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



AMERICAN SOCIETY OF
PLASTIC SURGEONS



PLASTIC SURGERY
EDUCATIONAL FOUNDATION

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

Material released March 2006.

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for the

In-Service Examination in Plastic Surgery



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Section 1: Comprehensive

1. A 6-month-old girl is brought to the office by her parents for consultation regarding a congenital melanocytic nevus covering one third of the back. Which of the following best represents the risk of malignant transformation of this nevus?
 - A) 0% to 10%
 - B) 30% to 40%
 - C) 60% to 70%
 - D) 90% to 100%

The correct response is Option A.

Although difficult to assign, there is an increased risk of malignant transformation in giant congenital melanocytic nevi. Studies show rates of up to 20%; however, a recent systematic review of eight large studies showed a transformation rate of 2.8% of 432 affected patients. Other estimates are between 4% and 5%. Difficulty arises because the definition of these lesions is not standardized (large versus giant) and true long-term prospective studies are lacking. Parents of affected children, however, need counseling regarding the risks of not excising the lesions versus the extensive surgeries often required for complete resection.

References

1. Orlow SJ. Congenital melanocytic nevi. In: Aston SJ, Beasley RW, Thorne CHM, eds. *Grabb and Smith's Plastic Surgery*. Philadelphia: Lippincott-Raven; 1997:127-130.
2. Watt AJ, Kotis SV, Chung KC. Risk of melanoma arising in large congenital melanocytic nevi: a systemic review. *Plast Reconstr Surg*. 2004;113:1968-1974.

2. A 67-year-old woman comes to the office for consultation regarding prominent nasolabial folds. Injection of which of the following agents is the most appropriate management?

- A) Botulinum toxin
- B) Hyaluronic acid
- C) Hydroxyapatite
- D) Liquid silicone

The correct response is Option B.

Hyaluronic acid (Restylane, others) is an injectable product that acts as a temporary soft-tissue filler. It has been shown to be useful in improving the appearance of nasolabial folds, lip augmentation, and other signs of facial aging.

Botulinum toxin (Botox) is a neuromuscular blocking agent and not a soft-tissue filler. It is useful for temporary improvement of dynamic skin deformities associated with muscle contractions in the brow, forehead, and lateral orbital areas.

Hydroxyapatite is a permanent product that is used to augment bone structures such as the malar area or the mandible. Because it becomes a firm substance, its use in soft tissue such as the nasolabial folds is not recommended.

Medical-grade liquid silicone (Adatosil 5000, Silikon 1000) is approved by the U.S. Food and Drug Administration (FDA) for intraocular ophthalmic injections but not for use as a soft-tissue filler. Previous experience with silicone injections has resulted in long-term complications that are difficult to treat. Despite its unfavorable history, liquid silicone injections are becoming popular again. Proponents claim the new liquid silicone is more pure than that used in the past. They also recommend the microdroplet (0.01 to 0.04 ml) technique of injection, because larger injection doses produce foreign-body granuloma reaction. Given the potential complications, the difficulty of removing it from soft tissue, and the lack of FDA approval, the use of liquid silicone should wait until long-term studies are able to provide more information on the risks and benefits of its use.

References

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5. Fagien S. Botox for the treatment of dynamic and hyperkinetic facial lines and furrows: adjunctive use in facial aesthetic surgery. *Plast Reconstr Surg.* 1999;103:701-703.

3. Which of the following benign lesions is most common in individuals with Fitzpatrick type VI skin?
- A) Chondrodermatitis nodularis
 - B) Dermatoses papulosa nigra
 - C) Melasma
 - D) Seborrheic keratosis

The correct response is Option B.

Dermatoses papulosa nigra is a variant of seborrheic keratosis and is primarily seen in African Americans and some Asians. These lesions typically begin in adolescence and are most commonly noted in the cheek area. Dermatoses papulosa nigra can also present as multiple lesions. Shave excision, curettage, and cryotherapy are acceptable treatment plans, but hypopigmentation can result.

Melasma is a common hyperpigmentation of the face and neck area that is commonly associated with pregnancy or estrogen use. Seborrheic keratoses are proliferations of normal-appearing epithelial cells commonly seen on the trunk and neck area. Actinic keratoses are dark raised lesions seen in sun-exposed areas. Varying degrees of cellular atypia can be seen and malignant degeneration can be seen in approximately 10% of lesions. Chondrodermatitis nodularis chronica helices is usually seen in men older than 40 years and is a nodular or ulcerative lesion located on the helix, antihelix, or antitragus. All of these lesions are more commonly seen in light-skinned patients than in patients with darkly pigmented skin.

References

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2. Morganroth GS, Leffell DJ. Nonexcisional treatment of benign and premalignant cutaneous lesions. *Clin Plast Surg.* 1993;20:91-104.



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

4. A 12-year-old boy is brought to the office for consultation regarding a lesion on the ear (shown), which has been present and unchanged for the past two years. On physical examination, the lesion is flat, well defined, and nontender. Which of the following is the most appropriate management?
- A) Observation
 - B) Shave biopsy
 - C) Excisional biopsy
 - D) Resection with 10-mm margins
 - E) Helical wedge resection

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

The correct response is Option C.

Spitz nevus, also known as juvenile melanoma, is common in children and is benign. Pathologically, it is very similar in appearance to melanoma. Some believe it may represent a premalignant lesion, but adequate treatment consists of excision with narrow margins. No additional wide resection or adjuvant therapy is indicated. Helical wedge resection would be too aggressive as a primary treatment modality in this patient.

References

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2. Roth ME, Grant-Kels JM. Important melanocytic lesions in childhood and adolescence. *Pediatr Clin North Am*. 1991;38:791-809.

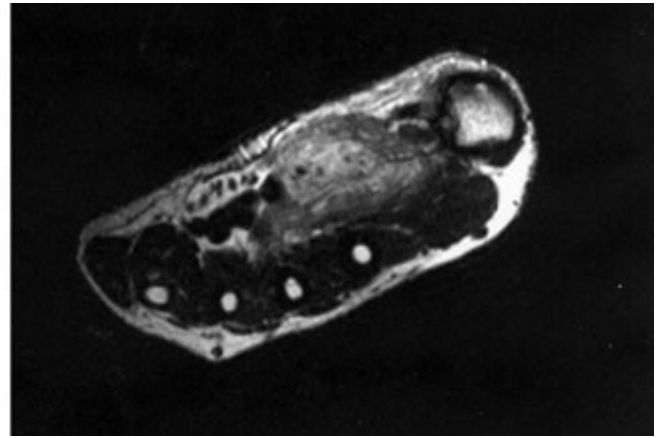
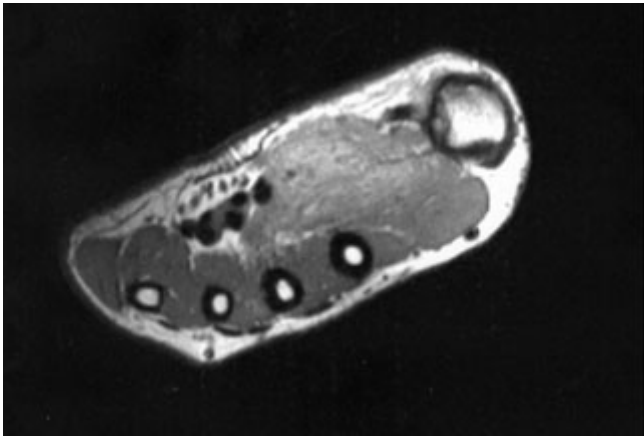
5. A 25-year-old woman who sustained burns to 85% of the total body surface area in a house fire undergoes staged excision of the wound but has limited donor sites for skin grafting. Cultured epidermal autografts are applied for resurfacing. Which of the following is the most significant advantage of this procedure?
- A) Cost effectiveness
 - B) Expansion of donor keratinocytes
 - C) Immediate availability of autogenous materials
 - D) Short cultivation period
 - E) Stable coverage of grafted wounds

The correct response is Option B.

Cultured epidermal autografts (CEAs), also known as cultured keratinocytes, are theoretically attractive to help resurface large wounds, such as in the massively burned patient with limited donor sites. After obtaining a small skin biopsy, tissue is then processed *ex vivo* by a commercial tissue-engineering laboratory. Within three weeks, keratinocytes can be expanded 10,000-fold and are ready for grafting. CEAs, however, must be grown with murine fibroblasts and fetal calf serum, both of which contain xenogeneic proteins, which survive to transplantation and may account for “rejection” of these autografts. Furthermore, CEAs lack a dermal component and are extremely fragile, susceptible even to mild sheer forces. Finally, CEAs are very expensive, costing as much as \$13,000 for every 1% total body surface area ultimately covered.

References

1. Rue LW, Cioffi WG, McManus WF, et al. Wound closure and outcome in extensively burned patients treated with cultured autologous keratinocytes. *J Trauma*. 1993;34:662-668.
2. Hultman CS, Brinson GM, Siltharm S, et al. Allogeneic fibroblasts used to grow cultured epidermal autografts persist in vivo and sensitize the graft recipient for accelerated second-set rejection. *J Trauma*. 1996;41:51-60.
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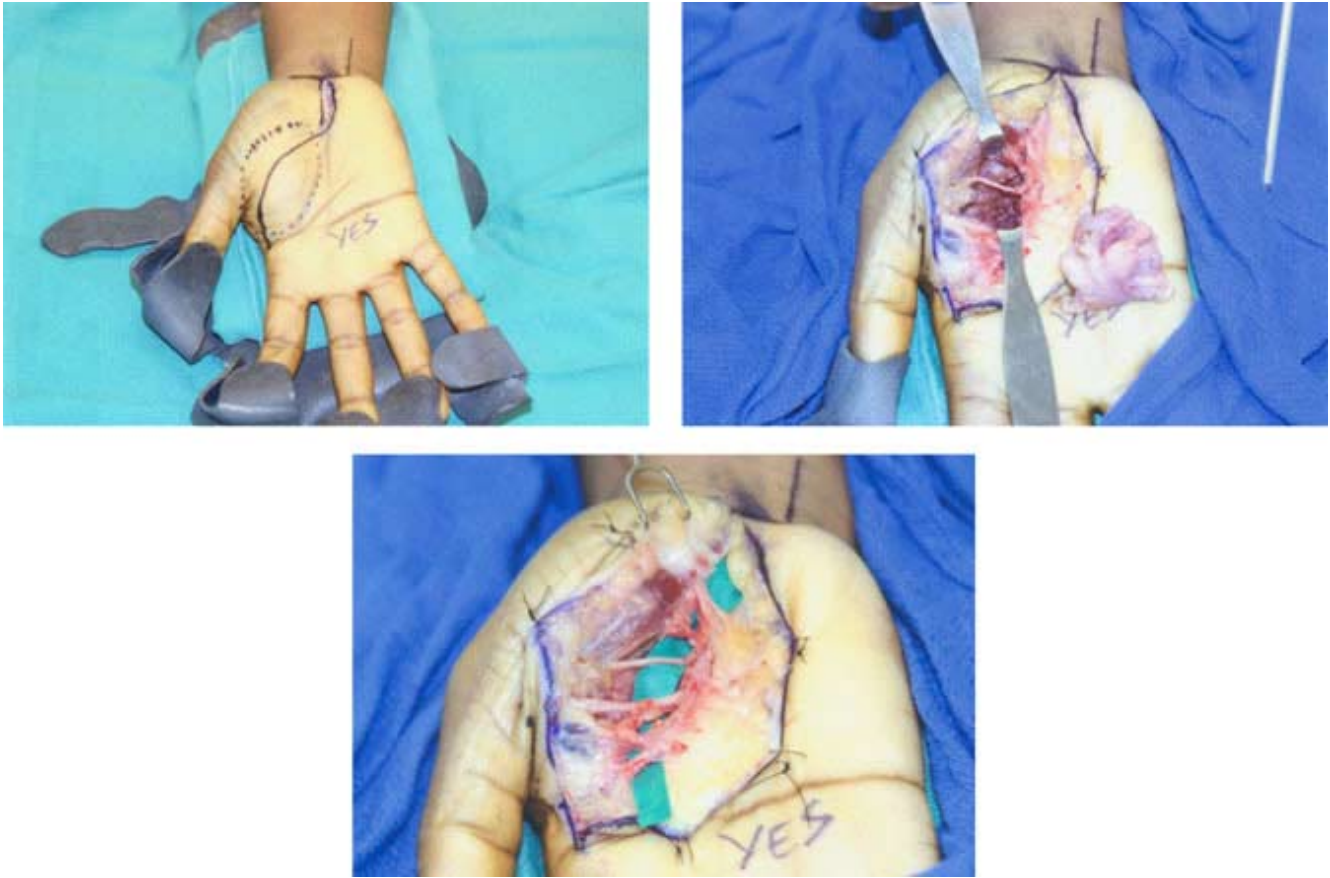


6. A 26-year-old woman comes to the office for consultation regarding a painful mass in the right palm that has been enlarging over the past three years. She has had paresthesia of the hand and weakness of the thumb during this time. Gadolinium-enhanced MRI (shown) shows a high-flow arteriovenous malformation involving the thenar muscles, supplied mostly by the radial artery, and extending to the first and second metacarpals. Which of the following is the most appropriate initial management?
- A) Pulsed-dye laser therapy
 - B) Ligation of the radial artery
 - C) Embolization of the radial artery
 - D) Selective intralesional embolization
 - E) Surgical resection

The correct response is Option D.

This patient must be counseled that any surgical intervention could devascularize her hand or digits, due to postoperative vasospasm of the abnormal digital arteries. Ligation of the radial artery may result in transiently decreased flow to the arteriovenous malformation (AVM), but this lesion will almost certainly develop collaterals from the ulnar system and remain symptomatic. Surgical resection alone, even with the use of a tourniquet, may be technically very difficult with significant risk of injury to digital vessels or nerves. Selective embolization of the lesion, which is performed by an interventional radiologist, creates a window of opportunity for staged surgical resection, due to decreased flow to the AVM. Selective preoperative embolization may, in fact, be performed several times prior to surgical resection, for a complex or large AVM. Pulsed-dye laser therapy would not be helpful for deep, high-flow vascular malformations.

Preoperative photographs are shown below.



References

1. Sofocleous CT, Rosen RJ, Raskin K, et al. Congenital vascular malformations in the hand and forearm. *J Endovasc Ther.* 2001;8:484-494.
2. White RI, Pollak J, Persing J, et al. Long-term outcome of embolotherapy and surgery for high-flow extremity arteriovenous malformations. *J Vasc Interv Radiol.* 2000;11:1285-1295.

7. A 50-year-old woman has ptosis of the upper eyelids after undergoing injection of botulinum toxin to the glabellar region. This finding is most likely due to paresis of which of the following periorbital muscles?

- A) Corrugator
- B) Levator
- C) Müller's
- D) Orbicularis
- E) Procerus

The correct response is Option B.

Use of botulinum toxin for management of hyperkinetic frown lines and furrows is an effective primary, adjunctive, or prophylactic therapy for patients desiring facial rejuvenation. Adverse effects can be minimized with a thorough understanding of the facial soft-tissue anatomy, proper patient selection, and administration of the lowest effective doses with minimal volume of delivery.

The treatment of glabellar frown lines typically involves injection of toxin into the medial eyebrows (corrugators). Other targeted facial hyperkinetic lines include lateral canthal rhytides (crow's feet) and horizontal forehead furrows. Diffusion of the toxin into the levator muscles upon injection of toxin into the corrugator muscles causes blepharoptosis. This adverse effect typically lasts only a few weeks because the dose of migrated toxin to the affected muscle is reduced significantly from the site of initial injection.

Injection into the procerus at the central glabella or into the frontalis muscle for horizontal forehead furrows would not likely lead to involvement of the levator muscle of the eyelid. Similarly, injection of the lateral portion of the orbicularis oculi at the outer canthal rhytides would not lead to the findings described in this patient. Müller's muscle lies deep to the levator muscle and is less likely to be injured than the levator during eyelid procedures.

References

1. Ferreira MC, Salles AG, Gimenez R, et al. Complications with the use of botulinum toxin type A in facial rejuvenation: report of 8 cases. *Aesth Plast Surg*. 2004;28:441-444.
2. Parsa FD. How to avoid eyelid ptosis when injecting botulinum toxin into the corrugators. *Plast Reconstr Surg*. 2000;105:1564-156

8. A 45-year-old woman undergoes placement of a dorsal only cartilage graft during secondary rhinoplasty. Which of the following operative steps is most likely to minimize warping of the cartilage graft?
- A) External stabilization
 - B) Maintaining recipient bed vascularity
 - C) Precise graft fixation
 - D) Preservation of perichondrium
 - E) Symmetrical design

The correct response is Option E.

Autogenous rib cartilage grafts have gained more widespread use in rhinoplasty as dorsal onlay grafts and columellar struts. However, the usefulness of rib as a donor site has been limited by difficulties with postoperative cartilage warping.

Symmetrical graft design decreases cartilage warping because it regulates the tendency of the inner mass of cartilage to expand and become distorted during the harvesting process. Studies have shown that the compact outer subperichondrial layer regulated the tendency of a loose inner cartilaginous mass to warp. Symmetric graft design was found to more evenly regulate the stresses that caused warping. When considering donor sites for the nasal dorsum, costal cartilage ribs have been shown to be particularly useful because of the availability of a generous and naturally straight segment requiring minimal trimming and carving.

Internal stabilization of autogenous rib cartilage grafts with Kirschner wires has been found to effectively prevent graft warpage.

Preservation of graft perichondrium influences cartilaginous growth through the preservation of chondrocytes. This concept has been found to be of particular use in the fabrication and reconstruction of ear cartilage framework in children.

Precise graft fixation is important in the avoidance of external distortion due to graft migration or displacement.

Maintaining recipient bed vascularity is important to avoid graft extrusion resulting from tissue compromise.

References

1. Gunter JP, Clark CP, Friedman RM. Internal stabilization of autogenous rib cartilage grafts in rhinoplasty: a barrier to cartilage warping. *Plast Reconstr Surg.* 1997;100:161-169.
2. Harris S, Pan Y, Peterson R, et al. Cartilage warping: an experimental model. *Plast Reconstr Surg.* 1993;92:912-915.
3. Brent B. Repair and grafting of cartilage and perichondrium. In: McCarthy JG, ed. *Plastic Surgery.* 17th ed. Philadelphia: WB Saunders;1990:559.
4. Gibson T, Davis WB. The distortion of autogenous cartilage grafts: its cause and prevention. *Br J Plast Surg.* 1958;10:257.

9. A 28-year-old woman undergoes laser removal of a multicolored tattoo on the upper arm. The tattoo was professionally applied. Which of the following laser wavelengths is most appropriate to remove the yellow portions of this tattoo?
- A) 532 nm
 - B) 698 nm
 - C) 755 nm
 - D) 1064 nm
 - E) 1320 nm

The correct response is Option A.

Choice of lasers for the treatment of tattoos is guided by the absorption spectrum of the ink colors present within the tattoo. Orange and yellow tattoo inks are targeted specifically by lasers in the low (500-nm) range, making the 532-nm Q-switched Nd:YAG laser or the 510-nm pulsed-dye laser optimal for treatment.

The Q-switched alexandrite (755-nm) and Q-switched ruby (694-nm) lasers can be used for black, blue, and green pigments. The Q-switched Nd:YAG (1064-nm) laser is optimal for black pigment.

Nd:YAG, long-pulsed 1320-nm laser treatment was the first system developed solely for nonablative skin remodeling.

References

1. Achauer BM. Lasers in plastic surgery: current practice. *Plast Reconstr Surg.* 1997;99:1442-1450.
2. Tanzi EL, Lupton JR, Alster TS. Lasers in dermatology: four decades of progress. *J Am Acad Dermatol.* 2003;49:1-34.

10. Two months after undergoing reduction mammoplasty, a 28-year-old woman has scars that are softening but maintaining strength. The mechanism by which this process occurs is an increase in which of the following?

- A) Chondroitin-4 sulfate
- B) Hyaluronic acid
- C) Integrin
- D) Type I collagen
- E) Water content

The correct response is Option D.

During the maturation phase of wound healing, the formerly indurated, raised, and pruritic scar becomes a mature scar while the wound continues to gain tensile strength. Tensile strength is measured as the maximum tension a material can withstand without tearing. Experimental evidence suggests that collagen fibers are largely responsible for the tensile strength of wounds. Most of the embryonic Type III collagen laid down in early wound healing gets replaced by mature Type I collagen until the normal skin ratio of 4:1 Type I to Type III is reestablished. Hyaluronic acid and chondroitin-4 sulfate levels decrease to resemble those of normal dermis, and the water content of the tissues gradually returns to normal.

References

1. Madden JW, Peacock EE Jr. Studies on the biology of collagen during wound healing. *Ann Surg.* 1971;174:511.
2. Peacock EE Jr. Collagenolysis: the other side of the equation. *World J Surg.* 1980;4:297.

11. Which of the following is the most common causative organism of infectious folliculitis?

- A) *Peptostreptococcus anaerobius*
- B) *Staphylococcus aureus*
- C) *Staphylococcus epidermidis*
- D) *Streptococcus milleri*
- E) *Streptococcus pyogenes*

The correct response is Option B.

Staphylococcal folliculitis is the most common form of infectious folliculitis. One or more pustules may appear, usually without fever or other systemic symptoms, on any body surface.

Staphylococcal folliculitis may occur because of injury, abrasion, or nearby surgical wounds or draining abscesses. The two gram-positive cocci, *Staphylococcus aureus* and *Streptococcus pyogenes* (group A), account for the majority of skin and soft tissue infections. The streptococci are secondary invaders of traumatic skin lesions and cause impetigo, erysipelas, cellulitis, and lymphangitis. *S. aureus* invades skin and causes impetigo, folliculitis, cellulitis, and furuncles. Elaboration of toxins by *S. aureus* causes the lesions of bullous impetigo and staphylococcal scalded skin syndrome.

References

1. Habif TP. *Bacterial Infections in Clinical Dermatology*. 4th ed. New York: Mosby; 2004:267-306.
2. Chambers HF. Infectious diseases: bacterial and chlamydial. In: Tierney LM, McPhee SJ, Papadakis MA, eds. *Current Medical Diagnosis & Treatment*. 44th ed. New York: McGraw-Hill; 2005:1350-1392.



