1. A 23-year-old woman sustains an avulsion injury involving most of the skin of the left upper eyelid in a motor vehicle accident. On examination, the globe is unaffected and the orbicularis oculi muscle is preserved; levator function is intact. Following initial debridement of the wound, the most appropriate management is reconstruction with which of the following?

(A) Full-thickness skin graft from the groin
(B) Full-thickness skin graft from the retroauricular sulcus
(C) Glabellar skin flap
(D) Skin flap from the lower eyelid
(E) Split-thickness skin graft

The correct response is Option B.

Following initial debridement, the most appropriate management in this patient who has sustained an avulsion injury to the left upper eyelid is reconstruction using a full-thickness retroauricular skin graft. Because grafting from the contralateral upper eyelid is often not an option in young patients, it is appropriate to seek an alternate graft to provide optimal long-term function and aesthetics while preventing complications such as scar contracture, lagophthalmos, and corneal ulceration. Full-thickness skin grafts from the head and neck region provide the best color and thickness and are less prone to contracture; grafts from the preauricular, postauricular, and retroauricular regions are preferred for their scar tolerance, optimal color match, and lack of hair. The preauricular and postauricular donor sites are aesthetically better donors but supply less usable skin than the retroauricular area.
Split-thickness skin grafts have a smaller dermal component; as a result, their use is more likely to lead to the onset of significant scar contracture. Full-thickness skin grafts from the groin have minimal morbidity but are usually deeply pigmented and hair-bearing; they are often used instead for areolar reconstruction. Glabellar skin flaps are excessively thick for use in eyelid reconstruction and would cause aesthetic and functional problems. A skin flap from the lower eyelid would provide the appropriate color and thickness match but would be too small to cover this patient’s large defect because the maximum amount that can be harvested in a young, healthy patient is 3 mm. Harvest of excess skin would lead to skin shortening and ectropion.

2. Which of the following is the most common cause of death in burn patients?
   (A) Burn wound sepsis
   (B) Hypovolemic shock
   (C) Pneumonia
   (D) Pulmonary embolism
   (E) Renal failure

The correct response is Option C. Currently, the most common cause of death in patients with burn injuries is pneumonia. This condition is most likely to be seen in burn patients with inhalation injuries and is also a common cause of death in patients who require intubation and ventilatory support. Previously, the most common cause of death within the first 24 hours after injury was hypovolemic shock secondary to inadequate resuscitation; after the first 24 hours, wound sepsis was most likely to cause death in burn patients.
However, with the improvements seen in burn care and the increasing availability of specialized burn centers, hypovolemic shock is much less likely to be fatal. In addition, the widespread availability of topical antibiotics has contributed to better control of burn wound sepsis. The risk for pulmonary embolism is not any greater in burn patients than in other hospitalized patients. Although renal failure can develop following electrical injury and lead to myoglobinuria, myoglobin-associated renal failure is frequently transient. This complication can be prevented by keeping the patient adequately hydrated, administering mannitol, and alkalizing the urine.

3. A 20-year-old man who works in a computer factory sustains hydrofluoric acid burns to the dominant right index finger. Following copious irrigation of the finger with water, the patient has persistent severe pain at the site of injury. Which of the following is the most appropriate next step in management?
(A) Application of cold packs every two hours until the pain resolves
(B) Irrigation of the wound with sodium bicarbonate
(C) Immersion of the hand in 1% copper sulfate
(D) Injection of the wound with 1% calcium gluconate
(E) Injection of the wound with 1% copper sulfate

The correct response is Option D. In this patient who has sustained hydrofluoric acid burns of the index finger, the most appropriate management is copious irrigation with water; if severe burning pain persists following irrigation, 1% calcium gluconate should be injected into the wound. The mechanism of hydrofluoric acid burns involves the action of hydrogen and fluoride ions within the acid compound on the skin, which results in tissue
necrosis. The affected patient will have intense pain at the wound site. In contrast, the calcium gluconate acts to bind fluoride ions, preventing the further spread of necrosis. Topical calcium gluconate can be used for more superficial burns but is less effective than subcutaneously injected calcium gluconate in preventing deep tissue necrosis.
Applying cold compresses will not neutralize the effects of a hydrofluoric acid burn and may instead exacerbate ischemia, leading to further tissue damage. Sodium bicarbonate neutralizes hydrogen ions but not fluoride ions and thus will not be completely effective in a patient with hydrofluoric acid burns. Copper sulfate is used in the management of white phosphorus burns to identify the areas of skin that contain residual chemicals following water lavage.

4. Mohs’ micrographic surgery is most appropriate in the management of which of the following types of basal cell carcinoma?
(A) Cystic
(B) Nodular
(C) Pigmented
(D) Sclerosing
(E) Superficial

The correct response is Option D.
During Mohs’ micrographic surgery, the surgeon removes the visible tumor in layers of increasing depth while mapping the exact size and shape of the malignancy. Frozen section “mapping” is performed until there is no longer any microscopic evidence of tumor. Indications for Mohs’ micrographic surgery as initial treatment include:
tumors located in sites that are reported to have relatively high rates of treatment failure (such as the periorbital, periauricular, and perinasal areas, as well as the nose)
tumors with poorly delineated clinical borders or tumors that arise from scar tissue
tumors that are larger that 2 cm or have aggressive malignant features
morpheaform or sclerosing basal cell carcinomas
tumors in locations in which it is best to preserve as much uninvolved tissue as possible (such as the eyelid)
squamous cell carcinomas with perineural invasion
microcystic adnexal carcinomas
dermatofibrosarcoma protuberans
desmoplastic melanomas

In addition, recurrent basal cell and squamous cell carcinomas are best treated with Mohs’ excision.

5. A 10-year-old boy has had unilateral facial paralysis since sustaining a temporal bone fracture in an automobile accident five years ago. He has not undergone any type of treatment. Which of the following reconstructive options is most likely to restore spontaneous smiling in this patient?
(A) Cross-face nerve grafting
(B) Cross-face nerve grafting followed by delayed free flap transfer
(C) Hypoglossal-to-facial nerve transfer
(D) Masseter muscle transposition
(E) Temporalis muscle transposition

The correct response is Option B.
In order to restore spontaneous smiling in this patient, the most appropriate reconstruction involves cross-face nerve grafting followed by delayed transfer of a free flap. Because this patient lacks viable facial muscles as a result of his prolonged course of facial paralysis, nerve grafting or transfer alone would not be useful. The cross-face nerve graft, when combined with a delayed free flap transfer, receives innervation from the unaffected facial (VII) nerve on the contralateral side of the face. This will allow for restoration of spontaneous smiling. As explained above, cross-face nerve grafting alone and hypoglossal-to-facial nerve transfer are not options in a patient who has had facial paralysis for five years because the involved muscles have become atrophied. Transposition of regional muscles (masseter or temporalis) will not produce spontaneous, symmetric smiling. Instead, voluntary contraction of the muscle is required.

6. Which of the following local anesthetics is associated with the greatest risk for development of a true allergic reaction?
   (A) Bupivacaine
   (B) Lidocaine
   (C) Mepivacaine
   (D) Prilocaine
   (E) Tetracaine

   The correct response is Option E.
   A true allergic reaction is most likely to occur following induction of local anesthesia with tetracaine, an ester anesthetic. Local anesthetics are categorized as ester or amide compounds, depending on their link between the aromatic portion and intermediate chain. Ester anesthetics, which undergo hydrolysis through the actions of pseudocholinesterase
within the plasma, have a shorter half-life and a lower toxicity. However, the potential for development of allergic reaction is greater with ester compounds. This may be due to a metabolization of esters to para-aminobenzoic acid. Other anesthetics in this class include chloroprocaine, cocaine, and procaine. Amide anesthetics have greater protein binding, a longer duration of action, and greater toxicity. Because this type of anesthetic is metabolized in the liver, true allergic reactions rarely occur. This class of anesthetics includes bupivacaine, lidocaine, mepivacaine, and prilocaine. It is important to be able to distinguish a true allergic reaction to a local anesthetic from local anesthetic toxicity, which is characterized by impairment of the cardiovascular and central nervous systems. Patients with anesthetic toxicity will develop depression of the cortical inhibitory mechanism and concomitant central nervous system excitation. Higher anesthetic doses may cause cardiovascular toxicity, which manifests as a sudden drop in blood pressure.

7. Which of the following best characterizes a stage III pressure ulcer?
(A) Partial-thickness skin loss involving the epidermis and/or dermis
(B) Full-thickness skin loss involving damage or destruction of the subcutaneous tissue that does not involve the underlying fascia
(C) Full-thickness skin loss involving damage or destruction of the subcutaneous tissue, fascia, and underlying muscle, but sparing the underlying bone
(D) Full-thickness skin loss involving damage or destruction of tissue, including underlying bone or supporting structures
(E) Full-thickness skin loss involving damage or destruction of tissue, including underlying bone but sparing the joint space

The correct response is Option C.
The National Pressure Ulcer Advisory Panel Consensus Development Conference has created a system to classify pressure ulcers according to four stages based solely on the depth of involved tissues. A classification table of this system is shown below.

Stage I: The skin is intact but has a red discoloration more than one hour after relief of pressure

Stage II: There is a blister or other break in the dermis, with or without infection

Stage III: There is subcutaneous destruction into the muscle, with or without infection

Stage IV: There is bony or joint involvement, with or without infection

8. Which of the following physiologic effects has been shown to be directly attributable to topical therapy with vitamin E?
   (A) Decreased incidence of postoperative scar formation following burn reconstruction surgery
   (B) Improved tendon healing following zone II flexor tendon repair
   (C) Increased incidence of breast implant capsular contracture
   (D) Increased incidence of intraperitoneal adhesions
   (E) Increased incidence of papular and follicular dermatitis

The correct response is Option E.
Although topically applied vitamin E has been thought to reduce postoperative scar formation, in reality the effects of vitamin E on surgical wounds are ambiguous. Topical application of vitamin E has been shown in animal models to minimally reduce breast implant
capsular contracture, diminish tendon healing, and decrease the incidence of intraperitoneal adhesions. However, according to clinical studies, topical application of vitamin E had no effect on scar formation in burn patients. In fact, topical vitamin E has only been shown to increase the incidence of papular and follicular dermatitis in the area of application.

9. A 46-year-old man has had the lesion shown in the photograph on the previous page since birth. Which of the following is the most likely diagnosis?
A) Arteriovenous malformation
B) Capillary malformation
C) Hemangioma
D) Lymphatic malformation
E) Venous malformation

The correct response is Option B. This 46-year-old man has findings consistent with an intradermal capillary malformation, or port-wine stain, in which the abnormalities are limited to the capillaries in the dermis. These lesions occur in 0.3% of neonates; they are present at birth and do not regress spontaneously. Patients with facial port-wine stains involving the first (ophthalmic) or second (maxillary) divisions of the trigeminal nerve (V1 and V2) are at significantly greater risk for ocular or nervous system involvement. Appropriate management of a port-wine stain involves laser coagulation using the flashlamp-pumped pulsed dye laser at 577 nm. Because this laser targets erythrocytes within the blood vessels, extravascular damage is minimal. If the lesion is left untreated, cobblestoning, ectasia, and progressive darkening may occur. In adults, the lesions are darker and
contain deoxyhemoglobin; as a result, port-wine stains are less likely to improve following treatment with the pulsed dye laser.
Arteriovenous malformations are high-flow lesions characterized by rapid blood flow through multiple feeding vessels. Pulsations and temperature changes in the affected area are associated, but dermal involvement is minimal. A bruit or thrill is heard on auscultation.
Hemangiomas typically appear shortly after birth and proliferate for several months before spontaneously regressing. They are characterized by proliferative primitive endothelial cell nests in syncytial masses, with and without vessel lumens.
Lymphatic malformations can be superficial or deep. Superficial lymphatic malformations are comprised of anomalous lymphatic remnants that manifest as clear vesicles. Deep lymphatic malformations appear similar to hemangiomas but are soft and compressible on palpation. Bony overgrowth is associated.
Venous malformations occur more frequently than port wine-stains. A venous malformation is characterized by its compressibility and by a propensity to fill with blood when the patient changes body positions. It is usually larger and extends deeper than its superficial structure indicates, and it frequently intertwines with neurovascular components. When the malformation is associated with thrombosis, pain may result.

10. A 2-year-old boy is brought to the emergency department after sustaining a 1-cm clean laceration of the forehead. His mother reports that the child’s tetanus immunization series is incomplete; he has received only the initial two injections. Which of the following is the most appropriate management?
(A) Closure of the wound without further immunization, followed by completion of the tetanus immunization
series according to the primary immunization schedule
(B) Administration of one dose of tetanus toxoid at the time of treatment, followed by delay of the primary immunization schedule
(C) Administration of one dose of tetanus toxoid at the time of treatment, followed by completion of the tetanus immunization series according to the primary immunization schedule
(D) Administration of one dose of tetanus toxoid and one dose of tetanus immune globulin at the time of treatment, followed by delay of the primary immunization schedule
(E) Administration of one dose of tetanus toxoid and one dose of tetanus immune globulin at the time of treatment, followed by completion of the tetanus immunization series according to the primary immunization schedule

The correct response is Option C.
In this child who has not completed his tetanus immunization series, the most appropriate management is administration of one dose of tetanus toxoid at the time of wound treatment; following treatment, the tetanus immunization series should be completed as dictated by the primary immunization schedule. Because this patient has a clean laceration that is not extensive, he will not require any additional treatment, and the immunization series can be completed without delay. Patients with tetanus-prone wounds (that is, those that are extensive and/or grossly contaminated) should be given one dose of tetanus toxoid and one dose of tetanus immune globulin. Prophylactic administration of tetanus immune globulin is not indicated in patients who have uncontaminated or minor wounds regardless of immunization status, or in patients who have already received more than two injections of tetanus toxoid according to schedule.
11. Prior to injection of bovine collagen for treatment of facial rhytids, a test dose of the collagen should be injected into the volar aspect of the forearm and the patient should be observed for how long to note any signs of adverse reaction?
(A) 48 hours
(B) One week
(C) Two weeks
(D) Three weeks
(E) Four weeks

The correct response is Option E. Following intradermal injection of 0.1 mL of bovine collagen (Zyderm and Zyplast) as a test dose, the patient should be monitored for a period of four weeks, as any adverse changes noted at the test site may indicate a delayed hypersensitivity reaction. This is defined as the onset of erythema, induration, tenderness, or swelling to any degree, with or without pruritus, that appears more than 24 hours after implantation and/or persists longer than six hours. Symptoms develop in approximately 3% of patients who receive an intradermal test dose. Injection of bovine collagen is contraindicated in these patients. An observation period of less than four weeks is inadequate.

12. Which of the following is the correct sequence of sensory recovery following full-thickness skin grafting?
(A) Light touch, pain, temperature
(B) Light touch, temperature, pain
(C) Pain, light touch, temperature
(D) Pain, temperature, light touch
(E) Temperature, pain, light touch
The correct response is Option C. According to clinical studies of human grafts, pain is the first sensation to return following skin grafting; light touch returns next, followed by temperature. Because nerves regenerate into grafted skin from the wound margins, the extent of total neural invasion is dependent on the graft’s thickness. Therefore, a thicker graft will have more neurilemmal sheaths available to the nerve fibers extending from the graft bed. As such, sensory recovery will be greater in a full-thickness graft than in a split-thickness graft.

