbitism. Cranial molding orthotics alone are not a first-line treatment.

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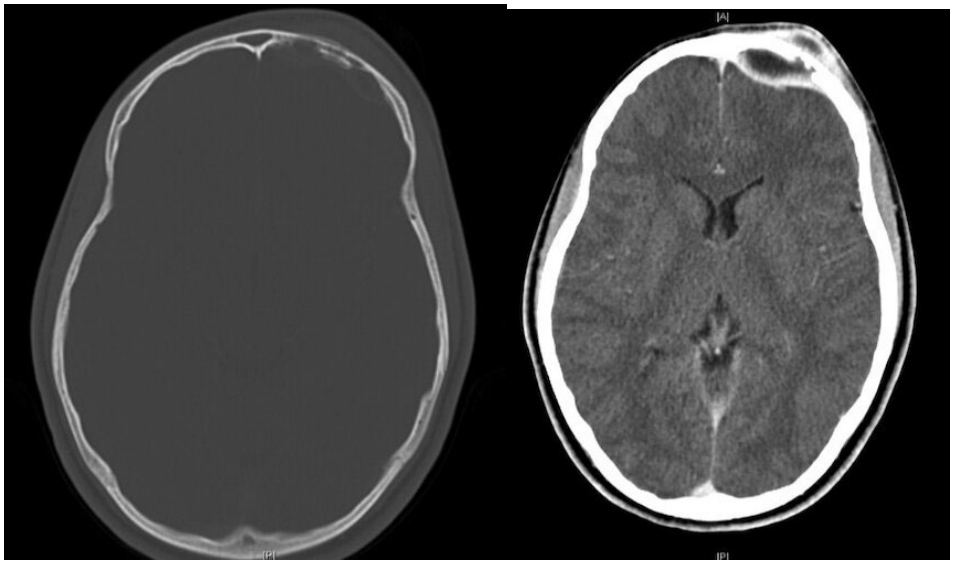

140. An 18-year-old man comes to the emergency department because of a severe headache. He reports onset of sinonasal congestion, nasal discharge, and cough 6 weeks ago. During the past week, he also noted an impaired sense of smell, foul-tasting postnasal discharge, and an enlarging, painful mass on the left forehead. CT scan of the head shows opacification of the maxillary, ethmoid, sphenoid, and frontal sinuses. Additional findings can be observed in the representative CT scans shown. Which of the following is the most appropriate treatment?

A) Caldwell-Luc approach sinus drainage

B) Endoscopic sinus drainage and open cranialization

C) Incision and drainage of the left forehead mass

D) Long-term, narrow-spectrum antibiotic therapy for 6 weeks

The correct response is Option B.

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The patient has developed a Pott puffy tumor in the setting of severe pansinusitis. Pott puffy tumor is not a true tumor, but rather osteomyelitis of the frontal bone with associated subperiosteal abscess resulting in forehead swelling. In addition to compromise of the outer table of the frontal sinus, the CT scan demonstrates inner table bone compromise with associated intracranial abscess. The most complete approach to treating this patient includes: 1) source control with drainage of all involved sinuses, including the frontal sinus; 2) drainage of the intracranial abscess with craniotomy; and 3) separation of the sinonasal cavity and the intracranial space with cranialization. Postoperative adjunctive therapy will likely include long-term broad-spectrum antibiotic therapy since a mixed polymicrobial infection is most common. Isolated sinus drainage or sinus drainage and obliteration would not achieve the necessary goals to resolve the acute infection and avoid recurrence.

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141. A 40-year-old man presents with acute left facial nerve paralysis that began 24 hours ago. In addition to a loss of facial expression on the left side of the face, the patient is most likely to report which of the following symptoms?

A) Crocodile tears

B) Excessive salivation

C) Gustatory sweating

D) Hyperacusis

E) Tongue numbness

The correct response is Option D.

The facial nerve not only innervates the muscles of facial expression but supplies parasympathetic input to the lacrimal gland and submandibular and sublingual salivary glands, as well as motor input to the stapedius, stylohyoid, and posterior belly of the digastric muscles. It also receives special sensory taste fibers from the anterior two-thirds of the tongue and general sensory fibers from the concha of the external ear. As such, intracranial injury to the facial nerve may result in weakness or paralysis of the face, dryness of the eye and the mouth (not excessive salivation), loss of taste (not numbness), pain or numbness in the ear, and increased sensitivity to loud sounds known as hyperacusis. Hyperacusis occurs due to loss of function of the stapedius muscle that normally dampens the movement of the stapes bone, which is one of three bones that transmit sound from the tympanic membrane to the cochlea. Note that because the facial nerve travels within the temporal bone in close association with the vestibulocochlear (VIII) nerve, hearing loss is also a possible symptom of cranial trauma, although not a symptom of facial nerve injury.

Gustatory sweating, also known as Frey syndrome, occurs when there is aberrant reinnervation of the sweat glands of the cheek by cut parasympathetic fibers from the auriculotemporal nerve that previously mediated saliva production by the parotid gland following parotidectomy. It is not associated with acute facial paralysis secondary to Bell palsy. Gustatory tearing, also known as crocodile tears or Bogorad syndrome, occurs when there is aberrant parasympathetic reinnervation of the lacrimal gland rather than of the salivary glands. It is a rare phenomenon and typically presents 6 to 9 months after the onset of Bell palsy.

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142. A 26-year-old woman is evaluated for class II malocclusion and obstructive sleep apnea refractory to conservative management. A lateral cephalogram shows an SNA angle of 77 degrees (N 82), SNB angle of 69 degrees (N 80), and an ANB angle of 9 degrees (N 2). Which of the following orthognathic movements is most appropriate to both treat this patient's obstructive sleep apnea and improve her dentofacial profile?

	Point A	Point B	Gnathion
A)	Advanced	advanced	advanced
B)	Advanced	unchanged	unchanged
C)	Setback	unchanged	advanced
D)	Unchanged	advanced	advanced
E)	Unchanged	setback	advanced

The correct response is Option A.

This patient is presenting with class II malocclusion in the setting of both maxillary and mandibular hypoplasia based on her cephalometrics, although mandibular hypoplasia is comparatively more pronounced. Maxillomandibular advancement has been demonstrated to be an effective surgical treatment for obstructive sleep apnea. The procedure entails both LeFort I advancement as well as bilateral sagittal split mandibular advancement. To address her dentofacial concerns, the mandible would be advanced more than her maxilla. The movement would include point A advancement, point B advancement, and gnathion advancement. Any setback movements would likely negatively impact her obstructive sleep apnea.

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143. A 6-year-old boy with a history of craniosynostosis is brought by his parents for routine follow-up evaluation. The patient underwent cranial vault remodeling in infancy. Annual ophthalmology follow-up is also planned. Which of the following types of craniosynostosis has the highest incidence of postoperative strabismus?

A) Lambdoid

B) Metopic

C) Sagittal

D) Unilateral coronal

The correct response is Option D.

Serial ophthalmologic evaluation is necessary for patients previously treated for craniosynostosis to monitor for papilledema and other ocular pathology. Strabismus may be detected either preoperatively or postoperatively. Due to the significant asymmetry of orbital anatomy in patients with unilateral coronal craniosynostosis, the incidence of postoperative strabismus is higher in this population compared with other forms of single-suture craniosynostosis.

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144. A 51-year-old woman is evaluated because of a 1-year history of a "twitch" in her left cheek. Medical history includes Bell palsy. The patient reports that the twitching happens throughout the day and is worse when smiling or laughing. She states that she has completed six sessions of physical therapy without improvement. MRI of the brain showed no abnormalities. Which of the following is the most appropriate next step in management?

A) Botulinum toxin type A injection

B) Continued physical therapy

C) Expectant management

D) Repeat MRI of the brain

E) Surgical exploration

The correct response is Option A.

Botulinum toxin type A injection is the most appropriate management for this patient. A study was performed in which 41 patients affected by facial synkinesis and hyperkinesis due to facial palsy were treated. The causes of the facial palsy included: 28 Bell palsy cases, nine iatrogenic cases (seven acoustic neuroma surgeries, one tympanojugular glomus tumor removal, and one middle ear surgery), three herpes zoster virus cases, and one case of Melkersson-Rosenthal syndrome. Botulinum toxin type A was used in the treatment. All patients showed some improvement of synkinesis and hyperkinesis after treatment. The mean values of the data obtained, regardless of the method of evaluation, gave statistically significant results. Correlation between objective and subjective evaluation methods was also statistically positive.

Continued physical therapy is not appropriate since the patient underwent physical therapy without improvement. MRI showed no abnormalities, thus repeat MRI is not indicated. She has no new symptoms or events warranting repeat MRI. Surgical exploration is not indicated in this patient. Watchful waiting is not the best treatment option. The patient has been experiencing symptoms for a year, and conservative management has failed.

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145. A 52-year-old man with left maxillary sinus cancer undergoes maxillectomy, including removal of the medial and inferior orbital walls. Reconstruction is performed with titanium mesh and an anterolateral thigh free flap. During resection and reconstruction, it is necessary to retract the globe to reach the posterior region of the orbit. Postoperatively, the patient reports loss of vision in the eye with only light and dark perception. Prior to surgery, the patient had normal (20/20) vision. The patient is most likely experiencing which of the following complications?

A) Enophthalmos

B) Extraocular muscle entrapment

C) Oculocardiac reflex

D) Traumatic optic neuropathy

E) Vertical orbital dystopia

The correct response is Option D.

This patient is most likely suffering from traumatic optic neuropathy secondary to excessive retraction of the globe and, consequently, injury to the optic nerve during surgery. In addition to prompt ophthalmologic consultation, radiographic imaging should be obtained to rule out a foreign body impinging on the optic nerve, such as the titanium mesh, or hematoma of the optic nerve sheath, which may be indications for a return to the operating room. Otherwise, management is controversial with limited data in the literature to date, suggesting that no treatment is necessarily superior to observation. Some authors support the use of high-dose corticosteroids.

Extraocular muscle entrapment may occur if any of the extraocular muscles become caught on an edge of the titanium mesh. Enophthalmos may occur if the reconstructed orbital cavity volume is larger than it was prior to surgery. Similarly, vertical orbital dystopia (hypoglobus), when the eye is at a lower vertical level than the contralateral side, may occur if the reconstructed orbital floor is more inferior than it was prior to surgery. The oculocardiac reflex is a reduction of the heart rate (bradycardia) resulting from direct pressure placed on the extraocular muscles, glove, or conjunctiva. This may occur during resection and/or reconstruction involving the orbit. It usually ceases when the inciting stimulus (eg, retraction of the globe) is removed. It can also be treated by administration of an intravenous

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anticholinergic drug (eg, atropine or glycopyrrolate). Once sinus rhythm is restored, it is usually safe to proceed with surgery.

None of the other options will result in vision loss.

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146. A 5-year-old girl is referred by a dermatologist for definitive treatment of a skin lesion. The patient underwent shave biopsy of the lesion 2 weeks ago. At that time, all of the visible lesion was removed, but microscopically positive lateral margins remain. The pathology report describes the lesion as having Kamino bodies present with no nuclear atypia or increased mitoses. Results of fluorescence in situ hybridization studies are negative for melanoma markers. Which of the following is the most appropriate next step in management of the lesion?

A) Electrodessication

B) Expectant management with periodic follow-up

C) Reexcision with 1-cm margins and sentinel lymph node biopsy

D) Reexcision with 1-cm margins only

E) Refer for PET-CT scan

The correct response is Option B.

The lesion is a Spitz nevus, without atypia. While frequently reexcised, these lesions are considered benign, and recent studies have supported expectant management of margin-positive excisions in children younger than 12 years of age.

Reexcision alone is less preferable than expectant management, since it would subject the patient to additional surgery for little to no clinical benefit in managing this benign lesion.

Reexcision with sentinel lymph node biopsy would also be incorrect for the above reasons, but also because the addition of sentinel lymph node biopsy would be overly aggressive for a benign lesion.

Electrodessication is not indicated in this scenario.

Further radiographic imaging is also not warranted in this scenario.

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147. An 18-year-old woman requires bimaxillary surgery (Le Fort I fracture and bilateral sagittal split osteotomy). Which of the following is the most common complication after bimaxillary surgery?

A) Dental injury

B) Hardware complications

C) Need for revisional surgery

D) Permanent nerve damage

E) Postoperative infection

The correct response is Option D.

When a patient undergoes bimaxillary surgery, the most common complication is permanent nerve injury at a rate of 9.3%. Other complications and occurrence rates include: infection (1.3%), hardware complications (6%), dental injury (5.3%), and revision surgery (6.6%).

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148. A 1-day-old male newborn is evaluated for a swollen, purpuric lesion over the scalp, posterior neck, and shoulder. Laboratory studies show a platelet count of 20 × 10^3/μL (N 150–450 × 10^3/μL). Which of the following is the most likely diagnosis?

A) Congenital angiosarcoma

B) Infantile hemangioma

C) Kaposiform hemangioendothelioma

D) Microcystic lymphatic malformation

E) Noninvoluting congenital hemangioma

The correct response is Option C.

The clinical scenario depicts a newborn with Kasabach-Merritt syndrome (KMS), a consumptive coagulopathy caused by platelet trapping. This occurs in patients with a kaposiform hemangioendothelioma and less frequently in those with tufted angiomas. The treatment for this condition is chemotherapy targeted at the lesion. Patients with extensive venous malformations may exhibit decreased platelet counts due to localized intravascular coagulation or, less frequently, diffuse intravascular coagulation. The pathologic mechanism differs from KMS, and the severity of thrombocytopenia is less. Infantile hemangiomas typically present shortly after birth and will grow during the first year of life before entering an involution phase. The other lesions listed may present in a newborn but do not cause thrombocytopenia.

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149. A 53-year-old man is evaluated because of a mass in the oropharynx. Examination of a specimen obtained on biopsy of the mass shows squamous cell carcinoma. Which of the following pathologic findings is the strongest indicator of a favorable prognosis in this patient?

A) Close (less than 5 mm) resection margins

B) Extracapsular extension

C) Human papilloma virus positivity

D) Nodal metastases

E) Perineural invasion

The correct response is Option C.

Human papilloma virus (HPV)-associated cancers, which arise in the oropharynx, have a better prognosis than non-HPV-associated cancers. In fact, in the 8th edition of the American Joint Committee on Cancer (AJCC)/International Union Against Cancer (UICC) staging system, HPV-associated oropharyngeal cancers are given a separate staging classification from non-HPV-associated cancers. Because of the difference in prognosis, all oropharyngeal cancer specimens should be tested for p16 or HPV DNA or RNA, all of which indicate HPV positivity, for staging purposes. In recent years, rates of oropharyngeal cancers have risen sharply in the United States, and the majority of these cancers are associated with HPV infection. Almost all of these cancers are caused by HPV16, a subtype of the HPV virus.

The presence of neck nodal metastases is the most important prognostic factor for oral squamous cell carcinoma. If present, there is a 50% reduction in survival rates. Perineural invasion, extracapsular (extranodal) extension, and close or positive resection margins are other negative prognostic factors and are usually considered indications for adjuvant radiation therapy.

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150. A 12-year-old boy with bilateral facial nerve paralysis secondary to Möbius syndrome is brought to the clinic to discuss facial reanimation. The patient reports psychosocial distress resulting from bullying in school. Which of the following procedures will most likely result in an animated, bilateral smile in the shortest amount of time?

A) Bilateral free gracilis flaps powered by a cross-face nerve graft

B) Bilateral free gracilis flaps powered by the motor nerve to masseter muscle

C) Bilateral hypoglossal nerve-to-facial nerve transfer

D) Bilateral in-line temporalis muscle transfer

E) Bilateral tensor fascia lata graft placement for a facial sling

The correct response is Option D.

Möbius syndrome is a congenital condition causing hypoplasia or absence of the facial (VII) nerve and mimetic musculature. Classically, the abducens (VI) nerve is also involved, but other cranial nerves may be involved. Hypoglossal nerve to facial nerve transfer is not a surgical option in this patient since there is no distal facial nerve branches or mimetic musculature recipient for the transfer. Bilateral free gracilis muscle flaps powered by the motor nerve to masseter muscle is a common procedure employed for facial reanimation for this patient population, but it will not result in the most rapid gain of smile function. Bilateral cases are often staged, and nerve regeneration from the masseter nerve to obturator nerve coaptation will delay the return of motor function. In-line temporalis muscle transfer (Labbé technique) can be completed bilaterally in a single procedure, and since the native innervation to the temporalis muscle is preserved, it offers a more rapid gain of smile function that may benefit this patient. Static sling reconstructions improve the resting tone and position of the face but do not provide a dynamic reconstruction. Finally, a free gracilis flap powered by a cross-face nerve graft offers the best possibility of spontaneous emotional smile responses, but it may not be employed in this case of bilateral facial nerve palsy without a donor facial nerve.

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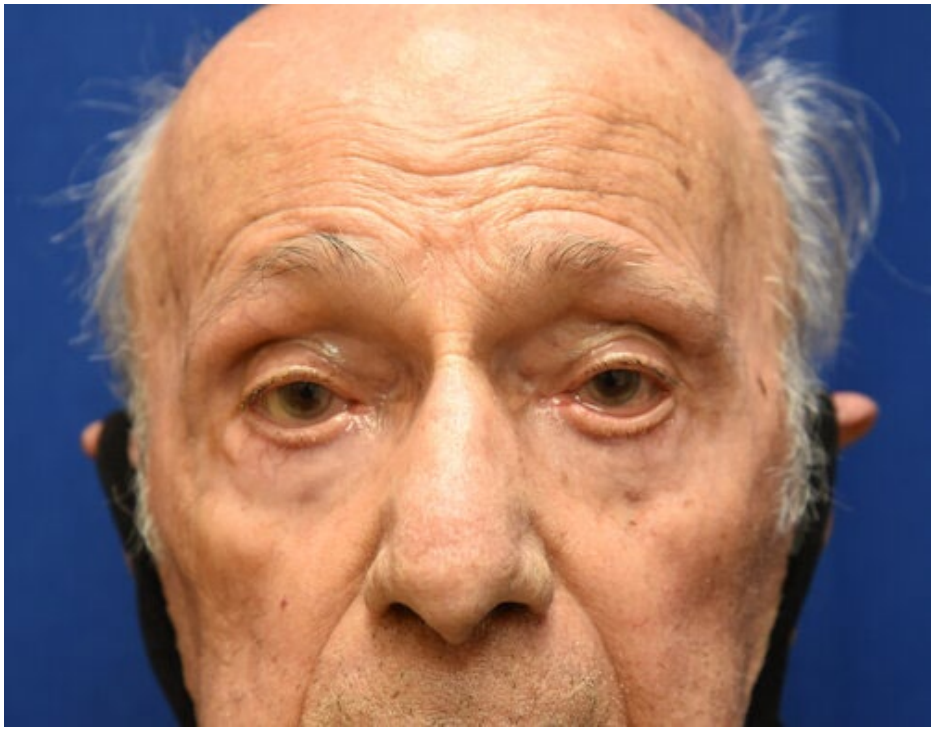
Section 4: Breast and Cosmetic



151. A 78-year-old man is evaluated because of superior visual field obstruction and drooping eyelids. Physical examination notes a levator excursion of 10 mm and a margin-reflex distance 1 of 2 mm. A photograph is shown. Phenylephrine eye drops do not significantly change the position of the eyelid margin. Which of the following procedures is most appropriate for this patient?

A) Direct brow lift

B) Frontalis sling

C) Levator advancement

D) Tarsoconjunctival Müllerectomy

E) Upper eyelid blepharoplasty

The correct response is Option C.

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This patient has acquired aponeurotic blepharoptosis. This is the result of dehiscence or disinsertion of the levator aponeurosis from the tarsal plate. This is characterized by ptosis of the eyelid margin, a high or absent lid crease, good levator function, and thin eyelid tissue. This patient has the following criteria that support the diagnosis: a margin-reflex distance 1 of 2 mm, a high eyelid crease noted on the photograph, and good (10 mm) levator function noted on examination.

The most appropriate operation in this patient is levator advancement. This operation uses an external approach to advance the levator muscle onto the tarsal plate, addressing the dehiscence. The operation can be performed through the approach for an upper eyelid blepharoplasty.

Upper eyelid blepharoplasty could treat dermatochalasis. Brow lift could address the eyebrow position, but in this case there is no skin overlying the eyelid margin that would impact the visual field. However, both upper eyelid blepharoplasty and direct brow lift will not correct the underlying problem, which is the dehiscence of the levator muscle.

A frontalis sling uses either a tendon graft or alloplastic material to suspend the upper eyelid complex to the frontalis muscle. Thus, the eyelid is elevated when the frontalis muscle is activated. A frontalis sling is indicated in patients with severe ptosis and little to no levator function, as in the case of congenital or paralytic ptosis.