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

12. A 16-year-old boy has right hemifacial hypoplasia secondary to radiation therapy of an orbital sarcoma when he was an infant. Right hemifacial soft-tissue augmentation with a partially buried omental free flap is performed. Photographs are shown. Which of the following is the most sensitive method of monitoring perfusion of this flap and detecting early anastomotic thrombosis?
- A) Clinical observation of the flap
 - B) Bedside duplex ultrasonography of the gastroepiploic vessels
 - C) Quantitative fluorometry of the flap with Wood's lamp
 - D) External Doppler probe monitoring of the gastroepiploic vessels
 - E) Implantable Doppler monitoring of the gastroepiploic vein

The correct response is Option E.

Buried free flaps and flaps without a cutaneous component can be difficult to monitor regarding postoperative flap perfusion. Early detection of anastomotic thrombosis is critical in successful salvage and revision of the failing free flap. Although color, temperature, and turgor can be used

to monitor free flap perfusion, the omentum does not contain a skin paddle to help with clinical examination. An external handheld Doppler probe can identify arterial and venous signals, but correlation with the actual pedicle can be difficult to determine. Duplex ultrasound examination of the neck provides a great deal of information, such as direction of flow, alterations in flap resistance, and increased pedicle turbulence, but such imaging is not immediately available and requires the expertise of a vascular technologist. Injection with fluorescein and observation with a Wood's lamp can assist with the qualitative assessment of flap perfusion if a skin paddle exists and can be monitored. Implantable venous Doppler monitoring will identify problems with both the arterial and venous pedicle.

A recent clinical report of 260 vascular microanastomoses with an implantable Doppler probe yielded six false-positive results and eight true-positive results. The overall free flap success rate was 99%; the reexploration rate was 8% and the salvage rate was 83%, partly due to the early detection of anastomotic thrombosis.

Doppler ultrasonography has been used to document changes in arterial blood flow after free tissue reconstruction in reconstruction of the head and neck. This modality can be helpful as an adjunctive tool in assessing flap perfusion but currently does not provide cost-efficient, continuous monitoring necessary to detect early anastomotic changes.

The photograph below shows the patient after successful reconstruction of hemifacial hypoplasia and after free tissue transfer of the omentum and secondary facelift and browlift, with intact facial nerve function.



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2. Disa JJ, Cordeiro PG, Hidalgo DA. Efficacy of conventional monitoring techniques in free tissue transfer: an 11-year experience in 750 consecutive cases. *Plast Reconstr Surg.* 1999;104:97-101.
3. Swartz WM, Izquierdo R, Miller MJ. Implantable venous Doppler microvascular monitoring: laboratory investigation and clinical results. *Plast Reconstr Surg.* 1994;93:152-163.
4. Sekido M, Yamamoto Y, Sugihara T. Arterial blood flow changes after free tissue transfer in head and neck reconstruction. *Plast Reconstr Surg.* 2005;115:1547-1561.

13. A healthy 27-year-old woman comes to the office for follow-up examination three months after undergoing bilateral prophylactic mastectomy and reconstruction with saline prostheses. She is concerned about the incision on her left breast because it is slightly swollen and warm to the touch. Physical examination shows mild erythema of the left breast and normal healing of the right breast. Which of the following is the most appropriate initial management?
- A) Observation
 - B) Oral antibiotic therapy
 - C) Open lavage of the implant pocket
 - D) Removal of the prosthesis
 - E) Exchange of the prosthesis

The correct response is Option B.

In a situation such as this, in which a patient has a minor infection and no actual or threatened exposure of the prosthesis, antibiotics alone are the treatment of choice. Follow-up certainly would be necessary because a mild infection could become severe if not properly treated. Severe infections around the prostheses or exposure of the prosthesis certainly dictates more aggressive therapy. In a prophylactic situation in which a patient has not had radiation therapy to the chest wall, infection of the prosthesis has been shown to be less likely than in the presence of radiation.

References

1. Spear SL, Howard MA, Boehmler JH, et al. The infected or exposed breast implant: management and treatment strategies. *Plast Reconstr Surg*. 2004;113:1634.
2. Mahabedian MY, Tsangaris T, Momen B, et al. Infectious complications following breast reconstruction with expanders and implants. *Plast Reconstr Surg*. 2003;112:467.

14. An 18-month-old girl is brought to the office by her parents for consultation regarding bilateral masses in the cheeks. Medical history includes appearance of small vascular changes in the skin of the cheeks shortly after birth that have enlarged disproportionately to her growth. Physical examination shows that the masses overlie the parotid gland and cover most of the surface of each cheek. Each mass is compressing the external auditory canal. Which of the following is the most appropriate management?
- A) Observation with regular hearing tests
 - B) Administration of a systemic corticosteroid
 - C) Administration of interferon
 - D) Laser therapy
 - E) Surgical excision and superficial parotidectomy

The correct response is Option B.

This patient has bilateral proliferating parotid gland hemangiomas. Hemangiomas are the most common tumor of infancy and the most common tumor of the parotid gland in childhood. They tend to be more common in females and may be bilateral. Administration of a systemic corticosteroid would be the most appropriate initial treatment. Observation is acceptable for smaller lesions and when functional compromise is not present. In this case, compression of the external auditory canal may result in speech problems due to impaired hearing.

Although systemic corticosteroids may have adverse effects, they tend to be well tolerated in patients without contraindications. Patients who do not respond to corticosteroids may still respond to interferon. Interferon is usually not the first line of treatment because it has more toxic adverse effects. Surgical excision is warranted if medical management is unsuccessful or if there are residual skin and soft-tissue changes after the lesion has involuted.

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15. A 45-year-old man with paraplegia undergoes closure of a 10-cm-diameter pressure ulcer on the ischium. After debridement, which of the following is the definitive management for wound closure?
- A) Girdlestone arthroplasty
 - B) Gracilis muscle flap
 - C) Vacuum-assisted closure
 - D) Vastus lateralis flap
 - E) V-Y hamstring advancement flap

The correct response is Option E.

Although all of the procedures mentioned may be useful in the treatment of this pressure sore (except the Girdlestone procedure), the most definitive method of wound closure is the V-Y hamstring advancement flap. The Girdlestone procedure involves resection of the proximal femur and is used in certain cases of trochanteric ulcers (but not ischial ulcers). The gracilis muscle flap would be too small to adequately close this 10-cm-diameter pressure ulcer. The vacuum-assisted closure technique may eventually lead to wound closure, but it would be slower than muscle flap transposition and probably would not provide adequate soft-tissue coverage for a stable wound in this pressure-sensitive area. The vastus lateralis flap is well described for trochanteric coverage but is not used for closure of ischial ulcers.

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16. A 41-year-old woman has been undergoing a series of intense pulsed-light therapy to treat fine wrinkles and areas of sun-induced hyperpigmentation on the face. She is pleased with the lightening of the brown spots but would like to see more improvement in the fine lines and skin texture. The patient's work schedule prohibits time off for recovery. Which of the following treatments is most appropriate for this patient?
- A) 4% Hydroquinone
 - B) 30% Glycolic acid
 - C) 30% Trichloroacetic acid
 - D) 33% Phenol peel
 - E) Jessner's solution

The correct response is Option B.

A 30% glycolic peel is the best choice for this patient, who does not want a lengthy recovery period. Depth of injury will be limited to the stratum corneum and perhaps mild epidermal peeling. The patient must realize that her result will be more subtle than with a deeper peel. A series of treatments at monthly intervals is advisable for maintenance therapy. Glycolic acid is an alpha-hydroxy acid that promotes superficial desquamation and may stimulate cell turnover and collagen production. Solutions of 50% or 70% may be used for deeper peels. Depth of injury is also time-dependent, and the acid must be neutralized or washed off with water.

A trichloroacetic acid peel of 30% is stronger than a comparable strength of glycolic acid. This peel causes a medium-depth injury, extending to the papillary dermis, resulting in a period of erythema and epidermal healing that will be unacceptable to this patient. Trichloroacetic acid treatments are effective for skin tightening and mild hyperpigmentation. Strengths of this treatment typically range from 15% to 35%.

Phenol peels are also medium- to deeper-level peels that require a longer recovery time for healing. Hydroquinone is a melanin inhibitor that is used primarily for the management of hyperpigmentation. Jessner's solution (14% lactic acid, 14% resorcinol, and 14% salicylic acid) is often used in combination with trichloroacetic acid to create a medium-depth peel. Concerning adverse effects, studies have shown that skin treated with Jessner's solution showed a significantly increased degree of exfoliation when compared with glycolic acid.

References

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17. Which of the following commonly used muscle flaps provides the versatility of two dominant vascular supplies?

- A) Gastrocnemius
- B) Latissimus dorsi
- C) Pectoralis major
- D) Rectus abdominis
- E) Sartorius

The correct response is Option D.

The Mathes and Nahai classification of muscle flaps is based on vascular supply. Type III muscles have two dominant pedicles. The rectus abdominis muscle is supplied by both the superior and inferior deep epigastric vessels. The superior epigastric pedicle is an extension of the internal mammary circulation and allows transposition of the rectus muscle to the chest for breast and thoracic reconstruction. Pedicle flaps based on the inferior circulation are useful for pelvic and abdominal reconstruction. If one end of the muscle is in the zone of injury and the other side is spared, then a portion of the muscle could still be available for flap transfer.

The gastrocnemius muscle flap is an example of a type I flap, having a single dominant circulation. Injury to the upper posterior calf would preclude safe use as a flap.

Both the latissimus and pectoralis major muscles are type V, containing both a dominant pedicle as well as a group of smaller, equally sized segmental vessels. These muscles may be elevated as flaps based on either the dominant circulation or on the group of segmental vessels, and therefore, also provide a degree of versatility.

The sartorius muscle is classified as type IV, having only a segmental circulation of multiple pedicles of equal size rather a dominant pedicle. The sartorius muscle is useful for coverage of the femoral sheath after a vascular surgical wound dehiscence with exposed prosthetic graft.

Type II muscle flaps have both a dominant pedicle and a minor circulation. The minor vessels are typically divided to allow use of a flap based on the dominant pedicle. Examples include the gracilis and biceps femoris muscles.

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18. In preparation for fat injection, which of the following is the most appropriate technique for processing the lipoaspirate to yield the highest volume of viable fat cells?

- A) Balanced centrifugation
- B) Exposure to air
- C) Filtration
- D) Gravity sedimentation
- E) Rinsing with isotonic saline

The correct response is Option A.

Balanced centrifugation is the appropriate technique for preparing lipoaspirate. The sediment of the harvested material separates reliably with brief centrifugation. Filtration, rinsing, or straining should not be performed because these methods lead to disruption of the fragile fat cells. Air exposure, even briefly, results in cytoplasmic lysis, and drying should be avoided. Gravity sedimentation is the optimal process but is lengthy. Duration of one to two hours ex vivo would increase the risk of drying and lipolysis.

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

19. A 3-year-old girl is brought to the office by her parents two months after sustaining an injury to the right ankle for evaluation of the scar shown. Which of the following is the most critical consideration in determining the next step in treatment?
- A) Age of the patient
 - B) Anatomic location
 - C) Histologic findings
 - D) Mechanism of injury
 - E) Natural history

The correct response is Option E.

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

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

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

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

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

References

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20. During the inflammatory phase of wound healing, which of the following cellular components is most likely to appear first?

- A) Fibroblasts
- B) Lymphocytes
- C) Macrophages
- D) Myofibroblasts
- E) Neutrophils

The correct response is Option E.

Wound healing begins at the moment that tissue integrity is traumatically disrupted. Platelets are the first cells to enter the wound and provide the first burst of soluble molecules that modulate and mediate an initial hemostatic phase of wound healing. As hemostasis ensues secondary to vasoconstriction, platelet

activation, and activation of the clotting cascade, various substances are present in the wound site that subsequently result in secondary vasodilation, increased capillary permeability, and chemoattraction and activation of leukocytes.

Neutrophils are the first leukocytes to enter the wound and thereby establish acute inflammation, peaking at approximately 24 hours post-wounding, followed shortly thereafter by the appearance of macrophages and lymphocytes.

The appearance of fibroblasts, epithelial cells, and endothelial cells characterize the subsequent proliferative phase of wound healing.

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21. In reconstruction mammoplasty after mastectomy, which of the following is the most significant advantage of self-filling osmotic tissue expanders over conventional tissue expanders?

- A) Anatomic shape
- B) Incidence of infection
- C) Permanent implantation
- D) Short filling phase
- E) Subcutaneous placement

The correct response is Option B.

Because there is no need for external fillings, the risk of infection and painful injections is obviated with self-filling osmotic tissue expanders, which contain osmotic-active hydrogel vinyl pyrrolidine and methylmethacrylate (developed by Wiese and produced by Osmed in Elman, Germany). The second-generation expander has a silicone membrane with small pores enclosing the osmotic hydrogel. This membrane reduces expansion speed, and final volume is accurately defined. It has been successfully used in delayed reconstruction mammoplasty, correction of breast anomalies (i.e., tubular breast, micromastia, etc.), and coverage of defects after excision of tumors, scars, burns, and alopecia.

As with conventional tissue expanders, self-filling osmotic expanders are not meant to be permanent, require submuscular placement, have a filling phase of 40 to 60 days, and require replacement with a

permanent prosthesis in four to six months. The anatomically shaped osmotic expander is prone to rotation, resulting in an inferior result.

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22. A 44-year-old woman undergoes narrow-margin, complete excision of a 1-cm lesion on the right forearm that has been present for several years and has only recently begun to change in color and appearance. The pathologist reports that the central portion of the lesion contains malignant melanoma with a depth of invasion of 2.2 mm with a clear margin. Patient history, physical examination, and laboratory studies are otherwise unremarkable. In addition to reexcision, which of the following is the most appropriate management?
- A) Observation
 - B) Interferon therapy
 - C) Sentinel lymph node biopsy
 - D) Isolated limb perfusion
 - E) Axillary lymphadenectomy

The correct response is Option C.

This patient has malignant melanoma of intermediate thickness, which requires excision with a 2-cm margin and sentinel lymph node biopsy. The thickness, or depth of invasion, is the single most important determinant of melanoma's clinical behavior. Current guidelines recommend a 1-cm margin of resection for lesions less than 1 mm in thickness. Intermediate thickness lesions (1 to 4 mm) require a 2-cm margin. Thick lesions (>4 mm) also require a 2-cm margin of resection; larger margins have not correlated with improved cure or survival.

Observation alone would result in an unacceptably high rate of local recurrence of this potentially deadly tumor.

Sentinel lymph node biopsy is advocated for intermediate thickness lesions (1 to 4 mm). Positive biopsies portend a worse prognosis, warranting complete lymphadenectomy. Routine lymphadenectomy is no longer recommended, as morbidity is high and there is no evidence of a survival benefit. Sentinel lymph node biopsy has not been shown to improve survival in patients with thick melanoma (>4 mm); these patients have high rates of local and distant metastases. Lymph node dissection is reserved for patients with clinically palpable disease.

To date, no standard adjuvant therapy has clearly increased overall survival in patients with malignant melanoma. Interferon therapy and isolated limb perfusion would not be appropriate without first establishing nodal status in this patient and are commonly reserved as treatment modalities for individuals with higher stage or recurrent disease.

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23. In a 65-year-old woman with Fitzpatrick type II skin, which of the following agents is the most effective single treatment of moderate facial rhytides?

- A) Ascorbic acid
- B) Glycolic acid
- C) Lactic acid
- D) Retinoic acid
- E) Trichloroacetic acid

The correct response is Option E.

Tretinoin and alpha-hydroxy acids, which include glycolic acids, are dependable components of any skin rejuvenation program. These products are well studied, and the results are predictable. Some improvement in fine wrinkles has been observed, although clear histologic improvement in photoaging remains controversial, with the primary clinical observations showing improvement in skin texture and “clarity.” Alpha-hydroxy acids, such as glycolic acid, are commercially available for in-office application as peeling agents on a regular schedule. Antioxidants such as ascorbic acid (vitamin C) have shown some clinical promise in the prevention of photoaging. Trichloroacetic acid (TCA) produces superficial exfoliation in concentrations of 15% to 35% and is appropriate for the treatment of more defined wrinkles.

Hyaluronic acid is currently being studied as a useful adjunct in the treatment of depressed scars and facial irregularities. It is used as a filler substance for augmentation of lips and to correct lines and wrinkles as well. Available in Europe, South America, and Canada, it is not yet approved for use in the U.S.

Although TCA peels are generally regarded as safer than phenol peels, informed consent must include the potential complications of all chemical peels. Depth and consistency of peel with TCA is variable and depends on pretreatment with tretinoin/hydroquinone, strength of solution (10% to 25% for light peels, 30% to 35% for intermediate peels, and 50% to 60% for deep peels), and duration of application (sparse and pinkish white changes for superficial peel, dense white frosting for intermediate to deep peels). Patients with a history of perioral herpes simplex should be pretreated for 24 hours before and five days after chemical peel to decrease potential for herpetic reactivation and superinfection. TCA peels should be administered only by a physician.

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24. In creation of a normal collagen molecule, the amino and carboxy terminal peptides must be removed from which of the following molecules?

- A) Collagen fiber
- B) Collagen fibril
- C) Hydroxylated lysine
- D) Procollagen
- E) Proline

The correct response is Option D.

Procollagen is the molecule that is secreted from the cells and has its amino and carboxy terminal ends cleaved off to form a collagen molecule. The collagen molecule then can crosslink with other collagen molecules to form a collagen fibril and those fibrils crosslink and weave with other fibrils to become a collagen fiber. Proline and lysine undergo intracellular hydroxylation early in the formation of the procollagen molecule. These processes require many cofactors and are altered in disease processes like Ehlers-Danlos syndrome.

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25. A 26-year-old man is brought to the burn unit after sustaining severe thermal burns and inhalation injury. Increase in which of the following elements on peripheral blood smear is most predictive of a fatal outcome in this patient?

- A) C-reactive protein
- B) Erythroblasts
- C) Erythrocyte sedimentation rate
- D) Hemoglobin
- E) Leukocyte count

The correct response is Option B.

A recent study from Germany studied the prognostic significance of erythroblasts in peripheral blood and their correlation with a fatal outcome from a burn injury. Erythroblasts are not normally present in peripheral blood, except in the fetus and the newborn. After that stage, they may be associated with severe disease states such as cancer, infection, and severe hematopoietic diseases. According to the study, the odds ratio estimate for the presence of erythroblasts and fatal outcome was 8.2. This is greater than the ratio for any other marker, including standard markers of age, sex, percentage of total body surface area burned, total area of third-degree burn, inhalation trauma, white blood cell count, C-reactive protein level, and hemoglobin level.

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26. A 24-year-old man who works as a chef comes to the office because he has ectropion of the left lower eyelid and ulceration of the cornea five months after he sustained an oil burn to the left side of the face. On physical examination, the burn scars are hypertrophic and immature, extending from the infraorbital rim to the mandibular border. Which of the following is the most effective management of the ectropion?
- A) Full-thickness skin grafting
 - B) Massage of the eyelid and injection of a corticosteroid
 - C) Palatal mucosal grafting
 - D) Tarsconjunctival flap
 - E) Tissue expansion

The correct response is Option A.

Cicatricial ectropion is best treated by full-thickness skin grafting to replace the skin deficit. A tarsal support procedure, such as a lateral canthoplasty, may be needed to fully restore the tone and position of the eyelid. Depending on their thickness and distribution, scars may be released by incision or excision. Cicatricial ectropion can be prevented by early surgical intervention with burn excision and grafting, thereby avoiding the need for late reconstructive procedures.

Most burn reconstruction should be delayed until scars have matured sufficiently, usually by one year after injury. Earlier intervention is needed when a vital skin function is impaired, such as corneal protection. Eyelid massage and corticosteroid injection are appropriate for minor scarring and scleral show after blepharoplasty but are unlikely to provide the rapid and complete relief needed for this patient.

Scarred skin does not expand effectively, limiting the role of tissue expansion in this patient. A tarsconjunctival flap is useful for posterior lamella reconstruction of a full-thickness deficit of greater than 50% of the lower eyelid. The radial forearm free flap may replace a broad area of cheek injury, although the flap tissue is too bulky for effective eyelid skin replacement.

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

27. A 54-year-old man has a nonhealing wound of the lateral aspect of the right ankle (shown) three months after he underwent open reduction and internal fixation of a fracture. Physical examination shows exposed bone at the base of the wound but no evidence of deep infection. Which of the following flap procedures is most appropriate for closure of this patient's defect?
- A) Bilateral V-to-Y advancement flaps
 - B) Dorsalis pedis fasciocutaneous flap
 - C) Extensor digitorum brevis muscle flap
 - D) Flexor digiti minimi muscle flap
 - E) Lateral calcaneal flap

The correct response is option E.

The most appropriate procedure to close this defect is a lateral calcaneal flap, which has an axial pattern based on the lateral calcaneal artery, a terminal branch of the peroneal artery. This flap is very reliable, even in older patients, and lateral calcaneal artery patency and flow can be determined by preoperative Doppler examination. The donor site is usually skin grafted. (See photographs below.) Other acceptable options include reverse sural flap and free tissue transfer.



Bilateral V-to-Y advancement would be difficult in this patient because there is edema and inflammation associated with a chronic wound. The dorsalis pedis fasciocutaneous flap would reach this defect but has significant donor site morbidity and should be reserved for situations in which other options are not available. The flexor digiti minimi muscle flap is lateral on the foot but is not able to reach the lateral ankle. The extensor digitorum brevis muscle flap has a large arc of rotation but requires sacrifice of the dorsalis pedis artery.

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28. A 65-year-old Caucasian woman comes to the office for consultation regarding 5-mm actinic keratosis. Which of the following percentages best represents the risk of malignant degeneration in this patient?
- A) 0%
 - B) 25%
 - C) 50%
 - D) 75%
 - E) 90%

The correct response is Option B.

Actinic keratosis is a common premalignant lesion due to the cumulative effects of sun exposure. It has up to a 25% chance of progressing to a squamous cell carcinoma. In general, curettage and electrodesiccation are the mainstays of treatment. Wide local excision is not advocated in the treatment of this premalignant lesion.

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29. A 7-year-old girl is referred to the office by a pediatrician for evaluation of a 2 × 3-cm red lesion on the tip of the nose. The child's parents say that the lesion appeared shortly after birth and grew rapidly to the present size by 7 months of age. Which of the following is the most appropriate management?

- A) Observation
- B) Oral corticosteroid therapy
- C) Pulsed-dye laser therapy
- D) Sclerotherapy
- E) Excision

The correct response is Option E.