13. A 45-year-old woman has a capillary malformation and hypertrophy of the right leg with underlying arteriovenous malformations. Which of the following is the most likely diagnosis?
(A) Kasabach-Merritt syndrome
(B) Klippel-Trénaunay-Weber syndrome
(C) Maffucci syndrome
(D) Ollier disease
(E) Parkes-Weber syndrome

The correct response is Option B. This 45-year-old woman has findings consistent with Klippel-Trénaunay-Weber syndrome. This disorder is characterized by skeletal hypertrophy of one extremity, most commonly the leg, with associated capillary malformations, also known as port-wine stains. Deep soft-tissue involvement, including venous and lymphatic malformations, is also seen.

Kasabach-Merritt syndrome is a disorder that is initially seen in infants during the first or second month of life. It is characterized by large hemangiomas that are associated with profound thrombocytopenia,
petechiae, ecchymoses, and internal hemorrhage. Infants with Kasabach-Merritt syndrome have a decreased platelet count, which will return to normal following regression of the hemangiomas. Localized consumptive coagulopathy may lead to depletion of clotting factors, which can be life-threatening.

Maffucci syndrome involves multiple enchondromas, most frequently affecting the hand, and venous malformations. Skeletal deformities occur subsequently. Symptoms manifest prior to adolescence. Approximately 20% of patients with Maffucci syndrome develop chondrosarcoma.

Ollier disease (multiple enchondromatosis) is caused by abnormal endochondral ossification. Benign cartilaginous tumors in the large and small tubular bones are characteristic. Multiple lesions of the small bones of the hand may cause loss of function. Malignant degeneration is associated.

Parkes-Weber syndrome is similar to Klippel-Trénaunay-Weber syndrome but is characterized instead by skeletal hypertrophy of one extremity associated with arteriovenous fistulas, not port-wine stains. As a result, the risk for morbidity is significantly greater in patients with this condition.

14. A 21-year-old woman is brought to the emergency department in shock one week after undergoing elective augmentation mammoplasty. On examination, she has purpura fulminans; the breasts are soft and there is no edema or induration. The incisions are clean and dry. Which of the following is the most likely causative organism?
(A) Candida albicans
(B) Pseudomonas aeruginosa
(C) Serratia marcescens
(D) Staphylococcus aureus
The correct response is Option D.
This patient has developed toxic shock syndrome resulting from infection with *Staphylococcus aureus*.
Characteristics of toxic shock syndrome include headache, fever, nausea, vomiting, profuse diarrhea, an erythematous rash, and desquamation of the palms and soles. If untreated, multiple organ failure results. Patients who have toxic shock syndrome resulting from *Staphylococcus aureus* organisms typically do not have purulent wounds; instead, the surgical wound may appear normal. Management should include removal of the foreign bodies (which in this patient are the implants), systemic administration of antibiotics, and supportive care in the presence of multisystem involvement.
Each of the other organisms listed produces septic shock, not toxic shock syndrome. Septic shock is similar to toxic shock syndrome but is not associated with gastrointestinal symptoms, macular erythroderma, or desquamation.

15. Ten days after undergoing mastectomy followed by breast reconstruction using a free transverse rectus abdominis myocutaneous (TRAM) flap anastomosed to the thoracodorsal system, a 45-year-old woman has total necrosis of the flap. In this patient, autogenous tissue reconstruction using a pedicled ipsilateral latissimus dorsi flap requires patency of which of the following arteries?
(A) Circumflex scapular
(B) Lateral pectoral
(C) Lateral thoracic
(D) Serratus branch of the thoracodorsal
(E) Second, third, and fourth anterior intercostal
The correct response is Option D.
Following complete loss of a free transverse rectus abdominis myocutaneous (TRAM) flap, autogenous tissue reconstruction with a latissimus flap can be performed if the serratus branch of the thoracodorsal artery has been preserved. Because the free TRAM flap provides a large amount of tissue and has a reliable vascular supply from the dominant inferior pedicle, it is often used, even in high-risk patients. However, anastomotic complications may lead to total flap loss. When harvesting a free TRAM flap using the thoracodorsal artery as the recipient vessel, the surgeon should divide the artery and vein proximal to the serratus branch to preserve retrograde perfusion to the latissimus muscle, allowing for potential harvest of the latissimus dorsi flap in the future.

The circumflex scapular artery is a branch of the subscapular artery. It divides into transverse and descending scapular vessels within the triangular space. These vessels supply blood to the scapular/parascapular free flap.

The lateral pectoral artery provides vascularity to the lateral border of the pectoralis muscle.

The lateral thoracic artery can be found along the anterior chest wall. It provides the vascular supply for the overlying skin, pectoralis major muscle, serratus anterior muscle, and breast.

The intercostal arteries are the primary vascular supply for the intercostal muscles and overlying skin.

16. A 4-year-old boy is brought to the emergency department after sustaining a dog bite to the face. Following irrigation and primary closure of the wound, which of the following is the most appropriate prophylactic antimicrobial agent?
The correct response is Option A.

This 4-year-old boy who has sustained a dog bite to the face should receive prophylactic antimicrobial therapy with amoxicillin-clavulanic acid. This agent is most effective against organisms that are likely to cause infection in patients who have dog or cat bite wounds, including *Capnocytophaga canimorsus*, *Pasteurella multocida*, *Staphylococcus aureus*, and *Streptococcus*. An extended-spectrum cephalosporin or trimethoprim-sulfamethoxazole combined with clindamycin can be administered to patients who are allergic to penicillin. Amoxicillin-clavulanic acid is also appropriate for prophylactic antimicrobial therapy for human bite wounds. Associated infectious organisms include *Eikenella corrodens*, *Staphylococcus aureus*, and *Streptococcus*. Patients who are allergic to penicillin should be treated with trimethoprim-sulfamethoxazole plus clindamycin. Tetracycline is also appropriate for adult patients. If administered alone, cephalexin, clindamycin, and penicillin will not provide adequate antimicrobial coverage. In addition to being ineffective in the treatment of animal bites, tetracycline should not be administered to a patient younger than age 8 years because of the potential for staining of the permanent dentition.

**17.** Which of the following types of skin graft undergoes the lowest primary contraction and the greatest secondary contraction?
The correct response is Option A.
A thin split-thickness skin graft will undergo the lowest primary contraction and the greatest secondary contraction.
Primary contraction of a skin graft occurs immediately after harvest and is caused by recoil of elastin fibers within the dermis. Grafts with the most amount of dermis undergo the greatest primary contraction. Primary contraction is maximized in a thick full-thickness skin graft and minimized in a thin split-thickness skin graft.
In contrast, secondary contraction occurs after wound healing and is dependent on both the graft and the recipient bed. The effect is opposite that of primary contraction because the amount of contraction is lessened when the relative proportion of dermis is greater. A lower amount of secondary contraction will be seen with full-thickness skin grafts than with split-thickness skin grafts. Greater rigidity of the recipient bed is associated with a decreased incidence of contraction.

18. In a patient undergoing leech therapy for management of venous congestion following thumb replantation, the most appropriate adjunctive treatment is administration of which of the following antibiotics?
(A) Ampicillin
(B) Cefazolin
(C) Erythromycin
(D) Penicillin
(E) Trimethoprim-sulfamethoxazole

The correct response is Option E.
Leeches effectively relieve congestion by digesting human blood through symbiotic bacteria within the gut. However, leech therapy is associated with an increased risk for development of infection; therefore, antibiotics should be administered concomitantly. Because *Aeromonas hydrophila* is the predominant organism within the leech gut, antibiotics that are effective against this organism, such as ciprofloxacin, tetracycline, and trimethoprim-sulfamethoxazole, should be administered. Ampicillin is less effective than trimethoprim-sulfamethoxazole in the management of *Aeromonas hydrophila* infection. Cefazolin, erythromycin, and penicillin are useful against gram-positive organisms but are not effective in patients with *Aeromonas hydrophila* infection.

19. During harvest of a vascularized iliac crest bone graft, the deep circumflex iliac artery will be found
(A) anterior to the iliacus muscle
(B) caudad to the inguinal ligament
(C) cephalad to the upper border of the internal oblique muscle
(D) medial to the external iliac vessels
(E) superficial to the transversus abdominis muscle

The correct response is Option A.
During harvest of a vascularized iliac crest bone graft, the deep circumflex iliac artery can be found on the anterior surface of the iliacus muscle. When harvesting this flap, the surgeon should dissect the dominant pedicle cephalad to the inguinal ligament and lateral to the external iliac vessels. The deep circumflex iliac artery will be found
caudad to the lower border of the internal oblique muscle and deep to the transversus abdominis muscle; from there, it courses upward and lateral to the iliac crest.

The surgeon should also be careful to avoid transecting the lateral cutaneous nerve of the thigh, which lies within the superficial plane at the lateral aspect of the dissection.

20. Each of the following is a histologic finding in expanded human tissue EXCEPT
(A) flattening of the rete ridges
(B) presence of a multilayer capsule
(C) thinning of the epidermis
(D) thinning of the dermis
(E) thinning of the subcutaneous tissues

The correct response is Option C.

Following tissue expansion, histologic evaluation of the expanded skin will show thickening of the epidermis, thinning of the dermis with flattening of the rete ridges, thinning of the subcutaneous tissues, and the presence of a complex, multilayer capsule comprised of four zones that surrounds the tissue expander. The inner zone of the capsule, which borders the expander, is composed of macrophages and fibrillar material, while the central zone is composed of fibroblasts and myofibroblasts that are compressed between thick bundles of collagen. Loose bundles of collagen are contained in the transitional zone, along with few blood vessels. In the outer zone, there is dilation of pre-existent blood vessels and growth of new, small-caliber vessels within a stroma of collagen and thick elastic fibers. Because the presence of the capsule typically results
in a significant increase in vascularity within the flap, it is not usually removed.
Other studies have shown the untoward effects of tissue expansion, including muscle atrophy and areas of depression and thinning in the underlying bone. In addition, attempts at elongating nerves and blood vessels during expansion have met with mixed results.

21. A 2-year-old boy is brought to the emergency department after sustaining a burn to the corner of the mouth when he bit on an electric cord. A photograph is shown above. The most appropriate management is splinting of the oral commissure for a minimum of what period of time?
(A) Six weeks
(B) Two to three months
(C) Six months
(D) One year

The correct response is Option C.
In this child who has sustained a burn to the oral commissure, the oral commissure should be splinted for a period of at least six months. Approximately 90% of all burns of the oral commissure occur in children younger than age 4 years, and boys are twice as likely to be injured; most of these injuries occur when a child places a live electric cord into the mouth. The flow of saliva produces an electrical short, resulting in thermal damage to the tissues. Because long-term splinting has been shown to prevent microstomia and preserve function in patients who have injuries confined to the oral commissure, a custom-made device (either fixed or removable) should be applied to compress the commissure. It should be worn continuously
for a minimum of six months and then at night only for several more months.
In these children, there is a 10% incidence of bleeding from the labial artery following injury. The child’s parent should be instructed to place the thumb and finger on the artery to control the bleeding if this does occur.
In children who have more severe injuries or for whom splinting is not practical, early surgical intervention or delayed reconstruction following scar maturation is recommended. If the injury extends beyond the oral commissure, functional lip reconstruction should be performed.

22. In a patient who has undergone resection of a squamous cell carcinoma of the floor of the mouth, which of the following free flaps will provide vascularized bone and a sensate skin paddle?
(A) Iliac crest flap
(B) Lateral arm flap
(C) Parascapular flap
(D) Serratus anterior flap

The correct response is Option B. Because the lateral arm flap provides both vascularized bone and a sensate skin paddle, it is best used for reconstruction of this patient’s defect involving the floor of the mouth. Vascularity and skin sensibility are provided by the radial collateral artery and posterior brachial cutaneous nerve (C5-6), respectively. As much as 7 cm × 12 cm of skin can be elevated with the flap; in addition, because of its periosteal attachments, as much as one-third of the posterior lateral humerus (or 10 cm to 15 cm in length and 1 cm to 1.5 cm in diameter) can be harvested.
The iliac crest osteocutaneous flap, which is based on the deep circumflex iliac artery, can provide a skin paddle as large as 12 cm × 6 cm and a bone segment as large as 8 cm × 18 cm. Although this flap can be used for reconstruction of large mandibular segments and extensive soft-tissue defects, the skin component is bulky and insensate. Meticulous closure of the donor site defect is required to prevent hernia formation. The parascapular flap is based on the circumflex scapular artery. Advantages of this flap include multiple skin paddles, a large segment of bone, and a high degree of independent motion between the skin and bone segments. The serratus anterior and/or latissimus dorsi muscles can be included with the flap to reconstruct complex defects. However, the skin paddles of this flap are also bulky and lack a cutaneous sensory nerve. The serratus anterior flap is extremely versatile. Skin, muscle, and an iliac bone graft can be included with this flap; its pedicle is long and has a large diameter. It can be harvested as a functional muscle flap with inclusion of the branches of the long thoracic nerve; however, the upper four to five muscle slips must be preserved in order to prevent winging of the scapula. This primary disadvantage of this flap is that any bone incorporated with it will be less substantial and have poor vascularization when compared with other osteocutaneous flaps. The skin component of this flap is also insensate.

23. Which of the following best characterizes black widow spider (*Latrodectus mactans*) venom?
(A) Hemotoxin
(B) Myelotoxin
(C) Neurotoxin
(D) Tissue toxin
The correct response is Option C.
The venom of the black widow spider (*Latrodectus mactans*) is a neurotoxic agent that causes the hallmark findings of muscle pain and cramping that appear within 15 minutes after the bite. This common species of spider is found throughout the United States. Most patients with latrodectism are bitten by female spiders; in contrast, the bite of the male spider rarely penetrates the skin. Affected patients have sharp pain at the wound site with two small red spots marking the location of puncture. Late findings include pain and cramping of the striated muscles, abdominal pain, vomiting, tremor, excessive salivation, and shock.

In a patient who is bitten by a black widow spider, the most appropriate therapy is administration of 10 mL of 10% calcium gluconate solution over a period of 15 to 20 minutes; 1 ampule of methocarbamol or 5 mg to 10 mg of diazepam can be administered additionally. Improvement of the patient’s symptoms following treatment is diagnostic of latrodectism. In immunocompromised patients, a diluted dose of black widow spider antivenin (Lyovac) should be administered intravenously at a slow rate.

In contrast, the brown recluse spider produces a toxin known as sphingomyelinate, a dermonecrotic factor. Envenomation with sphingomyelinate results in hemolysis, coagulation, and platelet aggregation, often affecting fatty tissue. Symptoms can range from mild irritation to severe necrosis.

Hemotoxins, such as cobra venom, are exotoxins that result in hemolysis.
24. According to Wolff’s law, which of the following factors is critical to the long-term survival of grafted bone?
(A) Presence of membranous bone
(B) Preservation of the periosteum
(C) Preservation of vascularity
(D) Stress

The correct response is Option D.
Wolff’s law states that stress is necessary for preservation of the strength and volume of grafted bone. This law has been used to correctly predict the resorption of bone grafted to heterotopic recipient sites and areas lacking the required stress.
Although membranous bone grafts have shown increased long-term survival rates when compared with endochondral grafts, this difference is believed to result from differences in bony architecture as opposed to embryologic origin.
Preservation of an intact periosteum increases graft survival at all stages following transplantation. Delayed revascularization and decreased peripheral bone growth have been demonstrated in bone grafted without periosteum.
Vascularized bone is used for flaps and not for grafts.