Tarsoconjunctival Müllerectomy excises a portion of the conjunctiva and Müller muscle through a posterior approach. Phenylephrine eye drops used preoperatively can predict the success of a Müllerectomy. After drops are instilled, one looks for correction of the eyelid margin to within 1 mm of the desired end result. In this patient, Müllerectomy is not indicated because the phenylephrine drops did not significantly change the eyelid position.

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152. A 28-year-old woman undergoes open septorhinoplasty secondary to internal nasal valve narrowing. During elevation of the mucoperiosteal flap, there is brisk arterial bleeding from the superior dorsal cranial septum. Which of the following arteries is the most likely source of the bleeding?

A) Angular

B) Anterior ethmoid

C) Internal maxillary

D) Posterior septal

E) Sphenopalatine

The correct response is Option B.

The S-point is located at the superior portion of the nasal septum around the middle-turbinate axilla projection, posterior to the septal body. The branch at this site, the anterior ethmoid, can be injured during mucoperiosteal elevation in this area.

The internal maxillary, sphenopalatine, and posterior septal arteries are incorrect because the internal maxillary artery and its branches, the sphenopalatine artery and posterior septal artery, are posterior and inferior to this area. The angular artery is incorrect because it's located on the external nasal wall.

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153. An otherwise healthy 13-year-old boy is brought to the plastic surgeon's office because of a 6-month history of bilateral breast enlargement. The patient takes no medications. There is no family history of breast cancer. Examination shows bilateral, 3-cm, firm, rubbery, subareolar masses without nipple discharge. No testicular masses are noted. Workup shows no other abnormalities. The patient reports that he is afraid of being teased. Which of the following is the most appropriate management?

A) Direct surgical excision

B) Initiation of tamoxifen

C) Liposuction

D) Mammography

E) Observation

The correct response is Option E.

Adolescent gynecomastia is common, and there is often spontaneous regression after 6 months. While the cause is often unknown, hormonal influences are thought to play a significant role. Because the overwhelming majority of pubertal gynecomastia regresses over the course of several years, observation is the mainstay of treatment.

Mammography is not necessary if the history and physical examination findings are consistent with physiologic gynecomastia, and it is often unhelpful in adolescent gynecomastia. While tamoxifen can be effective for gynecomastia and some studies have shown safe use in adolescent boys, it is not a first-line treatment for mild disease as described in this case. It has been used for severe disease, but it is not FDA-approved for this purpose.

Surgical treatment, whether liposuction or surgical excision, should be reserved for failure of conservative management.

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154. A 51-year-old woman comes to the office because of unilateral fullness, pain, and swelling of the lower cheek after undergoing rhytidectomy and platysmaplasty 6 weeks ago. Which of the following is the most likely cause of this patient's symptoms?

A) Digastric muscle hypertrophy

B) Low hyoid bone position

C) Sialocele

D) Simple ranula

E) Tail of parotid pleomorphic adenoma

The correct response is Option C.

The patient has symptoms consistent with sialocele, including unilateral fullness, pain, and swelling in the location of the submandibular gland.

A low hyoid bone position would not cause unilateral swelling just below the jawline.

Tail of parotid pleomorphic adenoma is incorrect because a mass of the parotid would be at the angle of the jawline.

Digastric muscle hypertrophy is incorrect because it can lead to bilateral submandibular fullness.

Ranulas are cysts which most commonly form in the submandibular gland under the tongue in the floor of the mouth.

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155. A 62-year-old woman undergoes face and neck rhytidectomy. Preoperatively, oral clonidine is administered, and at the time of incision, intravenous tranexamic acid is administered. Topical platelet-rich plasma is applied to the superficial musculoaponeurotic system, followed by fibrin tissue sealant. Drains are placed prior to skin closure. Which of the following perioperative interventions is most likely to lead to a decreased risk for postoperative hematoma in this patient?

A) Intravenous administration of tranexamic acid

B) Oral administration of clonidine

C) Placement of drains

D) Topical application of platelet-rich plasma

E) Use of fibrin tissue sealant

The correct response is Option B.

Clonidine is an alpha-agonist and helps control perioperative blood pressure. Blood pressure control between 100 and 140 mmHg has been shown to decrease the risk for hematoma formation.

Drains have not been shown to decrease hematoma formation, but they may decrease seroma and ecchymosis formation.

Fibrin tissue sealants help eliminate dead space and decrease postoperative drainage, and they may decrease edema and ecchymosis formation.

Tranexamic acid (TXA) and platelet-rich plasma have not been shown to conclusively decrease the risk for hematoma formation. TXA was shown to decrease the risk for fluid collections and ecchymosis formation.

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156. A 56-year-old woman is referred for evaluation because of chronic pain in the left breast after undergoing mastectomy and implant-based reconstruction. The patient also reports hypersensitivity at the mastectomy flaps, diminished sensation in the proximal medial left arm, and burning pain in the left chest wall. On examination, the breasts appear normal and are somewhat firm to the touch. There are no signs of infection. Which of the following is the most appropriate next step in management?

A) Capsule excision

B) Implant removal

C) Initiation of gabapentin

D) Intraincisional injection of triamcinolone

E) Ultrasonography of the breast

The correct response is Option C.

The patient has findings consistent with postmastectomy pain syndrome (PMPS). PMPS is a clinical diagnosis characterized by neuropathic pain of the ipsilateral chest wall, axilla, or extremity. Patients can also report intercostobrachial neuralgia pain and sensory disturbances in its distribution. Of note, infection or recurrent disease must not be present as alternative explanations for the findings.

While treatment of PMPS is multidisciplinary and multimodal, the initial treatment strategy for PMPS includes the anticonvulsant gabapentin, which has shown benefit in the treatment of neuropathic pain. If there is evidence of a clear neuroma, targeted interventions for the neuroma, such as block or excision, may be appropriate. Clinical trials of serratus anterior block, which has shown benefit for PMPS, are underway.

Capsule excision might be appropriate if the patient had a capsular contracture, but the description points to, at most, a Class 2 capsular contracture, which would not warrant removal. Removal of the capsule is unlikely to address the neuropathic pain described. Similarly, removal of the implant will not address PMPS. Ultrasonography would be appropriate to assess for lesions or fluid, but it is unhelpful in diagnosing PMPS. Intraincisional triamcinolone injection can be useful for hypertrophic scarring but is not used for PMPS as described.

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157. A patient with Fitzpatrick Type V skin presents for removal of a 5-year-old tattoo on his forearm that is primarily black in color. The most appropriate laser for removal of the pigment in this patient uses which of the following wavelengths?

A) 532 nm

B) 694 nm

C) 755 nm

D) 1064 nm

E) 10,600 nm

The correct response is Option D.

Laser type	Tattoo pigment	Wavelength	Additional info
Frequency-doubled Q-switched Nd:YAG	red, orange, yellow, purple	532 nm	more effective for removal of red and yellow pigments than other Q-switched lasers
Q-switched ruby	black, blue, green	694 nm	well-absorbed by melanin which may result in hypopigmentation; caution in darker skin types
Q-switched alexandrite	black, blue, green	755 nm	well-absorbed by melanin which may result in hypopigmentation; caution in darker skin types
Q-switched Nd:YAG	black, blue, green	1064 nm	minimal effect on melanocytes and epidermis, producing less hypopigmentation and blistering; safe in darker skin types (Fitzpatrick Types IV-VI)
Carbon dioxide	nonspecific	10,600	targets water, causing ablation of superficial layers of skin, resulting in partial pigment removal with significant inflammation and scarring

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158. A 64-year-old man with upper eyelid dermatochalasis and lower eyelid fat pad pseudoherniation with skin excess undergoes a bilateral skin-only upper blepharoplasty and lower blepharoplasty with a subciliary approach. During the next 12 weeks, the patient reports dry eye symptoms that worsen progressively. Which of the following glands is most likely dysfunctional in this patient?

A) Lacrimal

B) Meibomian

C) Moll

D) Wolfring

E) Zeis

The correct response is Option B.

Meibomian glands (also named tarsal glands, palpebral glands, and tarsoconjunctival glands) are sebaceous glands located inside the tarsal plate at the rims of the eyelid. Meibum is produced by the meibomian glands and is an oily substance that prevents evaporation of the eye's tear film. Dysfunctional meibomian glands are believed to be the most common cause of dry eyes and can result from upper and lower blepharoplasty since there are about 25 such glands on the upper eyelid and 20 on the lower eyelid.

Glands of Zeis are unilobar sebaceous glands found on the margin of the eyelid. These glands produce an oily substance that is issued through the excretory ducts of the sebaceous lobule into the middle portion of the hair follicle and service the eyelashes. When infected, folliculitis may take place, leading to abscesses and sties. A Moll gland, also known as ciliary gland, is a modified sebum-secreting apocrine sweat gland found on the margin of the eyelid near the base of the eyelashes in the same region of the glands of Zeis, anterior to the meibomian glands within the distal eyelid margin. These glands are relatively large and tubular-shaped, and they empty into the adjacent lashes. Moll glands are prone to infection, and blockage of a gland's duct causes swelling which can manifest as a stye. The lacrimal glands are paired exocrine glands located in the upper lateral region of each orbit that secrete the aqueous layer of the tear film. These glands produce tears, which are secreted by the lacrimal ducts and flow over the ocular surface into canals that connect to the lacrimal sac. Wolfring glands are accessory lacrimal glands located at the nonmarginal border of the tarsal plate. They are not typically affected during the named procedure and have a nominal contribution to aqueous production.

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159. A 56-year-old woman is scheduled for carbon dioxide laser treatment of facial rhytides. Which of the following is the primary chromophore for a carbon dioxide laser?

A) Deoxyhemoglobin

B) Melanin

C) Methemoglobin

D) Oxyhemoglobin

E) Water

The correct response is Option E.

A carbon dioxide laser emits light at a wavelength of 10,600 nm that is absorbed strongly by water.

The classic target chromophore for vascular lesions has been oxyhemoglobin, which has the greatest absorption peaks at 418 nm, 542 nm, and 577 nm.

Venous lesions may benefit from wavelengths of light that target deoxyhemoglobin. The alexandrite laser at 755 nm is close to a deoxyhemoglobin absorption peak and has been used for refractory or hypertrophic port-wine stains, venocapillary malformations, and venous lakes.

Methemoglobin absorption (which occurs after 585-nm or 595-nm treatment at or above 5 J/cm^2) has been recognized as another potential target chromophore.

Since melanin absorbs light at a wide range of wavelengths, from 250 nm to 1200 nm, almost any laser with sufficient power causing thermal denaturation can be used to remove benign pigmented lesions of the epidermis. Eumelanin, the primary chromophore in the epidermis and darkly pigmented hair follicles, has a broad absorption spectrum spanning from ultraviolet light to the near infrared region.

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160. A 46-year-old woman undergoes circumareolar mastopexy to address aesthetic concerns after breast-feeding her three children. Which of the following suboptimal outcomes is most likely to result from the circumareolar approach?

A) Bottoming out

B) Constricted inferior pole

C) Flattened projection

D) Superior nipple dislocation

E) Wound separation

The correct response is Option C.

The suboptimal outcome most associated with a circumareolar mastopexy approach is flattened anterior projection. A circumareolar mastopexy is prone to flattening the anterior projection of the breast shape. A vertical mastopexy is more commonly associated with a constricted-appearing inferior pole, most often in the early postoperative period. Superior nipple dislocation and bottoming out may be associated with techniques that move the nipple superiorly disproportionately from the control of the vertical dimension of the breast mound and are frequently discussed in relation to Wise-pattern approaches, particularly with use of the inferior pedicle. Wound separations occur most commonly at the triple point of a Wise-pattern incision. Scar widening may be associated with a circumareolar approach, but wound separation is not a particular concern specifically with a circumareolar mastopexy.

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161. A 20-year-old woman presents with a right-sided sunken anterior chest wall, hypoplasia of the breast, superiorly placed nipple-areola complex, normal pectoralis muscle, and normal sternal position. Which of the following is the most likely diagnosis?

A) Anterior thoracic hypoplasia

B) Breast hypoplasia

C) Poland syndrome

D) Scalp-ear-nipple syndrome

E) Tuberous breast deformity

The correct response is Option A.

The patient has anterior thoracic hypoplasia. It is a rare disorder and separate from Poland syndrome. It presents with posterior displacement of the ribs, an anteriorly unilateral sunken chest wall, hypoplasia of the ipsilateral breast, and a superiorly displaced nipple-areola complex. However, the sternum and pectoralis major are normal.

Poland syndrome is characterized by various degrees of thoracic and ipsilateral upper extremity anomalies, including some or all of the following: absence or hypoplasia of the breast, absence of the nipple, absence of the pectoralis major or minor, absence of adjacent muscles and sometimes costal cartilage, rib abnormalities, and upper extremity deformities (eg, syndactyly, brachydactyly, or micromelia).

Tuberous breast deformity is a spectrum of aberrant breast shape, characterized by a high and tight inframammary fold, enlarged diameter of the nipple-areola complex, herniation of breast parenchyma through the nipple-areola complex, and most often breast asymmetry.

Scalp-ear-nipple syndrome is characterized by a triad: areas of hairless raw skin over the scalp (present at birth and healing during childhood), prominent hypoplastic ears with nearly absent pinnae, and bilateral amastia.

Breast hypoplasia refers to underdeveloped breasts.

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162. A 55-year-old woman is evaluated because of an abnormal mammogram of the right breast. History includes neither an inherited gene mutation nor a strong family history of breast disease. She undergoes ultrasound-guided core needle biopsy, which discloses pleomorphic lobular carcinoma in situ. Which of the following is the most appropriate next step?

A) Chemotherapy

B) Radiation

C) Repeat mammography in 6 months

D) Surgery

E) Observation only

The correct response is Option D.

Pleomorphic lobular carcinoma in situ (PLCIS) of the breast is an infrequent, more aggressive histopathologic subtype of classic lobular carcinoma in situ (LCIS). The frequency of upgrade to invasive lobular carcinoma, invasive ductal carcinoma, and ductal carcinoma in situ when PLCIS is found with core needle biopsy (CNB) ranges from 18 to 75%. Therefore, lumpectomy after CNB diagnosis of PLCIS is the standard of care to assess for potential upgrades. Typical LCIS can be managed with observation or chemoprevention. Repeated imaging with ultrasonography or mammography has no utility. Radiation is not indicated for local disease.

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163. A 34-year-old man undergoes a four-lid blepharoplasty. Before he leaves the facility, he reports to the postanesthesia recovery nurse that he has severe pain in the right eye and visual acuity changes that include flashes and a sensation that a shade has been pulled over the eye. Preliminary diagnosis is retrobulbar hematoma. Which of the following is the most appropriate initial management of this patient?

A) Evacuation of the hematoma within the next 3 hours

B) Intravenous administration of acetazolamide 500 mg

C) Intravenous administration of mannitol 20% 1.5 to 2 g/kg

D) Lateral canthotomy

E) Three-dimensional CT scan of the orbits

The correct response is Option D.

The bony walls of the orbital canal in humans do not derive from a single bone; they are a mosaic of seven embryologically distinct structures. The orbits are conical, or four-sided pyramidal cavities, which open into the midline of the face and point back into the head. Each consists of a base, an apex, and four walls. During blepharoplasty, unabated hemorrhage can lead to a hematoma that compromises the structures that lie at the base and apex.

The incidence of postblepharoplasty retrobulbar hemorrhage causing visual loss is reported to be 0.04%, or one in 2500 cases. This corresponds to a one in 10,000 risk for permanent visual loss. The majority of hemorrhages occur within the first 24 hours after surgery (96%), and of these, more than half occur intraoperatively or within the first 6 postoperative hours.

Acute retrobulbar hematoma may compress neurovascular structures, leading to ischemia of the retina, central artery, and optic nerve. Symptoms include severe pain, visual changes including hemianopsia or amaurosis fugax (like a "window shade" over the lower half of the visual field), and scintillating scotomas (sparkles and flashes). Examination often shows a tense and protuberant periorbital area with diminished or absent extraocular movements.

Once a patient is diagnosed, treatment requires immediate attention, because 90 to 120 minutes of ischemia leads to irreversible blindness. First, all dressings should be removed and sutures released at bedside, and a lateral canthotomy should be performed immediately. The

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patient should be given mannitol 20% 1.5 to 2 g/kg intravenously (with the first 12.5 g over a 3-minute period and the remainder over a 30-minute period), 500 mg of acetazolamide intravenously, 95% oxygen/5% carbon dioxide to dilate intraocular vessels, methylprednisolone sodium succinate 100 mg intravenously, and betaxolol, one drop immediately, then twice daily. These actions should be taken while the patient is being taken back to the operating room for re-exploration.

The first step is to identify those hemorrhages that require surgery based on ophthalmic examination. When bleeding threatens the visual system or is worsening, surgical therapy is required. The incision is opened widely through the orbital septum to explore the surgical site and orbit for bleeding. Clots are evacuated, and cautery is applied. If the condition remains unresponsive, additional lateral canthotomy and cantholysis are performed. In severe cases, both the inferior and superior crus of the lateral canthal tendon can be released. When these measures fail, an emergent CT scan without contrast is warranted. If a posteriorly organized hemorrhage is identified, bony decompression may be warranted to relieve orbital apex compression. Treatment should be aggressive for the first 24 to 48 hours postoperatively, since vision has been reported to return in patients with "no light perception" that was present for 24 hours.

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164. A 13-year-old girl is brought to the office by her mother because of a birthmark that has recently begun to grow since menarche. Physical examination shows the mass is well-circumscribed and nontender, and it lies within the inframammary fold. There is no evidence of an infectious process, and results of laboratory workup are normal for the patient's age. Which of the following is the most likely diagnosis?

A) Mondor disease

B) Poland syndrome

C) Polythelia

D) Tubular breast deformity

E) Virginal breast hypertrophy

The correct response is Option C.

Breast tissue begins to develop from the ectoderm during the fifth week of gestation. Paired mammary ridges, consisting of thickened ectoderm, expand bilaterally from the axillae to the groin and undergo apoptotic regression during the seventh and eighth weeks of gestation. This leaves behind only primordial breast tissue on the ventral thorax, which penetrates the underlying mesenchyme during weeks 10 to 14. This mesenchymal connective tissue that now surrounds the breast ultimately forms the superficial fascial system and suspensory ligaments of Cooper. Canalization occurs at 20 weeks. Late in fetal development, the mammary pit forms from an invagination of the epidermis at the origin of the mammary gland, contributing to development of the nipple. Differentiation of the breast tissue continues until birth and resumes at puberty under hormonal influences. Once puberty begins with proliferation of glandular and adipose tissue, the breast becomes a pendant structure with its inferior border defined by the inframammary fold.

Remnants of the mammary ridge form a track from the axilla to the groin along which supernumerary nipples may form after failure of regression at 3 months' gestation. This abnormality is not uncommon and has an incidence of 0.2 to 2.5%. These nipples are most commonly found below the breast but above the lower abdominal skin. They have been reported to be bilateral in 50% of patients and found in unusual locations such as the scapula, posterior thigh, head, and neck. Although this is usually no more than an aesthetic concern to the patient, the nipples may respond in a normal physiologic manner and be susceptible to the

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same disease processes. Although there are reports of associated congenital abnormalities, no syndrome has ever been described. The most appropriate treatment for the majority of patients is simple excision.

The tubular breast may have a constricted base but does not have herniation of breast tissue through the areola, causing its enlargement. This rare disorder occurs sporadically, without a well-known estimate of its incidence or cause. The central abnormality is a ring of fascia beneath the areola constricting its radial outgrowth, causing herniation of tissue just posterior to the nipple-areola complex at the natural hiatus in the outer layer of the superficial fascia. This has been reported as bilateral in approximately 89% of patients, and asymmetry of more than 100 g is present in over two-thirds of these patients. Although the presentation may be aesthetic in nature, the psychological impacts of this disorder can be severe.

Poland syndrome is a combination of chest wall deformity and absent or hypoplastic pectoralis muscle and breast, associated with shortening and brachysyndactyly of the upper limb. Clinical presentation varies widely; therefore, reconstructive procedures have to be adapted to the deformity, the range including chest wall stabilization or augmentation, dynamic muscle transfer, nipple and areola repositioning, and augmentation mammaplasty using prosthesis or autologous tissue transfer.

Juvenile virginal hypertrophy presents in late childhood and early adolescence. Mammary hypertrophy appears to be related to end-organ responsiveness to estrogens and not increased circulating blood levels. It is the fatty and fibrous elements of the breast that increase, whereas the glandular component remains unchanged.