Although conservative management is usually proposed for hemangiomas occurring in infancy, the presence of these tumors on the face may result in severe complications and may provide an indication for treatment. Hemangiomas that cause functional disturbances or serious psychological distress deserve surgical excision before the age of expected spontaneous regression; surgery can provide active treatment with excellent results and minimal morbidity. Severe complications can be encountered, including visual occlusion, repeated bleeding, and distortion of adjacent structures. Early surgery, often before 2 years of age, is recommended in the management of large periocular hemangiomas, to prevent secondary amblyopia, and in the management of proliferative labial tumors, which are prone to bleeding and to cause difficulty while eating. Early surgical management is also recommended for nasal-tip hemangiomas, which regress very slowly and may result in severe distortion of the cartilaginous framework. The operative technique depends on the location and size of the lesion and focuses on resection of the tumor and reconstruction of the adjacent structures when necessary. Postoperative outcomes can be very satisfactory.

In this patient, oral corticosteroids would not be recommended, and both pulsed-dye laser therapy and sclerotherapy would not be efficacious treatment modalities for a lesion of this magnitude.

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30. A 39-year-old woman with exposed hardware after spinal fusion undergoes an external oblique turnover muscle flap procedure. The blood supply to this flap is primarily from which of the following vessels?

- A) Deep circumflex iliac
- B) Deep inferior epigastric
- C) Iliolumbar
- D) Intercostal
- E) Subscapular

The correct response is Option D.

The external oblique turnover muscle flap is not commonly used but has the potential to provide adequate coverage of large defects of the back that extend to the midline at the level of T10 to L4. The upper half of the flap is supplied by the 4th through 11th intercostal arteries, whereas the lower half is supplied by one or two vessels from the deep circumflex iliac artery (95%) or the iliolumbar artery (5%). The upper half has a strictly segmental blood and nerve supply, whereas the lower half has segmental innervation but derives its blood supply from one artery.

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31. A 36-year-old man with paraplegia is brought to the office for evaluation of a pressure ulcer. Physical examination shows a grade IV wound over the trochanter. Which of the following tests is most appropriate to confirm the diagnosis of osteomyelitis?

- A) Bone biopsy
- B) Bone scan
- C) CT scan
- D) MRI
- E) Radiographs

The correct response is Option A.

Bone biopsy is still the gold standard for confirming osteomyelitis, which is suggested in this patient. An additional benefit of the biopsy is having a tissue specimen for culture and sensitivity, which would be useful for identifying specific antibiotic treatment. Of the incorrect options, an MRI may be the second best modality to rule out an invasive, deep osteomyelitis of the pelvis. In one study examining MRI of the pelvis in paraplegics, MRI used for the diagnosis of osteomyelitis yielded a sensitivity of 98% and a specificity of 89% compared with bone biopsy. MRI is better than radionuclide studies for differentiating osteomyelitis from soft tissue infection with periostitis. Radiographs and CT scans are not as sensitive or specific as other imaging studies.

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32. Which of the following most accurately describes the classic histologic response of skin to tissue expansion?

- A) Epidermal and dermal thickening
- B) Epidermal and dermal thinning
- C) Epidermal thickening and dermal thinning
- D) Epidermal thinning and dermal thickening
- E) No change in epidermis and dermis

The correct response is Option C.

Histologic changes in tissue expansion are as follows: epidermal thickening by cellular hyperplasia and intercellular space narrowing. Dermal thickness is decreased with the appendages separated from each other without significant morphologic changes. The vascularity is increased along with atrophy of some adipose tissue. Total collagen content and distribution has been shown in experiments to be generally unchanged after tissue expansion.

References

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33. A 30-year-old woman comes to the office for consultation regarding deep “ice-pick” scarring of the cheeks. Which of the following is the most effective management?

- A) Intense pulsed-light therapy
- B) Glycolic acid peel
- C) Microdermabrasion
- D) Collagen injection
- E) Direct excision

The correct response is Option E.

Ice-pick scarring is a full-thickness injury to the skin and does not respond well to superficial treatments. The best option is direct excision and closure of each ice-pick scar.

Intense pulsed-light (IPL) therapy may improve the collagen in the dermis but will not correct a full-thickness injury.

Glycolic acid peels and microdermabrasion have their main effect on the epidermis. These modalities may reduce fine rhytides but will not affect ice-pick scars.

Collagen injections have been used to correct scars associated with acne, but the results are temporary.

References

1. Grossman KL. Facial scars. *Clin Plast Surg.* 2000;27:627-642.
2. Bernard RW, Beran SJ, Rusin L. Microdermabrasion in clinical practice. *Clin Plast Surg.* 2000;27:571-577.
3. Slavin JW. Considerations in alpha hydroxy acid peels. *Clin Plast Surg.* 1998;25:45-52.

34. Patients with Sturge-Weber syndrome usually have intracranial vascular abnormalities in addition to which of the following skin anomalies?

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

The correct response is Option B.

By definition, a vascular malformation is always present at birth, although the anomaly may not become obvious until the early neonatal period. Usually one type of abnormal vascular channel may predominate in a vascular malformation, frequently combined with capillary, arterial, venous, and lymphatic components, as well as some complex combined anomalies often referred to as specific syndromes.

Sturge-Weber syndrome is considered a vascular developmental anomaly of the pial and ocular regions along with capillary malformation of the trigeminal dermatomes. The most common dermatome to be involved is ophthalmic, although maxillary and mandibular dermatomes may also be involved. The anomalies can cause seizures, contralateral hemiplegia, retinal detachment, glaucoma, and developmental delays. Seizures and neurologic deterioration typically develop in the first year of life rather than in adulthood and rarely after the third decade.

References

1. Mulliken JB. Vascular anomalies. In: Aston SJ, Beasley RW, Thorne CH, eds. *Grabb & Smith's Plastic Surgery*. 5th ed. Philadelphia: Lippincott-Raven; 1997:191-203.
2. Hussain MS, Emery DJ, Lewis JR, et al. Sturge-Weber syndrome diagnosed in a 45-year-old man. *CMAJ*. 2004;170:1672.

35. A 26-year-old man who works at a glass factory comes to the emergency department 30 minutes after both hands and forearms were exposed to hydrofluoric acid in a chemical accident. Immediately after the injury, the hands were wrapped in gauze. Examination of the hands and upper extremities shows erythema and severe pain. Which of the following is the most appropriate next step in management?
- A) Application of topical polyethylene glycol solution to the burned areas
 - B) Lavage of the burned areas with sodium bicarbonate solution
 - C) Subcutaneous injection of calcium gluconate into the burned areas
 - D) Intravenous infusion of sodium bicarbonate
 - E) Excision of burned tissue to the level of the subcutaneous fascia

The correct response is Option C.

The best treatment for this patient with hydrofluoric acid topical burns is calcium gluconate injection. Hydrofluoric acid, which is commonly used in industrial occupations, produces burn when it comes into contact with skin. Initial treatment of lavage with copious amounts of water reduces the amount of acid in the skin. Irrigation with bicarbonate solution is unnecessary and not readily available. Hydrofluoric acid exposure causes soluble fluoride ions to traverse the skin into the subcutaneous tissue, where it results in tissue liquefaction necrosis. Fluoride ions also bind magnesium and calcium, resulting in hypomagnesemia and hypocalcemia. Appropriate treatment would consist of subcutaneous or arterial infiltration (into the burned site) of calcium or magnesium gluconate to inactivate the fluoride ions. This binding of fluoride ions immediately reduces pain in the site and can be used as an indication of appropriate therapeutic levels. Intravenous sodium bicarbonate is not indicated in hydrofluoric acid burns. Topical polyethylene glycol solution application would not be appropriate because it has not been demonstrated to be effective in this type of chemical burn. Excision is unnecessary as a first-line treatment.

References

1. Dibbell DG, Iverson RE, Jones W, et al. Hydrofluoric acid burns of the hand. *J Bone Joint Surg.* 1970;52:931-936.
2. Koehnlein HE, Achinger R. A new method of treatment of hydrofluoric acid burns of the extremities. *Chir Plast.* 1982;6:297-305.
3. Murray J. Cold, chemical and irradiation injuries. In: McCarthy JG (ed). *Plastic Surgery*, Philadelphia: WB Saunders; 1990:5431-5451.

36. A 45-year-old woman comes to the office for consultation regarding lesions characteristic of actinic keratosis on the face. Worsening of the lesions most likely indicates the presence of which of the following disorders?

- A) Basal cell carcinoma
- B) Keratoacanthoma
- C) Malignant melanoma
- D) Seborrheic keratosis
- E) Squamous cell carcinoma

The correct response is Option E.

Actinic (solar) keratoses are the most common premalignant skin lesions and are usually seen in older, light-complexioned individuals. They are the result of cumulative exposure to ultraviolet light, and 20% to 25% of these lesions progress to invasive squamous cell carcinoma.

Malignant melanoma is not associated with actinic keratosis. It arises from the pigmented melanocytes in the dermis.

Keratoacanthomas have a characteristic rapid growth phase and may involute and disappear without treatment. However, these lesions may undergo malignant transformation; therefore, surgical excision is frequently recommended.

Basal cell carcinomas arise from the epithelium basal layer and occur most often at sites with high concentrations of pilosebaceous follicles. Unlike squamous cell carcinoma, it does not arise from malignant changes occurring in preexisting mature epithelial structures.

Seborrheic keratoses are benign lesions that do not have a risk of malignant transformation.

References

1. Stahl S, Spira M. Basal and squamous cell carcinoma of the skin. In: Aston SJ, Beasley RW, Thorne CHM, eds. *Grabb and Smith's Plastic Surgery*. Philadelphia: Lippincott-Raven; 1997:107-120.
2. Kumar V, Abbas AK, Fausto N. *Robbins and Cotran's Pathologic Basis of Disease*. Philadelphia: Elsevier Science; 2005:1240-1241.

37. A 36-year-old woman comes to the office for consultation regarding surgical augmentation of the chin. Which of the following postoperative outcomes is most likely to occur in this patient if a porous polyethylene prosthesis is used instead of a solid silicone prosthesis?

- A) Capsular contracture
- B) Infection
- C) Ingrowth of tissue
- D) Migration of the prosthesis
- E) Resorption of the prosthetic material

The correct response is Option C.

Porous polyethylene facial prostheses are less likely to migrate after implantation than solid silicone prostheses. The pore size (100- to 250- μ m diameter) of porous polyethylene prostheses used in facial augmentation procedures is sufficient to allow fibrous tissue ingrowth and, thus, relative incorporation of the prostheses. Smooth surface prostheses, such as solid silicone, inevitably become encased in a fibrous tissue capsule through the host/foreign-body response. Neither porous polyethylene nor silicone prostheses are resorbed after implantation. The lack of capsule formation in porous polyethylene implants may make their explantation more difficult as compared with solid silicone prostheses.

References

1. Yaremchuk MJ. Facial skeletal reconstruction using porous polyethylene implants. *Plast Reconstr Surg.* 2003;111:1818-1827.
2. Rubin JP, Yaremchuk MJ. Complications and toxicity of implantable biomaterials used in facial reconstructive and aesthetic surgery: a comprehensive review of the literature. *Plast Reconstr Surg.* 1998;102:1767-1768.



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

38. A 57-year-old woman comes to the office for management of a gradually enlarging lesion on the nose (shown). Which of the following is the most appropriate management?

- A) Radiation therapy
- B) Dermabrasion
- C) Carbon dioxide laser ablation
- D) Tangential excision
- E) Full-thickness excision and skin grafting

The correct response is Option D.

In this patient with rhinophyma, radiation therapy would not be helpful in reducing the size of the lesion or in preventing growth.

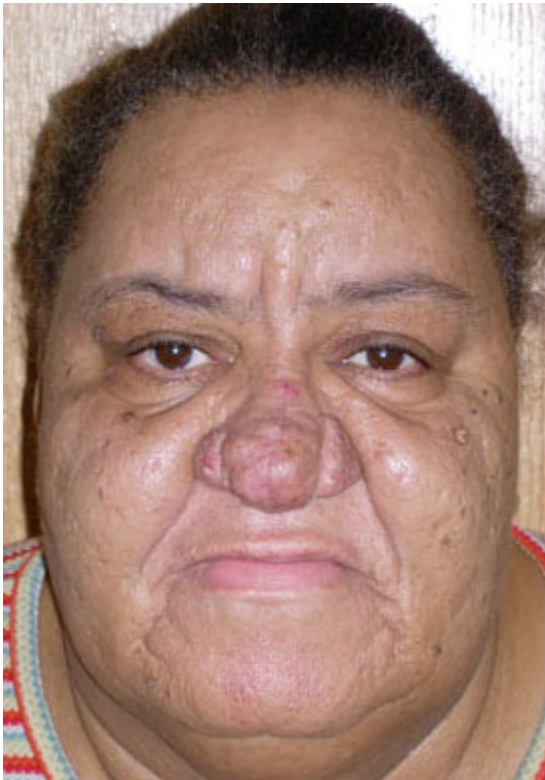
Considering the high incidence of skin cancer with rhinophyma (3% to 10%) and the increasing size of this patient's nose, any therapy involving ablation (such as cryotherapy or laser destruction) without tissue sampling would be contraindicated. The presence of skin cancer in the specimen should prompt referral to a Mohs' surgeon for definitive reexcision.

Although dermabrasion alone is indicated for mild to moderate cases of rhinophyma, this patient would benefit most from debulking via tangential excision, dermabrasion for final contouring, and carbon dioxide laser therapy for hemostasis only. Postoperative wound care would include application of petrolatum gauze dressing (Xeroform) and topical bacitracin for up to one week, indefinite use of sunscreen, and topical Retin-A beginning one month after wound closure.

Full-thickness excision with grafting is reserved for severe, recurrent cases of rhinophyma.

In terms of pharmacologic therapy, isotretinoin (Accutane) is indicated for rosacea and early rhinophyma, but patients must wait one year after discontinuation of this drug before undergoing surgery. Isotretinoin destroys sebaceous glands and would prevent reepithelialization after tangential excision, dermabrasion, or laser resurfacing.

The photograph below shows the patient after undergoing a combination of direct and tangential excision.



References

1. Rohrich RJ, Griffin JR, Adams WP. Rhinophyma: review and update. *Plast Reconstr Surg.* 2002;110:860-869.
2. Curnier A, Choudhary S. Triple approach to rhinophyma. *Ann Plast Surg.* 2002;49:211-214.



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

39. A 2-year-old girl is brought to the office for consultation because she has had the lesion shown for the past two months. Physical examination shows tenderness and a fragile eschar that bleeds profusely when touched. Which of the following is the most likely diagnosis?

- A) Basal cell nevus syndrome
- B) Mucocoele
- C) Nevus sebaceus of Jadassohn
- D) Pyogenic granuloma
- E) Spitz nevus

The correct response is Option D.

The facial lesion in this child is a pyogenic granuloma. These lesions are common in children and young adults. Usually rapidly developing, they are prone to bleeding and local irritation. Treatment consists of excision and cauterization of the base. Nevus sebaceus of Jadassohn is present at birth and presents as salmon-colored and waxy. Nevus sebaceus is treated with complete excision, as malignant potential transformation to basal cell cancer is possible. Spitz nevus lesions are usually smooth and range in color from pink to brown; histology is similar to malignant melanoma. Appropriate treatment is excision; a Spitz nevus also has capability of malignant transformation. Basal cell nevus syndrome appears as multifocal basal cell cancer in teens and young adults, with additional findings of jaw cysts and palmar skin pits.

References

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40. In micrografting hair transplantation, which of the following best represents the structure of the transplanted unit?

- A) Isolated hair follicles
- B) Hair follicles with dermal elements
- C) Hair follicles with subcutaneous tissue
- D) Hair follicles with galea
- E) Hair follicles with pericranium

The correct response is Option B.

Hair in healthy scalp grows in one, two, three, or four hairs, each with their own associated neurovascular bundles, sebaceous glands, sweat glands, and piloerectile muscles surrounded by collagen. These “physioanatomic” units, when used as micrografts, have been shown to provide excellent results in hair transplantation.

The anatomy of an individual hair follicle includes the dermal papillae bulb, consisting of the dermal and epidermal coat. The dividing cells within the bulb form a cement column of keratinized dead cells held together with a cystine matrix to make the hair shaft.

The macroscopic hair transplantation technique of hair plugs with multiple hair follicles, intervening skin, subcutaneous tissue, epicranial and subepicranial tissue can successfully transplant hair but with an unnatural appearance.

References

1. Barrera A. The use of micrografts and minigrafts in the aesthetic reconstruction of the face and scalp. *Plast Reconstr Surg.* 2003;112:883-890.
2. Barrera A. Hair transplantation for men with advanced degrees of hair loss. *Plast Reconstr Surg.* 2003;111:422-424.
3. Bernstein RM, Rassman WK, Seager D, et al. Standardizing the classification and designation of follicular unit transplantation and mini-micrografting techniques. *Dermatol Surg.* 1998;24:957.
4. Vallis CP. Hair replacement surgery. In: McCarthy JG, ed. *Plastic Surgery*. Philadelphia: WB Saunders; 1990:1514-1537.

41. A 9-year-old boy is brought to the emergency department because he has nausea and vomiting as well as pain in the left hand one hour after he sustained a snakebite during a camping trip. Physical examination shows fang marks on the left thumb and swelling of the distal aspect of the forearm. Sensation is intact and no ecchymosis is noted. Which of the following is the most appropriate management?
- A) Elevation of the extremity and application of a tourniquet
 - B) Fluid resuscitation with normal saline
 - C) Administration of antivenin after skin testing with dilute horse serum
 - D) Immediate cryotherapy to the affected area of the hand
 - E) Measurement of compartment pressures and subsequent fasciotomy

The correct response is Option C.

In this clinical scenario of a snake bite to the upper extremity, the patient meets criteria for moderate envenomation, which can also yield orthostatic changes and mild coagulation parameter changes. Guidelines for management include the administration of 10 to 20 vials of antivenin after skin testing with horse serum for possible hypersensitivity reaction. Criteria for minimal envenomation include fang marks, local swelling or pain, and no systemic reaction; therapy includes delivery of up to five vials of antivenin. Severe envenomation can produce subcutaneous ecchymosis, marked swelling of the extremity, coagulopathy, shock, and compartment syndrome; therapy includes delivery of 20 or more vials of antivenin (without delaying for skin testing), resuscitation with correction of acidosis and coagulopathy, and fasciotomy for compartment pressures greater than 30 mmHg or worsening findings on neurologic examination.

Tourniquets and cryotherapy, although used in the past, are controversial and may be associated with increased tissue damage.

Resuscitation should be performed with lactated Ringer's solution. Normal saline is contraindicated because this solution will exacerbate metabolic acidosis due to its high chloride load (154 mEq/l).

In a series of 107 patients with pit viper snakebites managed at a university teaching hospital in the southeastern U.S., 27% of patients underwent surgical debridement and 4% of patients required fasciotomies. Antivenin was administered to 34 patients, and serum sickness developed in nine patients. Coagulopathy was present in 4% of patients, and no deaths were reported. Copperhead bites accounted for 68% of all envenomations.

References

1. Lawrence WT, Giannopoulos A, Hansen A. Pit viper bites: rational management in locales in which copperheads and cottonmouths predominate. *Ann Plast Surg.* 1996;36:276-285.
2. Sullivan JB, Wingert WA, Norris RL. North American venomous reptile bites. In: Auerbach PS, ed. *Wilderness Medicine.* St. Louis: Mosby; 1995:680-709.



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

42. One year after ear piercing, a 21-year-old woman has the slow-growing posterior auricular lesion shown. Pathologic examination of this lesion is most likely to show excess of which of the following?
- A) Basal cells
 - B) Collagen
 - C) Fat
 - D) Melanin
 - E) Myofibroblasts

The correct response is Option B.

The lesion pictured is an earlobe keloid, which is clinically characterized by exuberant growth of proliferative scar outside the boundaries of the initial scar bed. Lesions may develop many months after the initial healing period and rarely regress. The lesion has been associated in certain populations with autosomal dominant inheritance pattern and is much more likely in dark-pigmented individuals (4% to 16%). No gender predominance is known, and the lesions are highly recurrent -- in some studies 50% or greater. On histology, no myofibroblasts are noted, unlike hypertrophic scars. The characteristic histologic finding reveals extensive random collagen fibrils in densely packed bundles. The clinical history and lesion as pictured do not

represent another skin tumor (basal/squamous cell carcinoma or melanoma) nor do they represent a deeper subcutaneous fatty growth (lipoma).

References

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2. Marneros AG, Norris JEC, Olsen BR, et al. Clinical genetics of familial keloids. *Arch Dermatol*. 2001;137:1429-1434.
3. Rahban SR, Garner WL. Fibroproliferative scars. *Clin Plastic Surg*. 2003;30:77-89.



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

43. The 67-year-old woman shown comes to the office for consultation regarding nasal reconstruction. One year ago, she underwent excision of a large basal cell carcinoma involving the left nasal ala, sidewall, and medial cheek followed by full-thickness skin grafting. In addition to cheek advancement, which of the following procedures will provide the best external coverage with the least amount of donor site scarring?

- A) Dorsal nasal flap
- B) Nasolabial flap
- C) Paramedian forehead flap
- D) Radial forearm free flap
- E) Scalping flap

The correct response is Option C.

Analysis of the deficit is critical. This complex deficit has loss of lining, framework, and skin of the nasal ala, a portion of the nasal sidewall, and the medial cheek.

An ipsilateral septal mucoperichondrial flap with septal and conchal cartilage grafts and staged paramedian forehead flap would provide the necessary tissues for this multilayered reconstruction.

Nasolabial flaps can provide excellent reconstruction for partial and small full-thickness nasal alar reconstruction. However, in this situation, due to the medial cheek resection, flap viability would be in question. In addition, there would be inadequate support and tissue to provide the necessary three-dimensional reconstruction.

A dorsal nasal flap, likewise, would work well with partial nasal defects in the tip and alar regions but would be inadequate in this situation.

Scalping flaps would carry a greater donor site morbidity and offer no advantage over a paramedian flap.

A staged, prelaminated, radial forearm flap followed by a paramedian forehead flap would be a consideration in a larger defect in which local lining flaps and structural support are not available.

References

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2. Menick FJ. A 10-year experience in nasal reconstruction with the three-stage forehead flap. *Plast Reconstr Surg*. 2002;109:1839-1855.
3. Menick FJ. Nose reconstruction by chondrocutaneous preauricular free flaps: anatomical basis and clinical results. *Plast Reconstr Surg*. 2004;113:845-846.
4. Rohrich RJ, Griffin JR, Ansari M, et al. Nasal reconstruction-beyond aesthetic subunits: a 15-year review of 1334 cases. *Plast Reconstr Surg*. 2004;114:1405-1416.
5. Walton RL, Burget GC. Aesthetic nasal reconstruction with free microvascular subunits. *J Reconstr Microsurg*. 2002;18:203-204.