25. In a patient undergoing lip enhancement using sheet acellular dermal homograft (Alloderm), which of the following is the correct anatomic placement of the graft?
(A) Subdermal placement along the white roll of the lip
(B) Submucosal placement along the white roll of the lip
(C) Submucosal placement along the wet/dry vermilion border of the lip
(D) Intramuscular placement
The correct response is Option C.
Following adequate anesthesia, sheet acellular dermal homograft (Alloderm) should be placed submucosally along the wet/dry vermilion border of the lip. In order to effectively enhance the lips, the surgeon should first create bilateral incisions approximately 0.5 cm from the commissure on both the upper and lower lips; this will allow for tunneling of the Alloderm along this border. After the Alloderm is placed, the lip is stretched, allowing proper sealing of the graft. The ends should then be tapered and placed in a submucosal pocket near the commissure. Suturing is associated with the development of dynamic lip deformities and thus should not be performed. Because subdermal placement is too superficial, the patient will be predisposed to the development of contour irregularities if the implants are placed at this level. Submucosal placement of the Alloderm along the white roll will result in unnatural lip aesthetics. Alloderm should not be placed within the muscle.

26. Which of the following types of skin graft can be expected to grow proportionately with a young child?
(A) Split-thickness
(B) Full-thickness
(C) Epidermal
(D) Cultured epithelial autograft

The correct response is Option B.
Full-thickness skin grafts can be expected to grow proportionately with a young child. In contrast, split-thickness skin grafts will exhibit some growth, although secondary and/or revision grafting is often required. Epidermal grafts and cultured epithelial autografts will not demonstrate proportionate growth with expansion of the surrounding tissues.
27. Bovine collagen is most effective when injected into which of the following anatomic regions?
(A) Epidermis
(B) Dermis
(C) Immediate subdermis
(D) Subcutaneous fat

The correct response is Option B. Bovine collagen provides the most effective aesthetic result when it is injected into the dermal layer. If injected too deeply (ie, into the subdermal or subcutaneous layers), its effects are highly transitory because resorption is often immediate. However, even with appropriate injection, the desired effect of bovine collagen can only be maintained for a maximum of three to four months, and repeat injections are required for a sustained effect. Injection of bovine collagen into the epidermal layer is often associated with contour deformities.

28. Which of the following is most characteristic of hydroxyapatite bone cement?
(A) Exothermic damage to the underlying dura and brain tissue
(B) Gradual loss of contour over time
(C) Osteoinductive growth of new bone
(D) Peripheral ingrowth of bone
The correct response is Option D.

Hydroxyapatite bone cement has been shown to have osteoconductive properties, resulting in growth of new bone over several months following its use in reconstruction. This bone cement is a mixture of amorphous and crystalline calcium phosphate compounds and is recommended for use in nonstress skeletal areas. Because the cement sets endothermically at body temperature, patients are not at risk for any endothermic reactions such as those seen with the use of methylmethacrylate cement. It can be molded and injected into various sites and has not been shown to interfere with craniofacial growth in children. In addition, it maintains its original contour over time. Because the x-ray defraction spectrum of hydroxyapatite cement is similar to bone, scatter effect is not seen on CT scan.

29. A 21-year-old man sustains an avulsion injury involving the skin of the dorsal aspect of the right hand. On examination, there is a loss of paratenon; the extensor tendons are exposed. A reverse radial forearm flap is to be used for coverage of the defect. The venous outflow of this flap depends primarily on which of the following vessels?
(A) Accessory cephalic vein
(B) Basilic vein
(C) Cephalic vein
(D) Radial venae comitantes
(E) Ulnar venae comitantes

The correct response is Option D.

All reverse flaps are based on a “retrograde flow” design, in which the blood flows into the artery and out of the vein, opposing normal physiology. In order for this to occur properly, either the valves of the
Peripheral veins must be incompetent or the flow of blood must circumvent the valves. The reverse radial forearm flap has small, intercommunicating veins that lie between the paired venae comitantes and act as shunts, bypassing the valves and allowing blood flow directly between the venae comitantes. Thus, retrograde flow is established, and a useful, viable vascularized flap is created. As long as the paired venae comitantes and intercommunicating veins remain intact, the reverse radial forearm flap can be used to cover large defects involving the dorsal aspect of the hand. Any mechanical separation of the venae comitantes during flap harvest will result in damage to the intercommunicating veins and lead to flap failure. In addition, an Allen’s test should be performed preoperatively to demonstrate an adequate retrograde flow of blood from the ulnar artery through the distal artery.

The cephalic vein originates at the radial aspect of the dorsal venous network and flows into the axillary vein. The basilic vein originates ulnarly within the dorsal venous network, joins with the median cubital vein, and ascends medial to the biceps tendon, perforating the deep fascia at the middle of the arm and then continuing as the axillary vein. The median vein of the forearm provides drainage for the superficial palmar venous plexus and ascends on the volar aspect of the forearm to drain into the basilic or median cubital vein. Because these veins and the accessory cephalic vein do not have interconnecting veins that allow for bypass of the valves, reverse flow is prohibited.

The ulnar venae comitantes act in conjunction with the ulnar artery and thus are not involved in the drainage of the reverse radial forearm flap.
30. A 5-year-old boy is brought to the emergency department after sustaining a laceration of the left lower extremity. Physical examination shows an isolated 2-cm lesion extending through the dermis. EMLA cream is applied prior to suturing. The surgeon should wait for how many minutes before suturing the laceration?
(A) 5 minutes  
(B) 10 minutes  
(C) 20 minutes  
(D) 30 minutes  
(E) 60 minutes

The correct response is Option E. Because EMLA cream reaches its peak efficacy approximately 45 to 60 minutes after initial application, the surgeon should wait for one hour before suturing the laceration. Studies show that EMLA cream is superior for anesthesia of simple extremity wounds and results in optimal anesthesia in open wounds after approximately 60 minutes. Cumulative sum (CUSUM) analysis has been used to confirm the minimal effective application time. EMLA cream, a eutectic mixture of local anesthetics, contains lidocaine 5% and prilocaine 5%. Following topical application of EMLA cream, the affected site should be covered with an occlusive dressing.

31. A 20-year-old man with paraplegia has a large grade IV pressure ulcer of the left ischium. He previously underwent ligation of the profunda femoris artery on the left. Which of the following flaps is most appropriate for reconstruction in this patient?
(A) Gluteal thigh flap  
(B) Gracilis flap  
(C) Rectus femoris flap
The correct response is Option A.
The gluteal thigh flap is most appropriate for reconstruction of this paraplegic patient’s ischial pressure ulcer because this is the only flap of those listed whose regional arterial vascularity is provided by a source other than the profunda femoris artery, namely the inferior gluteal artery and venae comitantes. As much as 10 cm × 35 cm can be harvested with this flap. It is frequently transferred as a fasciocutaneous flap with elevation of the inferior portion of the gluteus maximus muscle to the lateral edge of the sacrum.
The gracilis myocutaneous and rectus femoris flaps have a type II vascular pattern and can also be used for coverage of most ischial pressure ulcers. Circulation is provided by the profunda femoris artery via the ascending branch of the medial circumflex artery and venae comitantes for the gracilis flap and via the descending branch of the lateral circumflex artery and venae comitantes for the rectus femoris flap.
In contrast, the tensor fascia lata and vastus lateralis flaps both have a type I vascular pattern. The tensor fascia lata flap can be used for coverage of trochanteric, ischial, and sacral pressure ulcers and the vastus lateralis flap for coverage of trochanteric and ischial pressure ulcers. Like the rectus femoris flap, circulation of the vastus lateralis flap is provided by the profunda femoris artery via the descending branch of the lateral circumflex artery and venae comitantes. In contrast, vascularity of the tensor fascia lata flap is provided by the profunda femoris via the ascending branch of the lateral circumflex artery and venae comitantes.
32. The photograph shown on the previous page is of an otherwise healthy 7-year-old boy who has had progressive enlargement of the right upper extremity with pitting edema since birth. Radiographs of the right upper extremity show bone growth that is normal and equal to the left upper extremity. An enhanced MRI shows normal soft tissues. This patient’s findings are most consistent with

(A) Klippel-Trénaunay syndrome
(B) lymphatic malformation
(C) lymphedema praecox
(D) Milroy’s disease
(E) proteus syndrome

The correct response is Option D.

The findings in this 7-year-old boy are most consistent with Milroy’s disease, a rare, X-linked, autosomal dominant form of primary lymphedema that is diagnosed at birth. Unilateral pitting edema is seen in this patient and is in fact associated with all forms of lymphedema. Ocular manifestations have occurred in some patients. Radiographs will show normal bone growth and no hemihypertrophy of the affected extremity. MRI of the soft tissues may also be unremarkable. Klippel-Trénaunay syndrome is characterized by limb hemihypertrophy, most frequently affecting the leg, and lymphovenous malformations, often with a cutaneous component. A T1-weighted MRI will show a slow-flow lesion. Lymphedema is seen in as many as 30% of these patients. In infrequent cases, limb hypoplasia has been present in place of hypertrophy. A gadolinium-enhanced MRI is needed to distinguish lymphovenous malformations from mere lymphatic or venous lesions. Lymphatic malformations are composed of lymph-filled dysplastic vessels that can be classified as macrocystic, microcystic, or combined. Ultrasonography can be used to diagnose lymphatic malformations in utero or after birth. MRI will also aid in delineating a lymphatic malformation from lymphedema.
Lymphedema praecox is a noncongenital form of lymphedema; signs and symptoms usually first occur before puberty. Another form, lymphedema tarda, occurs in midlife. Proteus syndrome is a sporadic condition characterized by vascular, skeletal, and soft-tissue abnormalities. Common findings include growth asymmetry and subcutaneous tumor-like structures, such as lipomas, Schwann cell structures, and lipomatosis. Associated vascular anomalies may include capillary malformations, lymphatic malformations, capillary venous malformations, and combined lymphovenous malformations, all of which will appear abnormal on MRI.

33. Which of the following is most characteristic of an in vivo subglandular breast implant that was placed 10 years ago?
(A) Changes in the implant shell that may interfere with mammography
(B) Easier palpability resulting from increased stiffness of the implant shell
(C) Increased potential for the development of immune-related disorders
(D) Invasion of the implant shell by surrounding periprosthetic capsular tissue
(E) Loss of biomechanical shell strength when compared with preimplantation levels

The correct response is Option E. In a patient who underwent in vivo subglandular breast implantation 10 years ago, a loss of biomechanical strength of the implant shell, when compared with preimplantation levels, is most likely to be identified. Because the implant shell is composed of a vulcanized silicone elastomer, its mechanical strength has been shown to weaken over time.
following implantation. This weakening, which may result from various factors such as lipid infiltration of the silicone elastomer, has been linked to aging and rupture of the implant. Any changes that occur in the implant shell will not interfere with mammography or with the palpability of the implant. However, other complications, such as capsular contracture, will affect the findings seen on mammography. Therefore, it is important for patients who have breast implants to undergo mammographic evaluation at specialized centers experienced at obtaining mammograms using the displacement (Eklund) technique, which maximizes visualization of the breast parenchyma. The stiffness of the implant shell does not change with time. In the same way, the incidence of immune-related disorders remains steady over the duration of implantation, at one in 40,000 patients. Infiltration of the implant shell by the surrounding capsule has not been demonstrated or implicated in the rupture of aging implants.

34. Which of the following lesions is associated with trigeminal nerve distribution?
(A) Blue nevus
(B) Ephelis
(C) Nevus of Ito
(D) Nevus sebaceus of Jadassohn
(E) Nevus of Ota

The correct response is Option E.
The above photograph depicts a nevus of Ota, a bluish gray facial lesion that occurs along the distribution of the ophthalmic and maxillary branches of the trigeminal nerve (V1 and V2) and predominantly
involves the periorbital region. The cornea, nasal mucosa, and oral pharynx are rarely involved. Approximately 60% of these lesions are present at birth or develop by age 10 years, 80% are seen in female children, and 5% occur bilaterally. Because malignant transformation is rare, treatment is only indicated for cosmetic reasons.

A blue nevus is a small, well-defined intradermal nevus that rarely displays malignant transformation. Ephelis is a pigmented freckle that contains a normal quantity of melanocytes and an abnormally large quantity of melanin granules. There is no potential for malignancy. The nevus of Ito is similar to the nevus of Ota but instead follows the distribution of the lateral brachial cutaneous and supraclavicular nerves. The nevus sebaceus of Jadassohn is a yellowish orange, slightly elevated plaque seen at or soon after birth. It is a benign epidermal tumor that occurs most frequently on the scalp and face. Approximately 15% of these lesions develop into basal cell carcinoma.

35. A 5-month-old infant has a nodular, nonulcerated 2-cm capillary hemangioma of the upper eyelid that is obstructing the visual axis; a photograph is shown above. His parents report that the lesion grew rapidly and then decreased in size. Which of the following is the most appropriate next step in management?
(A) Systemic administration of corticosteroids
(B) Intralesional injection of corticosteroids
(C) Interferon alfa–2a therapy
(D) Radiation therapy
(E) Surgical resection of the lesion

The correct response is Option E.
In this infant who has a hemangioma that is obstructing the visual axis, the most appropriate management is immediate surgical resection to preserve vision. Studies have shown that children younger than age 1 year are susceptible to the development of amblyopia if visual obstruction is present for a period of time as short as one week. Once the hemangioma has been carefully excised, primary closure can be attempted; larger wounds should be covered with a skin graft or flap because of the risk for lagophthalmos and corneal exposure. Because systemic administration of corticosteroids has been shown to result in significant regression of lesions, it is the recommended course of therapy in patients with hemangiomas that do not obstruct the visual axis or airway. In these patients, doses of prednisone 2 mg/kg/daily to 4 mg/kg/daily are prescribed for two to three weeks and then tapered to 1 mg/kg/daily before the prednisone is discontinued. Although success rates of as high as 60% have been reported, associated complications in infants can include adrenal suppression, immunosuppression, growth arrest, and the development of cushingoid facies.

Intralesional corticosteroids such as betamethasone, dexamethasone, and triamcinolone can be extremely effective when injected at multiple sites under sedation or general anesthesia. As many as three separate injections can be administered every four to eight weeks, and marked involution has been reported in a majority of patients. Nevertheless, this course of treatment is rarely recommended because patients are at risk for significant complications, including perforation of the globe, infection, renal artery embolism, blindness, eyelid necrosis, and atrophy of soft tissues.