Mondor disease is a condition characterized by thrombophlebitis of the superficial veins of the breast and anterior chest wall. Initially this condition presents with rapid development of a subcutaneous red cord-like lesion that causes pain at an early stage and subsequently becomes a painless fibrous band.

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165. A 35-year-old woman with the *BRCA1* mutation wants bilateral prophylactic mastectomies and is judged to be a good candidate for nipple-sparing mastectomy. Which of the following incisions for this procedure is associated with the highest risk for nipple-areola complex ischemia?

A) Horizontal radial incision

B) Inferior mammary fold incision

C) Inferior radial incision

D) Periareolar

The correct response is Option D.

Of all the incisions used for nipple-sparing mastectomy, the periareolar incision, though preferred by breast surgeons, removes 50% of the blood supply to the nipple and is associated with a higher risk for nipple-areola complex ischemia.

After nipple-sparing mastectomy, the blood supply to the nipple-areola complex is dependent on the subdermal plexus that forms an anastomotic network around the areola from the medial and lateral sides. A periareolar incision disrupts this network, decreasing its blood supply. Similarly, horizontal and inferior radial incisions extending to the nipple-areola complex disrupt the subdermal plexus, increasing the risk for nipple-areola complex ischemia.

The inferior mammary fold (IMF) incision, especially a lateral IMF incision, preserves some of the inframammary perforators medially and is associated with a lower incidence of nipple-areola complex ischemia.

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166. A 29-year-old woman presents for a consultation for a reduction mammaplasty. Her mother was diagnosed with breast cancer at age 44 years, and her older sister was recently diagnosed with ovarian cancer at age 40 years. On examination, the patient has macromastia of both breasts with grade 3 ptosis. No masses are noted. Which of the following is most appropriate next step?

A) Genetics evaluation

B) Mammography

C) MRI

D) Prophylactic mastectomy

E) Ultrasonography of the breasts

The correct response is Option A.

This patient has a pedigree that is suggestive of a genetic predisposition for breast cancer. This is due to her mother being diagnosed with breast cancer under the age of 45 years and her sister having a diagnosis of ovarian cancer. As a result, the most appropriate next step in management is a referral for genetics evaluation. Results of this evaluation and genetic testing will stratify the risk for breast cancer developing in this patient. This risk stratification will have implications for shared decision-making with the patient.

Based on the results of the risk stratification, the patient may opt for ongoing radiologic screening or a risk-reducing prophylactic breast mastectomy. Radiologic screening typically consists of annual mammography and annual MRI. Ultrasonography may be considered in high-risk patients either as an adjunct to mammography or for those who cannot undergo MRI.

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167. A 28-year-old man is evaluated for rhinoplasty because he is dissatisfied with the appearance of his nose. Examination shows an underprojected nasal tip, moderate dorsal hump with a wide bony base, wide nasal base width with significant alar flaring, and moderate septal cartilage deviation. Rhinoplasty is scheduled to address these issues. Which of the following parts of the rhinoplasty is most appropriate to perform last?

A) Alar flare reduction

B) Bilateral osteotomy

C) Placement of a columellar strut graft

D) Removal of the dorsal hump

E) Septal cartilage resection

The correct response is Option A.

The sequence of surgical techniques in rhinoplasty is very important to address the patient's concerns. Some parts of the procedure could affect the outcome of the final results if performed in the wrong order.

In rhinoplasty, increasing tip projection may improve alar flaring to a point that alar flare reduction may not be necessary. On the other hand, tip deprojection may worsen preoperative alar flaring. For this reason, alar base surgery should be predominantly performed last because tip position has to be addressed completely before evaluating the alar flaring and nasal base width.

The other options may be performed throughout the operation; it is not essential to perform them at the end.

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168. A 59-year-old woman comes to the office because she is dissatisfied with the appearance of her face. History includes abdominoplasty 2 years ago. Physical examination shows loss of mid face volume, jowls, and moderate neck ptosis. She has minimal adiposity in the lower abdomen. In addition to rhytidectomy, fat grafting is being considered to improve the mid face volume. Which of the following is the most appropriate donor site for fat grafting in this patient?

A) Abdomen

B) Back

C) Gluteal region

D) Inner thighs

E) Submental area

The correct response is Option D.

Of the choices listed, the inner thighs would be the best choice since they would probably have an appropriate volume. The inner thighs and the lower abdomen (which is not available in this patient) have been shown to have the highest proportion of adipose-derived stem cells compared with the other sites listed. The submental area would not have the appropriate volume. The abdomen has undergone previous surgery and may not have the necessary volume. The back and gluteal areas would have a lower proportion of adipose-derived stem cells.

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169. A 32-year-old woman presents for neck rejuvenation. On examination, she has diffuse neck lipodystrophy involving the central and lateral neck. There is good skin recoil without excess skin, no visible platysmal edges, and no jowling. The patient is interested in a single treatment. Which of the following treatments will have the best aesthetic result?

A) Cryolipolysis

B) Deoxycholic acid

C) Direct excision

D) Lower rhytidectomy

E) Suction-assisted lipectomy

The correct response is Option E.

Suction-assisted lipectomy is the best option for young patients with good skin quality, diffuse lipodystrophy that extends beyond the central neck, and no need to manipulate the platysma. Aesthetic principles for neck rejuvenation include improving definition of the cervicomental angle, removing adipose tissue, correcting platysmal banding, and removing excess skin.

Cryolipolysis and deoxycholic acid are useful for young patients with good skin quality and no platysmal banding and who have focal lipodystrophy. Both of these nonsurgical interventions often require multiple treatment sessions to achieve patient satisfaction.

Direct excision of fat is most useful when patients require manipulation of the platysma as well as removal of deep central compartment fat. Overresection can create contour deformities.

Lower rhytidectomy is useful for patients with skin laxity.

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170. The flow resistance of a liposuction cannula is directly proportional to which of the following factors?

A) Internal diameter

B) Length

C) Suction strength

D) Tubing weight

The correct response is Option B.

Successful liposuction takes into consideration multiple technical factors. Cannula size impacts both efficiency and outcomes; larger cannula diameter increases liposuction efficiency but also increases the risk for contour deformity. The resistance of a uniform cylinder such as a cannula is given by $R=\rho L/A$, where resistivity ρ is a property of the material, L is the length of the cylinder, and A is the cross-sectional area. Of those, both diameter and cannula length are represented. Because cannula length is in the numerator, it is directly proportional to resistance. Resistance is inversely proportional, by contrast, to the diameter.

Put another way, liposuction will occur at a faster rate with a larger diameter tube and a shorter length cannula; aspiration rate is the inverse of resistance. Tubing weight may impact the ease of liposuction and surgeon fatigue but does not affect resistance. Similarly, suction strength is not a factor in resistance.

Thus, in choosing a cannula, both diameter and cannula length are important for resistance.

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171. A 25-year-old woman who had a cheek filler placed 1 week ago is concerned about the asymmetry of her cheeks. She directly messages the plastic surgeon on the practice's social media account. Which of the following is the most appropriate response from the surgeon?

A) Answer the patient's concerns through direct messaging

B) Ask office staff to call the patient

C) Block the patient on the account

D) Ignore the message

E) Make a new social media post regarding cheek asymmetry after filler

The correct response is Option B.

Social media is on the rise with plastic surgery practices, and it is important to avoid the pitfalls. One cannot provide medical advice by means of social media platforms; only general, impersonal information can be provided. The patient should be redirected to communicate through the office. Blocking the patient from social media negatively affects the physician-patient relationship without directly addressing the issue. It is important to inform the patient that any communication should be through the office.

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172. A 40-year-old woman presents for improvement of fine rhytides, uneven skin tone, and hyperpigmentation of the facial skin. A peel using a combination of modified Jessner solution and 35% trichloroacetic acid is applied. After application, uniform frosting with some background erythema is noted. Which of the following combinations of peel chemical and treatment depth is most likely responsible for the frosting response in this patient?

	Peel Chemical	Treatment Depth
A)	Modified Jessner solution	epidermis
B)	Modified Jessner solution	papillary dermis
C)	Modified Jessner solution and 35% trichloroacetic acid	reticular dermis
D)	35% Trichloroacetic acid	epidermis
E)	35% Trichloroacetic acid	papillary dermis

The correct response is Option E.

Uniform frosting with background erythema is seen in medium-depth peels which penetrate into the papillary dermal layer. A 35% trichloroacetic acid peel is an example of a medium-depth peel. The modified Jessner solution peel, which usually consists of a combination of lactic acid (17%), salicylic acid (17%), and citric acid (8%), is considered a superficial peel. A modified Jessner solution peel in the first step of a combination peel can increase the efficacy and decrease potential complications from a higher percentage trichloroacetic acid peel. Frosting is not seen with superficial peels since they penetrate only within the epidermal layers. A deeper peel would have more of a solid, white frost without erythema as it penetrates into the reticular dermis. Typically a trichloroacetic acid peel would have to be applied in a higher concentration (greater than 50%) to affect that response.

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173. A 23-year-old woman is concerned about excess fat bulging in the bilateral flanks. Cryolipolysis is recommended. Which of the following is the primary mechanism for achieving the outcomes in cryolipolysis?

A) Apoptosis

B) Atrophy

C) Necroptosis

D) Pyroptosis

The correct response is Option A.

One of the most recent forms of noninvasive fat reduction is cryolipolysis. Histologic studies show that during the process of cryolipolysis, an inflammatory response occurs at different stages with inflammatory cell infiltrates peaking at 30 days, which leads to adipocyte apoptosis. Apoptosis is a form of programmed cell death, or "cellular suicide," an orderly process in which the cell's contents break down and are packaged into small packets of membrane for "garbage collection" by immune cells.

Atrophy is the decrease in size of a body part, cell, organ, or other tissue.

Necroptosis is a mode of regulated cell death. It requires protein receptor-interacting serine/threonine-protein kinase 3 (previously well recognized as a regulator of inflammation, cell survival, and disease) and its substrate of mixed lineage kinase domain-like protein, the crucial players of this pathway.

Pyroptosis is a type of an inflammatory cell death that is usually caused by microbial or viral infection. It is accompanied by activation of inflammasomes and maturation of proinflammatory cytokines interleukin-1 beta and interleukin-18.

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174. A 57-year-old woman who underwent a mastectomy and axillary lymph node dissection is evaluated because of left arm lymphedema. Preoperatively, she received neoadjuvant chemotherapy. She reports that she uses compression garments every day, and she wakes up at night with pain and numbness in the index and middle fingers of the left hand. Examination shows pitting edema of the left arm. A Tinel sign is present over the median nerve at the left wrist, and the physician cannot pinch the skin over the dorsal aspect of the hand. Which of the following is a CONTRAINDICATION to liposuction as a treatment modality in this patient?

A) Carpal tunnel syndrome

B) Pitting edema

C) Positive Stemmer sign

D) Preoperative treatment with neoadjuvant chemotherapy

E) Use of compression garments

The correct response is Option B.

Postmastectomy arm lymphedema occurs because of radiation and surgical damage to the lymphatic system of the extremity. Because of this lymphatic damage, the system is ineffective in complete lymph management. Over time, with chronic extremity lymphedema, the adipose tissue becomes hypertrophied.

Pitting edema is a contraindication for liposuction because it indicates excess fluid rather than adipose hypertrophy alone. Studies have shown that liposuction can achieve significant long-term reduction of arm circumference but note that pitting edema greater than 5 mm was an exclusion criteria for a 5-year prospective study (Hoffner, Ohlin, Svensson, et al).

Use of compression garments is, in fact, a prerequisite for liposuction, both before and after the procedure, because it indicates optimizing conservative management. Carpal tunnel syndrome is not a contraindication; liposuction addresses subcutaneous fat and occurs proximal to the carpal tunnel.

A Stemmer sign, sometimes called Kaposi-Stemmer sign, is a finding from a physical examination maneuver to test for lymphedema. The examiner attempts to pinch and lift skin at the middle finger or the base of the second toe, if lower extremity lymphedema is being

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assessed. A positive test is considered pathognomonic for lymphedema. A negative test does not rule out lymphedema, although a negative test is often associated with other causes of swelling.

Neoadjuvant chemotherapy is chemotherapy administered prior to definitive surgical treatment and does not impact later treatment of lymphedema.

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175. A 58-year-old woman presents to the clinic because of concerns with smiling 2 days after undergoing a rhytidectomy. On examination, the right lower lip rides over the lower teeth and cannot be pulled down with grimacing. Which of the following right-sided nerves is most likely injured?

A) Buccal

B) Greater auricular

C) Marginal mandibular

D) Mental

E) Zygomatic

The correct response is Option C.

The marginal mandibular branch of the facial nerve is located in the mid mandible 2 cm posterior to the oral commissure. Injury results in paralysis of the lower lip. This is found clinically when the patient smiles with an inability to show the lower teeth on the affected side. This is a result of the denervated depressor anguli oris muscle, which acts to pull the corner of the mouth and lower lip down.

The greater auricular nerve is a cutaneous nerve originating from the cervical plexus giving sensory innervation to the lower ear and the skin over the parotid and temporal regions. There is no motor component. The zygomatic and buccal branches of the facial nerve have motor components and innervate muscles like the zygomaticus major that, in this case, elevate the corner of the mouth. They do not innervate muscles that cause lip depression. The mental nerve is a purely sensory nerve originating from cranial nerve V_3. It provides sensation in the area around the lower lip but does not have a lip-depressing motor function.

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176. A 25-year-old woman requests removal of multiple small bumps near the margin of the areolae bilaterally because she believes they signify breast cancer. On examination, the plastic surgeon determines that the concerning areas are normal physiological structures of the areolae. The most likely outcomes if these structures are removed is a decrease in which of the following aspects of the areola?

A) Contractility

B) Pigmentation

C) Sensation

D) Size

E) Skin lubrication

The correct response is Option E.

The most likely outcome if these normal structures are removed is decreased areola skin lubrication. The nipple-areola complex contains specialized structures including the termination of the lactiferous ducts and the Montgomery glands or tubercles. Montgomery glands or tubercles are accessory glands that vary in number and size and are often noted near the margin of the areola. Should these be removed, there is a potential for decreased quality of the skin of the areola. The character of these structures is not related to breast cancer. Limited removal of the structures without disruption of other anatomical components of the nipple-areola complex would not decrease nipple reactivity, areola sensation, or contractility of the areola as these are controlled by nerve and smooth muscle mechanisms rather than glands.

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177. A 42-year-old woman comes to the office to discuss abdominoplasty. Physical examination shows wide diastasis recti and excess skin above and below the umbilicus. Which of the following findings in this patient's history would be the strongest indication for further evaluation for thrombophilia and possible deep vein thrombosis chemoprophylaxis?

A) Family history of malignant hyperthermia

B) Sleep apnea

C) Three previous miscarriages

D) Type 2 diabetes

E) 20-Year history of smoking two packs of cigarettes daily

The correct response is Option C.

Screening for a patient's risk for deep vein thrombosis (DVT) begins with a focused medical history. The 2005 Caprini Tool for DVT Risk Assessment includes multiple miscarriages (≥3) as a risk factor. It is imperative for these patients to be identified and further evaluated. In patients with thrombophilia, the miscarriage is caused by placental thrombosis. The miscarriage usually occurs late in the pregnancy. These mothers can often be brought to term with anticoagulation therapy.

If these patients undergo abdominoplasty, chemoprophylaxis should be strongly considered. The most common inherited thrombophilia is factor V Leiden gene mutation that is present in 3 to 8% of people with European ancestry. Blood test evaluation will identify both inherited and acquired thrombophilia.

Thrombosis and thrombophilia are not the primary associations with the other medical conditions. Smoking and diabetes will increase wound healing problems. Malignant hyperthermia is a rare but potentially fatal sensitivity to volatile anesthetics and depolarizing neuromuscular blocking agents. It creates a hypermetabolic condition of skeletal muscle. Sleep apnea causes episodes of airway obstruction.

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178. A 51-year-old man diagnosed with Norwood Stage 4 pattern of androgenic alopecia applies topical minoxidil daily. Which of the following best describes the proposed mechanism of action of this medication?

A) Alpha-granule activation leading to release of transforming growth factor and vascular endothelial growth factor

B) 5-Alpha reductase type II inhibitor leading to decreased dihydrotestosterone concentration

C) Cytochrome C oxidase oxidation leading to increased adenosine triphosphate production

D) Potassium channel opening leading to blood vessel dilation

E) Prostaglandin F2alpha analog leading to increased outflow of aqueous fluid

The correct response is Option D.

There are currently only two FDA-approved drugs for the treatment of androgenic alopecia (AGA): minoxidil and finasteride. Several devices and modalities exist with promising data; however, the mechanism of action of many of these treatments is still not understood. Minoxidil is believed to work primarily by increasing blood flow by opening potassium channels leading to vasodilation at the follicular level, which promotes hair regrowth or hair stabilization in those follicles affected genetically by androgenic alopecia. Minoxidil was serendipitously noted to increase hair growth when the drug was studied as a potent treatment for hypertension because of its pronounced vasodilatory function. The drug causes hyperpolarization of cell membranes by functioning as a potassium channel opener. Blood vessel dilation (by opening potassium channels) allows more oxygen, blood, and nutrients to the follicles, theoretically causing follicles in the telogen phase to shed. These follicles are then replaced by thicker hairs in a new anagen phase.

Finasteride inhibits 5-alpha reductase type II, leading to decreased circulating levels of dihydrotestosterone, which leads to maintenance and/or increased amounts of terminal hairs in the anagen phase by inhibiting and sometimes reversing miniaturization of the hair follicle. Platelet-rich plasma is an emerging technology that shows significant promise in several medical disciplines. Through the centrifugation process, platelets are isolated from drawn blood and injected into the scalp dermis. Platelets are known to contain numerous growth factors (transforming growth factor-beta, fibroblast growth factor-2, platelet-derived growth

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factor, insulin-like growth factor-1, epidermal growth factor, hepatocyte growth factor, and vascular endothelial growth factor) in their alpha granules. Biologic activity occurs when growth factors come into contact with target receptors in numerous cell types. Bimatoprost is a prostaglandin F_{2alpha} analog approved by the FDA (originally) for the treatment of ocular hypertension by increasing the outflow of aqueous fluid from the eye. Unexpectedly, increased eyelash hair growth occurred. The drug is being studied in larger cohorts to assess impact on AGA. Low-level light therapy (LLLT) has been shown to induce hypertrichosis in several wavelengths. The mechanism of action is thought to be mediated through the mitochondria cellular respiratory chain. Absorption of photons from LLLT leads to oxidation of cytochrome C oxidase, resulting in increased adenosine triphosphate production. Upregulation of growth factors due to this mechanism has led to cellular proliferation and hair growth.

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179. A 15-year-old girl is brought to the plastic surgeon because of breast asymmetry. Examination shows a minimally tender, mobile mass of the upper outer quadrant of the left breast that measures approximately 4 cm in size. The patient reports that the mass has been present for 2 years. Which of the following is the most appropriate next step in management?

A) Excisional biopsy

B) Incisional biopsy

C) Mammography

D) MRI

E) Ultrasonography

The correct response is Option E.

The mass is most likely a fibroadenoma. Fibroadenomas are commonly located in the upper outer quadrant of the breast in adolescents and are circumscribed and mobile on physical examination. They are the most common breast mass in adolescents and commonly regress. If they are less than 5 cm in size, they can be observed. Giant fibroadenomas are characterized by sizes greater than 5 cm and should be excised.

Fibroadenomas that persist should be imaged, and the preferred imaging modality for adolescents is ultrasonography. Mammography confers a radiation dose that is not necessary for diagnosis, and adolescent breast tissue is dense. MRI is not necessary for diagnosis. While biopsy may ultimately be necessary, it is not performed prior to imaging.

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180. A 16-year-old girl is referred for evaluation of breast asymmetry. She wears a size 36C brassiere, but she notes that the right breast does not fill the cup. On examination, the left breast appears normal, and the right breast has no identifiable nipple-areola complex or palpable glandular tissue. The pectoralis muscle and ribs appear normal. The patient's development is consistent with Tanner stage 4. Which of the following is the most likely diagnosis?

A) Amastia

B) Amazia

C) Anterior thoracic hypoplasia

D) Athelia

E) Poland syndrome

The correct response is Option A.

Amastia is the complete absence of the nipple-areola complex and glandular breast tissue. Athelia is the absence of the nipple-areola complex; however, the glandular tissue is present. Amazia is absence of the breast tissue, but a normal nipple-areola complex is present.

In Poland syndrome, one finds varying degrees of thoracic and ipsilateral upper extremity anomalies. This typically includes some degree of breast hypoplasia or absence, and partial or complete absence of the pectoralis muscle. More involved cases may have the absence of ribs and the presence of digital abnormalities (eg, syndactyly, brachydactyly).