44. Which of the following best differentiates the Asian upper eyelid from the Occidental upper eyelid?

- A) Absence of epicanthal folds
- B) Decreased amount of suborbicularis oculi fat
- C) More superior fusion of the orbital septum and levator aponeurosis
- D) Relative lack of insertions from the levator aponeurosis into the dermis
- E) Well-defined supratarsal lid fold with a larger pretarsal segment

The correct response is Option D.

The Asian eyelid has specific anatomic variations compared with the Occidental eyelid. First, in as much as 50% of the Asian population, there is a general lack of insertion of the levator aponeurosis into the dermis, causing a lack of a supratarsal fold. The fusion of the orbital septum to the levator aponeurosis is typically more caudad and decreases the width of the pretarsal segment of the supratarsal lid fold when it is present. There are generally increased amounts of retro-orbicularis oculi fat and suborbicularis oculi fat. The Asian eyelid is likely to have more epicanthal folds than is the Occidental eyelid.

References

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2. Flowers RS, DuVal C. Blepharoplasty and periorbital aesthetic surgery. In: Aston SJ, Beasley RW, Thorne CHM, Eds. *Grabb and Smith's Plastic Surgery*. 5th ed. Philadelphia: Lippincott-Raven; 1997:610-611.

45. A 40-year-old woman with Fitzpatrick type II skin is scheduled to undergo carbon dioxide laser resurfacing for facial rhytides. Current use of which of the following medications is a contraindication for use of carbon dioxide laser resurfacing in this patient?

- A) Hydroquinone
- B) Isotretinoin
- C) Nicotine patch
- D) Oral contraceptive
- E) Valacyclovir

The correct response is Option B.

Laser resurfacing of the skin (as well as other resurfacing modalities such as dermabrasion and chemical peels) is contraindicated in patients who have used isotretinoin (Accutane, an oral retinoid) within 18 months. Isotretinoin suppresses skin appendageal activity and, therefore, prevents normal reepithelialization after resurfacing. If the wounded skin is not reepithelialized within 10 days, scarring may result. Many clinicians wait 24 months after the last oral retinoid dose was administered before performing skin resurfacing. Note that topical retinoids such as isotretinoin (Retin-A) do not have this effect on skin appendages and their use is not a contraindication to skin resurfacing.

Hydroquinone is a tyrosinase inhibitor and results in lightening (bleaching) of the skin. It is frequently used before and after skin resurfacing to prevent hyperpigmentation.

Valacyclovir, an oral antiviral, is indicated in patients with a history of oral herpes simplex outbreaks. It should be started before the procedure and continued until reepithelialization occurs.

Oral contraceptives and nicotine patches have not been shown to cause complications after skin resurfacing.

References

1. Weinstein C. Carbon dioxide laser resurfacing. *Clin Plast Surg*. 1998;25:109-130.
2. Apfelberg DB. Side effects, sequelae, and complications of carbon dioxide laser resurfacing. *Aesth Surg J*. 1997;17:365-372.



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

46. A 3-year-old boy with Fitzpatrick type IV skin has had the capillary vascular anomaly shown since birth. Treatment with which of the following lasers is most appropriate for this patient?

- A) Argon-pumped tunable dye
- B) Erbium:YAG
- C) KTP
- D) Pulsed dye
- E) Q-switched ruby

The correct response is Option D.

The target chromophore for this capillary malformation is oxyhemoglobin in the ectatic vessels within the dermis. The three primary absorption peaks are 418 nm, 542 nm, and 577 nm. The flashlamp-pumped, pulsed-dye laser was specifically designed for vascular lesions with a wavelength of 585 nm. It provides selective photothermolysis without unwanted thermal damage and can be used in patients with light and dark skin tones. Additional treatments may be required especially in the centrafacial area. Disadvantages include postoperative purpura and transient dyspigmentation. Vesiculation, crusting, textural change, and scarring occur rarely.

The KTP laser has a wavelength of 532 nm. It does work well with telangiectasias; however, it has decreased tissue penetration and is not as effective as the pulsed-dye laser in treatment of port wine lesions. Also, the 532-nm wavelength is absorbed by melanin, which limits its use in patients with darker skin tones.

The erbium:YAG (2490-nm) and Q-switched ruby (694-nm) lasers are not targeting the oxyhemoglobin chromophore and are used in other cutaneous applications.

The argon-pumped tunable dye laser can be used to treat capillary malformations. However, it causes nonspecific thermal damage with higher incidences of hypertrophic scarring, textural changes, and dyspigmentation.

References

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2. Lam SM. Practical considerations in the treatment of capillary vascular malformations or port wine stains. *Facial Plast Surg*. 2004;20:71-76.
3. Tanzi EL, Lupton JR, Alster TS. Lasers in dermatology: four decades of progress. *J Am Acad Dermatol*. 2003;49:1-34.

47. Male-pattern alopecia is typically caused by which type of genetic pattern?

- A) Autosomal dominant
- B) Autosomal recessive
- C) Multifactorial
- D) X-linked dominant
- E) X-linked recessive

The correct response is Option D.

Male-pattern alopecia is a genetically triggered condition in susceptible men. It is caused by a single X-linked dominant gene. This condition occurs in 60% to 80% of Caucasian men; hair loss can begin as early as age 20 years. In men with male-pattern alopecia, a genetically determined increase in the activity of 5-alpha-reductase in the susceptible follicles has been observed. Plasma testosterone levels are normal in these patients.

Hamilton's system has been used to classify male-pattern alopecia based on the appearance of the anterior hairline and the hair loss at the vertex. There are seven major classifications; each is used to draw conclusions regarding the potential for further hair loss and is helpful for planning surgical management.

References

1. Anderson RD. Scalp expansion for the treatment of male pattern baldness. *Perspect Plast Surg.* 1994;8:70-89.
2. Dardour JC. Treatment of male pattern baldness and postoperative temporal baldness in men. *Clin Plast Surg.* 1991;18:775.

48. A 35-year-old man is brought to the emergency department two hours after he sustained second- and third-degree burns to the entire anterior abdomen, chest, and lower extremities. Weight is 65 kg (143 lb). Which of the following is the most appropriate hourly volume of fluid resuscitation over the next six hours?

- A) 400 ml
- B) 800 ml
- C) 1200 ml
- D) 1600 ml
- E) 2000 ml

The correct response is Option C.

Initial fluid management of acute burns occurs over the first 24 hours after the burn injury. The total volume of fluids is determined using the Parkland formula ($4 \text{ ml} \times \text{weight in kg} \times \% \text{ total body surface area [TBSA]}$). Half of the total volume is transfused in the first 8 hours and the rest in the next 16 hours.

In an adult, TBSA is determined by the “Rule of Nines,” as follows:

- Head = 9%
- Each upper extremity = 9%
- Anterior thorax (chest + abdomen) = 18%
- Posterior thorax (chest + abdomen) = 18%
- Each lower extremity = 18%
- Groin = 1%

In this case, the TBSA is 18% for the anterior thorax + ($18\% \times 2$) for *both* lower extremities, for a total of 54%. Note that for purposes of the Parkland formula and resuscitation, only second- and third-degree burns are counted.

Therefore, in this patient, $4 \text{ ml} \times 65 \text{ kg} \times 54\% \text{ TBSA} = 14,040 \text{ ml}$ total fluids over the first 24 hours. The patient requires 7020 ml of fluids in the first 8 hours. Because two hours have passed since the injury, the 7020 ml will be evenly divided and administered over the next 6 hours with an hourly volume of 1170 ml.

References

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49. A 44-year-old woman comes to the office for consultation regarding loss of hair on the scalp. Which of the following findings in this patient is LEAST amenable to surgical follicular transplantation?

- A) Alopecia associated with chronic telogen effluvium
- B) Alopecia at the site of surgical scars
- C) Frontal temporal alopecia
- D) Generalized thinning of hair with discrete areas of alopecia
- E) Global diffuse thinning of hair

The correct response is Option A.

Female alopecia differs from male alopecia in that it requires a more in-depth history and workup because of the numerous hormonal and medical causes for hair loss in women.

Alopecia due to hormonal and medical causes, including chronic telogen effluvium (persistent increased telogen hair shedding), is usually not responsive to surgical hair restoration, and such procedures may exacerbate the alopecia.

Patients with global diffuse hair thinning may benefit from surgical restoration; however, in these patients, donor hair tends to be of poor quality.

Generalized hair thinning with discrete areas of alopecia is the most common pattern of hair loss in women and is responsive to surgical restoration. Traumatic or surgical scar alopecia may also respond to surgical restoration.

Women with frontal temporal alopecia may be treated in a similar manner as patients with male pattern hair loss.

References

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2. Vogel JE. Hair transplantation in women: a practical new classification system and review of technique. *Aesthetic Surg J*. 2002;22:247-259.

50. Acellular dermal matrix (AlloDerm) is used in plastic surgery for each of the following purposes EXCEPT

- A) correcting retraction of the lower eyelid after blepharoplasty
- B) decreasing adhesions after repair of an abdominal hernia
- C) reducing incidence of oronasal fistulas after cleft palate repair
- D) resurfacing thin pockets in mammoplasty
- E) treating osteomyelitis of the tibia

The correct response is Option E.

AlloDerm is cadaveric dermis that is processed to be acellular and nonimmunogenic and is then freeze-dried for preservation. Although AlloDerm seems to be used ubiquitously in plastic surgery; it is not indicated for management of osteomyelitis. One of the principles in management of osteomyelitis is the transfer of healthy vascularized tissue. Although AlloDerm provides a substrate for tissue ingrowth, it does not bring in any blood supply.

Use of AlloDerm matrix has been described in the literature for abdominal wall reconstruction, lower eyelid reconstruction, lining of breast implant capsules, and cleft palate repair.

References

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3. Baxter RA. Intracapsular allogenic dermal grafts for breast implant-related problems. *Plast Reconstr Surg*. 2003;112:1692-1696, 1697-1698.
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Section 2: Cosmetic

51. A 52-year-old woman comes to the office because she has had progressive hardening of the left breast for the past two months. She underwent augmentation mammoplasty with implantation of saline-filled prostheses three years ago. On physical examination, the left breast is firm and elevated compared with the right. It is cool and painful. The patient's symptoms are most consistent with which of the following Baker classification levels?

- A) I
- B) II
- C) III
- D) IV

The correct response is Option D.

Capsular contracture is the most likely cause of this patient's symptoms. Of the choices listed, only Class IV contracture would explain the malposition, pain, and firmness. In patients who have undergone breast augmentation, capsular contracture occurs in approximately 5% to 7% at one year after the procedure and in approximately 18% at three years postoperatively.

Baker originally classified contracture of breast implants into four categories:

Baker Classification of Capsular Contracture After Breast Augmentation	
Class I	Normal breast; augmentation is not noticeable
Class II	Minimal contracture; the implant can be palpated but is not visible
Class III	Moderate contracture; the implant is palpable and distortion is visible
Class IV	Severe contracture; the breast is distorted, hard, cool, and painful

Other common reasons for augmentation revision include patient request for size or shape change (30%), leakage or deflation (20%), contracture (18%), wrinkling (5%), and infection (5%).

References

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52. The superficial musculoaponeurotic system is continuous with which of the following?

- A) Superficial layer of the deep temporal fascia and the deep cervical fascia
- B) Superficial layer of the deep temporal fascia and the platysma
- C) Superficial temporal fascia and the deep cervical fascia
- D) Superficial temporal fascia and the platysma
- E) Temporalis muscle and the platysma

The correct response is Option D.

The superficial musculoaponeurotic system (SMAS) is continuous with the superficial temporal fascia (or temporoparietal fascia) above and the platysma below. Superiorly to inferiorly, the superficial layer continuous with the SMAS consists of galea, superficial temporal fascia, SMAS, platysma, and superficial cervical fascia.

The deep cervical fascia (DCF) makes up the most inferior extent of the layer deep to the SMAS. Superiorly to inferiorly, this layer consists of cranial periosteum, deep temporal fascia (DTF), parotidomasseteric fascia, and DCF.

The DTF splits into two layers, superficial and deep, which surround the superficial temporal fat pad as they extend inferiorly toward the zygomatic arch. The superficial and deep layers of the DTF extend anteriorly and posteriorly to the zygomatic arch, respectively. The superficial layer then becomes the parotidomasseteric fascia, and the deep layer becomes the posterior masseteric fascia.

The temporalis muscle lies deep to the DTF and, therefore, is also deep to the superficial temporal fascia, which is continuous with the SMAS.

References

1. Rees TD, Aston SJ, Thorne CH. Blepharoplasty and facialplasty. In: McCarthy JG, ed. *Plastic Surgery*. Philadelphia: WB Saunders; 1990:2373-2376.
2. Stuzin JM, Wagstrom L, Kawamoto HK, et al. Anatomy of the frontal branch of the facial nerve: the significance of the temporal fat pad. *Plast Reconstr Surg*. 1989;83:265-271.

53. A 65-year-old man has a 3-cm-diameter open wound of the medial cheek inferior to the lower eyelid after undergoing Mohs' micrographic surgery for excision of nodular basal cell carcinoma. Snap-back test of the lower eyelid shows poor tone. Reconstruction of the defect is performed with a cervicofacial flap. Which of the following is the most appropriate next step in management to avoid a deformity of the lower eyelid?
- A) Application of adhesive bandages to the lower eyelid and daily massage
 - B) Placement of a temporary tarsorrhaphy (Frost) suture
 - C) Reconstruction with a tarsoconjunctival flap
 - D) Horizontal shortening of the lower eyelid and lateral canthopexy
 - E) Full-thickness skin grafting of the lower eyelid

The correct response is Option D.

This patient is at increased risk for the development of ectropion of the lower eyelid, eversion of the lid margin away from the globe. The snap-back test can be used to assess horizontal laxity of the eyelid. After being pulled away from the eye, the time it takes for the lid to resume a normal position is measured. The result is graded from 0 (time indicating normal tone and laxity) to IV (time indicating loss of tone and severe laxity). Different lateral canthopexy and canthoplasty procedures have been described to prevent malposition of the lower eyelid and can be performed adjunctly with shortening of the lower eyelid. These procedures include repositioning of the inferior limb of the lateral retinaculum on the orbital rim; suturing of the lateral orbicularis oculi muscle to the orbital rim; suspension of a deepithelialized lower eyelid dermal pennant on the orbital rim; and suspension of a lateral orbit periosteal pennant on the orbital rim. All of the procedures commonly suspend or support the lateral canthus.

Ectropion of the lower eyelid may also result from vertical deficiency of the anterior lamella of the lid. Cicatricial changes with consequent vertical lid shortening may result from skin disease, trauma, and previous surgical procedures. Local therapy such as pressure and massage may be used to treat mild cicatricial changes. Further therapy to augment the anterior lamella with a full-thickness skin graft may also be required.

The use of tarsorrhaphy is a temporary means to protect the cornea from exposure. The suture itself will not prevent lower eyelid malposition. The tarsoconjunctival flap, which is elevated from the upper eyelid, may be used to reconstruct defects of the lower eyelid. In this case, there is no such defect.

References

1. Knize DM. The superficial lateral canthal tendon: anatomic study and clinical application to lateral canthopexy. *Plast Reconstr Surg*. 2002;109:1149-1157.
2. Jelks GW, Jelks EB. Prevention of ectropion in reconstruction of facial defects. *Clin Plast Surg*. 2001;28:297-302.
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54. A 22-year-old woman sustains an injury to the middle third of the external ear when she is bitten by a dog. She is concerned about her appearance because she works as a model. Physical examination shows a full-thickness defect (2.5×2 cm) involving the rim, antihelical fold, and concha. Which of the following techniques for reconstruction of the ear will best maintain symmetry of the ears?
- A) Postauricular transposition skin flap
 - B) Postauricular “revolving door” island flap
 - C) Rim advancement
 - D) Triangular kite flap
 - E) Wedge resection with direct closure

The correct response is Option A.

In the older patient, a partial middle ear defect can be treated by wedge resection and direct closure. In a younger patient, the cupping of the ear resulting from this approach would be aesthetically unacceptable; therefore, a more complete reconstruction is required. A full-thickness loss of rim, antihelical fold, and a variable amount of concha can be reconstructed only with a flap.

The postauricular transposition skin flap is the best solution. This flap is based at the edge of the hairline, and the width of the flap is equal to that of the defect. After 10 days, the base of the flap is divided and the remainder of the flap is used to resurface the posterior part of the ear. The donor area, if small, will heal spontaneously or a skin graft may be used.

A rim defect can be treated with a small triangular kite flap or a rim advancement flap. The postauricular “revolving door” island flap is ideal for defects of the conchal area.

References

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2. Jackson IT. Ear reconstruction. In: Jackson IT, ed. *Local Flaps in Head and Neck Reconstruction*. St. Louis: Quality Medical Publishing; 2002:251-271.

55. A 38-year-old woman comes to the office for consultation regarding surgical correction of sagging of the breasts. She breast-fed three children during the past five years; her youngest child was weaned two years ago. Physical examination shows second-degree ptosis. For this patient, which of the following is an advantage of mastopexy with augmentation over mastopexy alone?
- A) Decreased risk of loss of nipple sensation
 - B) Decreased risk of nipple malposition over time
 - C) Decreased stretch deformity of surgical scars
 - D) Increased longevity of correction of ptosis
 - E) Increased upper pole volume

The correct response is Option E.

The combination of implantation of a prosthesis with mastopexy can enhance the size and contour of the breast. This procedure often reduces the length of the incisions required to correct the ptosis because of the volume enhancement delivered by the implant.

There is no known difference in the degree of loss of sensation between the two methods. The weight of the prosthesis places additional tension at the site of incision, causing more rapid recurrence of ptosis. This is especially true for larger prostheses placed in the subglandular position. There is an increased risk of nipple malposition because the nipple is moved at the same time as the implant.

References

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56. A 38-year-old woman has severe congestion and edema of the left nipple-areola complex four hours after undergoing bilateral reduction mammoplasty. Examination shows rapid capillary refill. Which of the following surgical interventions is the most appropriate initial management?

- A) Debridement and healing by second intention
- B) Release of the suture line and exploration of the pedicle
- C) Conversion of the nipple-areola complex to a free composite graft
- D) Central wedge resection under the nipple-areola complex
- E) Removal of additional tissue from the breast

The correct response is Option B.

Loss of the nipple-areola complex after reduction mammoplasty may be caused by torsion of the pedicle or by excessive tension on the closure. In the first hours after reduction mammoplasty, attempted exploration of the pedicle should be performed to release any possible tension. A blue and engorged nipple may be the first sign of impending necrosis. Other methods such as use of nitroglycerin patch may aid vasodilatation of the vessels.

Conversion of the pedicle/nipple-areola complex to a free composite graft should be considered if release of the pedicle does not yield any improvement in the blood flow or if no correctable cause can be identified. Debridement and open packing of the wound is an appropriate management option when the tissues are already necrotic. Further reduction mammoplasty would release the tension on the skin flaps but would not necessarily improve the vascularity of the nipple-areola complex. Wedge resection of the central portion of the breast usually leaves unsightly scarring superior to the nipple-areola complex.

References

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2. Hallock GC, Cusenz BJ. Salvage of the congested nipple during reduction mammoplasty. *Aesth Plast Surg*. 1986;10:143-145.
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57. A 20-year-old woman has pollybeak deformity of the nose 18 months after she underwent primary rhinoplasty for reduction of a dorsal hump. Which of the following procedures is most appropriate for correction of this patient's deformity?

- A) Injection of a corticosteroid into the soft tissue of the supratip
- B) Rasping of the radix
- C) Weir excisions
- D) Resection of the caudal septum
- E) Placement of nasal tip grafts

The correct response is Option E.

The pollybeak deformity, also known as a supratip deformity, is a convexity of the region just superior to the nasal tip (the supratip) when viewed in profile. The nasal tip lacks projection relative to the dorsum. The most common causes are overprojection of the caudal nasal dorsum and inadequate preservation of tip projection. This can be corrected by increasing nasal tip projection using cartilage grafts.

Injection of corticosteroids can be used to correct a supratip deformity when given within three months of the primary rhinoplasty and when the deformity is due to formation of fibrous tissue in the deadspace between the over-resected dorsum and remaining nasal skin envelope. Injection of corticosteroids is not indicated for any type of supratip deformity more than three months after the primary rhinoplasty.

Reducing the radix by rasping will not correct a pollybeak deformity and may accentuate the deformity by causing the nasal dorsum to appear more prominent relative to both the radix (root of the nose) and supratip regions.

Weir excisions are resections of the alar bases used to reduce wide or flaring nostrils.

Resection of the caudal septum is performed to correct a hanging columella and will not affect a supratip deformity.

References

1. Guyuron B, DeLuca L, Lash R. Supratip deformity: a closer look. *Plast Reconstr Surg.* 2000;105:1140-1151.
2. Sheen JH, Sheen A. Problems in secondary rhinoplasty, supratip deformity. In: *Aesthetic Rhinoplasty*. 2nd ed. St. Louis: Quality Medical Publishing; 1998:1200-1241.

58. A 50-year-old woman comes to the office because she has irritation of and a scratching pain in the left eye four days after undergoing uncomplicated bilateral upper and lower blepharoplasty during intravenous sedation with local anesthesia. Physical examination shows mild edema and ecchymosis of the upper and lower eyelids bilaterally and severe swelling of the conjunctiva of the left eye. No ulceration of the cornea is noted on slit-lamp examination. Visual acuity is normal. Which of the following is the most appropriate next step in management?

- A) Administration of dexamethasone ophthalmic ointment
- B) Topical administration of an anesthetic
- C) Intravenous administration of parenteral antibiotics
- D) Temporary tarsorrhaphy
- E) Lateral canthotomy

The correct response is Option A.

This patient suffers from chemosis, which is an annoying and fortunately unusual complication of blepharoplasty. Swelling of the conjunctiva, attributed to disrupted lymphatic drainage, causes separation of the lower lid from the sclera and results in exposure of the conjunctiva. This exposure results in more conjunctival swelling and worsening irritation. To break this cyclical problem, treatment includes application of dexamethasone sodium phosphate ointment, instillation of eye lubricants, and consideration of patching the affected eye. Temporary tarsorrhaphy may also be considered but is usually reserved until medical management has failed.