Interferon alfa–2a is a newly recognized treatment of hemangiomas. This agent is thought to inhibit the migration and proliferation of endothelial cells through a blockade of basic fibroblast growth factor. Complications, which are infrequent, can include low-grade fever, a transient increase in liver enzymes, and rebound tumor growth, which can be prevented by prolonging the course of therapy. However, investigational studies of the use of interferon alfa-2a for the treatment
of hemangiomas have been limited to those patients in whom corticosteroid therapy has been unsuccessful. Radiation therapy is effective for treatment of proliferative hemangiomas but is often associated with significant adverse effects, especially in infants. These include the potential for injury to the globe and optic nerve, as well as the risk for subsequent induction of malignancy, such as thyroid carcinoma. Therefore, this treatment is limited to patients who have high risk lesions that have not responded to corticosteroid therapy.

36. A 57-year-old man undergoes composite resection of an advanced squamous cell carcinoma of the retromolar trigone. An osteocutaneous free flap that provides a 6-cm bone segment, intraoral lining, and external skin will be used for reconstruction of the defect. Which of the following osteocutaneous free flaps will allow for maximum independence in repositioning the skin paddle in relation to the bone segment?
(A) Fibular
(B) Iliac crest
(C) Lateral arm
(D) Radial forearm
(E) Scapular

The correct response is Option E. Reconstruction in this patient should be performed using the scapular flap, which will provide the greatest degree of leeway in positioning the skin paddle in relation to the bone segment. This is typically advantageous when using the flap to reconstruct complex defects of the head and neck. The scapular flap derives its primary blood supply from
the circumflex scapular artery, which originates from the subscapular artery and passes through the triangular space. Branches of the circumflex scapular artery consistently supply the lateral border of the scapula at a point prior to the division of the artery into transverse and descending branches. A 3-cm vascular pedicle extends from the border of the scapula to the overlying skin and allows for an additional three degrees of spatial freedom when insetting the skin paddle. In addition, the angular branch of the thoracodorsal artery has been shown to consistently provide an independent source of perfusion to the inferior pole of the scapula. This allows for a greater arc of rotation between the bone and skin paddle because each portion derives its vascularity from separate sources.

The fibular flap is based on the peroneal artery as well as its multiple periosteal vessels and cutaneous perforators; it can provide as much as 25 cm of bone for mandibular reconstruction. Because of the limited amount of skin that can be harvested with this flap, it is not often used in reconstruction without additional skin grafting; in addition, there is very little freedom in repositioning the skin relative to the bone. Harvest of this flap is contraindicated in patients with several peripheral vascular disease.

The iliac crest osteocutaneous flap, which is based on the deep circumflex iliac artery, can provide a skin paddle as large as 12 cm × 6 cm and a bone segment as large as 8 cm × 18 cm. Although this flap can be used for reconstruction of large mandibular segments and extensive soft-tissue defects, the skin component is bulky and insensate.

Meticulous closure of the donor site defect is required to prevent hernia formation.

Advantages of the lateral arm flap include a thin, pliable, sensate skin paddle and the potential harvest of as much as 12 cm of skin and one third of the diameter of the humerus. Because of these factors, the flap is often used for reconstruction of defects of the head and neck or upper extremities. A skin paddle as large as 6 cm can be harvested without skin grafting. However, the use of this flap is once again limited by its lack of freedom between the skin and underlying bone segment.
The radial forearm flap can provide thin, pliable skin and a maximum of 10 cm of bone, which can include a crosssectional area comprising approximately 40% of the radius. Once again, there is minimal freedom when positioning the skin paddle relative to the underlying bone. The quality of bone harvested with this flap is often poor, and it is rarely used in elderly patients because of the increased risk for radial fracture seen with the removal of such a large portion of bone.

37. Eight months after sustaining a deep second-degree burn of the dorsal aspect of the right hand, a 45-year-old woman has hyperextension of the metacarpophalangeal joint of the little finger resulting from a progressively worsening scar contracture. A photograph is shown above. Intensive occupational therapy has not improved this patient’s condition. Following release of the scar contracture, which of the following is the most appropriate operative management?
(A) Thin split-thickness skin grafting
(B) Full-thickness skin grafting
(C) Cultured epithelial autografting
(D) Coverage with a free lateral arm flap
(E) Coverage with a radial forearm flap

The correct response is Option B. This patient has a significant scar contracture after sustaining a deep second-degree burn, which by nature is defined as a partial-thickness burn. This type of burn is often associated with hyperextension scarring and preservation of the underlying extensor tendon mechanism. Following release of the scar contracture, this patient should undergo full thickness skin grafting of the hand. The paratenon of the extensor mechanism will readily accept a full-thickness skin graft, which will maximize long-term mobility of the metacarpophalangeal joint. In
addition, full-thickness skin grafts have the lowest associated scar contraction. 
Both thin and thick split-thickness skin grafts have higher secondary contraction rates than full-thickness skin grafts, with thin split-thickness skin grafts having the greatest rate of secondary contraction. Because full-thickness skin grafting will provide the best thin coverage of the burn wound, more difficult and sophisticated procedures, such as autografting or coverage with free or pedicled flaps, are unnecessary.

38. A 68-year-old woman has had a slowly enlarging nodule on the right upper eyelid for the past eight months. Physical examination shows a dark purple 8-mm nodule on the eyelid; ipsilateral parotid and cervical nodes can be palpated. Histologic examination of a biopsy specimen of the lesion shows uniform sheets of small oval cells within the deep epidermis and subcutaneous fat that have indistinct margins. These findings are most consistent with
(A) basal cell carcinoma
(B) malignant melanoma
(C) Merkel cell carcinoma
(D) microcystic adnexal carcinoma
(E) squamous cell carcinoma

The correct response is Option C. This patient has findings consistent with Merkel cell carcinoma, an extremely aggressive tumor most commonly encountered in the head and neck region of elderly women. These nodules are pink to deep purple in color and rarely ulcerate. Light microscopy will show dense sheets of oval cells with indistinct borders that invade the deep dermis,
subcutaneous fat, and muscle while sparing the papillary dermis and epidermis. Some surgeons advocate the use of electron microscopy and immunohistochemistry because these lesions can be mistaken for metastatic oat cell carcinoma or poorly differentiated lymphoma. A biopsy specimen of the lesion will most likely stain positive for neuron-specific enolase.

Because 33% of affected patients will experience a local recurrence within one year of initial treatment and approximately 50% will ultimately develop nodal metastases, wide local excision with a margin of 2.5 cm to 3 cm is indicated. En bloc resection of involved nodes and postoperative radiation therapy are also recommended; chemotherapy and prophylactic nodal dissection are controversial treatment options. Long-term survival rates are poor; only 55% of patients diagnosed with Merkel cell carcinoma will survive for three years. Factors that are associated with a poor prognosis include male gender, early age at initial onset, and location of the tumor on the head, neck, or trunk.

Basal cell carcinomas are common slow growing tumors of the head and neck that can be pigmented or ulcerated. Because these tumors rarely metastasize, local excision with 5 mm margins is recommended.

Malignant melanoma is a highly aggressive tumor of brown pigmentation that often develops within an existing nevus. Exposure to ultraviolet radiation has been associated. Melanomas of the hands and feet are associated with a significantly worse prognosis than those of the arm and leg. Excision with wide margins is advocated for treatment of malignant melanoma.

Microcystic adnexal carcinomas are rare, flesh colored nodules involving the upper lip, nose, and periorbital regions in middle aged patients. Perineural invasion is almost always seen with this locally aggressive and often recurrent tumor. Ulceration and nodal metastases are rare. Appropriate management of microcystic adnexal carcinoma is Mohs’ micrographic resection, including complete histologic examination of the tumor margins. Radiation therapy is ineffective.
Squamous cell carcinomas arise from the malpighian layer and have a strong association with actinic radiation. Cutaneous squamous cell carcinomas have a rough, ulcerated appearance and most frequently affect the head and neck region. The overall rate of metastasis is extremely low. Direct excision or radiation therapy are equally advocated as initial treatment. Recurrent lesions are treated with Mohs’ micrographic resection.

39. Sebaceous carcinoma most frequently affects which of the following anatomic sites?
(A) Eyelid
(B) Finger
(C) Nose
(D) Tongue
(E) Trunk

The correct response is Option A. Sebaceous carcinoma arises from the adnexal epithelium of the sebaceous glands. It can be divided into two subtypes; the ocular subtype, which is most common, typically arises from the meibomian gland of the eyelid. This is a more aggressive carcinoma, frequently resulting in metastasis. In contrast, extraocular lesions are common to hair-bearing areas, and metastases are infrequent.

40. A 25-year-old woman sustains a contact injury to the posterior aspect of the scalp. Following debridement, she has a 6 × 4-cm defect of
the posterior scalp with exposed bone. Which of the following is the most appropriate next step in management?

(A) Excision and primary closure
(B) Full-thickness skin grafting
(C) Coverage with a rotation flap
(D) Hair transplantation
(E) Tissue expansion

The correct response is Option C.

In this 25-year-old woman who has a 6 × 4-cm defect of the posterior aspect of the scalp, the most appropriate management is coverage of the defect using a rotation flap. This flap provides local hair-bearing tissue and can be used to cover defects as large as 6 cm. In order to advance an adequate length of flap, multiple relaxing incisions must be performed within the galea. If the galea is not carefully divided, injury to the subcutaneous vessels or hair follicles may result, leading to the onset of alopecia or delayed wound healing.

Tissue expansion is most appropriate for patients who have large defects of the scalp (typically greater than 15%) because the scalp defect will be covered with similar tissue. Donor site scarring is not a factor in most cases, and the expanders can be left in place if further tissue expansion is required. In addition, the hair follicles will be oriented correctly; as much as 50% of the scalp can be covered with expanded tissue without altering hair growth. However, the process of tissue expansion involves multiple procedures and frequent office visits over a lengthy period of time.

During the expansion process, the patient often expresses displeasure with his/her physical appearance.

Excision and primary closure combined with extensive undermining are only appropriate for patients who have defects measuring less than 5 cm. Patients with small areas of scalp alopecia may undergo multiple staged excisions of the alopecic scalp followed by advancement of hair-bearing tissue. Because this process involves fewer procedures and less follow-up, it can be used as an alternative to tissue expansion.
Although a full-thickness skin graft can be used for temporary wound coverage in a patient who will undergo further scalp reconstruction, it is not an appropriate long-term treatment because many donor sites do not provide adequate hair-bearing skin. Hair transplantation is currently being used with increasing regularity for treatment of traumatic or age-related alopecia.

41. A patient who wishes to undergo cosmetic surgery for correction of skin hyperextensibility has an inherited disorder of collagen polymerization that results in laxity of the joints and poor wound healing. These findings are most consistent with
(A) cutis laxa
(B) Ehlers-Danlos syndrome
(C) progeria
(D) pseudoxanthoma elasticum
(E) Werner’s syndrome

The correct response is Option B. This patient has Ehlers-Danlos syndrome, or cutis hyperelastica, an inherited disorder of abnormal molecular collagen cross-linking characterized by hyperextensibility of the skin and laxity of the joints. Cosmetic surgery is contraindicated in patients with Ehlers-Danlos syndrome because wound healing is poor. Patients with cutis laxa have coarsely textured, drooping skin resulting from a nonfunctioning elastase inhibitor or premature degeneration of elastin fibers. Because this condition is not associated with wound healing problems, rhytidectomy may be performed. Progeria is an autosomal recessive disorder characterized by skin laxity, loss of subcutaneous fat, and findings of generalized atherosclerosis similar to premature aging. Aesthetic surgery is contraindicated because
wound healing is poor; in addition, the lifespan of patients with progeria is shortened.
The mechanisms of action of pseudoxanthoma elasticum, an inherited disorder of premature skin laxity, include increased degradation of collagen and deposition of calcium within the elastic fibers. Rhytidectomy should be considered because healing is normal. Werner’s syndrome is a rare autosomal recessive disorder of unknown etiology. Associated features include sclerodermic skin changes and accelerated atherosclerosis, which can limit or prolong the wound-healing process.

42. In paraplegic patients with chronic pressure ulcers, which of the following is the most common cause of death?
(A) Pulmonary sepsis
(B) Pulmonary thromboembolism
(C) Renal failure
(D) Sepsis secondary to pressure ulcers
(E) Urosepsis

The correct response is Option C.
In paraplegic patients with chronic pressure ulcers, renal failure secondary to chronic amyloidosis is the most common cause of death. Pulmonary sepsis, thromboembolism, and respiratory failure are frequent causes of death immediately following the traumatic onset of paraplegia but not in patients with long-standing paraplegia who subsequently develop pressure ulcers. Sepsis secondary to pressure ulcers is uncommon. Although urosepsis is a common problem for patients with long-standing paraplegia, antibiotics decrease the likelihood of death.
43. Which of the following immunologic responses is most likely to be seen in a 50-year-old woman who has sustained a 50% total body surface area (TBSA) burn in a house fire?
(A) Augmented B lymphocyte function
(B) Decreased fibronectin levels
(C) Decreased quantity of suppressor T lymphocytes
(D) Increased complement activation
(E) Increased production of IgG and IgM antibodies

The correct response is Option B.
Immunologic responses anticipated in this 50-year-old woman who has sustained a 50% TBSA burn include decreased levels of fibronectin, diminished complement activation, and decreased production of immunoglobulin antibodies.
Patients who sustain burn injuries enter into an immunocompromised state, in which the ability to perform the functions of phagocytosis and pathogen elimination are severely limited, resulting in an inability to produce fibronectin. In addition, there is a generalized depression of the cellular immune response, including a decrease in the quantity and function of both B and T lymphocytes; however, the number of suppressor T lymphocytes is actually increased following acute thermal injury.
44. Which of the following impairs the process of epithelialization during wound healing?
(A) Basic fibroblast growth factor
(B) Epidermal growth factor
(C) Isotretinoin
(D) Keratinocyte growth factor
(E) Tretinoin

The correct response is Option C. Isotretinoin is the only agent of those listed that impairs epithelialization instead of promoting it. Isotretinoin (13-cis retinoic acid, or Accutane) is a retinoid, one of a family of vitamin A-related agents. Because of its antikeratinization effect, which results in thinning of the stratum corneum and decreased activity of skin appendages such as sebaceous glands, as well as its effect on wound epithelialization, it is used in the treatment of cystic acne. In addition, patients who have been taking isotretinoin experience delayed or poor wound healing following chemical peeling or laser skin resurfacing because of the effect on wound epithelialization. Therefore, it is recommended that isotretinoin be discontinued a minimum of one year before chemical peeling or laser peeling is performed.

Basic fibroblast growth factor is a polypeptide and a member of the family of fibroblast growth factors (FGF). This agent stimulates important aspects of wound healing, including angiogenesis, collagen and collagen matrix syntheses, wound contraction, and epithelialization. Epidermal growth factor is a polypeptide FGF that affects endothelial cells, fibroblasts, and smooth muscle cells. Because epithelial cells have been shown to have the greatest number of receptors for epidermal growth factor, the primary effect of epidermal growth factor is believed to be promotion of epithelialization. Keratinocyte growth factor is produced by fibroblasts and also primarily affects epithelialization; only epithelial cells have keratinocyte growth factor receptors. Delayed wound healing has been reported in transgenic animals that lack this signaling receptor.
Although tretinoin is also classified as a retinoid, its effects are far different than isotretinoin. Tretinoin (all-transretinoic acid, Retin-A) promotes epithelialization by stimulating mitotic activity and decreasing the turnover of follicular epithelial cells. As a result, tretinoin is often used as a pretreatment in patients undergoing chemical peeling and laser skin resurfacing to accelerate wound healing. Other conditions for which tretinoin has proved beneficial include skin aging, acne vulgaris, and dysplastic nevus syndrome, as well premalignant and malignant tumors such as actinic keratosis, carcinoma in situ, and superficial basal cell carcinoma.