Anterior thoracic hypoplasia consists of posterior displacement of the ribs, anterior unilateral sunken chest wall, hypoplasia of the breast on the involved side, and superior displacement of the nipple-areola complex. The sternum and pectoralis major are normal.

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181. A 62-year-old woman comes to the office for a facial rejuvenation consultation. She also expresses dissatisfaction about the thinning of her hair over the last few years. Physical examination shows that she has maintained her frontal hairline and has generalized thinning of her hair. Which of the following is the most appropriate initial treatment for the female pattern hair loss in this patient?

A) Bimatoprost

B) Finasteride

C) Minoxidil

D) Spironolactone

The correct response is Option C.

Female pattern hair loss differs from male pattern hair loss in that the loss of the terminal hairs in the affected region is usually incomplete. Thus, women will have diffuse thinning of the hair with preservation of the frontal hairline. There will be a visible reduction in hair density. The prevalence of female pattern hair loss is estimated at 19%.

Minoxidil is the first-line treatment for patients with female pattern hair loss. It has the strongest evidence for efficacy and is well-tolerated.

Bimatoprost is used for eyelash growth. It has been investigated for use in the scalp, but well-designed studies are not available as of yet.

Dutasteride and finasteride are 5-alpha reductase inhibitors. Both are approved for use in male pattern baldness; however, use for female pattern hair loss would be off-label. Because of the anti-androgenic effects, 5-alpha reductase inhibitors are not recommended in women of childbearing age.

Spironolactone is an aldosterone antagonist that competitively blocks androgen receptors and weakly inhibits androgen synthesis. It is used as an adjunct to minoxidil. Its use in female pattern hair loss is off-label. Evidence supporting its use in hair loss is of a lower level.

Platelet-rich plasma has been touted to be of benefit in female pattern hair loss. However, once again, studies that suggest a benefit are limited in their design and are of lower levels of evidence.

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182. A 30-year-old man presents with increased, rounded scleral show of the lateral triangle 4 months after undergoing open reduction and internal fixation of an orbital floor fracture. The patient reports no vision changes. Physical examination shows no ptosis. Which of the following is the most likely cause of the increased scleral show in this patient?

A) Cranial nerve III injury

B) Failure to suspend the lateral canthal tendon

C) Orbital floor plate malposition

D) Undiagnosed medial orbital wall fracture

E) Weakness of the inferior rectus muscle

The correct response is Option B.

Failure to suspend the lateral canthal tendon will cause rounding of the lower lid and increased lateral scleral show.

Orbital floor plate malposition and weakness of inferior rectus muscle are incorrect because the patient does not report vision changes or symptoms of malposition.

Cranial nerve III injury is incorrect because the patient does not have ptosis.

Undiagnosed medial orbital wall fracture is incorrect because the patient does not report vision changes because of medial rectus dysfunction. It is uncommon for medial orbital wall fracture to cause symptoms, but they can include enophthalmos, medial rectus entrapment, or fibrosis.

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183. A 70-year-old woman is evaluated because of left-sided breast cancer diagnosed after workup for persistent erythema of the skin. History includes type 1 diabetes (hemoglobin A_{1C} concentration of 5%). The patient wears a D-cup brassiere, and BMI is 34 kg/m^2. Examination of a specimen obtained on biopsy demonstrates tumor cells infiltrating the dermis. Which of the following risk factors is the strongest indicator for delayed, rather than immediate, breast reconstruction in this patient?

A) Advanced age

B) BMI category

C) Breast size

D) Cancer type

E) Medical comorbidity

The correct response is Option D.

The risk factor most strongly indicating delayed, rather than immediate, breast reconstruction is cancer type. The described findings of erythema of the skin and biopsy demonstrating tumor cells infiltrating the dermis are consistent with inflammatory breast cancer. Guidelines recommend against immediate breast reconstruction at the time of surgical treatment for inflammatory breast cancer because of the high likelihood of recurrence and severity of disease, which would make potential delay in adjuvant therapy more concerning. While age, higher BMI, breast size, and medical comorbidities may be considered potential contraindications, the severity of these factors in the scenario are not usually considered strict contraindications to immediate breast reconstruction.

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184. A 32-year-old woman presents with "double-bubble" deformities after undergoing primary augmentation mammaplasty 5 years ago because of a history of tuberous breasts. She has undergone several revisionary procedures to lessen the appearance of the native inframammary crease, but they were not successful. Implant exchange from the submuscular plane to the subglandular plane is planned. This procedure will most likely improve the "double-bubble" deformities in this patient through which of the following mechanisms?

A) Eliminating muscular displacement of the implant

B) Minimizing formation of a peri-implant capsule

C) Preventing ptosis of the breast tissue over the implant

D) Releasing the superficial fascial attachments to the skin

The correct response is Option D.

In some cases of recalcitrant "double-bubble" deformity, exchange of the implant to a subglandular plane may be beneficial. A "double-bubble" deformity occurs when the lower portion of the implant lies between the native inframammary crease and the new inframammary crease. Thus, two horizontal bands are present in the lower pole of the augmented breast; the more superior crease represents pull of the superficial fascia from the native inframammary crease on the overlying dermis, while the inferior crease represents one that was newly created during dissection and lowering of the fold. Tuberous breasts are at risk for developing a "double-bubble" deformity after primary augmentation mammaplasty with implants due to the characteristic findings of a high-riding inframammary crease, deficient breast tissue in one or more quadrants of the breast, and superficial fascial bands constricting breast parenchymal development. In augmentation mammaplasty of tuberous breasts, exchange of the implants to a subglandular plane will enable a more complete release of the superficial fascial attachments to the deep dermis and allow unfurling and expansion of the lower pole of the breast.

Muscular displacement of the implant inferolaterally is not the most likely reason for a visible crease in the breast, so eliminating muscular displacement of the implant is incorrect. Subglandular placement of the implants would increase the risk for capsular contracture, so minimizing formation of a peri-implant capsule is also incorrect. Preventing ptosis of the breast tissue over the implant refers to a "snoopy" breast deformity, not a "double-bubble" breast deformity.

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185. A 60-year-old woman who is considering silicone implant-based postmastectomy reconstruction asks about what she should expect for postoperative surveillance imaging. Which of the following is the best recommendation for asymptomatic surveillance in this patient?

A) High-resolution ultrasonography 5 years postimplantation

B) Implant displacement mammography 1 year postimplantation

C) Monthly self-examinations of the breasts

D) Noncontrast CT scan 7 years postimplantation

E) Noncontrast MRI 3 years postimplantation

The correct response is Option A.

The most accurate recommendation for asymptomatic silicone implant surveillance is high-resolution ultrasonography 5 years postimplantation. The FDA recently issued updated asymptomatic silicone implant surveillance imaging recommendations. These state that asymptomatic patients may undergo their first imaging 5 to 6 years after silicone implantation using ultrasonography or MRI, followed by imaging every 2 to 3 years afterward. The FDA recommends that MRI is preferentially used for symptomatic patients or those with equivocal ultrasonography results. Monthly self-examinations of the breasts and mammography are more appropriate screenings for breast cancer. The recommendation for an MRI at 3 years postimplantation is now outdated. No recommendations exist regarding CT scans, and the 7 year postimplantation time frame is longer than recommended for initial imaging.

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186. A 25-year-old woman comes to the office to discuss labiaplasty because of discomfort and dissatisfaction with the appearance of her labia. Examination shows asymmetry and prominence of the labia minora and clitoral hood. An edge labiaplasty and clitoral hood reduction are planned. Dissection in which of the following anatomic areas presents the greatest risk for sexual dysfunction and permanent injury to the sensory nerves in this patient?

A) Anterior clitoral hood

B) Clitoral frenulum

C) Interlabial sulcus

D) Lateral clitoral hood

E) Vaginal fourchette

The correct response is Option A.

Knowledge of the neuroanatomy of the vulvar area is essential for successful outcomes in labiaplasty and clitoral hood reduction surgery. Sensation to the clitoris is carried in paired dorsal nerves located in the anterior clitoral hood between the 2 o'clock and 11 o'clock positions. These nerves run just below the superficial fascia of the clitoral hood and can be injured if resection is more than skin-only. In contrast to "skin-only resection" of the clitoral hood, edge resection of excess labia minora is a full thickness resection. Temporary sensory changes are normal and usually resolve in weeks to months without sexual dysfunction.

The lateral clitoral hood would not contain these dorsal nerves; however, the skin is lax and mobile, and skin-only resections should be done throughout the clitoral resection. The clitoral frenulum is an extension of the labia minora to the clitoris. Most excision techniques end the resection at the frenulum. The interlabial sulcus is the crease between the labia majora and minora. Resection of the labia minora is not in the sulcus and usually begins at least 1 cm distal to the sulcus. The vaginal fourchette is the posterior extension of the labia minora where the two sides merge in a V-shaped skin fold.

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187. A 32-year-old woman presents for bilateral reduction mammaplasty. She is administered 1 g tranexamic acid (TXA) intravenously before incision. Which of the following best describes the mechanism of action of TXA?

A) Activates proteins C and S

B) Inhibits antithrombin III

C) Inhibits platelet aggregation

D) Inhibits proteolysis of protease-activated receptor-1

E) Prevents plasmin from binding to fibrin

The correct response is Option E.

Tranexamic acid is a synthetic reversible competitive inhibitor to the lysine receptor found on plasminogen. The binding of this receptor prevents plasmin (the activated form of plasminogen) from binding to and ultimately stabilizing the fibrin matrix. Heparin inhibits antithrombin. Aprotinin is a competitive inhibitor of several serine proteases, specifically trypsin, chymotrypsin, and plasmin, by inhibiting proteolysis of protease-activated receptor-1. Inhibition of platelet aggregation and activation of protein C and S are antithrombotic mechanisms.

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188. A 46-year-old woman who has moderate acne scars on her face is interested in improving the appearance of the scars. She has Fitzpatrick Type IV skin. The patient is very concerned about possible postprocedure dyspigmentation. Which of the following is the most appropriate technique that would address the patient's concerns?

A) Chemical peeling

B) Dermabrasion

C) Full-field CO_2 laser

D) Microneedling

E) Onion extract-based scar gel

The correct response is Option D.

Multiple treatment modalities have been shown to improve scar deformity, such as laser therapy, chemical peeling, dermabrasion, and microneedling. Although they can be effective, they also may be associated with prolonged recovery and adverse effects. Dyspigmentation, including postinflammatory hyperpigmentation and/or hypopigmentation, have higher risk of occurring in patients with Fitzpatrick Type IV to VI skin. Among the options, microneedling therapy carries a decreased risk for the many cutaneous adverse effects that can occur with conventional resurfacing modalities.

According to research studies, scar height and itchiness can be improved by applying onion extract-based gel (Mederma), but there are no changes in erythema and pliability, or overall appearance, compared with placebo.

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189. A 54-year-old woman with Fitzpatrick Type III skin plans to undergo Er:YAG laser (2940 nm) resurfacing to improve the appearance of periorbital rhytides. Prior to treatment, the plastic surgeon recommends a topical agent that inhibits enzymatic conversion of tyrosine to dihydroxyphenylalanine. Which of the following agents did the surgeon most likely discuss?

A) Brimonidine

B) Fluocinolone acetonide

C) Hydroquinone

D) Tretinoin

E) Zinc oxide

The correct response is Option C.

Use of nonsurgical skin rejuvenation has increased exponentially over the past 20 years, with over 4.6 million cases performed annually. This increase has led to expansion of different types of devices for resurfacing. The use of lasers for facial resurfacing has been discussed since the 1980s, initially with carbon dioxide lasers and then with erbium-doped yttrium aluminium garnet (Er:YAG) lasers in the late 1990s. Ablative laser treatments have been used to target actinic skin damage and moderate to heavy rhytides.

Post-inflammatory hyperpigmentation (PIH) is a common sequela of laser resurfacing procedures. Pretreatment with various topical agents can optimize the skin, decreasing the risk for this well-known adverse event. Hydroquinone decreases melanin production by enzymatically inhibiting the conversion of tyrosine to dihydroxyphenylalanine.

Tretinoin promotes cornified cell detachment and enhances shedding. It also increases mitotic activity, thereby increasing loosely adherent corneocytes turnover. Tranexamic acid is a synthetic derivative of the amino acid lysine and binds the five lysine binding sites on plasminogen. This inhibits plasmin formation and displaces plasminogen from the fibrin surface. In melasma, the hypothesized mechanism of action of tranexamic acid includes the shrinkage of dermal vasculature and decreased melanin synthesis by altering the interaction of keratinocytes and melanocytes and decreasing tyrosinase activity. Fluocinolone acetonide is a potent corticosteroid that is often used in conjunction with tretinoin and hydroquinone to treat pre-existing PIH and/or for pretreatment of the skin prior to laser resurfacing. By itself,

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fluocinolone does not have the aforementioned mechanism of action. Brimonidine gel, originally approved for the treatment of facial rosacea, causes direct vasoconstriction. This alpha-adrenergic receptor agonist is often used in conjunction with topical steroids to help decrease the risk for PIH. Zinc oxide is a physical barrier sunscreen.

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190. A 48-year-old woman presents to the office with chemosis in the right eye 17 days after undergoing bilateral upper and lower blepharoplasties with lateral canthopexy. Treatment with ocular lubrication and eye patching during the past 10 days has resulted in no improvement. On examination, she is able to close her eyes despite pronounced conjunctival prolapse. The color of the conjunctivae has a whitish appearance. Which of the following is the most appropriate next step to achieve the quickest resolution of chemosis in this patient?

A) Administration of celecoxib

B) Administration of methylprednisolone

C) Administration of tobramycin/dexamethasone eye drops

D) Conjunctival plication

E) Conjunctivotomy

The correct response is Option E.

The best option for this patient is a conjunctivotomy to drain the fluid. She may also benefit from a lateral tarsorrhaphy.

Chemosis can be classified as mild, moderate, or severe based on the degree of conjunctival prolapse between the eyelids. This patient had moderate chemosis based on significant conjunctival prolapse but maintaining the ability to close her eyelids.

Chemosis may develop intraoperatively and can be treated with conjunctival plication. It typically occurs within the first postoperative week. Initial treatment for mild chemosis includes lubricating drops and/or tobramycin/dexamethasone drops, which aim to decrease inflammation and potential infection. Moderate chemosis may benefit from the addition of eye patching.

After chemosis has been present for 2 to 3 weeks, the inflammatory phase has likely passed, as confirmed in this patient by the whitish appearance of the conjunctiva on examination. Anti-inflammatory medications, whether topical or oral, are no longer beneficial. Patients are likely to benefit from conjunctivotomy to drain the fluid that has accumulated.

Oral steroids, such as methylprednisolone, are not indicated until after attempted treatment with conjunctivotomy and lateral tarsorrhaphy.

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191. A 45-year-old woman comes to the office for a facial rejuvenation consultation because she wants to look her best at an upcoming high school reunion in 10 days. Which of the following is the best treatment to recommend for this patient?

A) 30 U of botulinum toxin type A injected to the forehead and crow's feet

B) 30% Glycolic acid peel

C) Phenol (carbolic acid) peel

D) Superficial papillary dermabrasion

E) 20% Trichloroacetic acid peel

The correct response is Option A.

Botulinum toxin type A has been used for the treatment of facial rhytides as well as various neuromuscular disorders such as strabismus, blepharospasm, and hemifacial spasm. Botulinum toxins are exotoxins of *Clostridium botulinum*, a gram-positive, anaerobic, spore-forming organism. There are eight distinct subtypes. Type A botulinum toxins have been used in treatment of cosmetic facial wrinkles, one of the main indications. The specific action of botulinum toxin is on peripheral cholinergic synapses that affects the receptor-mediated endocytosis in the areas of these synapses, with subsequent selective proteolysis of the vesicular synaptonemal-associated protein. This prevents release of acetylcholine into the neuromuscular synaptic gap and resultant muscular contraction. This patient would be best served by using botulinum toxin type A to achieve a smoother facial profile given her accelerated time frame.

Chemical peeling causes controlled destruction of parts of the epidermis and/or dermis, followed by regeneration of new dermal and epidermal tissues. In a controlled manner, a chemical peel induces injury at a specific depth of the skin. Peels are categorized as superficial (necrosis of epidermis only), medium depth (wound through the epidermis into the level of the upper reticular dermis), or deep (penetrate to the mid reticular dermis), depending on the level of injury.

A 20% trichloroacetic acid (TCA) peel causes medium-depth injury, extending to the papillary dermis, resulting in a period of erythema and epidermal healing that is unacceptable to patients who want short-term results. Depth and consistency of this peel is variable and depends on pretreatment with tretinoin/hydroquinone, strength of solution, and duration of application.

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Using a 30% glycolic acid peel, depth of injury is limited to the stratum corneum and perhaps mild epidermal peeling. This is an alpha-hydroxy acid that promotes superficial desquamation and may stimulate cell turnover and production. Solutions of 50 to 70% may be used for deeper peels. Depth of injury is also time-dependent, and the acid must be neutralized or washed off with water. This patient's time frame would not allow enough healing time to attempt this type of peel.

Phenol peels are also medium-deep level peels that require a longer recovery time for healing. Phenol (carbolic acid) is an aromatic hydrocarbon derived from coal tar. These peels provide a controlled, predictable chemical injury with consistent penetration to the upper reticular dermis. They have a profound effect on coarse facial rhytides. Patients must be monitored closely due to significant bleaching action and hypopigmentation. There is potential for the development of cardiac toxicity associated with increased levels of phenol in the blood.

Dermabrasion, a method of skin resurfacing involving controlled mechanical abrasion of the epidermis and a variable portion of the dermis, is especially useful for treatment of scars, facial rhytides, and skin deformities associated with rhinophyma. The process results in mechanical depression of scars and elevated tissues and induction of collagen synthesis. Following dermabrasion, wound repair begins in the remnant dermal appendages. The depth of dermabrasion is determined by the clinical endpoints encountered during the treatment process. The epithelium is removed initially; the dermal-epidermal surface is smooth and does not bleed. Sparse, punctate bleeding indicates that the superficial papillary dermis has been reached. Re-epithelialization typically occurs within 7 to 10 days, but erythema may persist for as long as 6 weeks after treatment.

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192. A 24-year-old woman with a round face comes to the office to discuss buccal fat pad removal. The parotid duct travels through which of the following structures of the buccal fat pad prior to emptying intraorally via the Stensen duct?

A) Buccal extension of the posterior lobe

B) Inferior portion of the anterior lobe

C) Intermediate lobe

D) Posterior portion of the anterior lobe

E) Pterygoid extension of the posterior lobe

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

The correct response is Option D.

The buccal fat pad is divided into three lobes anatomically: anterior, intermediate, and posterior. The triangular-shaped anterior lobe is located below the zygoma and extends anterior to the maxilla and buccinator muscle and posterior to the zygomaticus major muscle. The parotid duct passes through the posterior part of the anterior lobe. The facial vein passes through the anterior-inferior margin of the lobe, and the facial nerve branches lie on the outer surface of the capsule. The intermediate lobe lies in the space around the lateral maxilla between the anterior and posterior lobes. The posterior lobe is located in the masticatory space surrounding the temporalis muscle and tendon along the mandibular body. The posterior lobe forms the buccal, pterygoid, pterygopalatine, and temporal extensions.

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193. A 61-year-old woman comes to the office to discuss facial rejuvenation. Physical examination shows neck and jowl laxity, diastasis of platysma bands, and brow ptosis. Management with rhytidectomy, a superficial musculoaponeurotic system (SMAS) flap, platysmaplasty, and subcutaneous lateral brow lift is planned. Injury to the facial nerve in which of the following anatomic areas of dissection is most likely?

A) Sub-SMAS, at the lateral malar eminence

B) Sub-SMAS, 2 cm anterior to the tragus

C) Sub-SMAS, 1 cm inferior to the zygomatic arch

D) Subcutaneous, 6.5 cm inferior to the caudal edge of the external auditory meatus

E) Subcutaneous, 1 cm superior to the tail of the eyebrow

The correct response is Option A.

Knowledge of the three-dimensional anatomy of the facial nerve is essential to avoid motor nerve injuries. Although the two-dimensional branching patterns of the facial nerve are variable, the plane in which these nerves travel is consistent.

Dissection in the sub-superficial musculoaponeurotic system plane at the lateral malar eminence is a zone in which the zygomatic branch of the facial nerve is vulnerable to injury. The zygomatic branches exit the parotid gland anteriorly and innervate the zygomaticus major, which is superficially positioned just lateral to the malar eminence. The zygomatic and masseteric ligaments are fibrous bands located in this same area, which can obscure the correct plane of dissection. Injury to the zygomatic branches can result in an asymmetric smile.