Topical administration of anesthetics does not treat chemosis.

Immediate canthotomy is appropriate management for retrobulbar hematoma but not for chemosis.

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2. Levine M, Davies R, Ross J: Chemosis following blepharoplasty: an unusual complication. *Ophthalmic Surg Lasers*. 1994;25:593-596.

59. A 56-year-old man comes to the office for consultation regarding short-scar rhytidectomy with a vertical vector of skin lift. After the physician describes the procedure, the patient is still concerned about visible scars. Further explanation for the patient includes that hair will grow through a temporal scar with which of the following patterns?

- A) Beveled across the hair shafts
- B) In front of the hairline
- C) In a straight line
- D) Parallel to the hair roots
- E) Perpendicular to the skin

The correct response is Option A.

Beveling the temporal incision cuts through the hair root at variable levels and preserves the hair shaft and root to a small extent. This allows the hair follicle to continue to grow, and over time, the healing scar will produce a variable amount of hair. A zigzag pattern, as described in the minimal access cranial suspension lift, is a nice adjunct because it camouflages the scar in the temporal hairline in short-scar techniques that elevate the skin envelope in a vertical manner. Meticulous closure and elimination of tension on the skin also aid in camouflaging the scar. Incisions parallel to and beveled with the hairline preserve hair follicles on either side of the incision and can be used deep to the hairline. Incisions perpendicular to the skin surface closed in a precise manner typically do not have hair growth through the fine scar. An incision in front of the hairline (pretricheal) does not result in hair growing through the scar. However, a straight incision closed meticulously will result in a fine scar.

References

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2. Camirand A, Doucet J. A comparison between parallel hairline incisions and perpendicular incisions when performing a face lift. *Plast Reconstr Surg*. 1997;99:10-15.

60. A 2-month-old boy is brought to the office by his parents for consultation regarding congenital lop ear. On the basis of the physical examination, nonoperative correction of the deformity with thermoplastic splinting is planned. The parents ask how long their son will be required to wear the splint. The physician tells the parents that if their son wears the splint as directed, the most likely length of time between application of the device to full correction of the deformity is which of the following?
- A) One week
 - B) Two months
 - C) Four months
 - D) Eight months
 - E) One year

The correct response is Option B.

Nonsurgical treatment of various congenital auricular deformities has been reported in children of neonatal age. More recently, this has also been achieved in children who are several years of age. The splints are made from a malleable thermoplastic material and are applied to the ear by hand until a normal form is attained. Remodeling can be performed once per week until a desired correction is achieved. In one study involving 290 patients, 70% of cases could be treated with good results. The average time for treatment was 1.9 months (range, one week to four months). All patients showed remarkable improvement within the first one to two weeks after beginning the treatment. Young age, cooperation of the parents and patient, elasticity of the cartilage, and type of deformity are all contributing factors in the time required for treatment.

References

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2. Matsuo K, Hirose T, Tomono T, et al. Nonsurgical correction of congenital auricular deformities in the early neonate: a preliminary report. *Plast Reconstr Surg.* 1984;73:38-50.

61. A 15-year-old girl comes to the office with a six-month history of sudden, rapid, asymmetric enlargement of her left breast. On physical examination, there is a large palpable mass occupying the left breast, which also has marked nipple-areola stretching, prominent dilated veins, and skin ulceration superolateral to the nipple. Mammograms and sonograms show a dense, circumscribed, 6-cm-diameter homogeneous mass occupying the left breast. Which of the following is the most likely diagnosis?

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

The correct response is Option C.

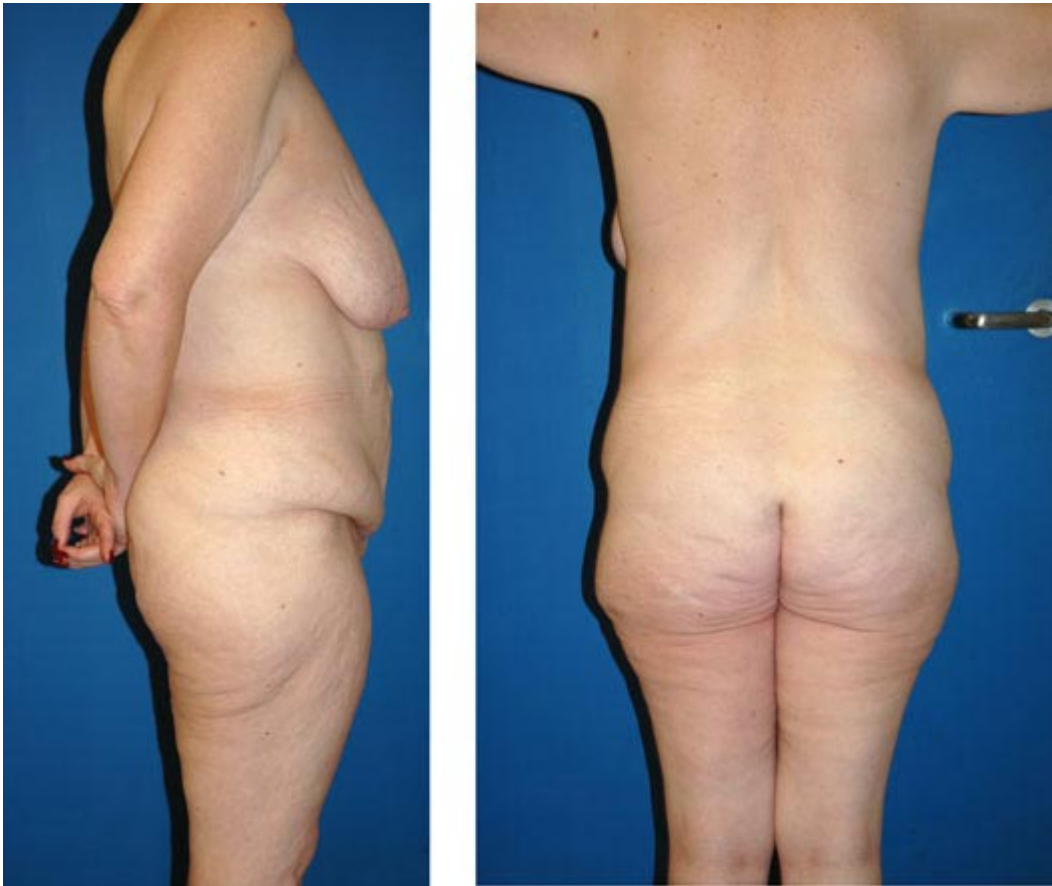
The differential diagnosis of a large lesion in the breast of an adolescent girl includes giant fibroadenoma, phyllodes tumor, and virginal hypertrophy. Fibroadenoma is the most common breast neoplasm in the adolescent patient, and giant fibroadenoma is characterized by size greater than 5.0 cm in diameter, presentation at or soon after puberty, and short doubling time. The lesion is usually solitary, firm, and nontender and presents as a rapid asymmetric breast enlargement with prominent veins over the tumor and occasional skin ulceration due to pressure. Giant fibroadenomas are benign lesions that can be excised by enucleation with minimal risk of local recurrence. Mastectomy is not necessary for management of these lesions, and no adjuvant treatment is indicated.

Phyllodes tumors are large, benign tumors that occur primarily in the perimenopausal patient. They are histologically distinct from giant fibroadenomas, and atypical changes in these tumors are rare in the adolescent.

Juvenile breast hypertrophy is a rare but well-described entity in young, early pubertal girls. It presents as diffuse enlargement of the breast without any nodularity or presence of a discrete mass. Management is reduction mammoplasty.

References

1. McGrath MH. Benign tumors of the teenage breast. *Plast Reconstr Surg.* 2000;105:218.
2. Souba WW. Evaluation and treatment of benign breast disorders. In: Bland KI, Copeland EM, eds. *The Breast: Comprehensive Management of Benign and Malignant Diseases.* Philadelphia: WB Saunders; 1991:715.
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(Please note that this pictorial appears in color in the online examination.)

62. A 50-year-old woman comes to the office for consultation regarding body contouring one year after undergoing a gastric bypass procedure. She has lost 160 lb since the procedure was performed. Preoperative photographs are shown above. Which of the following is the most appropriate surgical procedure for improvement of the thigh and buttock regions in this patient?
- A) Direct excision of gluteal skin folds
 - B) Suspension of a dermal fat flap
 - C) Augmentation of the gluteal region
 - D) Liposuction
 - E) Lower body lift

The correct response is Option E.

In this patient, the best option for improvement of the buttock and thigh regions is a lower body lift. This procedure is indicated in patients with relaxation and resultant ptosis of the buttock and thigh tissues. In addition to moderate or more severe skin laxity, the potential for laxity to develop after liposuction is an indication for an excisional lifting procedure over liposuction alone. In this patient, placing the incision at the level used in the lower body lift will create a better hip contour as well as lift the descended thigh and buttock tissue. This can be combined with thigh liposuction to address any thigh lipodystrophy.

Direct excision of the gluteal fold can result in flattening of the buttocks, asymmetry, and hypertrophic scarring. Suspension of a dermal-fat flap is performed using a gluteal fold incision. Flattening of the buttocks and loss of gluteal fold definition, as well as hypertrophic scarring, can also result from this technique. Gluteal implants have the associated risks of implant extrusion, infection, and malposition. Furthermore, these three techniques do not address the primary pathology of the descent of tissue and do not restore the tissues to a more anatomic position. Liposuction can be used in the patient with good skin quality where adequate retraction is likely. However, if there is potential for skin laxity, liposuction may result in a worsening of the deformity as the tissue is deflated. Liposuction also carries a risk of worsening buttock ptosis, loss of gluteal fold definition, and contour irregularities. Liposuction can be used as an adjunct to excisional techniques.

References

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2. Lockwood TE. Contouring of the arms, trunk, and thighs. In: Achauer BM, Erikson E, Guyuron B, et al, ed. *Plastic Surgery: Indications, Operations, and Outcomes*. St. Louis: Mosby; 2000:2839-2857.
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63. A 7-year-old boy is brought to the office by his parents for consultation regarding prominence of the entire ears. On physical examination, the antihelical folds are intact. On the basis of this finding, which of the following deformities is the most likely cause of prominence of the ears in this patient?

- A) Hypertrophy of the concha
- B) Hypertrophy of the helix
- C) Hypertrophy of the tragus
- D) Lobular protrusion
- E) Prominent antitragus

The correct response is Option A.

Conchal hypertrophy is the second most common deformity and is usually bilateral. The most common deformity is loss of the antihelical fold. The ear deformities can be classified as: 1) absent or insufficient antihelical folding, 2) conchal hypertrophy, 3) both absent or insufficient antihelical folding and conchal hypertrophy, 4) any of the aforementioned deformities with lobular protrusion. If the patient is also lacking an antihelical fold, a large concha can be reduced by placing the antihelical fold more medially in the concha, thus reducing its height. If this is not enough, plication of the concha to the fascia can be performed with permanent sutures. In cases in which further correction is needed, a posterior wedge can be taken out of the conchal cartilage.

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2. Preuss S, Eriksson E. Prominent ears. In: Achauer BM, Eriksson E, Guyuron B, et al, eds. *Plastic Surgery: Indications, Operations and Outcomes*. St. Louis: Mosby; 2000:1057-1065.

64. A 40-year-old woman undergoes rhinoplasty for correction of boxy tip deformity. Which of the following is the primary purpose of a transdomal suture during this procedure?

- A) Decrease in tip projection
- B) Improvement of columellar projection
- C) Narrowing of the domes
- D) Rotation of the tip
- E) Strengthening of the tip

The correct response is Option C.

Transdomal sutures are horizontal mattress sutures placed at the dome or in the lateral crus of the lower lateral cartilage during tip rhinoplasty. The primary purpose of the transdomal suture is to narrow the domes. The secondary purpose of the transdomal suture is to narrow the convexity of the lateral crura. At times, the transdomal suture may also have a tertiary effect of slight increase in tip projection.

Regarding suture technique for tip rhinoplasty, columellar projection and tip projection are more commonly affected by the interdomal suture. The columella-septal suture rotates the tip. Both the interdomal and columella-septal suture strengthen the tip. Both interdomal and transdomal sutures may control tip symmetry.

References

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2. Gruber RP, Friedman GD. Suture algorithm for the broad or bulbous nasal tip. *Plast Reconstr Surg*. 2002;110:1754-1758.

65. A 57-year-old man comes to the office for consultation regarding enlargement of the breasts. Physical examination shows bilateral large, ptotic, female-appearing breasts with firm, tender, glandular-like tissue deep to each nipple. Laboratory studies show increased beta-human chorionic gonadotropin level. Which of the following studies is the most appropriate next step in establishing the diagnosis?
- A) Biopsy of the breast
 - B) CT scan of the abdomen
 - C) Mammography
 - D) MRI of the brain
 - E) Ultrasonography of the testes

The correct response is Option E.

In adults with gynecomastia, thorough medical evaluation is required. History and physical examination should identify new medications, drug and alcohol abuse, and endocrine, hepatic, or pulmonary disease. Laboratory studies should measure electrolytes, blood urea nitrogen, creatinine, testosterone (total and free), estradiol, follicle-stimulating hormone, luteinizing hormone, beta-human chorionic gonadotropin (β -hCG), prolactin, liver function, and thyroid function. Radiography should also be performed. These tests are intended to rule out germ cell tumors, primary hypogonadism, hyperthyroidism, androgen resistance, pituitary tumors, secondary hypogonadism, and lung cancer. Mammography is not routinely used unless there is a finding on physical examination that shows possible presence of breast cancer; there is no known association between gynecomastia and breast cancer (except in Klinefelter syndrome). Imaging of the brain is not routinely ordered unless there is some other finding suggestive of a brain tumor. If the β -hCG concentration is increased, ultrasonography of the testes is indicated to rule out germ cell and non-germ cell tumors. CT scan of the abdomen should be ordered only if ultrasonography of the testes is negative.

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2. Carlson HE. Gynecomastia. *N Engl J Med*. 1980;303:796-799.

66. A 54-year-old woman has increasing pain around the right eye and visual impairment one hour after undergoing bilateral upper and lower blepharoplasty. Physical examination shows proptosis of the right eye and ecchymosis of the right upper and lower eyelids. Decreased visual acuity is noted, but the patient is able to perceive light in the right eye. Which of the following is the most appropriate initial management?
- A) Consult with an ophthalmologist and monitor for a change in vision
 - B) Administer intravenous mannitol and acetazolamide and monitor for a change in vision
 - C) Administer intravenous and topical dexamethasone
 - D) Open the incisions and explore for a bleeding vessel
 - E) Open the incisions and release the septum orbitale and lateral canthus

The correct response is Option E.

Retrobulbar hemorrhage is a rare but serious complication of blepharoplasty that must be acted on immediately to prevent blindness. Retrobulbar hemorrhage is characterized by pain, exophthalmos, and ecchymosis of the eyelid. If these three findings are present and vision is normal, opening of the incisions, evacuation of the hematoma, and exploration for a bleeding source are indicated. If there is any sign of visual impairment, which could range from minor difficulties such as blurred vision to severe problems such as no perception of light, immediate surgical decompression of the orbit, including a lateral canthotomy and release of the septum orbitale, is indicated. Further medical treatment such as the administration of mannitol, acetazolamide, dexamethasone, and a 95% oxygen/5% carbon dioxide mixture may also be used to reduce intraocular pressures further and to dilate intraocular vessels, but these treatments should not be used instead of surgical decompression.

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

67. A 45-year-old woman who underwent reconstruction of the left breast with a TRAM flap followed by radiation two years ago is evaluated for a second reconstruction procedure on the left breast (shown). She requests that only reconstruction with her own tissues be performed and is opposed to surgery of the right breast to restore symmetry. On physical examination, the breast is shrunk and firm. After removal of the unsalvageable left breast, which of the following is the most appropriate reconstruction technique at this time?
- A) Deep inferior epigastric perforator (DIEP) flap
 - B) Free TRAM flap
 - C) Latissimus dorsi myocutaneous flap
 - D) Superior gluteal artery perforator (SGAP) flap
 - E) Thoracoepigastric flap

The correct response is Option D.

When there is near-total loss of a TRAM flap for breast reconstruction, it is important that a second breast reconstruction procedure be successful, with special consideration for safety. When there is insufficient lower abdominal tissue for tissue expansion and transfer of a second flap, neither a free TRAM flap nor a deep inferior epigastric perforator (DIEP) flap recruiting soft tissue in the same lower abdominal areas is an option. A latissimus dorsi myocutaneous flap is a reliable source of autogenous tissue; however, considering the size of the contralateral breast in this patient, a latissimus dorsi myocutaneous flap would need to be supplemented by a permanent expander implant to provide sufficient volume. A staged breast reconstruction with tissue expander would also require permanent implantation of a prosthesis upon completion of the expansion process. A gluteus free flap is considered when the latissimus dorsi flap is not sufficient or available and the patient requests autogenous tissue breast reconstruction. The free sensate superior gluteal artery perforator (SGAP) flap is a free sensate flap based on the superior gluteal artery perforator. It has an abundance of adipose tissue (specimens up to 760 g), even in thin patients, a relatively long vascular pedicle, a discrete scar, improved projection compared with the DIEP and TRAM flaps, and preservation of the entire gluteus maximus muscle with extremely low donor site morbidity.

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68. A 56-year-old woman undergoes a brow lift procedure. Dissection is performed medial to the zone of fixation of the deep fascia of the temporalis muscle and the frontal bone periosteum. Which of the following structures is at greatest risk for injury in this patient?

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

The correct response is Option C.

The deep division of the supraorbital nerve innervating the frontoparietal scalp runs from the orbital rim between the deep galea plane and periosteum under the glide plane space toward the temporal fusion line (zone of fixation). It then runs 5 to 15 mm parallel to the zone of fixation cephalad until it enters the scalp. The superficial division of the supraorbital nerve courses from the orbital rim fissure into the frontalis muscle, innervating the forehead and terminating variably in the anterior scalp. Therefore, the deep branch of the supraorbital nerve is at risk for injury when dissecting just medially to the temporal line in the subgaleal plane. The supratrochlear nerve is most at risk during dissection of the glabellar folds and procerus muscle. Lateral to the temporal fusion line, the frontal branch of the facial nerve is at risk for injury. Medial to the superficial orbital fissure, the superficial branch of the supraorbital nerve and the supratrochlear nerves are at risk for injury.

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69. A 25-year-old woman comes to the office because she has loss of sensation in the nipple-areola complexes three months after she underwent bilateral reduction mammoplasty. Which of the following intercostal nerves were most likely injured during the procedure?

- A) First and second
- B) Third and fourth
- C) Fifth and sixth
- D) Seventh and eighth
- E) Ninth and tenth

The correct response is Option B.

Recently, two separate groups have shown patterns of cutaneous innervation of the breast through detailed anatomic studies in cadavers. In general, cutaneous branches of the intercostal nerves are noted to pass through the deep fascia of the chest wall at two anatomic points: the lateral cutaneous branches at the midaxillary line and the anterior cutaneous branches beside the sternum. The breast skin is innervated by the lateral and anterior cutaneous branches of the T1 through T7 intercostal nerves. However, the contributions of the T1 and T7 intercostal nerves are small, and thus the branches of the T2 through T6 intercostal nerves are likely more important. There is no contribution by the T8 through T12 intercostal nerves to innervation of the breast skin.

Innervation to the nipple-areola complex is supplied by the anterior and lateral cutaneous branches of the T3 through T5 intercostal nerves. While all of these nerves supply branches, the T4 intercostal nerve is the most consistent in its contribution to innervation to the nipple-areola complex. Also, the cutaneous area of sensation of the nipple-areola complex, supplied by the T4 intercostal nerve branches, is larger than that supplied by the T3 or T5 intercostal nerve branches. Therefore, the T4 intercostal nerve is the primary nerve for cutaneous innervation to the nipple-areola complex, but it is not the sole supplier of this innervation.

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70. A 34-year-old man undergoes rhinoplasty using local anesthesia. During resection of the nasal spine, the patient tells the surgeon that he feels pain. Inadequate anesthesia of which of the following nerves is the most likely cause?

- A) Anterior ethmoid
- B) Infraorbital
- C) Internal nasal
- D) Lesser palatine
- E) Nasopalatine

The correct response is Option E.

In the case described, the nasopalatine nerve was not adequately anesthetized. The nasopalatine nerve branches from the pterygopalatine ganglion to innervate the inferior septum and travels through the incisive foramen to join the greater palatine nerve from the palate.

The anterior ethmoid nerve supplies sensation to the tip of the nose and the lateral nasal vault. The internal nasal nerve is a branch of the anterior ethmoid nerve supplying the anterior nasal lining.

The infraorbital nerve supplies sensation to the lateral nasal walls and ala.

The lesser palatine nerve supplies sensation to the soft palate.

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71. A 34-year-old woman comes to the office for consultation regarding breast augmentation. She is 5 ft 2 in tall and wears a size 34A brassiere. Submuscular implantation of 300-ml prostheses is planned. She asks for information about silicone versus saline implants. The primary advantage of using saline-filled implants is which of the following?

- A) Easier detection of rupture
- B) Increased softness
- C) Less capsular contracture
- D) Less leakage
- E) Less wrinkling

The correct response is Option A.

Although both silicone and saline implants will rupture eventually, a saline rupture is more easily detected because the saline is resorbed into the body. The breast will be smaller in volume with prominent wrinkling. A ruptured silicone implant retains its volume and is more difficult to detect. Subtle changes, such as decreased upper pole fullness or increased softness, may be the only clues to silicone implant rupture on physical examination. Ultrasonography or MRI may be needed to make the diagnosis.

Saline implants are firmer than silicone and are more likely to be palpable than silicone implants. Saline implants are easier to place because they can be inflated after placement and are placed through narrow long tunnels if warranted. Neither implant has been associated with systemic immune syndromes, and both implants produce contractures, wrinkling, and leakage at similar rates.

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72. A 50-year-old man who weighs 155.5 lb (70 kg) is scheduled to undergo liposuction of the abdomen, flanks, and chest with administration of epinephrine and lidocaine for tumescent anesthesia. Which of the following amounts of lidocaine is the maximum for this patient?
- A) 7 mg
 - B) 35 mg
 - C) 150 mg
 - D) 490 mg
 - E) 2450 mg

The correct response is Option E.