45. Which of the following structures provides motor innervation to the gracilis free muscle flap?
(A) Anterior branch of the obturator nerve  
(B) Femoral nerve  
(C) Inferior branch of the superior gluteal nerve  
(D) Medial femoral cutaneous nerve  
(E) Median sural nerve

The correct response is Option A. The anterior branch of the obturator nerve provides motor innervation to the gracilis free muscle flap. This nerve branch courses between the adductor longus and adductor brevis tendons to innervate the gracilis muscle. 

The femoral nerve innervates the rectus femoris muscle at the level of the thigh, while the inferior branch of the superior gluteal nerve supplies motor innervation to the tensor fascia lata. The medial femoral cutaneous nerve, which is a branch of the femoral nerve, supplies sensory innervation to the medial thigh flap. The median sural nerve is found below the knee and courses parallel to the lesser saphenous vein.
46. Patients with erythroplasia of Queyrat have squamous cell carcinoma affecting which of the following sites?
(A) Arm
(B) Ear
(C) Nose
(D) Penis
(E) Scalp

The correct response is Option D.
Erythroplasia of Queyrat is an irregular, erythematous patch of full-blown squamous cell carcinoma or carcinoma in situ that affects the penis. It is a feature of the condition known as Bowen’s disease, which is characterized by widespread erythematous, brown, scaly patches. These lesions are composed of squamous cells that can completely replace normal dermis at the affected sites. Because approximately 15% of Bowen’s disease lesions progress to become invasive squamous cell carcinoma, surgical excision of an erythroplasia of Queyrat is recommended.

47. Which of the following is the predominant type of collagen found in basement membrane?
(A) Type I
(B) Type II
(C) Type III
(D) Type IV
(E) Type V

The correct response is Option D. Type IV collagen is the predominant collagen in basement membrane. In contrast, type I collagen is most often found in normal, mature skin, as well as in tendon and bone. Type II collagen is present in hyaline cartilage and the tissues of the eye. Type III collagen is located in the papillary dermis, arteries, intestinal walls, and uterus. In addition, hypertrophic and immature scars can contain as much as 30% type III collagen. Type V collagen is also found within the basement membrane in lesser amounts than type IV collagen.

48. Which of the following graft types exhibits the lowest relative volume loss and resorption?
(A) Bone graft
(B) Cartilage graft
(C) Macro-fat graft
(D) Micro-fat graft
(E) Muscle graft

The correct response is Option B. Because of its unique composition, cartilage is a tissue well formulated for grafting due to its minimal volume loss and resorption. The metabolic rate of cartilage resorption is far less than other human tissues, and its glycolic activity and relatively low consumption rate result from a decreased quantity of cells and a relatively isolated cartilage matrix. Sites that are easily accessible for harvest include the auricular cartilage, rib cartilage, and septum.
Rates of resorption following bone grafting typically depend on graft size and clinical variables. Macro-fat grafts are often unreliable and associated with high rates of resorption. Dermal fat grafts are more commonly used because of their lower rates of resorption and fibrosis. Although micro-fat grafts obtained by injection may be more reliable, resorption rates have been reported as 25% to 50% of the volume of the originally injected fat. Muscle alone is not routinely transferred as a graft; vascularized muscle is more often used in flaps.

49. Which of the following sites is most susceptible to the development of a keloid following injury?
(A) Eyelid
(B) Genitalia
(C) Upper arm
(D) Palm
(E) Sole

The correct response is Option C. Although keloids can occur in persons of any race, they are most frequently seen in dark-skinned persons. Keloids are most likely to develop on the face, cheek, earlobe, shoulder, upper arm, and anterior chest; in contrast, they are rarely seen on the eyelid, cornea, umbilical cord region, palm, genitalia, or sole. The origin of this regional susceptibility is unknown.
50. A 70-year-old woman has a skin defect with a diameter of 1 cm after undergoing resection of a basal cell carcinoma of the right upper eyelid. Primary closure of the defect is not possible. Which of the following is most appropriate for cutaneous full-thickness coverage of the defect?
(A) Cross-lid flap
(B) Retroauricular skin graft
(C) Skin graft from the contralateral upper eyelid
(D) Supraclavicular skin graft
(E) Wedge resection and primary closure of the remaining eyelid

The correct response is Option C. A skin graft from the contralateral upper eyelid should be used for full-thickness coverage of this patient’s defect. Because older patients typically have dermatochalasia, there is often sufficient skin in the unaffected upper eyelid that can be harvested and used to cover small skin deficits. A cross-lid flap is more appropriate for coverage of a full-thickness defect. Grafts harvested from the retroauricular and supraclavicular regions are better used for skin grafting of the face due to their optimal color match; however, this skin is often too thick for use in the upper eyelid. Wedge resection is an excessive, unnecessary procedure.

51. A patient develops an infection at the wound site five days after beginning leech therapy. Which of the following is the most appropriate antibiotic therapy?
(A) Cephalexin
(B) Clindamycin
(C) Metronidazole
(D) Penicillin
(E) Trimethoprim-sulfamethoxazole

The correct response is Option E. This patient has developed infection with *Aeromonas hydrophila* after undergoing leech therapy for five days. Medicinal leeches such as the *Hirudo medicinalis* species (which is the most commonly used leech and is endemic to Southeast Asia and Europe) can be applied to flaps or replanted limbs in order to relieve venous congestion. However, a common complication of leech therapy is the development of infectious organisms such as *Aeromonas hydrophila*, a gram-negative rod that can be detected in as many as 20% of persons within the first 10 days of therapy. Infiltration of *Aeromonas hydrophila* organisms can result in a rapidly progressive infection with gas in the soft tissues that can resemble clostridial myonecrosis. If infection does develop, trimethoprim-sulfamethoxazole is recommended for first-line therapy. Fluoroquinolones such as ciprofloxacin are also effective. Antibiotics that are still effective but less frequently recommended include antipseudomonal aminoglycoside, imipenem, meropenem, tetracycline, and second-, third-, or fourth-generation cephalosporins.

52. Which of the following physiologic mechanisms is increased during the first 24 hours following thermal burn injury?
(A) Cardiac output
(B) Central venous pressure
(C) Circulating erythrocyte volume
(D) Circulating glucose concentration
(E) Plasma volume

The correct response is Option D.
The circulating glucose concentration is increased during the first 24 hours following thermal burn injury. The affected patient develops glucose intolerance due to the release of catecholamines from the burn site. Because of this, glucose should not be added to the fluids given intravenously for acute resuscitation.

Following burn injury, the release of myocardial depressants diminishes cardiac output. Cardiac output is decreased to 40% to 60% of normal as a result of decreased plasma volume and increased systemic vascular resistance.

Cardiac output then returns to normal but is not increased. The aforementioned decrease in plasma volume, which occurs in part from a capillary leak, subsequently leads to a decrease in central venous pressure. In addition, there is a decrease in circulating erythrocyte volume, due in part to a direct destruction of erythrocytes by the injured tissue.

53. A 40-year-old man has a dark purple “cobblestone” lesion covering the entire right cheek. This finding is most consistent with
(A) an arteriovenous malformation
(B) a capillary malformation
(C) a hemangioma
(D) a lymphatic malformation
(E) a venous malformation

The correct response is Option B.

This 40-year-old man has a capillary malformation, or port-wine stain. These lesions are often seen in the distribution of the abducens (VI) and facial (VII) nerves. If left untreated, cobblestoning and progressive darkening may occur due to ectasia of the vessels within the capillary malformation.
An arteriovenous malformation is a high-flow lesion often characterized by a palpable thrill or bruit. Compression of the lesion results in occlusion of the associated arteriovenous fistula, causing a baroreceptor response and an increase in blood pressure. This leads to a decrease in heart rate and is known as the Branham sign. Hemangiomas are vascular tumors that appear just after birth and rapidly enlarge during the first year of life. Because spontaneous regression is common, conservative management is suggested for non-life-threatening lesions that do not obstruct the airway or visual axis. Lymphatic malformations, also known as cystic hygromas, occur most frequently in the head and neck region and often enlarge in response to an adjacent infection. Recurrent swelling can lead to scarring, which will significantly decrease the size of the lesion. Venous malformations are low-flow lesions composed of dilated venous channels. These lesions are compressible and have a propensity to fill with blood when the patient changes body positions. When the malformation is associated with thrombosis, pain may result.

54. In a 47-year-old woman who has used topical tretinoin for the last four years, which of the following histologic features is most likely?
(A) A compact stratum corneum
(B) A decrease in dermal mucin
(C) A decrease in epidermal thickness
(D) A decrease in hyaluronic acid
(E) An increase in melanin production

The correct response is Option A. Topical tretinoin (Retin-A) can be used to decrease the effects of photoaging, including those resulting from solar exposure. Long-term
studies have uncovered several histologic features resulting from the topical application of tretinoin, including compactness of the stratum corneum, which produces smoothing of the skin; an increase in hyaluronic acid, which is thought to reduce the appearance of fine lines; an increase in epidermal thickness with return of the granular layer thickness to a baseline value; an increase in dermal mucin; and a decrease in melanin production.

Adverse effects associated with tretinoin use include erythema and crusting of the skin. Alternate-day therapy or daily therapy using a dilute dose has been shown to decrease these effects. Because tretinoin is also associated with sun sensitivity, skin protection during sun exposure is advocated.

55. In patients who exhibit allergic sensitivity to bovine collagen, which of the following types of immunologic response is most common?
(A) IgA antibodies
(B) IgD antibodies
(C) IgE antibodies
(D) IgG antibodies
(E) IgM antibodies

The correct response is Option D. Anti-bovine collagen (Zyderm) antibodies are classified as IgG antibodies. Zyderm is a purified form of bovine collagen that consists of 95% type I collagen with 5% type II collagen. It is available in two concentrations, 35 mg/mL and 65 mg/mL, as well as in a glutaraldehyde cross-linked form known as Zyplast, which in theory degrades more slowly. Enzymatic processing is used to remove the nonhelical portion of the collagen molecule, thus reducing most of its associated antigenicity.
These various forms of injectable collagen are used for correction of depressed scars, shallow or soft acne scars, and fine facial rhytids associated with aging. Ice pick acne scars cannot be treated with collagen injections. In patients undergoing treatment, the collagen is injected intradermally in excess amounts, which are necessary to compensate for absorption of the saline component of the solution. Some of the injected collagen is lost over the next six to nine months as collagen breakdown occurs.

Because approximately 3% of all treated patients will have an allergic reaction to injectable bovine collagen, skin testing should be performed prior to any treatment. Following intradermal injection of a test dose into the volar forearm, the patient should be assessed 72 hours after injection and again at four weeks after injection, as any adverse changes noted at the test site may indicate an allergic reaction. This is defined as the onset of erythema, induration, tenderness, or swelling to any degree, with or without pruritus, that appears more than 24 hours after injection and/or persists longer than six hours.

Approximately 66% of those patients who are allergic to injectable collagen will have a positive reaction within 72 hours, while 33% will develop positive findings within four weeks. An additional 1% will have negative findings on skin testing but will subsequently develop an allergic reaction following injection. One study of those patients who had negative skin tests and subsequent allergic reactions showed that 56% developed a reaction following the first treatment, while 28% experienced the reaction after two treatments. All of the patients who exhibited allergic sensitivity developed IgG antibodies against bovine collagen. In contrast, 50% developed IgA antibodies; IgD, IgE, and IgM antibodies were not identified.
56. Which of the following characteristics of a full-thickness skin graft has the greatest effect on inhibition of wound contraction?
(A) Epidermal-to-dermal ratio
(B) Percentage of grafted dermis
(C) Presence of muscle at the base of the recipient bed
(D) Skin thickness of the recipient bed
(E) Thickness of the entire graft

The correct response is Option B.
Full-thickness skin grafts inhibit wound contraction by accelerating the rate of dissolution of myofibroblasts from the wound. Because of this, it is the percentage of grafted dermis, rather than the absolute thickness of the total graft, that has the greatest effect on inhibition of wound contraction.
The epidermal-to-dermal ratio, skin thickness of the recipient bed, and presence of muscle within the recipient bed play only minor roles in inhibiting wound contraction.

57. An 8-year-old boy has a bulky soft-tissue anomaly of the right upper extremity. Radiographs show bony destruction of the underlying humerus. These findings are most consistent with
(A) arteriovenous malformation
(B) hemangioma
(C) hereditary hemorrhagic telangiectasia
(D) lymphatic malformation
(E) venous malformation

The correct response is Option A.
This 8-year-old boy has findings consistent with an arteriovenous malformation, a congenital vascular soft-tissue anomaly that has extended to cause destruction of the underlying humerus. Arteriovenous
malformations are a subtype of vascular malformation involving arterial channels; they are present at birth and thus grow commensurately with the child’s growth. Associated physical findings can include increased warmth in the area of the malformation, mass effect, the presence of a thrill or bruit on auscultation, ulceration, and distal ischemia, which is related to the “steal” phenomenon (ie, diversion of normal blood flow). Skeletal changes, especially intraosseous extension and lytic changes, occur in 34% of affected patients.

Hemangiomas are also classified as vascular anomalies but instead appear shortly after birth and are characterized by a period of rapid growth (typically six to nine months) followed by slow involution. Rapid endothelial proliferation is characteristic, but skeletal changes are not, occurring in only 1% of patients. Lytic lesions are also not seen. Although hemangiomas are often unpleasant looking, they are typically only removed surgically if they begin to obstruct the airway or visual fields.

Hereditary hemorrhagic telangiectasia, or Osler-Weber-Rendu syndrome, is an autosomal dominant disorder that first manifests following puberty and is characterized by lesions with ectatic vessels involving the skin, mucous membranes, and viscera that worsen over time. Epistaxis, hematuria, and hematemesis are frequently associated. Neurologic symptoms may occur in patients who have involvement of the central nervous system. Skeletal malformations are not associated.

In patients with lymphatic malformations, skeletal hypertrophy and distortion are frequent. Venous malformations, especially those affecting the extremities, can cause hypoplasia and bone demineralization.
58. In normal wound healing, collagen synthesis and collagen breakdown typically reach a state of equilibrium approximately how many days after injury? 
(A) 7 
(B) 14 
(C) 21 
(D) 60 
(E) 90 

The correct response is Option C. 
In normal wound healing, collagen synthesis and collagen breakdown typically reach a state of equilibrium approximately 21 days after initial injury. Collagen synthesis depends primarily on production of procollagen by fibroblasts. This procollagen is inserted into secretory vessels that move toward the cell surface. It then is cleaved into collagen at the level of the cell membrane, and the collagen is then released into the wound. Macrophages help to regulate collagen synthesis by producing growth factors that stimulate fibroblast proliferation and subsequent collagen production. In collagen degradation, fibroblasts, granulocytes, macrophages, and other cells produce specific matrix metalloproteinases (MMP) at the wound site. The MMP family of zinc-dependent endopeptidases includes collagenase, gelatinase, and stromelysin. Several members of the MMP family have been linked to chronic wounds; these substances, such as MMP-2 and MMP-9, have been shown to be absent in acute wounds. A higher turnover of extracellular matrix is thought to contribute to the delayed healing or nonhealing seen in association with chronic wounds. Transforming growth factor-beta can be used to combat this; it has been shown to decrease MMP activity and increase the activity of MMP inhibitors.
59. A 25-year-old man has burn alopecia after sustaining a burn wound involving 35% of the hair-bearing scalp. Which of the following is the most appropriate method of reconstruction in this patient?
(A) Free flap reconstruction
(B) Micrografting
(C) Minigrafting
(D) Strip grafting
(E) Tissue expansion

The correct response is Option E. In patients with burn alopecia, the hair-bearing area of the scalp is amenable to tissue expansion; therefore, it is most appropriate for reconstruction in this patient. With this technique, large areas of the scalp can be resurfaced with similar tissue, resulting in reliable, consistent hair growth.