Dissection in the sub-superficial musculoaponeurotic system plane, 2 cm anterior to the tragus, is a safe area. The facial nerve is in a deeper plane and protected by the parotid gland and the parotid masseteric fascia. The facial nerve is also protected by the parotid gland and parotid masseteric fascia 1 cm inferior to the zygomatic arch.

The frontal branch of the facial nerve exits the parotid at the zygomatic arch and then travels cephalically in the temple. Nerve branches are deep to the temporal parietal fascia and the frontalis muscle. The frontal branch is usually 1 cm superior to the tail of the eyebrow; however, it is not in the subcutaneous plane. It is deep to the fascia and muscle.

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The great auricular nerve is vulnerable to injury at McKinney's point (6.5 cm below the external auditory meatus is the great auricular nerve). This is a sensory nerve and not a branch of the facial nerve.

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194. A 70-year-old woman considers a mastopexy to address the ptosis she has experienced after the onset of menopause. A decrease in which of the following hormones is most responsible for the involutional changes of the breast glandular parenchyma?

A) Estrogen

B) Follicle-stimulating hormone

C) Luteinizing hormone

D) Prolactin

E) Testosterone

The correct response is Option A.

The hormone decrease most responsible for the involutional changes of the breast glandular parenchyma during menopause is estrogen. During menopause, estrogen concentrations decrease, promoting glandular involution with decreased cellularity and vascularity of the glandular tissue. Prolactin decreases are less associated with menopausal changes to the breast. Luteinizing hormone and follicle-stimulating hormone have important impacts during different phases of the menstrual cycle before menopause and may both increase in concentration during menopause. Testosterone changes do not primarily impact the breast parenchyma during menopause.

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195. A 53-year-old woman comes to the office because she would like to improve the appearance of her jowls. She elects to undergo injection adipocytolysis of the inferior jowl fat pad. A line drawn between which of the following structures best defines the lateral limit of the fat pad?

A) Antegonial notch and ear lobule

B) Lateral canthus and antegonial notch

C) Lateral canthus and prejowl sulcus

D) Oral commissure and antegonial notch

E) Oral commissure and prejowl sulcus

The correct response is Option B.

Injection adipocytolysis is commonly performed with deoxycholic acid, which induces cellular injury by permanently destroying the cellular membrane of adipocytes. Treatment of the inferior jowl fat pad is popular for nonsurgically improving the appearance of the jawline. Surface landmarks and injection depth are paramount in treating the appropriate fat pad and minimizing injury to critical neurovascular structures (facial artery, facial vein, and marginal mandibular nerve) that cross the inferior border of the mandible to innervate and vascularize important lower face structures. The line between the oral commissure and prejowl sulcus defines the medial border of the inferior jowl fat pad. A line between the oral commissure and antegonial notch would bisect the fat pad and lead to suboptimal treatment. A line between the lateral canthus and prejowl sulcus would bisect the fat pad and lead to a suboptimal treatment. A line between the antegonial notch and ear lobule is not described as an important landmark for this treatment.

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196. A 36-year-old man presents to the office with submental fullness and undergoes injection adipocytolysis with deoxycholic acid. Seven weeks later, the patient reports diffuse patches of hair loss in his beard around the injection site. Which of the following is the most appropriate next course of action?

A) Injection of platelet-rich plasma

B) Oral administration of finasteride

C) Reassurance

D) Topical application of bimatoprost

E) Topical application of minoxidil

The correct response is Option C.

Deoxycholic acid disrupts adipocyte cell membranes when injected subcutaneously into fat, inducing an inflammatory response to clear cellular debris and liberated lipids from the injection site. Deoxycholic acid is a nonspecific cytolytic agent that injures tissue by injuring the cellular membrane of cells that come into contact with the naturally found substance. ATX-101 was FDA-approved in the United States and Canada in 2015 for treatment of patients diagnosed with moderate to severe amounts of fat accumulation in the submental fat pad. The treatment is a series/protocol of up to six treatments in patients requesting nonsurgical management of submental fullness. Patients are selected based on candidacy and their desire to avoid surgery. A youthful patient with mild to no skin laxity, minimal postplatysmal fat, mild to no digastric muscle hypertrophy, and minimally enlarged submandibular glands is a good candidate for the treatment.

Adverse events of the treatment include localized alopecia secondary to injury of the hair bulb/follicle with too-superficial injection in a male patient. Management is supportive, with most patients seeing full resolution of the facial hair. Minoxidil and finasteride are indicated for male-pattern scalp hair loss. Localized injection of platelet-rich plasma is being studied for improvement of thinning scalp hair. Bimatoprost is approved for improving the quality of eyelashes.

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197. A 5-year-old boy is brought to the office by his mother because she is concerned about the shape of his ears. Examination shows antihelical underdevelopment and increased conchal depth with anterior rotation. When this deformity is corrected by recreating the antihelical fold, Mustardé sutures are placed. These sutures adjust the position of the scapha relative to which of the following structures?

A) Conchal bowl

B) Cymba

C) Mastoid bone

D) Posterior sulcus

E) Tragus

The correct response is Option A.

Prominent ears are one of the most common congenital deformities of the head and neck region, affecting 5% of the general population. Abnormal projection of the ear typically results from antihelical underdevelopment and increased conchal depth. Conchoscaphal angles greater than 90 degrees are indicative of poor antihelical development, and they increase the distance of the helical rim from the scalp. A deepened conchal bowl (greater than 1.5 cm) or increased conchomastoid angle can further contribute to lateralization of the ear.

For prominent ear correction, most techniques involve a postauricular skin incision with the placement of sutures to address the obtuse conchoscaphal angle and decrease the anterior rotation of the conchal bowl. After the cartilage is exposed, Mustardé (conchoscaphal) sutures are placed to recreate the antihelical fold. If the cartilage is stiff, anterior scoring of the antihelical fold may be performed using an ear rasp. If the deformity is not corrected with Mustardé suture placement alone, a second row of Furnas (conchomastoid) sutures are placed to posteriorly rotate the conchal bowl.

Sutures from the concha to the posterior sulcus, tragus, or cymba would not result in recreation of the antihelical fold.

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198. A 35-year-old woman with Grade II ptosis undergoes mastopexy augmentation with a superomedial pedicle. Which of the following arteries provides the primary blood supply to the nipple-areola complex with this procedure?

A) Anterior intercostal

B) Internal mammary

C) Lateral thoracic

D) Posterior intercostal

E) Thoracoacromial

The correct response is Option B.

The internal mammary artery is the constant and most reliable blood supply to the nipple-areola complex, especially the first to fourth intercostal perforators. The second to fourth intercostal perforators are the main blood supply for a superior or superomedial pedicle, of which the second intercostal perforator is usually the dominant one.

The anterior intercostal arteries supply the nipple-areola complex with branches from the fourth to sixth intercostal spaces. The anterior intercostal arteries along with the internal mammary arteries supply the inferior pedicle.

The lateral thoracic artery supplies the nipple-areola complex with one or two branches, frequently anastomosing with the perforating branches of the internal thoracic artery above and below the nipple.

The posterior intercostal artery and the thoracoacromial artery also supply the nipple-areola complex, but they are not the primary blood supply in mastopexy/reduction mammaplasty.

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199. A 25-year-old woman who weighs 143 lb (65 kg) undergoes awake liposuction in an accredited office-based procedural room with a registered nurse and a surgeon. She was preoperatively treated with oral alprazolam 1 mg and intramuscular meperidine 50 mg. Intraoperatively, the patient is given tumescent lidocaine solution to 45 mg/kg. During the procedure, she reports that she is experiencing a metallic taste in her mouth and has a numbing sensation in her lips. Fifteen minutes later, she exhibits abrupt signs of confusion and agitation; her blood pressure has fallen from 125/88 mmHg to 95/60 mmHg, and her heart rate has increased from 80 bpm to 108 bpm. Which of the following is the most appropriate initial management of this patient?

A) Administer flumazenil 0.2 mg intravenously over 15 seconds

B) Administer an intramuscular injection of naloxone hydrochloride to the thigh

C) Administer 20% lipid emulsion bolus 1.5 mL/kg intravenously over 1 minute

D) Secure the airway to maintain oxygenation and prevent hypoxia and acidosis

E) Stop the procedure and call for help

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

The correct response is Option E.

Local anesthetic systemic toxicity can result in serious patient harm, including seizure, cardiac compromise, and fatality. Local anesthetics act on all parts of the nervous system and all nerve types. The primary therapeutic effect of local anesthetics is to block the action potential generated and propagated in peripheral nerves. Ester local anesthetics are metabolized in the circulation by plasma esterases, whereas amide local anesthetics (ie, lidocaine, mepivacaine, bupivacaine, ropivacaine) are processed in the liver by cytochrome P450-linked enzymes.

The canonical molecular structure of local anesthetics contains a lipophilic aromatic ring system attached by an ester or amide intermediate chain to a hydrophilic tertiary amine. At physiological pH, local anesthetics exist as a mixture of a protonated acid and neutral base because of their tertiary amine. However, only the uncharged form can cross the membrane, and once intracellular, the ionized cationic form binds to a site on the inner pore of the sodium channel. Lowering the arterial pH may create intracellular ion trapping, thereby modifying cellular effects and potentially worsening toxicity.

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Local anesthetic systemic toxicity can result from either inadvertent intravascular injection or delayed absorption into circulation from the site of injection or application. Large volumes of local anesthetics are used for cosmetic procedures, including tumescent liposuction. Klein and Jeske have been leaders in the study of safe tumescent anesthesia and suggested that infiltration of lidocaine doses up to 45 mL/kg is safe. However, individual patient sensitivities, comorbidities, and physician or practice deficiencies may predispose to catastrophic outcomes. Furthermore, there are no universal mandated or regulatory reporting requirements that would reliably capture all catastrophic local anesthetic systemic toxicity events. Reporting of fatalities attributable to lidocaine toxicity in otherwise healthy patients following tumescent liposuction has occurred. Cardiac arrest and death caused by local anesthetic systemic toxicity have occurred at outpatient plastic surgery centers, possibly related to large volumes or improper administration.

Management of serious local anesthetic systemic toxicity is different from other cardiac arrest scenarios. For local anesthetic systemic toxicity, airway maintenance and oxygenation are the priority in treatment, because both hypoxia and acidosis exacerbate clinical local anesthetic systemic toxicity. Drug administration in response to cardiac arrest caused by local anesthetic systemic toxicity is also different because the standard adult dose of epinephrine (1 mg) can impair resuscitation from local anesthetic systemic toxicity. Therefore, in this scenario, the individual doses of epinephrine should be decreased to less than 1 μg/kg. Pharmacologic management of local anesthetic systemic toxicity should avoid use of vasopressin, calcium channel blockers, beta-adrenergic blockers, or other local anesthetics. A practitioner who suspects local anesthetic systemic toxicity should immediately stop the procedure and call for assistance.

In a local anesthetic toxicity event, a summary of the critical steps required to manage the event after stopping the procedure includes: airway management (oxygenate and ventilate), secure intravenous access, seizure suppression, and, if needed, cardiopulmonary resuscitation. Alert the nearest facility that has a cardiopulmonary bypass capability, and administer 20% lipid emulsion.

Flumazenil is used to reverse the effects of benzodiazepine toxicity. Naloxone hydrochloride is used to reverse the effect of opiates.

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200. A 30-year-old woman expresses interest in a reduction mammaplasty 3 months after the birth of her child while still breast-feeding. She is counseled to wait until her breasts have returned to their baseline size after cessation of breast-feeding. Which of the following hormones is most directly responsible for milk production and the related breast enlargement?

A) Estrogen

B) Luteinizing hormone

C) Oxytocin

D) Progesterone

E) Prolactin

The correct response is Option E.

The hormone most directly responsible for milk production and related breast enlargement is prolactin. Toward the end of pregnancy, high concentrations of estrogen, progesterone, and prolactin exist. After delivery, the estrogen and progesterone decrease, allowing the prolactin to promote milk production and the ensuing breast enlargement. Oxytocin is important for the milk ejection reflex but does not directly impact breast size. Luteinizing hormone impacts other aspects of female reproductive cycles but does not directly impact breastfeeding.

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Section 5: Core Surgical Principles

201. A 47-year-old woman is evaluated because of an asymptomatic left lower eyelid lesion that has been present for 8 months. She underwent incision and curettage of the lesion 5 months ago, but she developed a recurrence soon after. Which of the following is the most appropriate next step in management?

A) Biopsy of the lesion

B) Corticosteroid injection in conjunction with repeat incision and curettage

C) Mohs micrographic surgery

D) Scrub with baby shampoo and warm compresses

E) Observation

The correct response is Option A.

Sebaceous carcinoma is often indistinguishable from chalazions on physical examination. Diagnosis is often delayed due to initial conservative management. Lesions that recur after curettage should be biopsied to rule out sebaceous carcinoma.

The steps in managing a malignant lesion include establishing a diagnosis, complete excision of the lesion, and reconstruction.

Topical treatment with baby shampoo and warm compresses and observation would be inappropriate next steps, given the recurrent nature of the lesion and the likelihood of a malignancy.

Steroid injection in conjunction with repeat incision and curettage would not aid in establishing a diagnosis of this recurrent lesion, and hence would not be appropriate next steps.

Mohs micrographic surgery would be an appropriate treatment modality after a diagnosis has been established.

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202. A 70-year-old woman is evaluated in the office for delayed breast reconstruction. The modified 5-Item Frailty Index is used to estimate her perioperative risk. A history of which of the following is considered in the calculation of this index?

A) Cerebrovascular accident

B) Congestive heart failure

C) Coronary artery disease

D) Peripheral vascular disease

E) Pulmonary hypertension

The correct response is Option B.

While advanced age has been historically considered a risk factor for increased postoperative complications, this idea has been challenged in the literature, particularly in plastic surgery where many procedures are elective and patients can be functionally optimized for surgery. More recently, the concept of frailty has been suggested as an alternative and better predictor for poor surgical outcomes. While the original Canadian Study of Health and Aging Frailty Index consisted of 70 items, the modified 5-Item Frailty Index has shown similar predictive value with increased simplicity. The components of the modified 5-Item Frailty Index include the following:

- Functional status before surgery
- Diabetes mellitus
- Chronic obstructive pulmonary disease
- Congestive heart failure
- Hypertension requiring medication

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203. A plastic surgery residency program director is developing criteria for allowing postgraduate year 1 and 2 residents to perform laceration repairs in the emergency department without direct supervision by a more senior resident. In addition to at least 2 months on a plastic surgery rotation and 10 repairs observed and coached directly by a senior practitioner, the program director decides that the resident must submit a video of the resident repairing a standard laceration on a facial laceration model, which will be graded against a published rubric. In this scenario, which of the following is the purpose of the simulation of a facial laceration repair?

A) Certification to practice

B) Deliberate practice

C) Technique training

D) Verification of proficiency

The correct response is Option D.

For psychomotor skills like surgical skills, simulations can be used for training, practice, assessment, and certification. When simulation is part of a curriculum, its purpose must be clear to all stakeholders: the trainee, the instructor, the program, and the public.

Following adult learning principles, simulation used for training and instruction should be done in a low-stakes situation where the trainee has opportunity to try to a new skill without worrying about causing harm to another or being judged. For more basic skills with inexperienced individuals, low-fidelity experiences can inexpensively provide large gains in proficiency. As the complexity of the skill and the sophistication of the trainee increase, higher-fidelity experiences become more useful.

Deliberate practice is used to improve performance. Deliberate practice is directed at a specific aspect of performance and is observed and coached at the time of practice, such as having a golf professional coach by watching and redirecting performance of a player after each drive. Practicing by oneself is not deliberate practice. Self-directed practice has the potential to habituate and propagate mistakes. The repetition with immediate feedback by a mentor allows correct habits to develop and extinguishes bad habits.

Simulation can be used to verify that a trainee has learned the steps of a basic task such as laceration repair. The simulation can include the entire task (anesthetizing, cleansing,

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draping, repairing, and dressing) or can be limited to any step of the test. This model works well when the learner has an opportunity for observed practice and unobserved practice. It allows an element of self-evaluation as the resident has the rubric and submits the video when they feel they've achieved the criteria.

Simulation is being incorporated into surgical certification rapidly. A prominent example is the requirement to have passed Fundamentals of Laparoscopy Surgery and Fundamentals of Endoscopic Surgery during residency as prerequisite for the board certification process by the American Board of Surgery.

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204. A 55-year-old woman with lipodystrophy after massive weight loss is scheduled to undergo mastopexy and brachioplasty. She underwent Roux-en-Y gastric bypass 10 years ago. Preoperative complete blood count demonstrates macrocytic anemia. This condition is most likely associated with deficiency of which of the following?

A) Iron

B) Vitamin A

C) Vitamin B_{12} (cobalamin)

D) Vitamin C

E) Vitamin D

F) Vitamin E

The correct response is Option C.

Vitamin B_{12} (cobalamin) deficiency may cause megaloblastic anemia, a type of macrocytic anemia.

The process of vitamin B_{12} absorption is started by gastric acidity, which separates this vitamin from the food proteins it is attached to. Next, before it can be absorbed in the terminal ileum, vitamin B_{12} needs to be combined with a protein secreted by the stomach, called the intrinsic factor.

Bariatric procedures that include partial gastrectomy can substantially decrease the production of hydrochloric acid and intrinsic factor by the stomach, disrupting the absorption of vitamin B_{12} from one's diet. Thus, at least annual screening is recommended for patients who have undergone Roux-en-Y gastric bypass. Prevalence of vitamin B_{12} deficiency in the postbariatric population is thought to be as high as 18%.

Interestingly, serum measurement alone may not be adequate to identify vitamin B_{12} deficiency. It is recommended to include the serum concentration of methylmalonic acid (MMA) with or without homocysteine to identify metabolic deficiency of B_{12} in symptomatic

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and asymptomatic patients, in patients with history of B_{12} deficiency, or in patients with preexisting neuropathy.

Megaloblastic anemia is characterized by ineffective erythropoiesis resulting from disrupted DNA synthesis, most commonly caused by deficiency of vitamin B_{12} or folic acid (folate). An incidental finding in routine laboratory testing is the most common presentation, since anemia usually develops gradually and symptoms are present only in severely anemic patients. When caused by vitamin B_{12} deficiency, neurologic symptoms can be observed, including balance disorder, paresthesias, and lower extremity pain. Diagnostic suspicion should be raised when a complete blood count shows anemia and high mean corpuscular volume or high mean corpuscular hemoglobin.

The other vitamins listed are not associated with macrocytic anemias. Iron deficiency anemia may be common in patients with massive weight loss, but it causes a microcytic anemia.

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205. A 68-year-old man who underwent thoracic fusion is evaluated because of exposed spinal hardware. Physical examination shows a loss of soft tissue and an exposed hardware cage at the T2 level. There is no sign of infection. Coverage with a paraspinous muscle flap is planned. Which of the following is the Mathes and Nahai classification for this flap?

A) I

B) II

C) III

D) IV

E) V

The correct response is Option D.

Paraspinous muscle flaps are considered the "workhorse" of spinal reconstruction and are useful for the coverage of exposed hardware and the obliteration of dead space. The paraspinal muscles are classified as Type IV flaps with multiple segmental pedicles. The dominant pedicle of the paraspinous muscle flap consists of segmental perforating vessels arising from the posterior intercostal vessels. The minor pedicle includes lateral row perforators arising from the posterior intercostal arteries.

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206. Which of the following healthcare reform laws guarantees the transferability of a patient's health insurance coverage from one employer to another?

A) 21st Century Cures Act

B) Health Information Technology for Economic and Clinical Health Act

C) Health Insurance Portability and Accountability Act

D) Patient Safety and Quality Improvement Act

E) Women's Health and Cancer Rights Act

The correct response is Option C.

Numerous healthcare reform acts have been recently enacted as legislation. Many of these involved improved patient access to care as well as providing additional benefits to patient safety and privacy. While the Health Insurance Portability and Accountability Act (HIPAA) was the first to institute regulations for protected health information through its privacy rules, this legislation also guarantees the transferability of a patient's healthcare insurance coverage from one job to another.

The Patient Safety and Quality Improvement Act protects healthcare workers who report unsafe conditions and encourages reporting of medical errors. The Health Information Technology for Economic and Clinical Health Act promotes the expansion and adoption of health information technology while updating both the privacy rules as well as an individual's right to access their electronic health information (EHR). The 21st Century Cures Act helps define the specifics of EHR interoperability and increases a patient's access to a broadened scope of their medical record in a timely fashion. The Women's Health and Cancer Rights Act mandates insurance coverage of breast reconstruction after cancer treatment.

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207. Which of the following methods of achieving osteosynthesis is most likely to result in relative stability?