For subcutaneous infiltration with 1% lidocaine with 1:100,000 epinephrine, 7 mg/kg of lidocaine is generally recommended. It has been shown, however, that the use of “tumescent fluid” with 1:1,000,000 epinephrine can be safely given with lidocaine doses as high as 35 mg/kg. Lidocaine toxicity can have an excitatory effect on the nervous system, such as tingling, numbness, mental status changes, and, eventually, seizures. Subsequent manifestations include CNS depression with cessation of convulsions, unconsciousness, and respiratory depression or arrest. In the heart, this mechanism depresses $V_{\max}$ (i.e., the rate of depolarization during phase 0 of the cardiac action potential) and might lead to reentrant arrhythmias. Additionally, conduction through the sinus and atrioventricular (AV) nodes is suppressed. Acceleration of the ventricular rate has been reported in patients with atrial arrhythmias. Lidocaine also might elevate fibrillation thresholds. A negative inotropic effect on the myocardium and direct peripheral vasodilation might occur, which can produce hypotension. Lidocaine commonly is associated with sinus tachycardia, whereas bupivacaine has been known to cause ventricular tachycardia and fibrillation. Widening of the PR interval, increased QRS duration, sinus tachycardia, sinus arrest, and partial or complete AV dissociation can be seen.

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73. A 60-year-old woman undergoes Mohs' micrographic surgery for resection of basal cell carcinoma of the nose. The roughly circular full-thickness resection leaves a defect of the nose measuring 25 mm in diameter that encompasses the lower 10% of the nasal dorsum and 80% of the nasal tip. Both lower lateral cartilages are exposed and denuded but intact. Which of the following reconstruction techniques is most likely to yield the best aesthetic result?
- A) Excision of the remainder of the nasal dorsum subunit and coverage with a bilobed flap
 - B) Excision of the remainder of the nasal dorsum subunit and coverage with a forehead flap
 - C) Excision of the remainder of the nasal tip subunit and coverage with a bilobed flap
 - D) Excision of the remainder of the nasal tip subunit and coverage with a forehead flap
 - E) No further excision and coverage with a forehead flap

The correct response is Option D.

The concept of aesthetic subunits was first proposed for reconstruction of the nose. When a defect encompasses more than 50% of a subunit, the remainder of the subunit should be excised and the entire subunit should be reconstructed. This usually yields a superior aesthetic result compared with a reconstruction involving a scar crossing an aesthetic subunit.

The forehead flap can provide sufficient tissue surface area to reconstruct the entire nasal skin surface. The bilobed flap, on the other hand, cannot reconstruct defects on the nose greater than approximately 15 mm in diameter.

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74. A 3-year-old boy is brought to the office by his parents because of new onset of bilateral epiphora. The boy's parents say that similar symptoms occurred in one of their older children but resolved without treatment. On physical examination, the lashes of both lower eyelids rub against the inferior cornea. Which of the following is the pathophysiologic mechanism underlying this patient's condition?
- A) Abnormal attachment of the canthal tendons
 - B) Abnormal attachment of the orbital septum
 - C) Enophthalmos
 - D) Laxity of the tarsal plate
 - E) Redundancy of skin and orbicularis muscle

The correct response is Option E.

The elevation of these tissues near the eyelid margin forces an upward and inward rotation of the lower lashes. A common result of this rotation is contact between the lower eyelashes and the cornea or inferior bulbar conjunctiva. Laxity of the tarsal plate may be seen as an atrophic change in adults with involutional entropion. Laxity of the canthal tendons is an involutional change and would not be expected in children. Abnormal septum attachments may occur as a postoperative or posttraumatic complication but are unlikely the cause of eyelash malposition.

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75. When performing liposuction using a tumescent technique, the ratio of infiltrate to aspirate is closest to which of the following?

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

The correct response is Option E.

Tumescent suction lipectomy calls for the largest volume of infiltrate, using up to 3 or 4 ml of infiltrate for each 1 ml of planned aspirate. With this technique, blood loss is approximately 1% of the aspirate volume.

The first method of suction lipectomy, the dry technique, was performed under general anesthesia without infiltration of subcutaneous solutions before insertion of the suction lipectomy cannula. This technique commonly caused substantial swelling and discoloration and blood loss of 20% to 45% in the suction aspirate. Except in limited applications, this approach has been abandoned.

In the wet technique, 200 to 300 ml of infiltrate or wetting solution, with or without additives, is injected into the operative field before insertion of the suction lipectomy cannula. Small doses of the vasoconstrictor epinephrine are added to the infiltrate, which decreases blood loss to 4% to 30% of the aspirate.

The superwet technique uses a larger volume of subcutaneous infiltrate, obtaining a 1-to-1 ratio of infiltrate to aspirate. The infiltrate consists of saline or Ringer's lactate solution, epinephrine, and in some cases, lidocaine. With this technique, blood loss is comparable with that of the tumescent technique, at approximately 1%.

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76. A 70-year-old man comes to the office for consultation regarding the hollowed, tired, and haggard appearance of his face. Physical examination shows prominent atrophy of the midface. For restoration of round, full, and youthful contour of the face using an implant, which of the following is the most appropriate positioning of the prosthesis?

- A) Infraorbital rim lateral to the infraorbital nerve
- B) Malar area lateral to the posterior zygoma
- C) Malar to the mid-zygomatic arch
- D) Paranasal area at the nasal maxillary suture line
- E) Submalar area over the upper masseter muscle

The correct response is Option E.

Augmentation of the malar area medially or laterally would increase the size of the cheekbones and possibly produce a dramatic, chiseled look that may accentuate the atrophy of the midface and make the patient appear more haggard. Paranasal augmentation would not affect the tired appearance and is more commonly indicated for severe maxillary deficiency. A prosthesis in the submalar zone, bounded posteriorly by the masseter muscle, superiorly by the malar eminence, and medially by the nasal labial fold, would fill out the atrophy and round out a tired and haggard midface. Implantation of the prosthesis would produce the best results if performed in conjunction with rhytidectomy.

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77. A 55-year-old woman has nipples located 8 cm inferior to the inframammary fold and at the lowest point of the breast contour. Which of the following best describes the degree of breast ptosis in this patient?

- A) Glandular ptosis
- B) Grade 1
- C) Grade 2
- D) Grade 3
- E) Pseudoptosis

The correct response is Option D.

Ptosis is often graded on a scale of 1 to 3. Grade 1 ptosis exists when the nipple is at or above the level of the inframammary fold. Grade 2 ptosis exists when the nipple is below the level of the inframammary fold but not at the lowest point of the breast contour. Grade 3 ptosis exists when the nipple is at the lowest point of the breast contour. Pseudoptosis and glandular ptosis describe similar states in which the nipple is at or near the level of the inframammary fold, but there is breast tissue and a skin envelope that descends or hangs below the level of the inframammary fold.

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78. A 63-year-old man comes to the office for consultation regarding correction of large breasts. Detailed history and physical examination show no cause of his condition. The breasts are a size C cup with ptosis and excessive skin. The nipples are 5 cm in diameter. Mastectomy and free nipple grafts are planned. The desired new size and shape of each areola are closest to which of the following?
- A) 1 cm, round
 - B) 2 cm, round
 - C) 2 cm, oval
 - D) 3 cm, oval
 - E) 4 cm, round

The correct response is Option D.

Larger forms of gynecomastia with significant ptosis present a challenge to plastic surgeons with respect to the size, shape, and position of the nipple on the chest wall. In addition, the nipple-areola complex may need to be reconstructed due to loss from cancer or trauma.

Two recent studies investigated the anatomical parameters of the nipple-areola complex in men. These studies demonstrated the following characteristics. More than 90% of the male subjects had nipples that were oval in configuration. The average areolar diameter in one study was 2.8 cm. The average areolar diameter in the other study was 2.7 cm. Furthermore, in men, the position of the nipple on the chest wall is typically 20 cm from the sternal notch and 18 cm from the midclavicular line. The ideal nipple-to-nipple distance in men is 21 cm.

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79. A 22-year-old man who is a professional boxer comes to the emergency department because he has a hematoma on the anterior surface of the left ear one hour after he sustained a direct blow to the ear during a match. Which of the following is the most appropriate management?

- A) Application of pressure and ice to the ear
- B) Application of a mold to the ear
- C) Percutaneous drainage of the hematoma
- D) Open drainage of the hematoma and application of a bolster dressing
- E) Open drainage of the hematoma and reshaping of the cartilage

The correct response is Option D.

Auricular hematomas are common in athletes, such as wrestlers and boxers, in whom direct trauma to the ear is possible. Untreated subperichondrial hematomas can lead to formation of new cartilage and the appearance of a thickened and deformed ear (cauliflower ear). To maintain the natural contour of the ear, appropriate management consists of open drainage of the hematoma followed by closure of the incision and application of a tie-over bolster dressing. Percutaneous drainage techniques or simple cold compresses are generally not adequate in completely removing the hematoma. Molds can be used to shape the ear of an infant but not of an adult. Cartilage reshaping techniques, such as scoring, are not necessary in the management of acute auricular hematomas but may be needed for later reconstruction of cauliflower ear.

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80. A healthy 55-year-old woman comes to the office for consultation regarding reduction of frown lines between her eyebrows. Injections of botulinum toxin are planned. The patient has never undergone this treatment. Which of the following is the most appropriate initial dose of botulinum toxin type A for injection into the glabellar region in this patient?

- A) 1 U
- B) 5 U
- C) 20 U
- D) 45 U
- E) 100 U

The correct response is Option C.

Clostridium botulinum toxin type A (Botox) is supplied in a vial containing 100 U of vacuum-dried neurotoxin complex. The recommended starting dose of botulinum toxin type A for improvement of glabellar wrinkles is 20 U. Prescribing information recommends five injection sites along the medial brow and glabellar region. The corrugator supercilii, procerus, and depressor supercilii are the muscles of the glabellar region that are targeted. The most common complication in treatment of the glabellar complex is ptosis of the upper eyelid.

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81. A 65-year-old man comes to the office for follow-up examination three days after undergoing rhytidectomy. Physical examination shows a 6-cm postauricular hematoma that is not compromising the overlying skin. Which of the following is the most appropriate management?

- A) Observation
- B) Application of cold compresses
- C) Aspiration of the hematoma
- D) Placement of a percutaneous drain and application of a pressure dressing
- E) Suture release and evacuation of the hematoma

The correct response is Option E.

At five days postoperatively, the hematoma is still solid. Hematomas liquefy between the seventh and tenth days. Therefore, aspiration of the hematoma would not be possible at this time. Placement of a drain would not facilitate the removal of solid clot. Application of cold compresses would not help an already formed collection of blood. No treatment would result in skin firmness, irregularity, and discoloration that may persist for months.

Evacuation of the hematoma through release of several sutures and gentle pressure or suction is easily accomplished in the office. Large hematomas or expanding hematomas would require drainage in the operating room.

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82. A 34-year-old woman comes to the office for consultation regarding bilateral lower eyelid blepharoplasty. She has no skin excess and is mainly concerned with fullness of the lower eyelids. Transconjunctival blepharoplasty using an inferior fornix approach is planned. To resect the orbital fat, the structure the surgeon must divide is which of the following?

- A) Capsulopalpebral fascia
- B) Levator aponeurosis
- C) Orbital septum
- D) Suborbicularis oculi fat
- E) Tarsal plate

The correct response is Option A.

At the level of the inferior fornix, the transconjunctival incision proceeds first through the conjunctiva and then through the capsulopalpebral fascia, and next to the orbital fat. The dissection is posterior to the orbital septum and suborbicularis oculi fat (SOOF). The dissection is several millimeters posterior to the tarsal plate. The levator aponeurosis is a structure that is present in the upper eyelid.

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83. A 38-year-old man who plays ice hockey undergoes rhinoplasty for correction of a deformity caused by repetitive injury to the nose. During the procedure, spreader grafts are placed. This intervention is most appropriate to achieve which of the following?

- A) Decrease the angle of the internal valve
- B) Narrow the mid vault
- C) Recreate the dorsonasal line
- D) Rotate the nasal tip
- E) Stabilize the external valve

The correct response is Option C.

Spreader grafts are a very useful adjunct in rhinoplasty procedures because they can recreate the dorsonasal line. The dorsonasal line extends from the eye to the nasal tip, making its aesthetics of special concern during rhinoplasty. The graft can be placed above the septal plane to be visible or below the septal plane to be more concealed. When placed above the septal line, the graft will more aggressively define the dorsal aesthetic line. Spreader grafts can be sutured to the septum and to the upper lateral cartilages at the level of the apex of the internal valve. Spreader grafts can also reconstruct the dorsonasal roof, widen the internal nasal valve, or straighten and buttress a high dorsally deviated septum. The spreader grafts would make the internal valve angle more obtuse and open the airway; they would not narrow the mid vault but make it more augmented as well as prevent or treat the inverted V deformity.

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84. A 30-year-old woman undergoes augmentation mammoplasty with silicone gel prostheses. During the procedure, smooth prostheses are positioned subglandularly. The subglandular placement increases this patient's risk of which of the following complications?

- A) Capsular contracture
- B) Double-bubble appearance
- C) Infection of the implant
- D) Rippling of the implant
- E) Rupture of the implant

The correct response is Option A.

Capsular contracture remains one of the main drawbacks to the use of silicone breast prostheses. Submuscular placement is a well-established method of reducing the rate of contracture. The introduction of implant-surface texturing in the late 1980s has greatly reduced the contracture rate for prostheses placed subglandularly.

Development of capsular contracture is clearly more common in the first two years after subglandular implantation, regardless of the implant type. The large difference in the rate of contracture between textured and smooth prostheses in the subglandular position seems to be negligible in subpectoral placement; both types of implant have low contracture rates.

The causes of capsular contracture and the effect of surface texturing and implant position in reducing its incidence are still not clear. Capsule formation is a normal response to the introduction of foreign material and, like most physiologic responses, varies by degree and timing. Additionally, there are general patient factors and local breast factors. The literature suggests that capsule response may be altered by other factors such as infection, diffusion of silicone gel, and smoking.

The introduction of surface texturing alters the capsule response. Texturing may produce a more disorganized collagen pattern in the capsule. It has been suggested that subpectoral prostheses have a lower rate of capsular contracture, regardless of surface texturing, because of the massaging action of the overlying pectoralis major.

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85. A 36-year-old woman who underwent panniculectomy three weeks ago has infection of the surgical wound requiring open drainage and packing with daily dressing changes. Medical history includes Roux-en-Y gastric bypass surgery 20 months ago. Physical examination shows a 35 × 12-cm open wound that has not decreased in size since completion of the procedure. No significant formation of granulation tissue is shown, but the wound is otherwise clean; no signs of fat deposits or necrosis are noted. Which of the following interventions is the most appropriate management?

- A) Administration of an antibiotic
- B) Nutritional supplementation
- C) Hyperbaric oxygen therapy
- D) Primary closure
- E) Surgical debridement

The correct response is Option B.

Roux-en-Y gastric bypass (RYGB) is the most commonly performed bariatric procedure and combines elements of restrictive and malabsorptive procedures. The size of the stomach is reduced by stapling, and a variable segment of small bowel is bypassed using a Roux limb. Major elective surgery will require an increased calorie and protein consumption of approximately 25%.

Most bariatric patients who have stabilized in their weight loss should be able to meet these needs. However, burns, trauma, infection, and large open wounds can substantially increase these nutritional requirements to the point at which they cannot be met through oral intake. In addition to increased metabolism resulting from these pathologic processes, a substantial amount of protein can be lost from a large wound. Exudate from an open wound may contain up to 44 mg/ml protein and result in losses that the bariatric patient cannot match. In this patient, the large open wound has failed to show expected progress in healing. Aggressive nutritional evaluation and supplementation should be performed. If oral intake with protein supplements is not adequate, endoscopic placement of an enteral feeding tube or total parenteral nutrition may be necessary. Hyperbaric oxygen therapy is unlikely to improve healing in this case. Surgical debridement is not necessary because the wound is free of necrosis. Wound biopsy would be appropriate for a chronic non-healing wound to exclude malignancy.

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86. For reconstruction mammoplasty, which of the following is an advantage of the extended latissimus dorsi flap over the standard latissimus dorsi myocutaneous flap?

- A) Better flap perfusion
- B) Decreased need for breast implant
- C) Fewer donor-site seroma
- D) Less sacrifice of latissimus dorsi muscle
- E) Smaller donor-site scar

The correct response is Option B.

The latissimus dorsi (LD) myocutaneous flap was one of the first methods of breast reconstruction ever described. However, with the increasing popularity of transverse rectus abdominis myocutaneous (TRAM) flap breast reconstruction, for many, the LD flap has become a secondary choice for autologous breast reconstruction. One reason for this has been that the standard LD flap alone often does not provide sufficient volume for breast reconstruction. In fact, it is a common practice to combine the LD flap with a prosthesis to achieve adequate breast volume.

Variations of the LD flap have been described to increase its volume and avoid the addition of a prosthesis. The first “extended” LD (ELD) flap was described by Hokin in 1983 and included lumbar fat extensions of the LD flap. Others have used the buried de-epithelialized LD myocutaneous flap for breast reconstruction. McCraw and Papp modified this technique by using a fleur-de-lis skin paddle design to carry additional fat on the surface of the LD muscle, creating the totally autogenous LD breast reconstruction.

The design of the ELD flap has evolved to include the parascapular and scapular “fat fascia” in addition to the lumbar fat for additional volume. The main advantage of the ELD flap is that it can provide autogenous tissue to replace breast volume without an implant and with acceptable donor site contour and scar. Because the ELD flap transports additional tissue from the back so a breast prosthesis is not required, this avoids all potential problems associated with implants, e.g., development of capsular contracture and deformation of the reconstructed breast.

With ELD flaps, donor site complications, including seroma formation and wound necrosis, can be a significant problem.

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87. A 70-year-old man who underwent total resection of the right ear followed by radiation because of squamous cell carcinoma one year ago comes to the office for consultation regarding reconstruction of the ear. He says he needs the ear to support his eyeglasses. Medical history shows chronic obstructive pulmonary disease. Which of the following reconstruction techniques is most appropriate in this patient?

- A) Fixation of autogenous cartilage under local flaps
- B) Implantation of osseointegrated auricular prostheses
- C) Placement of porous polyethylene framework and coverage with a radial forearm free flap
- D) Placement of silicone rubber (Silastic) framework and coverage with a temporoparietal flap
- E) Tissue expansion and placement of porous polyethylene framework

The correct response is Option B.

Ear reconstruction techniques are needed to address a variety of congenital, traumatic, and ablative defects. Both an intricate framework and stable covering are needed to obtain a consistent and aesthetically pleasing reconstruction. Cartilage has been the framework of choice for many years, but this involves some donor morbidity. Silastic and porous polyethylene frameworks offer synthetic alternatives but can become infected or exposed. Covering can be accomplished by local tissue if available, expanded tissue, and local or distant skin flaps.

Prosthetic ears have been available for many years but were limited by the harsh adhesives necessary to keep them in place. The use of osseointegrated titanium implants for the retention of dental prostheses opened a new possibility for implant fixation in other areas of the body.

Several recent studies document the recommended indications for autogenous versus prosthetic techniques. One study of 98 patients recommends autogenous reconstruction for pediatric microtia patients and prosthetic reconstruction for traumatic or ablative defects in adults. In addition, prosthetic ears are also recommended for severe soft tissue hypoplasia, low or unfavorable hairline, and failed autogenous reconstruction. Another study of 55 patients recommended autogenous reconstruction for classic microtia, relatively normal lower one third of the ear, patient preference, and noncompliant patients. The principal indications for osseointegrated implants were major cancer extirpation, poor local tissue, absence of the lower half of the ear, salvage following unsuccessful surgery, and poor operative risk patients.

In this case of an older patient with medical problems and poor local tissue, the fastest and safest option is a prosthetic ear implant. His radiation would preclude tissue expansion or a

temporoparietal flap. A rib donor site would have significant morbidity in a patient with chronic obstructive pulmonary disease. A free flap is also high risk in this patient, with its longer anesthetic time and need for anticoagulation.

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

88. A 24-year-old woman comes to the office for consultation regarding surgical correction of the breast deformity shown above. Which of the following is the most appropriate management?
- A) Augmentation with Wise-pattern mastopexy of both breasts
 - B) Augmentation with periareolar mastopexy of both breasts
 - C) Latissimus dorsi myocutaneous flap reconstruction of the left breast and periareolar mastopexy of the right breast
 - D) Extended dorsi myocutaneous flap reconstruction of the left breast and periareolar reduction of the right breast
 - E) Transaxillary augmentation of the left breast and periareolar mastopexy of the right breast

The correct response is Option B.

The patient described has tuberous breast deformity, which is characterized by three components: herniation of the breast tissue into the nipple-areola complex with a cylindrical projection accompanied by a relatively large areola; deficiency of the lower pole of the breast in both vertical and horizontal axes; and hypoplasia. Periareolar mastopexy with augmentation will give access for radial-releasing incisions, which will allow expansion of the base of the breast

and simultaneous areolar reduction. Wise-pattern mastopexy is indicated for more severe breast ptosis. Reconstruction with latissimus flap is a form of treatment for congenital chest wall deformities such as Poland syndrome. Contralateral reduction will not address the tuberous deformity problem. Transaxillary augmentation of the breast will not correct the nipple-areola complex or the constricted base.

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89. A 25-year-old man has congestion of the right ear 10 hours after he underwent replantation of the auricle due to near-total amputation of the ear in a motor vehicle collision. During microscopic surgery, a single small artery was anastomosed to relocated superficial temporal vessels. No vein could be located. Which of the following is the most appropriate management of this patient's current symptom?
- A) Elevation of the head
 - B) Topical application of nitroglycerin
 - C) Leech therapy
 - D) Vein grafting
 - E) Surgical reexploration

The correct response is Option C.

Microsurgical ear replantation provides another option in select cases of ear amputation, providing the potential for an unsurpassed aesthetic result. In those relatively few cases in which it is attempted, the small size of the vessel and the component of avulsion can make primary repair of the vessels difficult. Venous congestion occurs to some extent in nearly every case and is the most common cause of postreplantation complications. There have been several case reports of successful ear replantation without a venous anastomosis, although venous anastomosis is recommended whenever possible. Despite this, postoperative congestion can be managed with leech therapy for vascular compromise. Arterial compromise demands reexploration, whereas venous compromise can be managed nonoperatively. Topical vasodilators, such as nitroglycerin, are not recommended for venous congestion. Efforts should be made to improve outflow; therefore, conservative management is not recommended. Elevating the patient's head may be useful but does not replace the proven effectiveness of leeches and heparin in clear cases of congestion.