Grafting techniques, such as the use of micrografts, minigrafts, or strip grafts, are appropriate for management of male pattern alopecia but are unreliable in a patient with a compromised recipient site, such as a burn wound. Free flap reconstruction will allow rapid wound healing in a patient who has acute extensive and/or deep injuries involving exposed, devitalized skull.

Although hair transplantation is an option in patients with burn-related alopecia, it would not be the treatment of choice in this patient because of the diminished vascularity and severe scarring seen in the recipient bed.

60. Which of the following flaps is most appropriate for coverage of a 2-cm full-thickness skin defect of the columella?
(A) Bi-lobe flap
(B) Glabellar flap
(C) Median forehead flap
(D) Nasolabial flap
(E) Scalping flap

The correct response is Option D. The nasolabial flap should be used for coverage of a 2-cm full-thickness skin defect of the columella. This flap, which is based on the angular artery (terminal branch of the facial artery), can be tunneled deeply to provide tissue for intraoral or columellar reconstruction. It can also be used to cover defects of the lower nose, nasal alae, and upper lip. Bi-lobe flaps are best used for coverage of defects involving the upper and middle thirds of the nose, not the columella and nasal tip. Glabellar flaps are used for coverage of defects involving the medial canthal and upper nasal regions. The median forehead flap, which is based on the supratrochlear artery, is more useful for coverage of large defects of the nose. A scalping flap is appropriate for near-total and total nasal reconstruction.

61. A vastus lateralis muscle flap elevated on its dominant pedicle provides reliable coverage for each of the following anatomic sites EXCEPT the
(A) acetabulum
(B) groin
(C) knee
(D) perineum
(E) trochanter

The correct response is Option C. When the vastus lateralis flap is based on its dominant pedicle, the descending branch of the lateral femoral circumflex artery, it has an area
of rotation that will provide vascularized coverage of the lower abdomen, groin, perineum, ischium, trochanter, and acetabular fossa. However, the flap must be reversed in order to rotate and provide coverage of knee defects. When used in this manner, the flap is then based on a branch of the lateral genicular artery, which is a minor distal pedicle. Because the risk for partial flap loss is greater, this flap is not often advocated for coverage of knee defects.

62. Each of the following is an effective technique for continuous postoperative free flap monitoring EXCEPT
(A) differential surface temperature monitoring
(B) external Doppler ultrasonography
(C) intravenous injection of fluorescein
(D) laser Doppler ultrasonography
(E) photoplethysmography

The correct response is Option C. Although fluorescein 15 mg/kg is often administered intravenously to determine the viability of a flap’s skin paddles, this cannot be used for continuous free flap monitoring because fluorescein often takes several hours to clear from the skin. Lower doses of fluorescein can be used for sequential monitoring, but not for continuous monitoring. Each of the other options listed can be used for continuous flap monitoring. Although external Doppler ultrasonography is the most frequent choice for flap monitoring, difficulties can be experienced when the flap pedicle is located close to a large artery. External Doppler ultrasonography also cannot be used with buried flaps. Differential surface temperature monitoring compares the temperature of the transferred tissue with the normal surrounding tissue. A temperature
difference of greater than 1.8EC (35.3EF) is believed to be significant. Laser Doppler ultrasonography and photoplethysmography both involve the measurement of reflected light from a source that penetrates the flap.

63. A 72-year-old woman has had a long history of a compressible, nonpulsatile lesion on the lip and chin; photographs are shown above. The lesion swells with activity, sometimes produces pain, and is associated with episodes of bleeding and ulceration. These findings are most consistent with which of the following types of malformation?
(A) Arteriovenous
(B) Capillary
(C) Lymphatic
(D) Venous

The correct response is Option D. This 72-year-old woman has a classic venous malformation, a dark lesion that often becomes swollen with dependency and is exsanguinated easily. Venous malformations occur in 1% to 4% of patients and may vary from well-localized lesions to diffuse generalized ectasia. Intermittent pain can develop secondary to generalized thrombosis; analgesics are frequently prescribed for relief. Wedge resection is most appropriate for removal of this patient’s small lesion on the chin. Other recommended procedures include sclerotherapy and surgical resection. Laser therapy can be used to remove small superficial lesions, and compression garments can be applied for lesions on the extremities. More invasive techniques are reserved for symptomatic malformations characterized by chronic pain, ulceration, and bleeding.
Arteriovenous malformations are generally pulsatile and not associated with pain. Surgery is often recommended because of the risk for hemorrhage. Capillary malformations (i.e., port-wine stains), which involve the intradermal capillaries, are most frequently seen on the face and can be linked to other anomalies. Although lymphatic malformations appear as superficial lesions characterized by cutaneous vesicles, they are much deeper than their appearance, involving both the dermis and subcutaneous tissue.

64. Which of the following muscles comprise the borders of the triangular space?
(A) Anterior border of the scapula, serratus anterior, and long head of the triceps muscles
(B) Latissimus dorsi, teres major, and teres minor muscles
(C) Medial border of the scapula, rhomboideus major, and rhomboideus minor muscles
(D) Triceps, teres major, and teres minor muscles

The correct response is Option D. The triceps, teres major, and teres minor muscles comprise the borders of the triangular space. A knowledge of this region is essential to harvest the scapular and parascapular flaps, which receive their blood supply from the circumflex scapular artery. The pedicle of the parascapular flap arises from the triangular space and enters the deep surface of the flap. The other muscles listed above can be identified in the region of the shoulder and trunk but do not define the triangular space.
65. Which of the following proteins has been implicated in the pathogenesis of breast implant capsule formation?
(A) Albumin
(B) Fibrinogen
(C) Complement
(D) IgG

The correct response is Option B.
The surface-bound protein fibrinogen has been implicated in the generation of inflammatory responses to biomaterials (ie, implants); early protein absorption of these biomaterials mediates the foreign body response. Understanding the intricate pathways that result in fibrinogen absorption and its subsequent inflammatory response, leading to capsule formation, may aid in the prevention and management of breast implant capsular contracture. Other dominant proteins in the body, such as albumin, complement, and immunoglobulin G (IgG), have not been shown to play a critical role in capsule formation resulting from foreign body reaction.

66. A neonate has a 4 × 4-cm congenital defect of the scalp and underlying skull. The brain is visible beneath a gray membrane. Which of the following is the most appropriate initial management?
(A) Frequent application of silver sulfadiazine ointment
(B) Wet-to-dry dressing changes twice daily
(C) Biopsy of the wound margins
(D) Tissue expansion and coverage with scalp flaps

The correct response is Option A.
This neonate has cutis aplasia, or congenital absence of the layers of the skin and scalp that can also expand to include the skull. Conservative management is most appropriate; frequent application of silver sulfadiazine ointment and coverage with occlusive dressings will allow for wound healing. Some surgeons also advocate skin grafting over the exposed areas to prevent wound desiccation. Use of dry dressings can actually result in desiccation of the dura and rupture of the sagittal sinus, a fatal complication. In patients with cutis aplasia, the wound must be kept moist at all times. Biopsy of the wound margins is not indicated because this patient does not have a malignant or premalignant condition. Tissue expansion is not required for this small wound, which will heal by secondary intention without reconstruction.

67. In a patient who is undergoing dissection of a gracilis musculocutaneous flap, the gracilis muscle can be identified immediately posterior to which of the following muscles in the thigh?
(A) Adductor longus muscle
(B) Adductor magnus muscle
(C) Pectineus muscle
(D) Sartorius muscle

The correct response is Option A. In order to effectively identify the gracilis muscle prior to flap harvest, the patient should be placed in the supine position with the knee in abduction. With the patient in this position, the adductor longus muscle can be palpated before surgery. Following incision, the gracilis muscle is easily identified posterior to the adductor longus. The adductor magnus muscle lies posterior to the gracilis, and the pectineus muscle is found anterior to the adductor longus at the floor of
the femoral triangle. The sartorius muscle overlies the gracilis muscle distally.

68. Inadequate fluid resuscitation in a burn patient is most likely to result in which of the following conversion mechanisms?
(A) Zone of coagulation to zone of hyperemia
(B) Zone of coagulation to zone of stasis
(C) Zone of stasis to zone of coagulation
(D) Zone of stasis to zone of hyperemia

The correct response is Option C.
There are three zones of injury in burn patients. The zone of coagulation lies in the center of the wound and is characterized by irreversible tissue destruction. It is immediately surrounded by the zone of stasis, an area of decreased perfusion with demonstrated damage to the microvasculature. The surrounding zone of hyperemia sustains the least amount of damage.
During the first 48 hours following burn injury, patients who are not properly resuscitated are at increased risk for conversion of the zone of stasis to a zone of coagulation. In contrast, if appropriate resuscitation is begun immediately, the zone of stasis can be reversed, potentially preventing the development of necrosis.
A 25-year-old woman who sustained the forearm avulsion shown in the photograph above subsequently underwent reconstruction using a free groin flap based on the superficial circumflex iliac artery. Which of the following best describes the vascular anatomy of this flap?

(A) The superficial circumflex iliac artery arises directly from the external iliac artery in approximately 85% of patients
(B) The superficial circumflex iliac artery arises from a common trunk, terminally splitting with the superficial inferior epigastric artery in approximately 70% of patients
(C) The superficial circumflex iliac and superficial inferior epigastric arteries have separate origins in approximately 40% of patients
(D) The superficial circumflex iliac artery is generally found approximately 1 cm below the inguinal ligament in approximately 70% of patients

The correct response is Option C.

The free groin flap is typically an axially patterned flap that receives its vascularity by the superficial circumflex iliac artery, which arises from the common or superficial femoral artery and then traverses laterally, parallel to the inguinal ligament, typically 2 to 3 cm inferior to the ligament. Although it provides excellent thin soft-tissue coverage of cutaneous defects and is associated with minimal donor site morbidity, especially in women, its use is limited by potential variations in vascular anatomy.

In 45% to 50% of persons the superficial circumflex iliac artery and superficial inferior epigastric artery arise from a common trunk, as shown in the figure on the left. In contrast, 40% to 45% of persons have a superficial circumflex iliac artery and superficial inferior epigastric artery that arise from separate origins, as shown in the figure on the right.

The middle figure demonstrates a large superficial circumflex iliac artery without a superficial inferior epigastric artery, which is present in 10% to 15% of persons. In patients being considered for reconstructive procedures using the free groin flap, vascular anatomy can be determined preoperatively using Doppler ultrasonography.
In addition to its usefulness in coverage of cutaneous defects, as shown in the postoperative photograph below, the free groin flap can also be deepithelialized and transferred as soft-tissue fill in patients with Romberg’s disease or hemifacial microsomia.

70. A 33-year-old man who weighs 80 kg is brought to the emergency department eight hours after sustaining deep partial-thickness burns involving 25% total body surface area (TBSA) and full-thickness burns involving 15% TBSA.

According to the Parkland formula, how many milliliters (mL) of crystalloid should be administered for initial fluid resuscitation over the next eight hours?

(A) 3200
(B) 6400
(C) 9600
(D) 12,800
(E) 16,000

The correct response is Option C.

In a patient who has a burn injury that covers more than 20% of the total body surface area (TBSA), acute fluid resuscitation should be performed with administration of crystalloid during the initial 24 hours after injury. The Parkland formula is used to estimate the amount of fluid required. According to this formula, lactated Ringer’s solution 4 mL/kg/% TBSA burned should be administered during the first 24 hours. A total of 50% of the solution should be administered during the first eight-hour period and the remaining 50% over the next 16 hours. An 80-kg patient who has burns involving 40% TBSA will require 12,800 mL of fluid during the first 24 hours: 6400 mL during the first
eight hours and the remaining 3200 mL in both the second and third eight-hour periods. Because he received no fluid during the first eight hours immediately following injury, 9600 mL of crystalloid should be administered over the next eight hours in order to adequately resuscitate the patient.

71. A 70-year-old woman has a firm, pink 1.2-cm nodule located anterior to the tragus. Histologic examination of an incisional biopsy specimen of the lesion shows Merkel cell carcinoma. Which of the following is the most appropriate management?
(A) Excision with 1-cm margins and ipsilateral neck dissection
(B) Excision with 1-cm margins, superficial parotidectomy, and ipsilateral neck dissection
(C) Excision with 3-cm margins
(D) Excision with 3-cm margins and ipsilateral neck dissection
(E) Excision with 3-cm margins, superficial parotidectomy, and ipsilateral neck dissection

The correct response is Option E.
The most appropriate management of this patient’s Merkel cell carcinoma is excision with 3-cm margins followed by superficial parotidectomy and ipsilateral neck dissection. Merkel cell carcinoma is a rare cutaneous malignancy believed to arise from neuroendocrine cells within the skin. It typically occurs on the head, neck, and other sunexposed areas in patients 50 to 70 years of age. Lymphatic and distant metastasis are common, and prognosis is poor; mortality rates as high as 67% have been reported. Excision of the tumor with margins of 2 to 5 cm is generally recommended; prophylactic neck dissection is advocated because approximately 50% of affected patients have positive regional nodes at the time of initial diagnosis. Because the parotid gland
is a primary drainage basin for preauricular lesions, superficial parotidectomy should also be performed. Although radiation therapy can be performed adjuvantly, it is inadequate when used with excision alone.