A) Compression plate

B) Intramedullary nail

C) Lag screws

D) Tension band

The correct response is Option B.

Absolute stability is achieved by interfragmentary compression, which allows for direct bone healing without the formation of a callus. Forms of this osteosynthesis include lag screws, compression plates, and tension banding. Relative stability does not have interfragmentary compression at the fracture site, and healing is achieved through callus formation. Types of relative stability include intramedullary nailing, bridge plating, external fixation, and splinting/casting.

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208. A 38-year-old man is brought to the emergency department after a snowboarding accident that resulted in his being trapped under snow for 5 hours. He has no medical comorbidities and does not smoke cigarettes. Physical examination shows edema, erythema, and blistering of the left foot extending proximally to the distal third of the lower leg. X-ray study shows no fracture. Which of the following actions is CONTRAINDICATED given the patient's injury?

A) Administration of aspirin 75 mg orally

B) Administration of ibuprofen 400 mg orally twice daily

C) Infusion of warm intravenous fluids

D) Rubbing of the affected limb

E) Technetium-99 triple-phase bone scanning

The correct response is Option D.

Frostbite is a cold thermal injury that occurs when tissues are exposed to temperatures below their freezing point. The formation of extracellular ice crystals produces cellular damage. Several factors determine the severity of injury, including absolute temperature, duration of exposure, and patient comorbidities such as smoking, peripheral vascular disease, and neuropathies.

A number of interventions have been identified as beneficial in the management of frostbite injuries. It is important to bring the patient’s core temperature to above 35.0°C (95.0°F) before initiating frostbite warming. This is accomplished with warm intravenous fluids, which also corrects any coexisting dehydration secondary to cold diuresis due to suppression of antidiuretic hormone.

Rewarming the frozen limb is ideally accomplished using a water bath set at 38.0°C (100.4°F) with added antiseptic solution (chlorhexidine or povidone iodine). Rubbing the affected limb is not recommended because of the potential for worsening direct tissue injury. The extremity should subsequently be splinted and elevated in a loose protective dressing.

Since rewarming the extremity can become painful, nonsteroidal anti-inflammatory drugs (eg, ibuprofen) are often administered and provide for systemic anti-prostaglandin activity that limits the cascade of inflammatory damage. Aspirin is frequently administered for its rheologic effect.

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Technetium-99 triple-phase bone scanning is typically obtained on day 2 after injury and accurately predicts the level of amputation in 84% of cases.

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209. A 3-year-old boy is brought to the clinic for evaluation of severe unilateral ptosis of the upper eyelid that has been present since birth. The boy's parents are very concerned, and he has been referred for surgical correction. The surgeon recommends a frontalis sling procedure. The sling portion of this procedure is most likely to use which of the following materials?

A) Chromic gut

B) Poliglecaprone

C) Polydioxanone

D) Polyglactin

E) Silicone elastomer

The correct response is Option E.

There are many materials used for frontalis sling procedure. This includes many synthetic materials such as silicone, polytetrafluoroethylene, autologous tissue such as fascia lata and palmaris tendon, and nonabsorbable sutures. The commonality in this situation is all materials are long-lasting and nonabsorbable. Polyglactin, poliglecaprone, chromic gut, and polydioxanone are all absorbable sutures that would not make an ideal material for long-lasting effect in a frontalis sling procedure.

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210. A 63-year-old woman undergoes sternal reconstruction. On postoperative day 1, she goes into cardiac arrest, advanced cardiac life support protocols are initiated, and pulse resumes. Four days later, the patient remains ventilator-dependent, unresponsive, and in a comatose state. Which of the following physical examination findings provides the strongest support of brain death/death by neurologic criteria in this patient?

A) Absent pupillary response to light

B) Loss of bicep reflexes

C) Positive Babinski reflex

D) Positive Hoffman sign

E) Urinary incontinence

The correct response is Option A.

Use of the terms "whole brain death" and "brainstem death" is no longer recommended. Currently, the term brain death/death by neurologic criteria should be used. According to Greer et al, brain death/death by neurologic criteria can be defined as "the complete and permanent loss of brain function as defined by an unresponsive coma with loss of capacity of consciousness, brainstem reflex, and the ability to breathe independently."

In this scenario, the patient is not conscious and is in a coma, in addition to being unable to breathe independently. Of the listed responses, the pupillary reflex is the only brainstem reflex.

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211. A 31-year-old woman is evaluated for augmentation mammaplasty and mastopexy. She sees a local primary care physician who specializes in medical weight loss. In addition to diet modifications and a rigorous exercise regimen, she was also prescribed phentermine. Which of the following is the most common perioperative complication associated with administration of this drug?

A) Cardiac dysrhythmia

B) Hypotension

C) Metabolic acidosis

D) Metabolic alkalosis

E) Seizures

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

The correct response is Option B.

Phentermine is a sympathomimetic amine that is prescribed for weight loss. Phentermine is a centrally acting sympathomimetic that is structurally related to amphetamines. It stimulates the hypothalamus to release norepinephrine, causing appetite suppression.

Historically, formulations of the drug included a combination treatment with fenfluramine known as "fen-phen," which was discontinued in the late 1990s after several patient deaths stemming from cardiorespiratory complications. Over the last decade, however, stand-alone treatment with phentermine has been demonstrated to be safe and effective, and it remains the most prescribed anti-obesity weight loss drug in the country.

Perioperatively, phentermine is associated with refractory hypotension on the induction of general anesthesia, hypothetically stemming from catecholamine depletion and subsequent autonomic dysfunction. In this situation, hypotension may not respond to vasopressors that stimulate catecholamine release (eg, ephedrine), and direct sympathetic agonists (eg, phenylephrine) may be needed.

Other complications described in the literature include hypertension and hyperthermia, but these are much less common. Cardiac dysrhythmia, metabolic acidosis, and metabolic alkalosis are not described complications associated with phentermine use, and neither are seizures in the

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perioperative period.

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212. A 21-year-old man is brought to the emergency department after being assaulted with a baseball bat. Physical examination shows bilateral periorbital ecchymosis and extensive facial edema, with fluid draining from the nostrils bilaterally. Filter test of the fluid demonstrates a halo sign. CT scan of the head and neck shows a moderately displaced naso-orbital-ethmoid (NOE) fracture. Which of the following is the most appropriate next step in management?

A) Bed rest and head-of-bed elevation

B) Endoscopic repair

C) Initiation of prophylactic intravenous vancomycin

D) Placement of a lumbar drain

E) Urgent operative reduction of the NOE fracture

The correct response is Option A.

This patient has an isolated naso-orbital-ethmoid (NOE) fracture with an associated cerebrospinal fluid (CSF) leak. The vast majority of CSF leaks stop spontaneously within 10 days. Prophylactic antibiotics are not indicated because there is a very low incidence of meningitis with conservative management, and vancomycin would be inappropriate because it does not cross the blood-brain barrier and does not target the correct flora. Operative reduction and fixation of the NOE (if indicated) would be performed in a delayed fashion because of the extensive local edema. Lumbar drain placement or endoscopic repair of the CSF leak would be considered if the leak did not stop with 10 days of conservative management.

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213. An increase in which of the following is the strongest contributor to impaired cutaneous wound healing in older adults?

A) Cellular turnover

B) Collagen production

C) Cutaneous blood flow

D) Matrix metalloproteinase

E) Nutrient exchange between skin layers

The correct response is Option D.

The physiologic effects of aging lead to thinning of the epidermis, atrophy of the dermis, overall frailty of the skin, and a disruption in the normal wound-healing process. Cells involved in the wound-healing process show age-related changes, including diminished cellular turnover (proliferation and migration), decreased response to growth factors, and decreased cytokine production. This in turn impairs the proliferation phase of wound healing, decreases angiogenesis, and decreases collagen deposition. Response to hypoxia is impaired, and nutrient exchange between the layers of the skin is diminished. Matrix metalloproteinase concentrations, however, increase in aged skin, which contributes to enhanced collagen degradation.

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214. A 31-year-old nulliparous woman undergoes bilateral reduction mammaplasty with a vertical-pattern technique for symptomatic macromastia. Which of the following pathologic findings is most likely to prompt referral to an oncologic surgeon for breast cancer risk stratification?

A) Apocrine metaplasia

B) Atypical ductal hyperplasia

C) Fibrocystic breast changes

D) Flat epithelial atypia

E) Sclerosing adenosis

The correct response is Option B.

Atypical ductal hyperplasia (ADH) is a benign proliferative breast lesion involving hypercellularity of the ductal cells. It is linked to a moderate increase in breast cancer risk. Due to this risk, closer follow-up is warranted and may include more frequent physical examinations or imaging. Treatment might also involve hormone therapy.

Sclerosing adenosis is a benign proliferative breast condition without atypia. It involves overgrowth of the lobular breast tissue with associated fibrous areas similar to scar tissue. If there is any link to increased risk for breast cancer, it is small.

Apocrine metaplasia is a nonproliferative breast disorder characterized by alteration of the ductal epithelium to resemble apocrine sweat glands. It is not associated with an increased risk for breast cancer.

Fibrocystic breast change is a benign condition involving the formation of cystic areas and fibrosis. While it may cause symptoms such as pain and swelling, sometimes in response to the menstrual cycle, it does not increase the risk for breast cancer.

Flat epithelial atypia is a benign proliferative breast disorder with columnar cell changes and cytologic atypia. It is distinct from atypical hyperplasia (both ductal and lobular), and while there may be a link to a slight increase in breast cancer risk, it is generally agreed that this increase does not even approach that of ADH.

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215. A 15-year-old boy is brought to the office by his mother because of new pink-red stretch marks that she noticed on his lower back when she saw him in swim trunks at the pool. The patient is 5 ft 7 in (167 cm) tall, and BMI is 21 kg/m^2. Physical examination shows a Fitzpatrick Type III complexion with typical tan lines. Over the lumbar area, he has a handful of medium pink-red parallel striae. Which of the following underlying processes is the most likely cause of the striae?

A) Addison disease

B) Cushing disease

C) Exogenous steroid use

D) Rapid growth

E) Weight loss

The correct response is Option D.

Striae can be associated with Cushing disease, exogenous steroid administration, obesity, pregnancy, and rapid growth in adolescence. They are all situations involving hormonal excess (physiologic or nonphysiologic) as part of the presumed cause. Exogenous steroid use and Cushing disease would also be associated with central obesity. The patient's BMI does not indicate obesity. Addison disease is not associated with stretch marks.

The rise in hormones and rapid growth in height seem to leave the lumbar area, buttocks, and calves susceptible to stretch marks in adolescent boys. The natural history of striae is to present with an inflammatory phase (striae rubrae), during which they are red and may be itchy and slightly raised. With time, the inflammatory aspects subside, leaving hypotrophic-appearing white striae (striae albae). There are multiple approaches to management of striae that include strategies to decrease vascularity, increase collagen production, and increase melanin deposition. These approaches individually and in combination can produce incremental improvement in appearance, but none are curative. Striae are associated with weight gain, not weight loss.

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216. A 25-year-old woman presents to a plastic surgeon to discuss breast reconstruction. She is a carrier of the *BRCA1* mutation and has decided to undergo risk-reducing mastectomies. Which of the following is the approximate average risk for this patient developing breast cancer by the age of 70 years if she does not undergo bilateral mastectomies?

A) 20%

B) 40%

C) 60%

D) 90%

The correct response is Option C.

In this clinical scenario of accurate counseling, it is important to know the risk for developing cancer in women with the *BRCA1* and *BRCA2* mutations. Based on multiple epidemiological studies, the risk for developing breast cancer by age 70 years is 57% in *BRCA1* mutation carriers and approximately 49% in *BRCA2* mutation carriers. The risk for developing cancer and associated mortality decreases with age. For example, a 55-year-old woman has an approximately 35% risk for developing breast cancer and a 6% mortality, compared with a 25-year-old woman who has a 65% chance of developing breast cancer with a 14% mortality. This being said, it is important to consider to benefits of prophylactic mastectomies beyond mortality, including patient-specific factors such as the desire to decrease screening and seeking peace of mind.

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217. A 40-year-old woman who underwent surgery of the chest is evaluated because she is dissatisfied with the raised, thick, widened scars. She is offered intralesional 5-fluorouracil injection as a treatment. Which of the following best describes the mechanism of action of 5-fluorouracil?

A) Coagulation in microthermal zones and preservation of the integrity of the epidermis

B) Decrease in fibroblast proliferation and decrease in collagen synthesis

C) Decrease in leukocyte and monocyte migration and phagocytosis

D) Localized hypoxia and increase in collagenase activity

E) Protein denaturation and tissue coagulation

The correct response is Option B.

5-Fluorouracil has been used as an effective and safe treatment for hypertrophic scar and keloid injections. Studies have largely shown 5-fluorouracil to be safe and efficacious with a comparable or lower recurrence rate when compared with intralesional steroid injections. The mechanism of action is inhibition of fibroblast proliferation with a decrease in collagen synthesis, thereby causing scar degradation.

Intralesional steroid injections decrease leukocyte and monocyte migration and phagocytosis, and laser therapy acts by protein denaturation and tissue coagulation, as well as by coagulation in microthermal zones and preserving the integrity of the epidermis. Localized hypoxia and increased collagenase activity is associated with pressure therapy.

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218. A 37-year-old woman undergoes left breast reconstruction with a deep inferior epigastric artery perforator flap. During dissection of the internal mammary vessels, a small tear is inadvertently made in the left parietal pleura. The decision is made to repair the tear primarily, using a single figure-of-eight suture. Which of the following ventilatory maneuvers is most appropriate immediately prior to cinching the stitch for pleural closure?

A) Decreasing positive end-expiratory pressure

B) Disconnecting the endotracheal tube

C) Pausing at end-expiration

D) Sustaining maximal inspiration

E) Switching to volume-controlled ventilation mode

The correct response is Option D.

The most appropriate ventilatory maneuver to perform just before cinching the last stitch of the repair of an isolated parietal pleura tear is sustaining maximal inspiration for a few seconds, also known as a modified Valsalva maneuver. Once the parietal pleura is closed, normal lung ventilation can resume. The goal is to fully inflate the lungs to maximize positive pressure in the pleural cavity, displacing any residual pneumothorax through the pleural defect before finishing an air-tight repair of the parietal pleura or chest wall. The maneuver is probably most commonly performed manually by the anesthesiologist (using the ventilator's built-in bag valve mask), but it can also be done by holding ventilation at the end of an inspiratory cycle or by significantly increasing the positive-end-expiratory pressure (PEEP).

Pausing ventilation at the end of expiration (without first increasing PEEP), disconnecting the endotracheal tube, decreasing PEEP, or switching to volume-controlled ventilation would not achieve the goal of increasing/maximizing pleural pressure.

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219. A 33-year-old woman presents with a drug-resistant gram-positive bacterial infection of an implant after undergoing implant-based breast reconstruction. Which of the following mechanisms is most likely responsible for this bacterial drug resistance?

A) Increased carotenoid content in cell membrane

B) Increased esterification of cell membrane lipoteichoic acid

C) Inhibition of protease expression

D) Reduction of biofilm

E) Suppression of binding ligands against host defense peptides

The correct response is Option B.

Bacterial resistance to host defense peptides is an unfortunate reality that is clinically and experimentally observed. The significant diversity of host defense peptide mechanisms requires the resistance strategies to use equally numerous solutions based on the specific peptide or target organism.

Common resistance mechanisms used by bacteria against host defense peptides include:
1) decreased carotenoid content in cell membranes (not increased)
2) increased protease expression (not inhibition)
3) biofilm production (not reduction)
4) increased expression of binding ligands to host defense peptides (not suppression)

Esterification of cell membrane lipoteichoic acid with D-alanine is a commonly used mechanism of gram-positive bacterial antimicrobial resistance.

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220. A 24-year-old woman presents to the clinic for follow-up 2 days after undergoing bilateral subpectoral augmentation mammaplasty using 450-cc silicone-filled breast implants. The patient formerly wore an A-cup brassiere and now wears a D cup. On examination, the patient reports feeling tightness of the chest and shortness of breath since the procedure. Which of the following is the most appropriate next step?

A) Chest tube placement in the fourth intercostal space in the mid-axillary line

B) Chest x-ray study

C) Needle aspiration at the second intercostal space

D) Re-evaluation in 3 days

E) Routine 2-week follow-up examination

The correct response is Option B.

Most plastic surgeons believe that development of a pneumothorax in a breast augmentation patient is rare. Major surgical procedures of the chest wall, such as rib graft harvesting, latissimus dorsi and pectoralis major musculocutaneous flap elevation, and chest wall reconstruction, can be complicated by a pneumothorax. This complication is not usually suspected because of the rare occurrence; however, it likely occurs more often but goes undiagnosed.

There are many possible causes of pneumothorax, and determining the precise cause is difficult in an individual patient during or after augmentation mammaplasty.

According to a survey performed by Osborne et al, it appears that pneumothorax as a complication of augmentation mammaplasty is more common than has been generally thought. This has led to a change in practice.

Any patient who undergoes a subpectoral augmentation mammaplasty who presents in the postoperative period with shortness of breath should heighten the suspicion of a pneumothorax. The patient should undergo workup, at least with a proper examination of breath sounds and chest x-ray study initially.

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Given the ongoing shortness of breath in this patient, re-evaluation in 3 days and routine 2-week follow-up examination would not be appropriate because of the possibility of acute worsening of pulmonary status in the interim. However, invasive interventions (eg, chest tube placement or needle aspiration) prior to establishing a diagnosis would similarly be inappropriate.

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221. Data collection is complete in a study examining Patient-Reported Outcomes Measurement Information System Upper Extremity (PROMIS UE) scores following intramedullary screw placement in the treatment of an isolated proximal phalanx fracture. Which of the following is the most appropriate statistical test to compare the mean PROMIS UE scores at 2 weeks with those at 12 weeks?

A) Independent samples *t*-test

B) One-sample *t*-test

C) One-way analysis of variance

D) Paired samples *t*-test

The correct response is Option D.

Understanding appropriate statistical analysis is essential for conducting and reviewing research. There are four main ways in which means can be compared, assuming that the data are normally distributed.

An independent samples *t*-test is a comparison of the mean for two different data sets that are independent from each other. For example, an independent samples *t*-test might be used to compare PROMIS UE scores at the end of healing between male and female patients, where male versus female is the independent variable.

A paired samples *t*-test is a comparison of two measurements on the same subject at two different time points. The paired sample *t*-test is appropriate in this scenario because researchers are looking for differences in PROMIS UE scores at two discrete times after surgery.

A one-sample *t*-test is used when a mean is compared with a specified constant, such as comparing PROMIS UE scores at one time point with the expected PROMIS UE score in the general adult population.

One-way analysis of variance is used to compare the means in more than two groups.

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222. In the design of a proper randomized clinical trial, concerns about a selection bias confounder are best addressed at which of the following stages?

A) Data analysis

B) Data collection

C) Data publication

D) Initial literature search

E) Study design

The correct response is Option E.

Confounders are extraneous risk factors associated with both causal factors and disease-related entities that can influence accurate data analysis. These can result in overestimation or underestimation of the study effect. The five main parts of a well-designed clinical trial study are the initial literature review, study design and execution, data collection, data analysis, and data publication. Examples of confounders that may negatively impact these specific stages include publication bias (initial literature review), selection bias (study design and execution), and information bias (data collection).

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223. A 28-year-old woman presents with a 4-cm mass of the left breast. Examination of a specimen obtained on biopsy discloses a benign phyllodes tumor. Which of the following is the most appropriate treatment for this lesion?

A) Intensity-modulated radiation therapy

B) Mastectomy with sentinel lymph node biopsy

C) Neoadjuvant chemotherapy

D) Wide local excision

E) Observation

The correct response is Option D.

Phyllodes tumors are uncommon fibroepithelial masses. They are classified as benign, borderline, or malignant based on histology. Local recurrence risk is not insignificant. The standard of care includes wide local excision with a clear margin. Although the recommended surgical margin is an area of some controversy, many authors suggest at least a 1-cm rim of normal tissue surrounding the tumor. Very large phyllodes tumors might necessarily lead to mastectomy. However, the patient in this question has a smaller tumor, which would not require mastectomy. Sentinel lymph node biopsy might be considered for a malignant phyllodes tumor, but it is not indicated for a benign tumor. Surgical extirpation of phyllodes tumors may be quite extensive and therefore can present significant challenges to the reconstructive surgeon. There are no data to recommend chemotherapy or radiation therapy in the setting of a benign phyllodes tumor. Observation of the primary tumor is not recommended.

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224. A pregnant woman in the second trimester undergoes ultrasonography for anatomic screening. The screening discloses that the fetus has an omphalocele without liver involvement. Which of the following chromosomal findings is most likely in this fetus?