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90. A 55-year-old woman undergoes periorbital rejuvenation. A combined upper and lower blepharoplasty, rhytidectomy, and lateral brow lift are performed. Release of which of the following structures will allow the greatest cephalad movement of the lateral brow in this patient?

- A) Arcus marginalis
- B) Brow depressors
- C) McGregor patch
- D) Orbital retaining ligament
- E) Periosteum

The correct response is Option D.

The orbital retaining ligament is located over the zygomatic frontal suture. It is also referred to as the zygomatic orbital retaining ligament in some texts. It is a 5-mm-long fibrous band that attaches the zygomatic frontalis suture line to the dermis. A neurovascular bundle passes through this structure, and its release allows superior-lateral movement of the forehead flap. Other attachments of the dermis to the periosteum are found at the anterior-inferior border of the mandible in the parasymphyseal region anterior to the jawl, the anterior-inferior border of the zygomatic arch posterior body of the zygoma -- often referred to as McGregor patch -- and the buccal maxillary ligaments from the zygomatic maxillary suture to the dermis. Together, these attachments are referred to as the “fence” of the cheek. These attachments are the true retaining ligaments, and their release allows free movement of the skin and soft tissue. These ligaments also can contain a neurovascular bundle that requires some care during dissection. Release of these structures allows movement of soft tissue during facialplasty, and their location is helpful during dissection.

Release of the arcus marginalis will allow freeing of the medial brow but often does not allow lateral brow mobility without release of the orbital retaining ligament. The periosteum does not need to be released for superior brow movement; however, a safer plane of dissection is subperiosteal within 1.5 cm of the orbital rim to avoid injury to the supraorbital and supratrochlear sensory nerves and arteries. Release of the brow depressors is performed to prevent recurrent brow ptosis, and their release is often not associated with further superior flap advancement. However, it is prudent to consider preoperative paralysis through injections of botulinum toxin to allow unopposed movement and preoperative evaluation of what their relaxation allows in terms of cephalad brow movement.

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91. A 68-year-old man comes to the office for consultation regarding rhinoplasty. Examination of the nose shows drooping and elongation of the tip complex. The primary cause of these findings is age-related loss of intrinsic support of which of the following structures?

- A) Columella
- B) Lower lateral cartilage
- C) Nasalis muscle
- D) Septum
- E) Upper lateral cartilage

The correct response is Option B.

The most significant and distinctive changes in the patient with advancing age occur in the nasal tip. Therefore, it is usually the area that needs the most refinement. This manifests as a drooping, elongated tip complex. The mechanism is multifactorial; however, it is primarily due to loss of intrinsic lower lateral cartilage support.

Other factors that contribute to nasal tip changes are: weakening or loss of suspensory ligament support with loss of medial crural support; thickening and possible ossification of cartilages, leading to greater prominence; thickening of the overlying skin and subcutaneous tissue with concomitant increased vascularity, leading to increased bulkiness and weight of the tip; and maxillary alveolar hypoplasia with resultant divergence of the medial crural feet and columellar shortening.

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92. A 5-year-old girl is brought to the office by her parents for consultation regarding deformity of the left side of the chest and the left upper extremity. Physical examination shows athelia, brachydactyly, and absence of the left pectoralis major muscle. Which of the following additional findings is most likely?

- A) Absence of the 12th rib
- B) Bilateral syndactyly
- C) Hypoplasia of the left rectus abdominis muscle
- D) Left brachial cyst
- E) Shortened right ulna

The correct response is Option A.

The child described has Poland syndrome, which is characterized by anomalies of the upper limbs and torso. The most common finding in patients with Poland syndrome is absence of the sternal head of the pectoralis major muscle. Other muscles, including the external oblique, latissimus dorsi, pectoralis minor, and serratus muscles, may be absent or hypoplastic. The rectus abdominis muscle is not involved. Ribs and costal cartilages of the affected side may be absent. Other anomalies of the chest include athelia and hypoplastic skin covering the chest wall. Anomalies of the ipsilateral upper extremity include brachysyndactyly as well as foreshortening and hypoplasia of the forearm. Correction of the breast deformity is not recommended until the patient has reached full breast maturity.

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93. A 13-month-old girl has had tearing and discharge from the right eye since birth. Which of the following is the most appropriate management?

- A) Observation
- B) Instruction of the parents in massage with antibiotic ointment
- C) Silastic intubation
- D) Probing of the nasolacrimal duct
- E) Dacryocystorhinostomy

The correct response is Option D.

A child with congenital tearing is likely to have a nasolacrimal duct problem. Punctual agenesis, lacrimal sac fistula, and other rare abnormalities should be ruled out with dye disappearance testing, which usually is markedly asymmetric in a nasolacrimal duct problem. Generally, a nasolacrimal duct problem should be treated with massage and antibiotic drops until the child is age 12 to 13 months. For about 70% of children with tearing at age 6 months, this conservative treatment leads to resolution by age 12 months. If tearing persists, probing of the nasolacrimal duct should be performed. The longer probing is delayed beyond age 13 months, the greater the number and complexity of the procedures needed to successfully treat congenital dacryostenosis. Therefore, initial probing and irrigation should be performed before age 13 months.

Observation alone is not appropriate because it delays treatment, which increases the number and complexity of the procedures required. Massage with antibiotic ointment is not appropriate for this 13-month-old girl, although it could have been done before age 12 months. If probing is unsuccessful, Silastic intubation should be done. Dacryocystorhinostomy is reserved for those rare cases that do not respond to Silastic intubation.

Typically, the Jones test is not needed to make the diagnosis. The Jones I test involves instillation of fluorescein dye into the conjunctival sac. A cotton pledget is placed inside the nose close to the orifice of the nasolacrimal duct. Staining of the pledget, a positive test result, indicates that flow through the lacrimal system is uninhibited. A negative result on the Jones I test indicates obstruction but does not localize it in the upper or lower system. In the Jones II test, the punctum is anesthetized and dye is inserted through an irrigation cannula. Then the system is irrigated with saline. If dye is collected from the nose, a positive test result, the

nasolacrimal duct is partially obstructed, but the upper system from the conjunctiva to the lacrimal sac is not obstructed.

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94. A 28-year-old man comes to the office for consultation regarding a “small” chin. Which of the following is most likely to be achieved with implantation of a silicone prosthesis in this patient’s chin?

- A) Addition of height to the lower face
- B) Correction of asymmetries of the anterior mandible
- C) Effacement of the labial mental fold
- D) Enhancement of sagittal projection to the pogonion
- E) Increase in the bigonial distance

The correct response is Option D.

In this patient, a silicone prosthesis positioned correctly would add sagittal projection to the pogonion. Silicone chin prostheses are very popular because of their ease of insertion and low risk of complications. However, they have significant limitations. The patient has a decreased height of the lower lip and a deep labial mental fold, which would not be appreciably helped and could be potentially harmed by the placement of the prosthesis. Modest augmentation of the sagittal projection is the key advantage to a silicone prosthesis. Silicone prostheses cannot reliably improve asymmetries. A patient with a significant vertical deficiency and deep labial mental fold would be better served with an osseous genioplasty, or a rigidly fixed porous polyethylene (Medpor) prosthesis, to vertically lengthen the chin, efface the labial mental fold, and add sagittal projection. Porous polyethylene (Medpor) prostheses can also increase the bigonial width when used to augment the mandibular ramus.

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95. A 45-year-old woman with Bell's palsy comes to the office because she has had inability to close the right eye, sagging of the right side of the mouth, and difficulty breathing through the right side of the nose for the past six months. Dysfunction of which of the following muscles of the external nose is the primary cause of this patient's symptoms?

- A) Corrugator supercilii
- B) Depressor septi nasi
- C) Nasalis
- D) Procerus
- E) Zygomaticus major

The correct response is Option C.

The alar fibers of the nasalis muscle and the levator labii superioris are responsible for dilating the nasal apertures. The transverse fibers of the nasalis serve as nostril constrictors. The depressor septi nasi muscle functions to depress the nasal tip. These muscles comprise the inferior group of nasal musculature and are innervated by the buccal branch of the facial nerve.

The corrugator and procerus muscles are responsible for vertical frown lines and glabellar furrowing, respectively. They comprise the superior group of external nasal muscles and are innervated by the temporal branch of the facial nerve. The zygomaticus major elevates the oral commissure and is not considered part of the muscles of the external nose.

Facial paralysis can contribute to nasal airway obstruction.

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

96. A 50-year-old woman comes to the office for consultation regarding closing of the right eye one year after she had an episode of Bell's palsy on the right side. She says her right eye closes when she chews. Photographs are shown. Which of the following is the most appropriate management of this patient's symptoms?

- A) Injection of botulinum toxin into the orbicularis muscle
- B) Repair of levator aponeurosis
- C) Fascial suspension of the brow
- D) Unilateral temporal brow lift
- E) Upper blepharoplasty

The correct response is Option A.

As shown in the photographs, this patient has right-sided orbicularis oculi contracture with orbicularis oris contracture. Her symptoms and history of Bell's palsy are consistent with recovered facial nerve animation with synkinesis. Her right eye closes when she eats. Injection of botulinum toxin to the orbicularis muscle would treat the synkinesis and allow the adverse effect of lower lid lagophthalmos. Repair of levator aponeurosis and fascial suspension of the brow treat forms of eyelid ptosis. A temporal brow lift would treat unilateral brow descent secondary to residual palsy of the temple branch of the facial (VII) nerve. Upper blepharoplasty would treat upper-eyelid excess skin only; however, this patient does not display eyelid or brow ptosis, and there is no significant excess of upper-eyelid skin.

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

97. A 16-year-old girl has persistent ptosis of the eyelid (shown) six months after undergoing reconstruction of the forehead and supraorbital bar for fibrous dysplasia. One month postoperatively, a wound developed from extrusion of hardware through the medial eyelid. Debridement of the wound with excision of the involved inflammatory tissue and reconstruction with a pericranial flap were performed at that time. On current examination, no levator function is noted medially in the eyelid and lateral movement of the eyelid is minimal. Which of the following interventions is the most appropriate next step in management?
- A) Lysis of adhesions
 - B) Kuhnt-Szymanowski procedure
 - C) Fasanella-Servat procedure
 - D) Suspension to the frontalis muscle with fascia lata grafting
 - E) Advancement of the levator muscle

The correct response is Option D.

This patient has traumatic ptosis as a complication of prior surgical procedures. At the time of debridement, either a portion of the levator muscle was excised or the muscle function is limited by scar tissue. In either case, the function as shown in the photographs is minimal, and the ptosis is best managed by a frontalis suspension procedure. It is generally agreed the fascia lata is the material of choice for the sling. Alloplastic materials, such as silicone slings, can also be

used but have a risk of extrusion and infection. The advantage of alloplastic sling reconstruction is that there are no risks to the donor site.

The Fasanella-Servat procedure involves excision of a portion of the conjunctiva, tarsus, orbital septum, levator aponeurosis, and Müller muscle. It can be used in cases of mild ptosis (1-2 mm). Levator function must be present.

The Kuhnt-Szymanowski procedure is used to correct lower eyelid ectropion. It involves a wedge excision of the lower eyelid.

Levator advancement surgery could possibly be used in this case if, during exploration of the eyelid, the levator was noted to be present and not compromised by scar. However, in this case, the levator mechanism was likely excised in the process of debriding the wound tract and inflammatory tissue. Therefore, in light of the degree of ptosis, the noted limited elevation of the upper eyelid, and the mechanism of injury, frontalis suspension is a better choice for ptosis repair in this patient.

With no evidence of muscle function, it is unlikely that adhesions alone are the cause of restricted eyelid movement. Therefore, lysing the scar would likely be inadequate treatment.

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98. A 2-year-old boy with isolated unilateral microtia is brought to the office by his parents for consultation regarding reconstruction of the ear. Which of the following is the most appropriate management?

- A) Delay of reconstruction of the ear until 6 years of age
- B) Fitting of a prosthetic ear
- C) Placement of a postauricular tissue expander
- D) First-stage reconstruction of the ear using a cartilage rib graft
- E) First-stage reconstruction of the ear using a polyethylene prosthesis

The correct response is Option A.

Reconstruction of the ears should be delayed until at least 5 to 6 years of age and preferably until 7 to 8 years of age. At younger ages, patients often do not strongly desire the reconstruction, are more likely to have difficulty with postoperative compliance, and may not have rib cartilage large enough to create an auricular framework if autogenous cartilage is to be used. In addition, reconstructing an ear too early in life may result in an ear that is too small if it does not grow with the patient.

Tissue expansion of postauricular skin may be used during ear reconstruction but should be delayed until at least 5 to 6 years of age. A criticism of tissue expansion for ear reconstruction is that the expanded skin is less supple than unexpanded skin and is less able to conform to the anatomic details of an autologous or prosthetic ear cartilage framework.

Prosthetic ears are not appropriate for young children because they are usually too physically active to keep a prosthesis attached and are too young to care for a prosthesis.

First-stage ear reconstruction can be successfully accomplished using autologous cartilage or prosthetic material to recreate the underlying ear framework but should be delayed until this child is older.

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99. With the tumescent liposuction technique, which of the following percentages of the aspirate is blood?

- A) 1%
- B) 4%
- C) 8%
- D) 12%
- E) 15%

The correct response is Option A.

With tumescent liposuction, blood makes up 1% of the aspirate. This technique produces the greatest degree of hemostasis. This technique consists of infiltration to skin turgor, which represents approximately 2 to 3 ml of infiltrate to 1 ml of aspirate.

Superwet technique consists of 1 ml of infiltrate for each 1 ml of aspirate to be removed. This technique also has an estimated 1% blood loss in the aspirate.

Wet technique consists of infiltration of 200 to 300 ml per area and is not based on the amount to be aspirated. With this technique, 4% to 30% of the aspirate is blood.

In the dry technique, which does not involve any infiltration of the tissue, blood has been estimated to comprise 20% to 45% of the aspirate.

References

1. Rohrich RJ, Beran SJ, Fodor PB. The role of subcutaneous infiltration in suction-assisted lipoplasty: a review. *Plast Reconstr Surg.* 1997;99:514-515.
2. Karmo FR, Milan MF, Stein S, et al. Blood loss in major lipoplasty procedures with the tumescent technique. *Aesth Surg J.* 1998;18:34.

100. A 36-year-old woman comes to the office for consultation regarding breast reconstruction one year after she underwent right modified radical mastectomy. The procedure was followed by six weeks of radiation therapy. She has no history of other surgical procedures or serious medical illnesses. Height is 5 ft 4 in tall and weight is 135 lb. She wears a size 32B brassiere. Which of the following is the LEAST appropriate breast reconstruction procedure for this patient?
- A) Extended latissimus dorsi flap
 - B) Latissimus dorsi flap with saline-filled prosthesis
 - C) Superior gluteal artery perforator (SGAP) flap
 - D) TRAM flap
 - E) Two-staged reconstruction with a tissue expander and saline-filled prosthesis

The correct response is Option E.

Radiation therapy has significant negative effects on the outcome of breast reconstruction with prostheses. There is a significant increase in capsular contracture and other complications, which are unrelated to implant type.

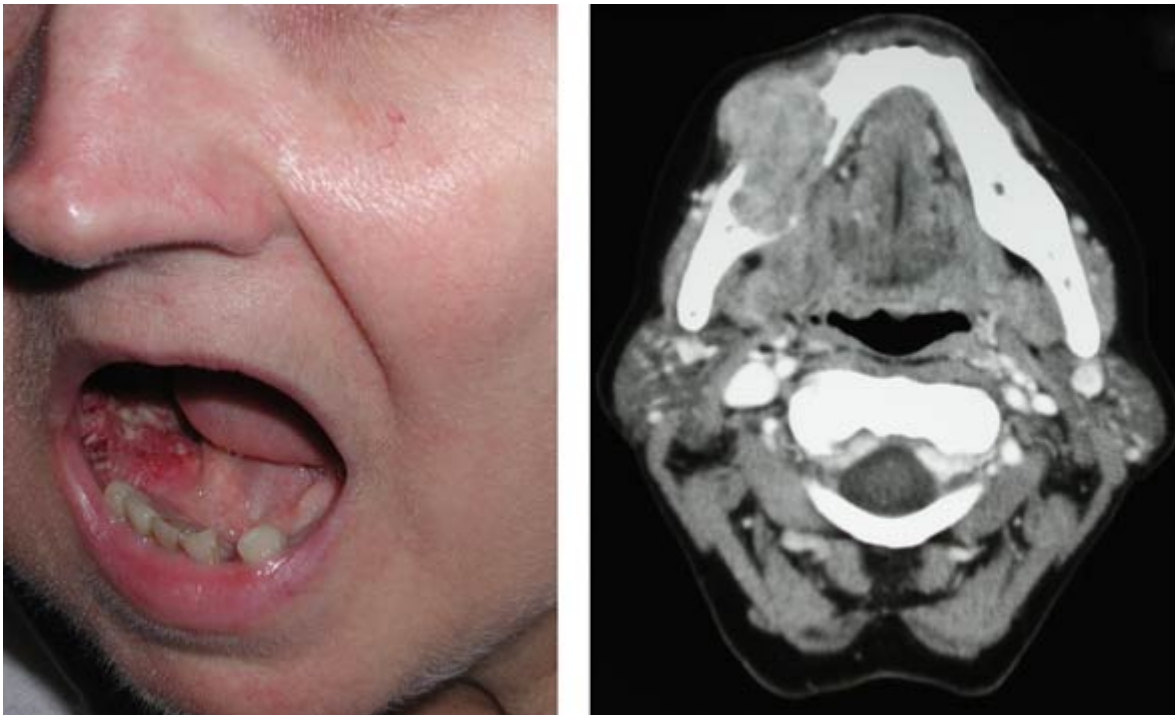
Totally autologous reconstruction is the best option for managing the radiated breast. The extended latissimus flap might have adequate volume in this patient (size 32B brassiere) without use of a prosthesis. Even if a prosthesis is required, the new nonradiated skin and muscle of a latissimus flap are advantageous for softness and thickness. The superior gluteal artery perforator (SGAP) and TRAM flaps would also bring in new nonradiated tissue and foreign bodies would not be placed in the breast.

Although the final outcome of a two-stage reconstruction with tissue expanders and prostheses can be acceptable in the radiated field, it is generally not as good as those obtainable with autologous tissue alone.

References

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2. Evans GR, Schusterman MA, Kroll SS. Reconstruction and the radiated breast: is there a role for implants? *Plast Reconstr Surg.* 1995;96:1111.
3. Tran N, Chang D, Gupta A, et al. Comparison of immediate and delayed free TRAM flap breast reconstruction in patients receiving postmastectomy radiation therapy. *Plast Reconstr Surg.* 2001;108:78-82.

Section 3: Craniomaxillofacial



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

101. A 54-year-old woman comes to the office for consultation regarding a mass in the mouth that was diagnosed as squamous cell carcinoma. Physical examination shows one ipsilateral 1-cm lymph node. A photograph and CT scan are shown. Which of the following is the most appropriate TNM staging of this patient's tumor?

- A) I
- B) II
- C) III
- D) IV

The correct response is Option D.

According to the American Joint Committee on Cancer (AJCC) TNM staging, if a tumor invades the mandible through the cortical bone, it is, by definition, a stage IV tumor regardless of size. In this case, considering that there is one node less than 3 cm on the ipsilateral side, the appropriate staging of this tumor is IVA.

Stage II and III tumors do not involve invasion of the mandible or adjacent structures. Stage IVB involves metastasis to a lymph node more than 6 cm in greatest dimension. Stage IVC involves distant metastasis.

Oral Cavity:

- T1 Tumor <2 cm
- T2 Tumor >2 but <4 cm
- T3 Tumor >4 cm
- T4 Tumor invades adjacent structures such as cortical bone, tongue, skin, or soft tissues of the neck

- N1 One ipsilateral node <3 cm
- N2a One ipsilateral node >3 and <6 cm
- N2b Multiple ipsilateral nodes <6 cm
- N2c Bilateral contralateral nodes <6 cm
- N3 Any nodes >6 cm

- M0 No distal metastasis
- M1 Distal metastasis

References

1. Fleming ID, Cooper JS, Henson DE, et al. *AJCC Cancer Staging Manual*. Philadelphia: Lippincott-Raven; 1997.
2. Shockley WW, Pillsbury HC. *The Neck: Diagnosis and Surgery*. St. Louis: Mosby; 1994.

102. During development of a fetus, a cleft of the lip results when the maxillary process fails to fuse normally with which of the following processes?

- A) Lateral nasal
- B) Frontonasal
- C) Medial nasal
- D) Mandibular

The correct response is Option C.

The developing fetus has five facial prominences that are populated by neural crest cells. These five facial prominences are the frontonasal, paired maxillary, and paired mandibular. The frontonasal prominence gives rise to the nasal pit or placode, around which develops the medial and lateral nasal processes. A failure of fusion between the maxillary prominence and the medial nasal process results in a common cleft of the lip.

References

1. Sperber GH. Early orofacial development. In: Sperber GH, ed. *Craniofacial Development*. Hamilton, Ontario: BC Decker; 2001:31.
2. Gosain AK, Moore FO. Embryology of the head and neck. In: Aston SJ, ed. *Grabb and Smith's Plastic Surgery*. 5th ed. Philadelphia: Lippincott Raven; 1997:223.

103. Which of the following structures passes through the pterygomaxillary fissure?

- A) Mandibular artery
- B) Mandibular nerve
- C) Maxillary artery
- D) Maxillary nerve

The correct response is Option C.

The pterygomaxillary fissure appears on lateral cephalograms as an upside-down teardrop. It serves as a radiographic point of orientation. The posterior border of this opening is the anterior aspect of the pterygoid plates. The anterior border is the posterior aspect of the maxilla, and the superior border is the pterygopalatine fossa and sphenoid bone and the orbital process of the palatine bone. The inferior orbital fissure and the pterygomaxillary fissure are oriented at right angles to each other. They are separated by the small pterygopalatine fossa. The pterygomaxillary fissure connects the small pterygopalatine fossa with the much larger infratemporal fossa. It transmits the terminal branches of the maxillary artery and veins. The inferior orbital fissure transmits the maxillary nerve and branches of the pterygopalatine ganglion from the pterygopalatine fossa to the orbit. The mandibular nerve and branches pass through the infratemporal fossa but not through the pterygomaxillary fissure. Appropriate care must be taken during separation of the face from the pterygoid plates to avoid injury to the maxillary artery and veins. After separation of these components, down-fracture is often performed using digital pressure alone.