72. A Z-plasty revision procedure is to be performed for lengthening of a scar contracture. In order to achieve a theoretical 100% gain in the length, the angle of the Z-plasty should be how many degrees?
(A) 30
(B) 45
(C) 60
(D) 75
(E) 90

The correct response is Option D. The Z-plasty is a technique in which pairs of triangular transposition flaps are created adjacent to a scar and then transposed across the scar, resulting in an increase in the length of the central limb and a change in the orientation of the scar. This technique can be used in patients undergoing burn reconstruction to lengthen linear scar contractures, disperse linear scars, and realign the scars within the lines of minimal tension. The actual amount of scar lengthening correlates directly with the angle and length of the flap limbs.
A 45-year-old man has a painful lesion in the left conchal bowl. A biopsy specimen of the lesion shows chondrodermatitis nodularis helicis. Which of the following is the most appropriate management?
(A) Topical administration of retinoic acid
(B) Administration of acyclovir
(C) Administration of fluorouracil
(D) Administration of interferon
(E) Surgical excision of the lesion

The correct response is Option E.
Surgical excision is the most appropriate management of chondrodermatitis nodularis helicis, a painful erythematous nodule found on the helix, antihelix, or antitragus in persons older than 40 years. Although the cause of chondrodermatitis nodularis helicis is unknown, trauma, sun damage, and cold exposure may be mitigating factors.
Men are more frequently affected. Because these lesions can become ulcerated, resulting in exposure of underlying cartilage, early surgical excision is recommended. Adjunctive removal of the underlying cartilage lessens the risk for recurrence, which is common at the borders of the resection. Other forms of therapy such as topical retinoic acid, acyclovir, fluorouracil, and interferon have not been proven effective. Intralesional injection of a corticosteroid has been helpful in some patients.
74. After undergoing radical mastectomy of the left breast for management of breast carcinoma, a 40-year-old woman with obesity is scheduled for delayed reconstruction using a transverse rectus abdominis myocutaneous (TRAM) flap. Which of the following is the most likely sequela of a delayed TRAM flap procedure?
(A) Increased blood flow to the deep inferior epigastric artery
(B) Increased diameter of the superior epigastric artery
(C) Increased pressure within the superior epigastric vein
(D) Increased quantity of choke vessels
(E) Increased quantity of myocutaneous perforators

The correct response is Option B.
A delay procedure is appropriate for any patient considering TRAM flap reconstruction who has risk factors for flap loss, including obesity, a smoking history, a previous history of radiation therapy, or large volume requirements. A delayed procedure is typically performed in the outpatient setting and involves ligation of the deep and superficial inferior epigastric vessels, eliminating blood flow through the deep inferior epigastric artery. Studies of patients who have undergone this procedure demonstrated increased diameter and flow volume of the superior epigastric artery.
The vascular structures within the flap are also dilated during the delay procedure. The choke vessels connect adjacent vascular regions and have been shown in animal studies to achieve maximum dilation 48 to 72 hours after surgery. Cell hypertrophy has been demonstrated within the walls of the choke vessels.
75. A 53-year-old man has a chronic draining sinus of the perineal region one year after undergoing abdominoperineal resection of a low-lying rectal carcinoma followed by localized radiation therapy. Following debridement of the affected area, which of the following is the most appropriate management?
(A) Healing by secondary intention
(B) Primary closure
(C) Skin grafting
(D) Coverage with a fasciocutaneous flap
(E) Coverage with a muscle flap

The correct response is Option E.
In a patient who has a chronic, irradiated wound, the most appropriate management is coverage with a muscle or musculocutaneous flap with a vascular pedicle that lies outside the field of radiation, such as the gracilis flap. Secondary intention healing is unlikely to be successful in a radiated wound bed, and primary closure of a previously radiated, nonhealing wound will also not result in appropriate healing. Skin grafting will be ineffective due to the poor vascularity of the wound bed. A fasciocutaneous flap is less appropriate than a muscle flap to fill the dead space within the wound.

76. In a patient who has just undergone skin grafting of a recipient wound bed, which of the following is the immediate mechanism of graft survival?
(A) Coaptation of the cut vessels in the graft to the vessels in the recipient bed
(B) Development of a fine network of capillaries from the vascularized bed of exposed bone or tendon
(C) Maintenance of a barrier of blood between the graft and recipient bed
(D) Peripheral ingrowth of the capillary buds into the skin graft
(E) Plasmatic imbibition

The correct response is Option E.
Following the application of a skin graft to a recipient wound bed, initial graft survival is dependent on nourishment provided by transudate from the wound bed through a process known as plasmatic imbibition. The vascularization process is believed to involve ingrowth of capillary buds from the wound edges and bed into the grafted skin. Skin grafts will not take over exposed tendon or bone and are not adequate for coverage of vital structures. Because blood barriers have been demonstrated to be extremely potent, the development of a hematoma will result in graft loss even if infection is not present.

77. A 32-year-old man has severe pain and swelling of both hands after being exposed to hydrofluoric acid while working with a rust remover. On examination, there is significant edema, mottling, and exquisite tenderness of the index, long, and ring fingers of both hands. Digital pulses are present on Doppler ultrasonography. Following copious irrigation of the hands with water, which of the following is the most appropriate next step in management?
(A) Irrigation with 1% copper sulfate
(B) Topical application of phenol
(C) Application of a calcium sulfate splint
(D) Local injection of 10% calcium gluconate
(E) Debridement of the wounds and coverage with split-thickness skin grafts

The correct response is Option D.

This patient has sustained chemical burns to both hands after coming in contact with hydrofluoric acid, a corrosive material derived from elemental fluoride and used in rust removal and plastic and pottery manufacturing. Hydrofluoric acid burns can result in necrosis of soft tissues and decalcification of bone; affected patients can have pain that persists for days. The mechanism of action of this type of burn is due to the high concentration of hydrogen ions within the tissues, as well as liquefaction necrosis caused by the soluble free fluoride ion. Following copious irrigation of the burn site with water to remove as much of the hydrogen ion as possible, 10% calcium gluconate should be injected locally in multiple small doses to prevent vascular compromise. The calcium will bind to the fluoride ion, resulting in immediate relief of pain. A topical calcium gluconate paste can be applied in patients who have less severe burns, and intra-arterial injection is advocated for patients with more severe burns.

Copper sulfate is used for irrigation in patients with phosphorus burns to identify buried particles of phosphorus.

Phenol should not be applied because it can be absorbed through intact skin and further worsen injury. In patients who have sustained phenol burn injuries, topical application of polyethylene glycol or vegetable oil is recommended.

Similarly, calcium sulfate (eg, plaster of Paris) can result in exothermic burns when used in a splint or cast.

Debridement with split-thickness skin grafting should be considered only after the extent of demarcation of the injury is fully known; it may be necessary in patients who have persistent liquefaction necrosis, which manifests as unrelenting pain, even after treatment with calcium gluconate.
78. Which of the following is the most common unfavorable result of lip augmentation with acellular dermal homograft?
(A) Exposure
(B) Hematoma
(C) Infection
(D) Rejection
(E) Resorption

The correct response is Option E. Graft resorption has been reported as the most common complication of lip augmentation with acellular dermal homograft (Alloderm), a product derived from human cadaveric skin for use in soft-tissue augmentation. During harvest of the graft, the dermal and extracellular matrices are left intact, while the immunogenic components are removed. Alloderm can be used for skin grafting of burn wounds, nasal reconstruction, replacement of gingiva, and facial augmentation. Good results have been reported with the use of Alloderm for lip augmentation. Complications other than resorption, such as graft exposure or rejection, hematoma, and infection, have been reported to be minimal.

79. In a patient who has a halo nevus, which of the following is the primary indication for surgical excision?
(A) Elimination of circulating antibodies
(B) Premalignant potential
(C) Prevention of leukoderma
(D) Relief of pain
(E) Resemblance to melanoma
The correct response is Option E.

Halo nevi, so called because of the distinct “halo” area of depigmentation surrounding the benign nevus, are typically seen on the trunk in teenagers and young adults. Histologic examination will show nevus cells surrounded by a bandlike infiltrate of lymphocytes that may completely obliterate the lesion. Halo nevi have no known premalignant potential; however, because melanomas can also develop an irregular, incomplete halo, excisional biopsy should be performed for any halo nevus that becomes enlarged, asymmetric, or ulcerated or displays other characteristics similar to melanoma. The depigmentation around the nevus, known as leukoderma, is typically not painful. Although circulating antibodies to melanoma have been found in patients with halo nevi, this discovery alone is not an indication for nevus excision.

80. A 33-year-old man has the onset of necrosis after sustaining a brown recluse spider bite. Dapsone 50 mg twice daily is prescribed for the next 14 days. Which of the following adverse effects is most likely to be seen in this patient?
(A) Diarrhea
(B) Diplopia
(C) Headache
(D) Hemolysis
(E) Peripheral neuropathy

The correct response is Option D.
The brown recluse spider (Loxosceles reclusa) is one of two species of North American spider capable of envenomation. It is generally found throughout the southern United States. This spider is believed to be nocturnal but may also be active during the day; it does not weave a
web. Features include long slender legs and a distinctive fiddle-shaped marking on its dorsal cephalothorax. Both male and female brown recluse spiders are venomous. Most patients are unaware that they have been bitten by this spider until pain develops or the wound becomes noticeable. Blistering, ischemia, and ulceration may be seen and can ultimately lead to necrosis. Conservative treatment with administration of dapsone 100 mg daily for 14 days is advocated as the injury is often more extensive than initially thought. There is no antivenin to brown recluse spider venom. Dapsone is a leukocyte inhibitor that has both bacteriostatic and bacteriocidal properties and is frequently used in the treatment of leprosy. Hemolysis is the most common adverse effect of dapsone therapy. Because of the risk for hemolysis and other hematologic side effects, including methemoglobinemia, blood counts should be measured weekly. In addition, dapsone should not be administered to patients who have glucose-6 phosphate dehydrogenase deficiency. Diarrhea, diplopia, headache, and peripheral neuropathy are not complications of dapsone therapy.

81. A 36-year-old woman is being evaluated 17 years after undergoing augmentation mammoplasty with silicone gel implants. On examination, the implants are soft and minimally palpable; she reports no complications. This patient is at risk for which of the following?
(A) Implant rupture
(B) Increased silicon levels in breast milk
(C) Rheumatoid arthritis
(D) Scleroderma
(E) Silicone synovitis

The correct response is Option A.
This 36-year-old woman is at risk for implant rupture, which has been shown in recent studies to increase proportionately with the age of the implant. One retrospective study determined the mean age of implant rupture to be 13.4 years. MRI is most effective for assessing potential implant rupture, which in one study was reported in as many as 71% of implant patients. Another study showed that 50% of patients who had had implants for seven to 10 years showed evidence of rupture or hemorrhage on MRI.

Although attempts have been made to associate silicone gel implants to the onset of rheumatoid symptoms in children who were breast-fed, one study showed no difference in silicone levels measured in breast milk in women with implants versus controls. In addition, several large epidemiologic studies have shown no link between silicone gel implants and the subsequent development of either rheumatologic (ie, rheumatoid arthritis) or connective tissue (ie, scleroderma) diseases. Silicone synovitis occurs in patients who have silicone joint prostheses, but not in patients with silicone gel breast implants.

82. A 50-year-old man has a keratoacanthoma on the left arm. He underwent removal of skin tumors on three previous occasions. His brother and father have had similar findings; the father subsequently died of a malignant tumor. Which of the following is the most appropriate diagnostic test?
(A) Bone scan
(B) Colonoscopy
(C) CT scan of the chest
(D) Panoramic radiograph
(E) Plain radiographs of the long bones

The correct response is Option B.
This patient has findings consistent with Muir-Torre syndrome, an autosomal dominant disorder that typically has its onset between the ages of 50 and 70 years. Multiple skin malignancies (eg, keratoacanthomas, basal and squamous cell carcinomas, adenocarcinomas) are characteristic. Because malignancies of the colon, kidneys, bladder, ovary, pancreas, and breast are also associated and may even be present prior to the appearance of skin lesions, diagnostic testing (such as colonoscopy) should be performed in any patient with multiple keratoacanthomas, especially in this patient who has a family history of similar findings. The other diagnostic tests listed above would not be effective in detecting malignancies associated with Muir-Torre syndrome.

83. A 7-year-old boy has significant scar contractures of the anterior neck six months after sustaining a 20% total body surface area (TBSA) burn involving the neck, abdomen, chest, and axillae. He has previously undergone extensive skin grafting at a burn unit followed by splinting. Skin contractures are worsening despite physical therapy. Photographs are shown on the previous page. Which of the following is the most appropriate management at this time?
(A) Coverage with a free parascapular flap
(B) Full-thickness skin grafting with postoperative splinting
(C) Multiple Z-plasties
(D) Split-thickness skin grafting with postoperative splinting
(E) Tissue expansion of the surrounding skin graft

The correct response is Option A. Burn scars of the neck are particularly susceptible to the development of flexion contractures because a wide range of motion is required in this region and the skin overlying the neck is especially thin. Scarring results
in functional impairment and often facial disfigurement by increasing the tension on the facial skin. Management of flexion contractures is often unsuccessful, and the contractures typically recur, as in this child who has already undergone skin grafting. Transfer of free tissue, such as a parascapular flap, will provide soft, pliable, elastic coverage and prevent the development of hypertrophic scarring. Although full-thickness skin grafts are less likely to contract than split-thickness skin grafts, the risk for recurrent contracture is still present. In addition, coverage of the anterior neck would necessitate the harvest of an excess amount of skin for grafting. Multiple Z-plasties are used for smaller contractures but would not be appropriate for contractures of the entire anterior neck. Local flap transfer is often combined with the Z-plasties to produce optimal results. Postoperative splinting has been performed in the past but is associated with patient discomfort and the potential for breakdown of the burn scars on the chest. Tissue expansion of grafted skin is unlikely to provide significant laxity.

84. An otherwise healthy 3-year-old boy has enlargement and elongation of the right upper extremity. On examination, there is a port-wine stain on the forearm and tortuous vessels on the arm. A thrill can be palpated in the area of the vessels. These findings are most consistent with which of the following syndromes?
(A) Maffucci’s syndrome
(B) Parkes-Weber syndrome
(C) Proteus syndrome
(D) Rendu-Osler-Weber syndrome
(E) Sturge-Weber syndrome

The correct response is Option B.
This 3-year-old boy has findings most consistent with Parkes-Weber syndrome, an anomaly characterized by skeletal hypertrophy of one upper extremity with associated port-wine stains. Deep soft-tissue involvement, including capillary, lymphatic, and venous malformations, is also seen. Klippel-Trenaunay syndrome is similar to Parkes-Weber syndrome but instead involves the lower extremities. Patients with Maffucci’s syndrome have multiple enchondromas, most frequently affecting the hand, and venous malformations. The limbs are foreshortened. Approximately 20% of patients with Maffucci’s syndrome will develop chondrosarcoma. Proteus syndrome manifests as partial gigantism of the extremities. Hemifacial hemihypertrophy, macrocephaly, macrodactyly, localized exostoses, subcutaneous lipomas, and vascular malformations are also associated. Patients with Rendu-Osler-Weber syndrome have multiple bright red telangiectasias affecting the face, fingertips, and mucosal surfaces of the gastrointestinal tract, bladder, and bronchial lining. Brain involvement can lead to the onset of seizures. Sturge-Weber syndrome is associated with a large vascular malformation, usually a port-wine stain, in the distribution of the first and second branches of the trigeminal nerve (V1 and V2). Other findings include vascular anomalies of the choroid plexus and leptomeninges, focal motor seizures, and visual field defects, especially glaucoma. Mental retardation may also be seen.
85. An otherwise healthy 5-year-old child who weighs 22 kg sustains a 3-cm laceration of the right arm in a fall. A 1% lidocaine solution is to be injected prior to suturing. What is the maximum safe dose of lidocaine that should be used in this patient?
(A) 5 mL
(B) 10 mL
(C) 15 mL
(D) 20 mL
(E) 25 mL

The correct response is Option B.
In otherwise healthy children older than 3 years of age who have normal lean body mass, the maximum safe dose of lidocaine (Xylocaine) that can be administered is determined by the child’s age and weight. The maximum safe dosage in a 22-kg 5-year-old child is 22 multiplied by 4.5, or 100 mg of lidocaine. At a 1% concentration, which contains 10 mg lidocaine per milliliter (mL), the maximum dose is 10 mL, according to the manufacturer’s recommendation.