A) 5p monosomy

B) 22q11 microdeletion

C) Trisomy 13

D) 47,XXY

The correct response is Option C.

An omphalocele is a congenital abdominal wall defect through the umbilical ring, which contains varying amounts of abdominal viscera and organs covered by a fused membrane of infant peritoneum, Wharton jelly, and amnion into which the umbilical cord inserts. As indicated, giant omphaloceles contain more than intestines and have a large diameter that laterally displaces the rectus muscles as they insert onto the ribs. Once a giant omphalocele is diagnosed, antenatal counseling about the natural history of these malformations is provided. Considerations for the best course for the fetus, pregnancy, delivery, and neonatal period can be determined. Part of that counseling includes the high rate of aneuploidy of autosomes (30%) such as in trisomy 13 in these patients. Pediatric plastic surgeons may be asked to be involved with larger lesions to help reconstruct the abdominal wall. Timing and needs will be determined by pulmonary capacity and maturity, the presence of other anomalies, loss of domain, and reconstructive needs. The plastic surgeon should be conversant with all aspects prior to joining in antenatal or neonatal counseling.

22q11 microdeletion has many syndromic names, including velocardiofacial syndrome or DiGeorge syndrome, and is related to cleft palate.

47,XXY is Klinefelter syndrome and is not associated with omphalocele. Plastic surgeons may see these patients in adolescence with reports of gynecomastia.

5p monosomy is cri du chat syndrome and is also not associated with omphalocele. Plastic surgeons may be asked to evaluate facial differences, including small jaw and hypertelorism.

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225. A 2-year-old boy is brought to the emergency department because of a scald burn sustained after he pulled a pot of boiling water off the counter. Examination demonstrates deep partial thickness burns over the anterior and posterior trunk, equaling 22% total body surface area. Oxandrolone is administered on admission and continued in the weeks following resuscitation and reconstruction. Administration of this drug is most likely to result in which of the following?

A) Decreased bone mineral content

B) Decreased mortality

C) Increased cardiac output

D) Increased serum concentrations of alanine aminotransferase (ALT) and aspartate aminotransferase (AST)

E) Loss of lean body mass

The correct response is Option D.

Severe burns can lead to a physiologic hypermetabolic response, causing increased energy expenditure and protein consumption. Long-term effects include muscle mass wasting and delayed wound healing. To address these effects in patients with severe burns (including the greater than 20% total body surface area burn in this patient), oxandrolone has been used to combat the hypermetabolic response.

Oxandrolone is a synthetic testosterone derivative that is administered orally. During the catabolic phase, it counteracts the hypermetabolic response, leading to improved clinical outcomes including an increase in lean body mass and bone mineral content, as well as decreased length of stay in the inpatient setting. It does not have an impact on mortality. In the short-term, oxandrolone has been known to cause an increase in the liver enzymes alanine aminotransferase and aspartate aminotransferase, but it is not associated with long-term hepatotoxicity. The favorable effects of increased muscle mass extend to the myocardium, and patients treated may display decreased cardiac output and resting heart rate.

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226. A 56-year-old woman is evaluated after falling from a ladder onto her outstretched and extended right wrist. Three-view wrist x-ray study demonstrates a displaced, extra-articular fracture of the right distal radius with approximately 20 degrees of apex volar angulation. After reduction, repeat x-ray studies re-demonstrate the fracture, and the bony relationships are near anatomic. Which of the following treatment modalities is most appropriate for this patient?

A) Closed reduction and percutaneous pinning

B) Long-arm cast for 4 weeks followed by short-arm cast for 2 weeks

C) Open reduction and internal fixation with volar locking plate

D) Short-arm cast for 6 weeks

E) Sugar-tong splint for 4 weeks

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

The correct response is Option D.

Park et al performed a randomized, multicenter trial in which patients aged older than 55 years with stable distal radius fractures were placed into short- and long-arm casts at approximately 1 week following injury. The authors demonstrated no differences in Disabilities of the Arm, Shoulder, and Hand (DASH) scores, nor between visual analog pain scores at 3 and 6 months postoperatively. In the long-arm cast group, they did note a higher incidence of shoulder pain and disability when the dominant hand was casted. Two patients in the long-arm cast group required corticosteroid injection because of persistent shoulder pain.

Caruso et al corroborated these findings in a study of 74 patients with reducible extra-articular distal radius fractures. They found no differences in radiographic parameters at 12 weeks post injury. They reported better Mayo elbow scores at 4 weeks in the short-arm cast cohort, but this was no longer significant at 12 weeks.

Data are mixed regarding operative treatment of distal radius fractures in patients over the age of 50 years. In a recent meta-analysis of randomized controlled trials and observational trials, Li et al compared the outcomes of nonsurgical treatment and volar locking plate fixation of distal radius fractures in patients aged 50 years and older. When compared with nonsurgical treatment, the volar locking plate did not improve DASH scores, decrease complications, or

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improve range of motion. The authors did observe a statistical difference in grip strength and radiographic assessment in favor of the operative group.
Sugar-tong splinting may be important after reduction to maintain bony relationships with a stable fracture pattern, but it is not an appropriate method of casting.

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227. Which of the following laboratory values is most likely to be abnormal in a patient who takes daily aspirin?

A) Activated partial thromboplastin time

B) Bleeding time

C) D-dimer concentration

D) Platelet count

E) Prothrombin time/International Normalized Ratio

The correct response is Option B.

Aspirin causes an increase in bleeding time through the inhibition of prostaglandin biosynthesis and platelet secretion reaction. Platelet function is altered, but not the platelet count. Prothrombin time/International Normalized Ratio, activated partial thromboplastin time, and D-dimer concentration are unaffected by routine aspirin use.

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228. A 72-year-old man undergoes wide local excision of a T2 N0 squamous cell carcinoma in the left lateral border of the tongue, along with left cervical lymphadenectomy including sublevels IB and IIA and levels III and IV. The left internal jugular vein, sternocleidomastoid muscle, and spinal accessory nerve are preserved. Which of the following is the most appropriate classification of this neck dissection?

A) Extended

B) Modified radical

C) Radical

D) Selective

The correct response is Option D.

Removal of sublevels IB and IIA and levels III and IV is classified as a selective neck dissection.

Radical neck dissection was first described in 1906 by Dr. George Crile. It includes removal of cervical lymph nodes from levels I through V, along with the ipsilateral internal jugular vein, sternocleidomastoid muscle, and spinal accessory nerve.

Modified radical neck dissection refers to the removal of all cervical lymph nodes routinely included in a radical neck dissection (levels I through V), while preserving at least one of the nonlymphatic structures (internal jugular vein, sternocleidomastoid muscle, or spinal accessory nerve).

Selective neck dissection refers to a cervical lymphadenectomy that preserves at least one of the lymph node levels that are routinely removed in a radical neck dissection (I through V). Levels and sublevels are selected for removal based on the expected drainage pattern determined by the location of the primary tumor. Since many different selective neck dissections are possible, the recommended name of the procedure should include "selective neck dissection" followed by the list of levels or sublevels to be removed, as in: "left selective neck dissection (sublevels IB and IIA and levels III and IV)."

Extended neck dissection refers to the removal of additional lymph node groups (eg, paratracheal) or nonlymphatic structures (eg, hypoglossal nerve) that are not routinely included in a radical neck dissection.

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229. A 30-year-old woman undergoes tumescent liposuction with fat transfer to the buttocks (Brazilian butt lift). History includes anxiety, for which she takes sertraline. Twelve hours after the patient is discharged from the recovery room, she presents to the emergency department with nausea, vomiting, and anxiety. Which of the following is the most appropriate next step in management?

A) Administer benzodiazepine

B) Administer supplemental oxygen, and measure plasma lidocaine concentration

C) Obtain blood cultures and complete blood count, and administer broad-spectrum antibiotics

D) Order electrocardiography

E) Order ultrasonography of the lower extremities

The correct response is Option B.

This patient is showing signs of lidocaine toxicity. Blood lidocaine concentration peaks approximately 12 hours after tumescent infiltration. Many authors have reported safe use of lidocaine in tumescent liposuction at doses of 35 mg/kg or higher. Toxic effects are generally considered to occur at blood concentrations of 6.0 mg/L (μg/mL) and greater; however, signs of toxicity may occur at lower plasma concentrations. These include gastrointestinal effects (commonly nausea and vomiting), central nervous system effects (such as anxiety, confusion, or light-headedness), and more severe and life-threatening effects (such as respiratory depression, seizures, and cardiovascular collapse). Selective serotonin reuptake inhibitors (such as sertraline) are competitive inhibitors of CYP3A4, which is the same enzyme that metabolizes lidocaine. A patient showing systemic effects of lidocaine toxicity should be treated with oxygen administration, and their plasma lidocaine concentration should be checked. If increased, then overnight observation in the hospital is warranted.

Benzodiazepine treatment is not indicated for anxiety, and in fact, could further depress the respiratory system. It would only be indicated for treatment of lidocaine-induced seizures.

Electrocardiography is not the study of choice for evaluating lidocaine toxicity.

Obtaining blood cultures and complete blood count and administering broad-spectrum antibiotics are the first-line treatment of sepsis, but they are not indicated in this patient.

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Ultrasonography of the lower extremities can evaluate for deep venous thrombosis, but it is not indicated in this patient.

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230. A 45-year-old woman with newly diagnosed invasive lobular carcinoma of the right breast comes to the clinic to discuss immediate breast reconstruction following bilateral mastectomy. History includes a sulfonamide allergy; otherwise, she has no medical comorbidities and does not smoke cigarettes. Staged implant-based breast reconstruction is planned. Which of the following prophylactic antibiotic regimens is most appropriate for this patient?

A) Intravenous cefazolin for less than 24 hours perioperatively followed by no oral antibiotic

B) Intravenous clindamycin for less than 24 hours perioperatively, followed by a 5-day course of oral trimethoprim-sulfamethoxazole

C) Intravenous clindamycin for less than 24 hours perioperatively, followed by no oral antibiotic

D) Intravenous piperacillin/tazobactam for less than 24 hours perioperatively, followed by a 5-day course of oral ciprofloxacin

E) Intravenous vancomycin for less than 24 hours perioperatively, followed by a 5-day course of cephalexin

The correct response is Option A.

Postoperative surgical site infection (SSI) following implant-based breast reconstruction is a major complication that can mandate device removal and thereby result in reconstructive failure. As such, meticulous technique, maintenance of a sterile surgical field, and perioperative antibiotic prophylaxis are of utmost importance in decreasing postoperative infection rates.

Historically, antibiotics were used quite liberally following implant-based breast reconstruction with prophylaxis implemented for an extended duration, frequently until drain removal. More recent studies, however, have demonstrated that extended postoperative systemic antibiotics have no significant effect on decreasing the incidence of SSI. Importantly, Phillips et al demonstrated that antibiotic prophylaxis for an extended duration, versus less than 24 hours, was associated with a greater rate of expander loss. Therefore, contemporary recommendations call for antibiotic prophylaxis limited to the perioperative period only, for less than 24 hours.

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As to antibiotic choice, the use of beta-lactam antibiotics (eg, cefazolin) was recently demonstrated as superior to alternative antibiotics with a bacteriostatic mechanism of action (eg, vancomycin, clindamycin) in regards to rates of postoperative infection and reconstructive failure following immediate implant-based breast reconstruction. Trimethoprim-sulfamethoxazole would be contraindicated in this patient given her sulfonamide allergy. Since perioperative antibiotic prophylaxis is predominantly targeted against gram-positive bacteria (skin flora), intravenous piperacillin/tazobactam would not be an appropriate choice.

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231. A 28-year-old man who underwent transplantation of an upper extremity at the mid humeral level 6 hours ago is evaluated in the intensive care unit because his urine output is decreasing. On examination, the patient's urine is red-amber in color. Electrocardiography (ECG) shows T waves that are almost as tall as the QRS complex on the rhythm strip. In addition to fluid management and obtaining formal 12-lead ECG, the most appropriate next step is to order measurement of which of the following blood electrolytes?

A) Calcium

B) Magnesium

C) Phosphate

D) Potassium

E) Sodium

The correct response is Option D.

Replantation of composite tissues with high metabolic tissues such as muscle can result in an inflammatory reperfusion syndrome marked by acidosis, myoglobinuria, and hyperkalemia as the by-products of cellular breakdown are released into the circulatory system. In this scenario, myoglobinuria is suggested by the color of the urine and hyperkalemia becomes suspect with the peaked T waves. Calcium and magnesium can be used as cell membrane stabilizers to mitigate the effect of the potassium on the cardiac muscle. Glucose and insulin are used to move potassium intracellularly. Sodium balance is not directly affected in reperfusion. Phosphate plays a role in bone physiology.

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232. A pair of conjoined twins is evaluated to determine the surgical plan for soft-tissue coverage after their separation. The twins face one another and are conjoined from the sternum to the umbilical area. Which of the following terms best describes this type of conjoined twins?

A) Cephalopagus

B) Craniopagus

C) Omphalopagus

D) Parapagus

E) Thoracopagus

The correct response is Option E.

Conjoined twinning is an extremely rare phenomenon. They are monoamniotic and monochorionic twins that can be adjoined symmetrically, asymmetrically, ventrally, dorsally, laterally, or caudally. There is debate in the literature whether the phenomenon occurs because of fission of a single embryo at day 13 or fusion of two embryos between days 13 and 17 to create the single amnion/chorion.

In the United States, Willobee et al interrogated the Kids' Inpatient Database and identified 240 conjoined twin pairs born between 1997 and 2012, for an incidence of 1 per 100,000 live births. Approximately 60% of those pairs died in the perinatal period. Only 28% were able to be separated in the neonatal period. The 2020 Great Ormond Street study by Frawley reported the following incidences:

- Craniopagus – dorsal conjoined at the cranium – 5%
- Cephalopagus – ventral fusion from vertex to umbilicus – 3.4%
- Thoracopagus – ventral fusion of chest and thorax to umbilicus – 42%
- Omphalopagus – ventral fusion of lower chest to umbilicus – 5.5%
- Parapagus – lateral fusion of lower abdomen and pelvis – 14.5%

All studies emphasize the need for interdisciplinary management of these patients and stressed the use of imaging, model surgery, simulation surgery, and teamwork. The ethics of these cases can be very opaque with the high mortality for one or both twins, the intensive resources needed, and the highly publicized nature of these cases.

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233. A 57-year-old woman comes to the office to discuss breast reconstruction after mastectomy. When considering the dimensions of access to healthcare, the distance between the patient's geographic location and her reconstructive surgeon's location most significantly affects which of the following?

A) Accessibility

B) Accommodation

C) Affordability

D) Availability

E) Awareness

The correct response is Option A.

The results of Penchansky and Thomas's 1981 findings have been modified and summarized to explain modern concerns for access to care as follows:

1. Availability – relationship of the volume and type of existing services to the client's volume and type of needs.
2. Accessibility – relationship between the location of supply and the location of the client.
3. Accommodation – relationship between the manner in which the supply resources are organized and the client's ability to accommodate those factors.
4. Affordability – Relationship of the prices of services and the provider's insurance to the client's income, ability to pay, and existing health insurance.
5. Awareness – Awareness of services and the indications for its use.

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234. A plastic surgeon evaluates an 18-year-old woman for potential gluteal augmentation with high-volume fat grafting. The patient has seen the surgeon's posts on social media, and she states that she wants the same results but is unable to afford the cosmetic fees. The surgeon offers a discount on her procedure if she allows him to livestream the operation. She agrees, and the operation is performed the following week. Which of the following best describes the ethical violation in this interaction?

A) Age criterion not met for surgical consent

B) Discount offered by the plastic surgeon

C) Patient's lack of control over the posted video

D) Sexual harassment

E) None; both parties consented to the agreement

The correct response is Option B.

The American Society of Plastic Surgeons Code of Ethics states that there can be no coercion (such as financial coercion) on the part of a plastic surgeon to get a patient to participate in online marketing. Sexual harassment is defined as unwanted sexual advances, requests for sexual favors, and other verbal or physical harassment. For a competent adult, 18 years is considered the age of consent for self-treatment. Depending on the agreement with the social media venue used for posting, both the patient and the surgeon may lose future control over the video, but this is not an ethical violation.

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235. A 71-year-old man presents with a 6-month history of a lesion on the left cheek. The patient underwent resection of a basal cell carcinoma of the left cheek 16 months ago. Medical history includes type 2 diabetes and hypertension. Physical examination shows a lesion with indistinct borders. Examination of a specimen obtained on biopsy confirms a diagnosis of recurrent basal cell carcinoma. Which of the following is the most appropriate treatment for this patient?

A) Cryotherapy

B) Marginal excision

C) Mohs micrographic surgery

D) Radiation therapy

E) Topical 5-fluorouracil

The correct response is Option C.

The patient has a recurrent basal cell carcinoma (BCC). BCC is the most common type of skin cancer and the single leading cause of cancer among Caucasian patients. It originates in the epidermis and is associated with risk factors such as age, smoking, ultraviolet radiation, and basal nevus syndrome. Lesions within the H-zone have a greater risk for recurrence. BCCs grow invasive locally, causing extensive destruction if not treated.

The standard treatment of BCC is excision with adequate margins. While many treatment modalities exist, methods such as radiation therapy, cryotherapy, and electrodessication do not provide a tissue sample to confirm adequate tumor clearance. Hence, in the case described, Mohs micrographic surgery is the most appropriate treatment, since the lesion represents tumor recurrence with indistinct borders in a cosmetically sensitive area. When compared with marginal excision, Mohs micrographic surgery is associated with decreased recurrence rates. Furthermore, Mohs micrographic surgery is associated with smaller defect sizes, thereby simplifying reconstruction.

Topical 5-fluorouracil is not an appropriate treatment in this patient, given that he has a BCC recurrence.

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236. A male newborn with a large lumbar bulge receives a diagnosis of myelomeningocele. Which of the following findings supports the diagnosis of myelomeningocele over meningocele?

A) Absence of neural structure involvement

B) Alpha-fetoprotein concentration within the normal range

C) Minimal neurological symptoms

D) Presence of hydrocephalus

The correct response is Option D.

Meningocele and myelomeningocele are neural tube defects resulting in spinal dysraphism. Both are forms of spina bifida, with myelomeningocele being more severe due to the protrusion and underdevelopment of neural structures and meningocele only involving the meninges, commonly referred to as spina bifida occulta. Cerebellar tonsillar herniation with attendant hydrocephalus is part of myelomeningocele only. Because only the dural sac is involved in meningocele, neural deficits are milder. Alpha-fetoprotein concentration is tested in the first trimester of pregnancy.

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237. A 62-year-old woman with invasive ductal carcinoma of the left breast is scheduled to undergo a left-sided mastectomy with immediate reconstruction using a free deep inferior epigastric perforator flap. BMI is 30.2 kg/m^2. Preoperative examination shows bilateral lower extremity varicose veins. She has a right chest port that has been used for neoadjuvant chemotherapy. Chemoprophylaxis using a weight-based dose adjustment of which of the following drugs is most appropriate to decrease this patient's risk for postoperative venous thromboembolism?

A) Intravenous heparin

B) Oral apixaban

C) Oral rivaroxaban

D) Subcutaneous enoxaparin

E) No chemoprophylaxis is indicated

The correct response is Option D.

Venous thromboembolism (VTE) is a life-threatening postoperative complication. Numerous studies have demonstrated that chemical prophylaxis is impactful for high-risk plastic surgery inpatients. The patient presented here is a high-risk patient, given that she is an obese woman with a cancer diagnosis, varicose veins, and central venous access, and she is scheduled to undergo a surgical procedure lasting several hours. Hence, chemical prophylaxis is indicated.

Enoxaparin, a low-molecular-weight heparin, has been demonstrated to prevent VTE in high-risk plastic surgery patients. However, it has not been uniformly effective with breakthrough VTE events occurring in 4 to 10% of the highest risk patients. This has been attributed to the "one-size-fits-all" approach to enoxaparin prophylaxis (ie, the same dose is administered in all patients), irrespective of body weight and extent of surgery.

Recent level I evidence demonstrated that for plastic surgery inpatients, weight-based enoxaparin administration showed superior pharmacokinetics for avoidance of both under-anticoagulation and over-anticoagulation in postoperative patients receiving prophylactic enoxaparin.

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Intravenous heparin is not indicated for VTE prophylaxis, nor do studies support its use for routine management in free flap surgery.