86. Which of the following modalities best delineates the extent of involvement of an arteriovenous malformation with its surrounding tissues?
(A) Angiography
(B) CT scan
(C) MRI
(D) PET scan
(E) Ultrasonography

The correct response is Option C.
Arteriovenous malformations are structural anomalies that develop during the fourth through sixth weeks of gestation secondary to inhibited development of the capillary network. These malformations are typically present at birth but may be seen initially in persons of all ages. Hormonal changes, such as those seen in puberty and adolescence, can result in progression of the lesion; its growth is thought to be caused by increased blood flow and expansion and not by cellular proliferation. Although angiography has long been the standard for diagnosis of vascular lesions, defining their vascular anatomy and flow characteristics, this technique does not adequately delineate the involvement of the surrounding soft tissues. Thus, MRI and magnetic resonance angiography (MRA) are currently recommended as noninvasive means of determining both the extent of the lesion and its flow characteristics. Because contrast enhancement and ionizing radiation are unnecessary, both MRI and MRA can be obtained in the same setting. Angiography is still reserved for delineation of large, highly vascular lesions that require preoperative embolization. CT scan is used for bony evaluation but is now secondary to MRI as the diagnostic procedure of choice. PET scan is not effective in evaluating vascular malformations. Doppler ultrasonography may be performed in conjunction with MRI to determine the lesion’s flow characteristics but is not used alone.

87. A 54-year-old woman undergoes excisional biopsy of a 6-mm papule from the right alar crease followed by direct closure of the wound. Histologic examination of a biopsy specimen of the lesion shows sclerosing basal cell carcinoma with positive deep margins. Which of the following is the most appropriate next step in management?
(A) Observation and follow-up examination every two months
(B) Postoperative radiation therapy
(C) Reexcision with 5-mm margins and immediate reconstruction
(D) Reexcision with 1-cm margins and immediate reconstruction
(E) Mohs’ micrographic surgery and immediate reconstruction

The correct response is Option E.
This patient has many risk factors for recurrence of her basal cell carcinoma, indicating the need for surgical removal. The lesion is located within the “H” zone of the face (defined as the upper lip, nose, pericocular regions, and temporal and preauricular areas) which is associated with an increased risk for local recurrence. In addition, because the sclerosing and morpheaform types of basal cell carcinoma are more prone to recur, pathologic evaluation of the margins is indicated prior to reconstruction, especially in this patient who has positive deep margins. Therefore, Mohs’ micrographic surgery is recommended to excise this high-risk carcinoma and provide tissue for immediate horizontal frozen section analysis. This technique is associated with a high cure rate in patients with recurrent or large tumors, poorly differentiated or aggressive histologic-type lesions, and tumors with positive margins and/or perineural invasion. Standard frozen section analysis may also be considered in this patient. Although observation has been advocated in the past for the less aggressive variants of basal cell carcinoma (ie, not sclerosing and morpheaform variants), excision is now advocated because the recurrence rate has been shown to be high. Radiation therapy is appropriate only adjuvantly or as a first-line treatment in patients who are not surgical candidates.
The correct response is Option B. Although injection of autologous fat during aesthetic and reconstructive procedures is typically a safe procedure, adverse effects, such as fat embolism and central nervous system damage, have been reported. The surgeon should be particularly cautious when injecting fat into the glabellar region, as the ophthalmic artery, which connects directly to the glabellar vasculature, can be inadvertently divided. Methods to help minimize complications of fat injection include the use of blunt tip large bore cannulas, as well as retrograde injection techniques. Although the risk for injury exists with injection into the periorbital and nasal regions, it is less than that seen with injection into the glabellar region. Injection into the region of the frontalis muscle (ie, forehead), or into crow’s feet in the region of the lateral orbit, a tear trough, or the nasolabial fold is associated with a lower risk for fat embolism than injection into the glabellar region.
89. What percentage of hemangiomas are noted in the first month of life?
(A) 20%
(B) 40%
(C) 60%
(D) 80%
(E) 100%

The correct response is Option D. Approximately 80% of hemangiomas are noted in the first month of life. Hemangiomas are the most common tumors of infancy; their incidence at birth ranges from 1% to 3%, and nearly one-third are noted before the neonate is discharged from the nursery. Boys are reportedly three times more likely than girls to be affected. Approximately 60% of hemangiomas occur in the head and neck region.

90. Which of the following lesions is most likely to contain malignant cells?
(A) Acrochordons
(B) Cutaneous horn
(C) Dermatofibroma
(D) Molluscum contagiosum
(E) Seborrheic keratosis

The correct response is Option B. Cutaneous horns are most likely to contain malignant cells. These hard, cone-shaped cutaneous projections are typically caused by excessive epidermal growth and retention of keratin. Although cutaneous horns are most frequently associated with benign irregularities, approximately
20% are associated with premalignant lesions, and nearly 15% are associated with squamous cell carcinoma. Therefore, in patients with cutaneous horns, shave biopsy should be performed initially to exclude any underlying malignancy. Acrochordons are simple skin tags not linked to malignancy. Dermatofibromas are benign, localized, fibrous tumors contained within the dermis that can develop following trauma. Molluscum contagiosum are virally induced papules commonly seen in children and young adults and may be associated with sexual transmission. Seborrheic keratoses are benign keratinocytic tumors seen in patients older than 30 years of age. Although these lesions often affect sundamaged areas, they do not contain malignant cells.

91. In a patient undergoing lip enhancement using sheet acellular dermal homograft, which of the following is the correct anatomic placement of the graft?
(A) Subdermal placement along the white roll of the lip
(B) Subdermal placement along the wet/dry vermilion border of the lip
(C) Submucosal placement along the white roll of the lip
(D) Submucosal placement along the wet/dry vermilion border of the lip
(E) Intramuscular placement

The correct response is Option D. Following adequate anesthesia, sheet acellular dermal homograft (Alloderm) should be placed submucosally along the wet/dry vermilion border of the lip. In order to effectively enhance the lips, the surgeon should first place bilateral incisions approximately 0.5 cm from the commissure on both the upper and lower lips; this will allow for tunneling of the Alloderm along this border. After the Alloderm is placed, the lip is stretched, allowing proper sealing of the graft.
The ends should then be tapered and placed in a submucosal pocket near the commissure. Suturing is associated with the development of dynamic lip deformities and thus should not be performed. Because subdermal placement is too superficial, the patient will be predisposed to the development of contour irregularities if the implants are placed at this level. Submucosal placement of the Alloderm along the white roll will result in unnatural lip aesthetics. Alloderm should not be placed within the muscle.

92. In children, Spitz nevi are most frequently found at which of the following sites?
(A) Head and neck
(B) Upper extremities
(C) Trunk
(D) Genitalia
(E) Lower extremities

The correct response is Option A. The Spitz nevus was first described in 1948 when one researcher found that several children who had been previously diagnosed with melanoma were still alive at follow-up examinations as long as 13 years later. As a result, these lesions became known as benign melanomas. Although the diagnosis of Spitz nevus may be difficult to determine both clinically and pathologically, these are most commonly considered benign lesions. They are usually small, often less than 6 cm in diameter, and nodular, and may be multiple. In children, Spitz nevi are most commonly located in the head and neck region and first appear between ages 5 and 10 years. In adults, these lesions are most frequently found on the extremities.
93. Hutchinson’s freckle is another name for which of the following types of melanoma?
(A) Acral-lentiginous
(B) Lentigo maligna
(C) Mucosal
(D) Nodular
(E) Superficial spreading

The correct response is Option B. Hutchinson’s freckle is a misleading term for lentigo maligna melanoma, a melanoma in situ that is found within the layers of the epidermis only. This lesion typically occurs in fair-skinned, elderly persons and manifests as a macule or patch of darkened skin on the face or other sun-exposed areas. Although 5% to 10% of all melanomas can be classified as lentigo maligna, the risk for development of invasive melanoma in affected patients has been shown to range from 5% to 30% in various studies. Slow growth, often for a period of 10 to 20 years, is common initially and is then followed by an aggressive, invasive phase.
94. Administration of which of the following reverses the potential for development of premalignant lesions?
(A) Oxybenzone  
(B) Padimate  
(C) Para-aminobenzoic acid  
(D) Retinoids  
(E) Zinc oxide  

The correct response is Option D. Retinoids, which are natural derivatives of vitamin A, have been shown to reverse the formation and growth of actinic keratoses. Because approximately 5% of these lesions will undergo transformation into nonmelanotic malignancies, topical application of retinoids is recommended to reverse cutaneous actinic damage, resulting in a return to normal skin in the affected areas. Para-aminobenzoic acid, padimate, oxybenzone, and zinc oxide are sunscreen ingredients that limit the effects of ultraviolet-A and/or ultraviolet-B light but do not treat potentially premalignant lesions.

95. Which of the following arteries provide(s) the primary vascular supply to the gastrocnemius muscle?
(A) Inferior genicular arteries  
(B) Peroneal artery  
(C) Posterior tibial artery  
(D) Superior genicular arteries  
(E) Sural arteries  

The correct response is Option E. The sural arteries, which arise from the popliteal artery above the knee, provide the primary vascular supply to the gastrocnemius muscle.
Knowledge of the vascular anatomy is especially critical for management of patients with peripheral vascular disease, in which the vessels below the level of the popliteal artery are affected. Because the vascularity of the gastrocnemius muscle is derived from a level above the popliteal artery, use of the gastrocnemius muscle is not necessarily contraindicated. The inferior genicular, middle genicular, and superior genicular arteries also arise from the popliteal artery. The medial and lateral inferior genicular arteries are found on the popliteus muscle and beneath the head of the corresponding gastrocnemius muscle. These arteries form a portion of the anastomotic network surrounding the knee. The middle genicular artery courses directly anterior to the popliteal artery and pierces the oblique popliteal ligament; it supplies blood to the knee. The medial and lateral superior genicular arteries, which are also part of the anastomotic network of the knee, pass medially and laterally above the corresponding condyles of the femur and head of the gastrocnemius and deep to the hamstrings. The peroneal artery arises from the posterior tibial artery, which is a terminal branch of the popliteal artery located at the lower border of the popliteal muscle. Although the posterior tibial artery is considered to be the supplier of vascularity to the posterior compartment, it does not supply the gastrocnemius muscle.
96. Which of the following best describes a hemangioma?
(A) Aplasia
(B) Dysplasia
(C) Fibroplasia
(D) Hyperplasia
(E) Metaplasia

The correct response is Option D.
Hemangiomas are vascular lesions that enlarge through a process of rapid cellular proliferation known as hyperplasia. These lesions have an increased rate of cellular turnover uncommon to all other vascular malformations. Instead, vascular malformations, which can be classified as arterial, capillary, lymphatic, or venous, have structural anomalies not present in hemangiomas. Aplasia describes the lack of development of an organ or tissue; dysplasia refers to an abnormality in the developmental process. Fibroplasia is the formation of fibrous tissue. Metaplasia describes a change in the type of adult cells within a tissue to another form of cells not normal for that tissue.

97. Which of the following is most characteristic of an amateur tattoo?
(A) Irregular penetration of the dye in the superficial dermis
(B) Large pigment particles (50 μm)
(C) Organometallic pigments
(D) Penetration of the dye confined to the epidermis
(E) Uniform penetration of the dye in the deep dermis

The correct response is Option A.
Amateur tattoos are most frequently characterized by irregular penetration of the ink within the superficial dermis.
This type of tattoo is popular because it is inexpensive and easily created using ink and a needle. Blue and black dyes are generally used. Pigment particles within the tattoo are small, typically 5 μm or less. Professional tattoos are more likely to have brightly colored dyes and large pigment granules (greater than 50 μm). There is a consistently uniform depth of penetration within the deep dermis.

98. Which of the following is NOT an indication for Z-plasty?
(A) Adjusting soft-tissue contour
(B) Dispersing linear scars
(C) Lengthening linear scar contractures
(D) Preventing burn scar contractures

The correct response is Option D.
The Z-plasty is a fundamental plastic surgery technique that involves the elevation and interposition of two equal, interposed triangular skin flaps. This procedure can be used to improve soft-tissue contour via reorientation of skin, realign scars within the lines of minimal tension, and lengthen linear scar contractures. However, it is not performed for prevention of burn scar contractures.
99. Which of the following syndromes is NOT associated with capillary malformations?
(A) Kasabach-Merritt syndrome
(B) Klippel-Trenaunay syndrome
(C) Parkes-Weber syndrome
(D) Sturge-Weber syndrome

The correct response is Option A. Kasabach-Merritt syndrome is a disorder characterized by profound thrombocytopenia associated with a solitary hemangioma or diffuse hemangiomatosis. Capillary malformations, or port-wine stains, are not seen. Systemic heparin should not be administered to patients with Kasabach-Merritt syndrome because of the associated risk for exacerbation of bleeding diatheses. Instead, appropriate management includes embolization or compression of lesions, interferon therapy, radiation therapy, and systemic administration of corticosteroids. All of the other syndromes are associated with port-wine stains. Klippel-Trenaunay syndrome is characterized by a port-wine stain, typically involving one extremity, overlying venous and lymphatic malformations. Skeletal hypertrophy may also be seen. Although patients with Parkes-Weber syndrome have findings similar to Klippel-Trenaunay syndrome, arteriovenous fistulas are a distinguishing feature. Port-wine stains are most frequently seen in conjunction with Sturge-Weber syndrome. The malformation usually occurs in the distribution of the first and second branches of the trigeminal nerve (V1 and V2), and is associated with focal motor seizures, hemiparesis, and visual field defects, especially glaucoma. Mental retardation may result from leptomeningeal venous malformations.
In a 50-year-old woman who has a history of allergic reaction to tetracaine, which of the following anesthetics should NOT be used?

(A) Bupivacaine
(B) Etidocaine
(C) Lidocaine
(D) Mepivacaine
(E) Procaine

The correct response is Option E.

All local anesthetics can be classified as either ester- or amide-type. Ester-type local anesthetics, including procaine, benzocaine, chloroprocaine, and tetracaine, can produce allergic reactions. These anesthetics are metabolized by pseudocholinesterase, forming para-aminobenzoic acid (PABA). This compound triggers antibody formation and lymphocyte stimulation to elicit a hypersensitivity reaction. In one study of patients who had no known history of allergy to local anesthetics, 30% of patients developed a positive skin reaction following intradermal injection of an ester-type anesthetic.

Amide-type local anesthetics, including bupivacaine, etidocaine, lidocaine, and mepivacaine, are used more frequently for local infiltration than ester-type agents. These are stable solutions that do not cause true allergic reactions. Any “allergic” reaction to amide-type local anesthetics is most likely caused by methylparaben, a preservative that is structurally related to PABA. Preservative-free local anesthetics are currently available for use in any patient who has sensitivity to methylparaben. In the same study mentioned above, there were no allergic reactions to the amide-type agents. A trick to help remember which complexes belong to which group is that all amides have an “i” in the prefix before the “caine” (ie, bupivacaine, etidocaine, lidocaine, and mepivacaine).