Apixaban and rivaroxaban are not indicated for VTE chemoprophylaxis in plastic surgery patients. Indications for their use include:

- Decrease in the risk for stroke and systemic embolism in nonvalvular atrial fibrillation
- Prophylaxis of deep venous thrombosis following hip or knee replacement surgery
- Treatment of deep venous thrombosis/pulmonary embolism
- Decrease in the risk for recurrence of deep venous thrombosis/pulmonary embolism

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238. A 72-year-old man diagnosed with an oral squamous cell carcinoma undergoes segmental mandibulectomy and reconstruction with free fibula flap. The surgery is uneventful, and the patient is transferred to the floor on postoperative day 3. Two days later, he suddenly becomes unresponsive while mobilizing out of bed. A pulse cannot be palpated. Cardiopulmonary resuscitation is promptly started, and a cardiac monitor is attached. The electrocardiography tracing is consistent with pulseless electrical activity. Administration of which of the following drugs is the most appropriate next step in management?

A) Adenosine

B) Atropine

C) Diltiazem

D) Dopamine

E) Epinephrine

The correct response is Option E.

Epinephrine is the initial drug of choice in the acute management of this patient with cardiac arrest and pulseless electrical activity (PEA). The intravenous dose is 1 mg every 3 to 5 min, always followed by a 20-mL normal saline flush.

PEA is characterized by the absence of a palpable pulse and a variety of ECG waveforms, which can range from a near-flat line to resembling sinus rhythm. PEA does not respond to electric shock. Successful treatment depends on early administration of cardiopulmonary resuscitation and expeditious reversal of the cause of arrest. Hypovolemia and hypoxia are common reversible causes of PEA.

At the time of the last advanced cardiovascular life support guidelines-focused update in 2019, there were few published studies on the optimal timing of initial epinephrine administration for cardiac arrest. The majority of the authors reported higher rates of return of spontaneous circulation with "early" administration (variably defined). Unfortunately, the study protocols were inconsistent enough to preclude a meta-analysis, leading the American Heart Association to release only limited recommendations on the timing of initial epinephrine administration for cardiac arrests with a nonshockable rhythm (such as PEA or asystole): namely "as soon as feasible." Witnessed in-hospital cardiac arrests may be

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particularly well-suited for early administration of epinephrine by the physician providing the initial evaluation, while the code team is mobilized.

The other drugs listed are not indicated in the initial treatment of PEA. Atropine may be used in the treatment of bradyarrhythmias. Adenosine may be indicated for supraventricular tachycardia. Dopamine is a catecholamine with dose-dependent cardiovascular effects. Diltiazem is a calcium channel blocker commonly used for its vasodilatory effects, both peripheral and of the coronary arteries.

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239. A 45-year-old woman is admitted to the hospital because of multiple fluid collections in bilateral gluteal regions. She underwent abdominoplasty and gluteal fat grafting 2 weeks ago while traveling out of the country. She has obstructive sleep apnea, for which she uses a continuous positive airway pressure (CPAP) device at night. She is obese with a BMI of 42 kg/m^2. Vital signs are within normal limits. Surgical exploration of the gluteal collections is planned in the next 48 hours. The use of a CPAP device for this patient's obstructive sleep apnea is most appropriate during which of the following perioperative periods?

A) Immediate postoperative only

B) Neither preoperative nor immediate postoperative

C) Preoperative and immediate postoperative

D) Preoperative only

The correct response is Option C.

This patient with an established diagnosis of obstructive sleep apnea (OSA) should continue to use a continuous positive airway pressure (CPAP) device at night throughout her stay in the hospital, both preoperatively and immediately postoperatively.

Patients with OSA should be considered at an increased risk for perioperative complications, with studies reporting a two- to three-fold increase in adverse cardiopulmonary events.

Sudden discontinuation of CPAP use by patients previously adherent to treatment has been shown to result in recurrence of OSA-related symptoms within 1 to 3 days and physiologic derangements within 2 weeks.

An increasing number of studies suggest that CPAP therapy may play a role in mitigating the increased risk for perioperative complications in patients with OSA. Therefore, continued use of CPAP therapy is recommended during periods of sleep while hospitalized, including before and as soon as feasible after surgery. Adjustments may need to be made to the patient's baseline CPAP device settings to account for perioperative changes, such as facial swelling, upper airway edema, fluid shifts, pharmacotherapy, and respiratory function.

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240. Which of the following best describes the type and level of evidence in a *Plastic and Reconstructive Surgery* paper evaluating a retrospective series of surgical outcomes in 13 patients over 8 months?

A) Diagnostic, Level II

B) Diagnostic, Level III

C) Diagnostic, Level IV

D) Therapeutic, Level II

E) Therapeutic, Level III

F) Therapeutic, Level IV

The correct response is Option F.

The paper would fall into the therapeutic category, not diagnostic or risk, because the authors are discussing a surgical intervention. It is a case study looking at a result and would therefore be considered level IV evidence.

In early 2011, *Plastic and Reconstructive Surgery* unveiled their new program of a specialty-wide evidence-based initiative. From that time forward, level of evidence had to be listed on any and all articles that were amenable to such grading. This was believed to be a straightforward and visible way of promoting and advancing evidence-based medicine in the practice of plastic surgery. The three types of clinical questions addressed are diagnostic, therapeutic, and risk. Each article should fall into one of the three groups.

There are five levels of evidence, ranging from I being the most stringent, highest degree of evidence to V being mostly expert opinion-based. Level I studies are high-quality, multicenter or single-center, randomized controlled trials with adequate power or systematic reviews of these trials. Level II are lesser-quality randomized controlled trials or systematic reviews of these studies. Level III are retrospective cohort or case-controlled studies. Level IV are case studies with pre/post-test or only post-test outcomes. Level V studies encompass expert opinion developed by consensus, case reports, and clinical examples. The long-term goal of this process is to elevate the level of evidence of articles in *Plastic and Reconstructive Surgery*.

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241. A 45-year-old woman is brought to the emergency department after sustaining a crush injury to the left upper extremity when a heavy bookshelf fell on her. She reports no injury to any other part of her body. She has severe pain in the forearm. Which of the following findings would be the strongest indication to proceed with fasciotomy of the injured extremity in this patient?

A) Fracture of the distal radius and ulna demonstrated on x-ray study

B) History of trauma due to fall of heavy object

C) Intracompartmental pressure of the forearm at 35 mmHg

D) Pain relieved by morphine

E) Swelling of the left upper extremity

The correct response is Option C.

It is important in acute trauma management to recognize acute compartment syndrome of the extremities. While fractures are associated with the potential for acute compartment syndrome, neither the finding of a fracture alone nor history alone supports immediate fasciotomy; they should be accompanied by other findings. Swelling can also occur but not necessarily lead to acute compartment syndrome. Pain in the setting of acute compartment syndrome is generally not relieved by narcotic medications.

When acute compartment syndrome is suspected, measurement of intracompartmental pressures may be useful; however, generally a measurement under 30 mmHg does not indicate a need to proceed with a fasciotomy. Intracompartmental pressure at or above 30 mmHg indicates a high likelihood that the pressure is sufficient to cause muscle necrosis, and this measurement is an indication for fasciotomy. This is especially useful in a patient who may be unconscious or intubated and sedated. Intracompartmental pressure, however, is only one component of evaluating the patient. Clinical suspicion along with history may be sufficient to proceed with fasciotomy in a situation where either a manometer is not available or clinical signs, such pain on passive motion and history, indicate a high likelihood of compartment syndrome. With a compartment measurement under 30 mmHg and lack of other symptoms, observation needs to continue. Compartment syndrome is an evolving, dynamic process, and the patient's condition may deteriorate, leading to necessary reassessment and need for fasciotomy.

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242. A 59-year-old woman comes to the office because of a 24-hour history of a painful index finger. Physical examination demonstrates tenderness and erythema over the metacarpal head of the index finger of the right hand. Small white nodules are visible underneath the skin. Serum urate concentration is 11.0 mg/dL (N 4.0-8.5 mg/dL). Pathologic examination of joint aspiration demonstrates monosodium urate crystals. Which of the following findings in this patient is most helpful in confirming the suspected diagnosis?

A) Joint aspirate examination results

B) Monoarticular location

C) Onset of symptoms

D) Serum urate concentration

E) Subcutaneous nodules

The correct response is Option A.

Gout is caused by the deposition of monosodium urate crystals in articular structures throughout the body. As serum concentrations of urate increase, urate crystals are deposited in joints, leading to the sudden onset of painful, inflammatory arthritis.

Many features of gout may aid in its diagnosis. All components of this clinical scenario are suggestive of gout, but only joint aspiration with demonstration of monosodium urate crystals is the gold standard. A gout flare usually presents over several days with the sudden onset of pain and inflammation of a joint. Serum urate concentration is typically elevated, as in this patient, but this alone is not diagnostic of gout. The presence of small, subcutaneous, chalky white nodules is typical as the urate crystals collect in joint spaces. Finally, it is most common in the lower limbs, particularly the first metatarsophalangeal joint, but the upper limbs may be involved, as in this patient.

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243. A 35-year-old woman is scheduled to undergo wide local excision of a 3-mm–thick melanoma. General endotracheal anesthesia is induced, and a dual tracing approach is implemented with technetium 99m and isosulfan blue dye. Lidocaine 1% with epinephrine is injected intradermally for local bleeding control. Within moments, the patient becomes hypotensive, develops global urticaria, and desaturates. She progresses to cardiac arrest. Which of the following is the most likely cause of these symptoms?

A) Anaphylaxis to isosulfan blue dye

B) Anaphylaxis to lidocaine

C) Anaphylaxis to skin preparation agent

D) Histamine release from general anesthesia induction with depolarizing agent

E) Malignant hyperthermia

The correct response is Option A.

Anaphylaxis to isosulfan blue dye is a well-documented risk with an incidence of 1 to 3%. This patient's symptoms are not consistent with malignant hyperthermia. Additionally, local anesthesia was used during the punch biopsy, so anaphylaxis to lidocaine is also unlikely. A skin preparation agent anaphylaxis is improbable with the severity of the symptoms. Lastly, a depolarizing agent like succinylcholine can cause histamine release, but the effects are usually transient.

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244. A 23-year-old man is brought to the trauma bay with a stab wound to the neck. Physical examination shows a 3-cm laceration deep to the platysma, just lateral to the thyroid cartilage. Blood pressure is 125/80 mmHg, heart rate is 80 bpm, and respiratory rate is 16/min. Pulse oximetry shows oxygen saturation is 95%. There is no focal neurologic deficit. Which of the following is the most appropriate next step in management?

A) Cervical collar stabilization

B) CT angiography of the neck

C) Endoscopy of the upper aerodigestive tract

D) Laceration repair

E) Surgical exploration in the operating room

The correct response is Option B.

Classically, management of penetrating neck trauma was based on anatomic zones, with mandatory operative exploration for Zone II injuries (between the cricoid cartilage and the angle of the mandible). This led to many nontherapeutic operations, as well as risk for iatrogenic injury. With the advent of high-resolution, noninvasive imaging techniques, management has evolved into one of selective exploration.

This patient is hemodynamically stable. The most appropriate next step is CT angiography of the neck to evaluate for vascular injury. Once vascular injury is excluded, further evaluation can be tailored to other symptoms. For the unstable patient, or one who presents with hard signs of injury such as uncontrollable hemorrhage, respiratory distress, or expanding hematoma, appropriate management is operative exploration without delay.

Laceration repair should only be performed once other significant injuries have been fully evaluated. Endoscopy can evaluate for injury of the esophagus, pharynx, larynx, and trachea. A hard collar may be useful for cervical spine stabilization for trauma patients and is usually indicated in all high-energy head and neck injuries.

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245. A 29-year-old woman who weighs 176 lb (80 kg) undergoes fleur-de-lis abdominoplasty after a weight loss of 65 lb. During abdominal wall plication, 266 mg of liposomal bupivacaine combined with 40 mL of 0.25% bupivacaine hydrochloride is injected along the plication line. During skin closure, 40 mL of 1% lidocaine hydrochloride with 1:100,000 epinephrine is injected along the incisions. Which of the following is most accurate regarding the dose of liposomal bupivacaine in this patient?

A) It is reserved for patients undergoing regional analgesia (eg, brachial plexus blocks)

B) It is reserved for patients weighing over 220 lb (100 kg)

C) It may be safely combined with both 0.25% bupivacaine hydrochloride and 1% lidocaine hydrochloride

D) It may be safely combined with 0.25% bupivacaine hydrochloride only

E) It may be safely combined with 1% lidocaine only

The correct response is Option D.

Conventional local anesthetics provide effective postoperative analgesia but are limited by relatively short durations. Even longer-acting local anesthetics, such as bupivacaine hydrochloride, only last about 8 hours. Liposomal bupivacaine (Exparel) is a novel formulation designed for a rapid absorption and prolonged release of bupivacaine that maintains analgesia for up to 96 hours after surgery.

Liposomal bupivacaine is available in two doses, 266 mg (20 mL) and 133 mg (10 mL). Dosing is not weight-based. The recommended dose is based on the surgical area that requires analgesic coverage. Large areas, such as the abdominal wall in an abdominoplasty, use the larger volume (266 mg), while the lower volume is used for smaller surgical fields, such as the hand, foot, and brachial plexus for regional nerve blocks.

The volume of both doses may be safely expanded with saline or bupivacaine hydrochloride. Twenty mL of liposomal bupivacaine may be expanded with up to 280 mL of normal saline or Ringer's lactate, or up to 60 mL of 0.25% bupivacaine hydrochloride.

However, while bupivacaine hydrochloride or saline/Ringer's lactate may be used for volume expansion, the addition of other local anesthetic solutions can alter the release rate of the

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bupivacaine. Therefore, liposomal bupivacaine and lidocaine should not be mixed together or injected into the same area at the same time. In this patient, injecting liposomal bupivacaine into the abdominal wall plication and lidocaine hydrochloride along the vertical component of a fleur-de-lis incision may cause rapid release of the active medication and alter the safety and efficacy of liposomal bupivacaine. Consequences of bupivacaine toxicity include methemoglobinemia, central nervous system reactions (eg, seizures, respiratory arrest), and cardiovascular dysfunction (eg, hypotension, heart block, dysrhythmias, cardiac arrest).

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246. A 56-year-old man is brought to the emergency department after sustaining an isolated Gustilo Type IIIB fracture when he fell from a roof. He undergoes definitive orthopedic fixation and is left with a 10 × 15-cm wound in the distal third of the leg with exposed hardware. Free tissue transfer is successfully performed for wound closure at the time of fracture fixation. One week after closure, the patient is classified as weight-bearing as tolerated and is ready to be discharged from the hospital. Which of the following is the most appropriate prophylaxis for venous thromboembolism on discharge of this patient?

A) Aspirin 325 mg daily for 2 weeks

B) Aspirin 325 mg daily for 4 weeks

C) Low-molecular-weight heparin 40 mg daily for 2 weeks

D) Low-molecular-weight heparin 40 mg daily for 4 weeks

E) No prophylaxis is indicated

The correct response is Option D.

Venous thromboembolism (VTE) is a major complication following orthopedic injury. For patients who undergo major orthopedic surgery, it is suggested that dual prophylaxis with compression devices and antithrombotic agents be used while hospitalized. It is also suggested to extend venous thromboembolism prophylaxis, in the form of low-molecular-weight heparin, to a period of up to 35 days from the day of surgery rather than for only 10 to 14 days.

Aspirin is more commonly used in total joint arthroplasty and currently not recommended as VTE prophylaxis in orthopedic trauma patients.

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247. A 54-year-old man is brought to the emergency department (ED) 3 hours after sustaining superficial burns to the entire left upper extremity and deep partial-thickness burns to the entire right upper extremity and half of the right lower extremity during a house fire. He did not receive any resuscitation before arriving at the ED. He appears otherwise healthy, and he weighs 176 lbs (80 kg). According to the Parkland formula, which of the following is the starting rate of fluid resuscitation in this patient?

A) 360 mL/hr

B) 540 mL/hr

C) 576 mL/hr

D) 624 mL/hr

E) 864 mL/hr

The correct response is Option C.

The Parkland formula is used to calculate the initial resuscitation rate in burn patients. The formula is as follows: total fluid needed in 24 hours = (total body surface area) × (4 mL/kg) × (body weight in kg).

Only second- and third-degree (superficial partial, deep partial, and full-thickness) burns are used to calculate total body surface area in this equation. The "rule of nines" is used to calculate this with each total upper extremity accounting for 9%, each entire lower extremity accounting for 18%, and each side of the torso (anterior and posterior) accounting for 18%. This equation gives the total fluid requirements for the first 24 hours following the burn, and half of this fluid should be given in the first 8 hours after the burn while the remaining is given in the next 16 hours.

For this scenario, the patient will need 5760 mL in 24 hours ([9% for right upper + 9% for right lower] × 4 mL/kg × 80 kg). Half of this fluid (2880 mL) should be given in the first 8 hours, and since the patient arrived 3 hours after the accident, the 2880 mL should be given over the next 5 hours (2880 mL/5 hr = 576 mL/hr).

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248. A 42-year-old woman undergoes a circumferential body lift following a 110-lb (49.9-kg) massive weight loss due to a gastric sleeve. Eighteen hours after surgery, she begins vomiting and is noted to have disordered eye movements, ataxia, and mental status changes. Administration of which of the following is most appropriate to treat the symptoms in this patient?

A) Calcium

B) Folate

C) Iron

D) Vitamin B_1 (thiamine)

E) Vitamin B_{12} (cyanocobalamin)

The correct response is Option D.

All of the deficiencies listed are common in massive weight loss patients who present for plastic surgery. It is critical to identify that this woman is exhibiting signs of Wernicke encephalopathy (WE). It is characterized by the classic triad of ataxia, eye movement disorders, and mental status change. This acute neuropsychiatric syndrome results from a deficiency of thiamine. The total number of reported post-bariatric WE cases is growing, and it is important to keep this in the differential for plastic surgery patients.

Vomiting is the most frequently described presenting symptom. However, the most profound characteristic of WE identified is ataxia, which often presents itself as gait abnormalities up to the full inability to walk or move. Altered mental status manifests as delirium, confusion, and problems in alertness or cognition. Lastly, eye movement disorders, including nystagmus and ophthalmoplegia, resulting from extraocular muscle weakness, are seen in the majority of cases as well.

Adequate and timely thiamine treatment in patients who have undergone bariatric surgery is required to prevent the development of WE, which is a rare but severe complication.

Calcium deficiency presents more slowly, due to decreased absorption, and results in bone density loss, causing an increased risk for fracture. Folate deficiency also presents slowly secondary to decreased absorption. It results in anemia and can cause abnormal embryogenesis in pregnant women. Iron deficiency also presents slowly from a lack of

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adequate absorption and clinically causes anemia. Vitamin B_{12} requires stomach acid for it to be released from dietary protein. With a paucity of gastric tissue to produce that acid, this vitamin is also frequently deficient, resulting in a microcytic anemia.

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249. A 54-year-old woman undergoes lipoabdominoplasty under general anesthesia. She is positioned supine with arms abducted for 4 hours. Compression neuropathy of which of the following nerves is most likely in this patient?

A) Long thoracic

B) Median

C) Musculocutaneous

D) Radial

E) Ulnar

The correct response is Option E.

Eighty percent of surgical procedures take place supine. The most common postoperative neuropathy following these procedures is ulnar (28% of closed claims in 1999) followed by brachial plexus (20% of closed claims in 1999). They most commonly arise from improper padding and positioning.

Compressive neuropathy of the radial nerve, long thoracic nerve (with its location on the chest wall), musculocutaneous nerve, and median nerve is less common as a result of inadequate positioning or padding during surgery.

Nerve injury may be avoided by abducting the arms no more than 60 to 90 degrees, maintaining supination when arms are abducted, maintaining neutral positioning when arms are tucked at the patient's side, proper padding on the arm board, and the surgeon not leaning on the extremities throughout the case.

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250. According to the American Board of Plastic Surgery, the certification of a diplomate who fails to maintain the required ethical or professionalism standards may be classified under which of the following statuses?

A) Expired

B) Probation

C) Retired

D) Revoked

E) Suspended

The correct response is Option D.

According to the American Board of Plastic Surgery, a certified diplomate has fulfilled three requirements: 1) completed the written exam, 2) completed the oral exam, and 3) met the residency training requirements in an accredited institution. In the years following, certification status may change for a variety of reasons:

- Expired – Certification has lapsed; the diplomate has not met the requirements to renew certification.
- Retired – No longer in active practice of plastic surgery.
- Revoked – Certification is no longer valid due to a failure to maintain required ethical or professionalism standards.
- Suspended – Certification is suspended due to action on a medical license by a state medical board.
- Probation – Certification is placed on probation due to action on a medical license by a state medical board.

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246	(A) (B) (C) (D) (E)
247	(A) (B) (C) (D) (E)
248	(A) (B) (C) (D) (E)
249	(A) (B) (C) (D) (E)
250	(A) (B) (C) (D) (E)

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