References

1. Clemente CD, ed. *Gray's Anatomy of the Human Body*. 30th ed. Philadelphia: Lea & Febiger; 1985:160-161.
2. Moore KL, Dalley AF, eds. *Clinically Oriented Anatomy*. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 1999:950.



104. A 15-year-old boy is brought to the office by his parents because he has had swelling in the right lateral mandibular region for the past two months. Physical examination shows a firm, nonmobile mass of the body of the mandible. CT scan is shown. Biopsy of the lesion shows ameloblastoma. Which of the following is the most appropriate management?

- A) Cryotherapy
- B) Curettage
- C) Enucleation
- D) Segmental resection

Please note: The text of question 104 incorrectly stated “swelling in the right lateral mandibular region.” The text should read “swelling in the left lateral mandibular region.”

The correct response is Option D.

The surgical management of an ameloblastoma is controversial. Treatment modalities include cryotherapy, curettage, enucleation, or segmental resection and reconstruction. There are three main types of ameloblastomas: peripheral, unicystic, and multicystic tumors. Peripheral tumors

are odontogenic in origin and have histologic characteristics consistent with intraosseous ameloblastomas. However, they occur in the soft tissues covering the tooth-bearing parts of the jaw. These peripheral tumors can be treated with local excision. Unicystic ameloblastomas can be treated conservatively with enucleation because they appear clinically as a cyst. When the tumor involves the periphery of the connective tissue wall of the cyst, a peripheral ostectomy should be considered. Multicystic ameloblastomas or large ameloblastomas that involve the surrounding of the bone and extend into the soft tissues are locally aggressive and should be treated with segmental resection and reconstruction.

References

1. Chana JS, Chang YM, Wei FC, et al. Segmental mandibulectomy and immediate free fibula osteoseptocutaneous flap reconstruction with endosteal implants: an ideal treatment method for mandibular ameloblastoma. *Plast Reconstr Surg*. 2004;113:80.
2. Chapelle KA, Wilde PC, Brouns JJ, et al. Rational approach to diagnosis and treatment of ameloblastomas and odontogenic keratocysts. *Br J Oral Maxillofac Surg*. 2004;42:381.

105. A 24-year-old woman comes to the office for consultation regarding her appearance when smiling. Physical examination shows the mesiobuccal cusp of the first maxillary molar lying distal to the buccal groove of the first mandibular molar. Which of the following is the most appropriate Angle classification?

- A) I
- B) IIA
- C) IIB
- D) III

The correct response is Option D.

Occlusion as described by the Angle classification uses the relationship of the permanent first molars of the maxilla and mandible as its reference point. Patients with class I occlusion (normal) have the mesiobuccal cusp of the maxillary first molar lying in the buccal groove of the mandibular first molar. Patients with class II occlusion have the mesiobuccal cusp of the maxillary first molar located mesial to the buccal groove of the mandibular first molar. Class III occlusion, as illustrated in this case, is described as having the mesiobuccal cusp of the maxillary first molar positioned distal to the buccal groove of the mandibular first molar.

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1. Schendel SA. Orthognathic surgery. In: Vander Kolk CA, ed. *Plastic Surgery: Indications, Operations, and Outcomes*. St. Louis: Mosby Year Book; 2000:871-875.
2. Wolfe SA, Spiro SA, Wider TM. Surgery of the jaws. In: Aston SJ, Beasley RW, Thorne CH, eds. *Grabb and Smith's Plastic Surgery*. 5th ed. Philadelphia: Lippincott-Raven; 1997:321-333.

106. In planning open reduction and internal fixation in a patient with a low subcondylar neck fracture, which of the following extraoral incisions provides the safest and most versatile exposure to the fracture site?

- A) Postauricular
- B) Preauricular
- C) Retromandibular
- D) Submandibular

The correct response is Option C.

The retromandibular incision provides the safest and most versatile exposure for open reduction and internal fixation of submandibular fractures. When compared with the subcondylar and preauricular incisions, there is significantly less injury to the marginal mandibular, temporal, and zygomatic branches of the facial nerve.

The retromandibular incision allows access superiorly to the coronoid notch and inferiorly to the angle of the mandible. The addition of a transfacial trocar to this approach facilitates access to higher level subcondylar fractures as well. The preauricular, postauricular, and submandibular incisions provide a more limited view of low subcondylar fractures.

References

1. Van Sickels JE, Parks WJ. Temporomandibular joint region injuries. In: Fonseca RJ, Marciani RD, Hendler BH, eds. *Oral and Maxillofacial Surgery*. Philadelphia: WB Saunders; 2000:136-148.
2. Kademani D, Rombach DM, Quinn PD. Trauma to the temporomandibular joint region. In: Fonseca RJ, ed. *Oral and Maxillofacial Trauma*. St. Louis: Elsevier Saunders; 2005:523-568.

107. A 56-year-old woman undergoes reconstruction of the mandible using a free fibular flap. During the procedure, the microsurgeon dissects the external carotid artery; however, the superior thyroid artery cannot be located for anastomosis. Which of the following branches of the external carotid artery is the next distal vessel that would be suitable for anastomosis?

- A) Lingual
- B) Occipital
- C) Posterior auricular
- D) Maxillary

The correct response is Option A.

During the dissection of the neck vessels, the microsurgeon must be comfortable with the anatomy of the entire neck including the orientation and suitability of the available arteries. The branches of the external carotid artery, in order from proximal to distal, are as follows: superior thyroid, ascending pharyngeal, lingual, occipital, facial, posterior auricular, and maxillary arteries.

References

1. Netter FH. *Atlas of Human Anatomy*. Summit, NJ: Ciba-Geigy; 1991:29.
2. Langman J. *Medical Embryology*. Baltimore: Williams & Wilkins; 1981:41.

108. A 16-year-old boy with history of cleft lip and palate comes to the clinic for management of malocclusion. Medical history includes several surgical procedures on the palate for closure of an oral nasal fistula. Intraoral evaluation shows Class III malocclusion and 15-mm negative overjet. Lateral cephalometry shows decreased SNA angle with normal SNB angle. Which of the following surgical procedures is most appropriate for correction of this deformity?

- A) Mandibular setback
- B) Le Fort I osteotomy with bilateral sagittal split osteotomy of the mandible
- C) Le Fort I advancement by distraction osteogenesis
- D) Le Fort II advancement by distraction osteogenesis
- E) Le Fort III advancement by distraction osteogenesis

The correct response is Option C.

For this patient, the most appropriate surgical option is a Le Fort I advancement by distraction osteogenesis because he requires correction of the malocclusion and needs a large amount of movement. Le Fort I advancement can correct the malocclusion by moving the tooth-bearing segment of the maxilla. Distraction osteogenesis allows for large movement because it stretches the soft tissue envelope gradually to accommodate the bony framework. Also, this patient's prior surgery probably has resulted in scarring of the soft tissue of the palate. Such scarring is also an indication for distraction, which gradually stretches the scars. In contrast, an immediate large advancement is likely to be limited by scarring.

In this patient, mandibular setback alone produces too large a movement to correct the malocclusion and risks posterior placement of the base of the tongue, which could narrow the airway. In addition, it would not be aesthetically pleasing. A mandibular setback could be used as an adjunct if it were not possible to obtain the needed advancement by moving the maxilla alone.

Because this patient's nose, orbital rim, and malar prominences are in good position, a Le Fort II or Le Fort III advancement is not indicated.

References

1. Chin M, Toth BA. Le Fort III advancement with gradual distraction using internal devices. *Plast Reconstr Surg.* 1997;100:819-832.
2. Figueroa AA, Polley JW, Ko E. Distraction osteogenesis for treatment of severe cleft maxillary deficiency with the RED technique. In: Samchukov ML, Cope JB, Cherkashin AM, eds. *Craniofacial Distraction Osteogenesis*. St. Louis: Mosby; 2001:485-493.

109. A 64-year-old man comes to the office because he has numbness of the left medial cheek and infraorbital area. Physical examination shows a mass of the hard palate. Incisional biopsy shows adenoid cystic carcinoma. Further evaluation is most likely to show tumor involvement of which of the following foramina at the base of the skull?

- A) Anterior ethmoid foramen
- B) Foramen ovale
- C) Foramen rotundum
- D) Jugular foramen
- E) Stylomastoid foramen

The correct response is Option C.

Numbness in the left medial cheek and left infraorbital area suggest that the tumor has invaded the infraorbital nerve, which exits the middle cranial fossa from the foramen rotundum. Approximately 80% of patients with adenoid cystic carcinoma have perineural spread. The anterior ethmoid foramen emerges from the frontoethmoid suture line and contains the anterior ethmoid vessels. The foramen ovale and the stylomastoid foramen, respectively, contain the mandibular nerve (V3) and the facial nerve (cranial nerve VII). Cranial nerves IX (glossopharyngeal), X (vagus), and XI (spinal accessory) emerge from the jugular foramen.

References

1. Alvi A, Myers EN, Carrau RL. Malignant tumors of the salivary glands. In: Myers EN, Suen JY, eds. *Cancer of the Head and Neck*. Philadelphia: WB Saunders; 1996:532-535.
2. Harnsberger HR. The skull base. In: Harnsberger HR, ed. *Handbook of Head and Neck Imaging*. St. Louis: Mosby; 1995:399-425.

110. A 5-year-old boy who underwent repair of cleft palate via double opposing Z-plasty four years ago has hypernasality indicative of velopharyngeal insufficiency. Direct nasendoscopy shows a coronal closure pattern of the velopharyngeal port and little or no motion of the lateral pharyngeal wall. Which of the following surgical procedures is most appropriate for correction of the velopharyngeal insufficiency?

- A) Augmentation of the posterior pharynx
- B) Inferiorly based posterior pharyngeal flap
- C) Sphincter pharyngoplasty
- D) Superiorly based posterior pharyngeal flap
- E) V-Y pushback palatoplasty

The correct response is Option C.

Velopharyngeal competence results from sufficient apposition of the velar mucosa against the posterior pharyngeal wall and from motion of the lateral pharyngeal wall that causes sphincteric closure of the velopharyngeal port. Many patients with velopharyngeal insufficiency after cleft palate repair have a shortened, scarred velum, resulting in a deficiency in the anterior-posterior coronal closure pattern. Other patients, such as those with velocardiofacial syndrome, have generalized pharyngeal dysfunction with poor lateral pharyngeal wall motion, which contributes to a large central gap that leads to velopharyngeal incompetence.

To correct velopharyngeal insufficiency in this patient, a sphincter pharyngoplasty is most appropriate. In this procedure, the posterior tonsillar pillars (palatopharyngeus muscles) are bilaterally dissected from the tonsillar fossae and rotated 90 degrees medially. Then they are affixed in an overlapping fashion against the posterior pharyngeal wall. Because the palatopharyngeus muscles are a continuation of the soft palate and lateral pharyngeal walls, this procedure narrows the entire pharyngeal port in a sphincteric fashion and augments the posterior pharyngeal wall.

In a patient with little or no motion of the lateral pharyngeal wall, augmentation of the posterior pharynx is not appropriate. Although it may decrease the anterior-posterior coronal deficiency, it does nothing to treat the poor lateral wall motion. In addition, augmentation of the posterior pharynx has been attempted with multiple materials (including fat, Teflon, and silicone) in the past, without success. Today, the procedure has all but been abandoned.

Likewise, a posterior pharyngeal flap (whether inferiorly based or superiorly based) is not appropriate because it may not completely correct the hypernasality associated with velopharyngeal insufficiency. This is true because it does not allow the lateral pharyngeal walls to move medially and seal off the lateral ports between the pharyngeal flap and lateral pharyngeal walls.

V-Y pushback palatoplasty would not adequately correct the problem.

References

1. Kawamoto HK. Pharyngoplasty revisited and revised. *Oper Tech Plast Reconstr Surg.* 1995;2:239-244.
2. Sloan GM. Posterior pharyngeal flap and sphincter pharyngoplasty: the state of the art. *Cleft Palate Craniofac J.* 2000;37:112-122.

111. Which of the following muscles elevates the mandible?

- A) Digastric
- B) Genioglossus
- C) Geniohyoid
- D) Medial pterygoid
- E) Mylohyoid

The correct response is Option D.

The mandible is subject to muscular forces, which tend to add to the instability of certain fractures and necessitate treatment. The masseter, temporalis, and medial pterygoid muscles elevate the mandible, and the geniohyoid, genioglossus, mylohyoid, and digastric muscles tend to depress the mandible. The lateral pterygoid muscle inserts into the capsule of the temporomandibular joint and tends to remain attached and pull the condyle head medial when there is a high fracture.

References

1. Lettieri S. Facial trauma. In: Achauer BM, Eriksson E, Guyuron B, et al, eds. *Plastic Surgery: Indications, Operations, and Outcomes*. Philadelphia: Mosby; 2000:923-940.
2. Netter FH. *Atlas of Human Anatomy*. East Hanover, NJ: Novartis; 1997:47-49.

112. An 8-year-old girl has bilateral coloboma and retraction of the lower eyelids, ptosis of the upper eyelids, inferior displacement of the lateral canthi, hypoplasia of the temporalis muscles, microtia, and abnormal hairline. Which of the following additional findings in this patient represents the main underlying characteristic of the full expression of Treacher Collins syndrome?
- A) Absence of the malar bone and zygomatic arch
 - B) Bilateral Tessier cleft number 4
 - C) Deformed mandibular condyle
 - D) Premature fusion of the coronal sutures
 - E) Tessier cleft numbers 0 and 14

The correct response is Option A.

According to Tessier, the main characteristic of the complete form of Treacher Collins syndrome is the absence of the malar bone and zygomatic arch. This absence is caused by combined Tessier clefts numbers 6, 7, and 8. These clefts result in severe dysplasia or even absence of the zygoma. The number 6 cleft produces the lower eyelid findings. The number 7 cleft results in absence of the zygomatic arch, hypoplasia of the temporalis muscles, microtia, and abnormal hairline. The number 8 cleft causes inferior displacement of the lateral canthi.

The other findings listed do not occur in Treacher Collins syndrome. Unlike in this child, Tessier cleft number 4 begins lateral to Cupid's bow, passes onto the cheek, and curves onto the lower lid, disrupting the lower canaliculus. It can result in anophthalmia. Lack of formation of the mandibular ramus and condyle is typical in hemifacial microsomia. It produces asymmetric malformation, whereas Treacher Collins syndrome produces symmetric effects. Premature fusion of the coronal sutures results in acrocephaly or oxycephaly. It leads to extreme upward growth with reduced lateral and anteroposterior growth and occurs in Crouzon and Apert syndromes. Tessier cleft numbers 0 and 14 result in midline deformities, including hypertelorism and nasal deformities.

References

1. Stratoudakis AC. Craniofacial anomalies and principles of their correction. In: Georgiade GS, Riefkohl RR, Levin LS, eds. *Georgiade's Plastic, Maxillofacial and Reconstructive Surgery*. Baltimore: Williams & Wilkins; 1997:273-296.
2. Argenta LC, David LR. Craniofacial clefts and other related deformities. In: Achauer BM, Eriksson E, Guyuron B, et al, eds. *Plastic Surgery Indications, Operations, and Outcomes*. St. Louis: Mosby; 2000:741-754.

113. Which of the following muscles can function to close off the oral cavity from the oropharynx?

- A) Levator veli palatini
- B) Musculus uvulae
- C) Palatoglossus
- D) Palatopharyngeus
- E) Tensor veli palatini

The correct response is Option C.

The palatoglossus is a paired muscle that elevates the posterior tongue and pulls it against the soft palate, separating the oral cavity from the oropharynx. The muscle attaches to the side of the tongue on one end and the palatine aponeurosis on the other.

The levator veli palatini elevates the soft palate during swallowing and yawning. It attaches superiorly to the cartilage of the auditory tube and the petrous part of the temporal bone and inferiorly to the palatine aponeurosis.

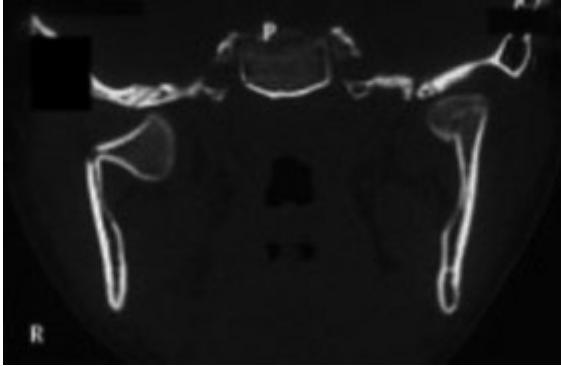
The palatopharyngeus muscle is part of the palatopharyngeal arch, attaching to the lateral wall of the pharynx, the hard palate, and the palatine aponeurosis. During swallowing, it tenses the soft palate while pulling the walls of the pharynx superiorly, medially, and anteriorly, effectively closing off the nasopharynx from the oropharynx.

The tensor veli palatini also tenses the soft palate and opens the eustachian tube during yawning and swallowing. It extends from the palatine aponeurosis to the medial pterygoid plate and spine of the sphenoid bone and the cartilage of the eustachian tube.

The musculus uvulae pulls the uvula superiorly and shortens it. The muscle fills the substance of the uvula, attaching to its mucosa and to the posterior nasal spine and palatine aponeurosis.

References

1. Moore KL. The head. In: Moore KL, ed. *Clinically Oriented Anatomy*. 3rd ed. Baltimore: Williams & Wilkins; 1992:637-780.
2. Clemente CD. Neck and head. In: Clemente CD, ed. *Anatomy: A Regional Atlas of the Human Body*. 4th ed. Baltimore: Williams & Wilkins; 1997:435-576.
3. Putz R, Pabst R. Head and neck. In: Putz R, Pabst R, eds. *Sobotta Atlas of Human Anatomy*. 13th ed. (English). Philadelphia: Lippincott Williams & Wilkins; 2001:30-163.



114. A 5-year-old child has malocclusion and limited opening of the mouth after falling from playground equipment. A CT scan is shown. Which of the following is the most likely long-term sequela of this patient's injury?

- A) Bimaxillary prognathism
- B) Mandibular hypoplasia
- C) Mandibular prognathism
- D) Maxillary hypoplasia
- E) Maxillary prognathism

The correct response is Option B.

This child is at increased risk for mandibular hypoplasia. The condyle serves as a growth center for the mandible and contributes primarily to vertical growth. The condylar cartilage is a site of secondary passive growth dependent on forces acting on it, notably the medial and lateral pterygoid muscles. Pediatric condylar fractures generally remodel and do not often cause growth disturbance. However, the thin, localized functional matrix of the condyle may disallow normal mandibular growth after it has been injured and may result in unilateral or bilateral hypoplasia depending on the injury. Pediatric mandibular fractures are frequently treated conservatively via closed reduction and short periods of maxillomandibular fixation.

References

1. Singh DJ, Bartlett SP. Pediatric craniofacial fractures: long-term consequences. *Clin Plast Surg*. 2004;31:499-518.
2. Demianczuk ANA, Verchere C, Phillips JH. The effect on facial growth of pediatric mandibular fractures. *J Craniofac Surg*. 1999;10:323-328.

115. A 29-year-old woman comes to the office for evaluation of orthognathic profile and class I occlusion. Physical examination shows isolated retrogenia and moderate vertical mandibular excess. Which of the following types of genioplasty is most appropriate?

- A) Advancement with horizontal osteotomy only
- B) Advancement with horizontal osteotomy and downgrafting
- C) Advancement with inferiorly angled osteotomy
- D) Alloplastic augmentation, extraoral approach
- E) Alloplastic augmentation, intraoral approach

The correct response is Option C.

The most appropriate genial treatment option is advancement with the osteotomy angled inferiorly. The angle of the osteotomy has an impact on the vertical dimension of the mandible as the segment is advanced forward. An osteotomy angled inferiorly in relation to the occlusal plane will provide a progressive decrease in the vertical dimension as the osteotomy segment is advanced. A 2- to 4-mm reduction in chin height can be achieved with this technique. When a larger height reduction (in excess of 5 mm) is indicated, a horizontal wafer of bone is removed above the horizontal sliding osteotomy. A horizontal osteotomy, relatively parallel to the occlusal plane, would provide a more pure anteroposterior movement.

Downgrafting the osteotomy site, with an interpositional bone graft or alloplastic material, would be indicated to increase the vertical dimension in a patient with vertical mandibular deficiency.

Alloplastic augmentation alone, whether placed through an intraoral or extraoral approach, is best indicated for a unidimensional change, such as a pure sagittal deficiency.

References

1. Sullivan SS. Genial procedures. In: Fonseca RJ, ed. *Oral and Maxillofacial Surgery*. Philadelphia: WB Saunders; 2000:403-415.
2. Cohen SR. Genioplasty. In: Achauer BM, ed. *Plastic Surgery, Indications, Operations and Outcomes*. St. Louis: Mosby; 2000:2683-2703.
3. Strauss RA, Abubaker AO. Genioplasty: a case for advancement osteotomy. *J Oral Maxillofac Surg*. 2000;58:783-787.
4. Bell WH, McBride K. Genioplasty strategies. In: Bell WH, ed. *Modern Practice in Orthognathic and Reconstructive Surgery*. Philadelphia: WB Saunders; 1992:2439-2488.

116. A 7-year-old boy is being evaluated after sustaining facial injuries when he fell while climbing playground equipment. Radiographs show a fracture of the orbit. Which of the following additional findings best supports urgent surgical repair in this patient?

- A) Acute enophthalmos
- B) Corneal abrasion
- C) Diplopia on upward gaze
- D) Entrapment of the rectus muscle
- E) Hyphema

The correct response is Option D.

Surgical repair of orbital fractures can be classified as emergent, urgent, or delayed. Most orbital fractures can be safely and effectively repaired within two weeks. This allows periorbital edema to resolve and makes the dissection easier. Indications for repairing orbital fractures include persistent diplopia in central gaze, early enophthalmos or vertical dystopia, and large fracture size, which may predispose later development of enophthalmos. Such fractures are repaired with some urgency within two weeks of the injury.

In the pediatric population, there is a subset of orbital fractures which require emergent repair, i.e., repair ideally within the first 24 hours after injury. A trapdoor fracture refers to an orbital floor fracture that, because of the elastic recoil of cartilaginous bone, traps orbital contents and the inferior rectus muscle within the maxillary sinus. Often, the recoiled floor appears uninjured. CT scan, however, will demonstrate the incarcerated muscle. This should be considered an ischemic injury, as demonstrated in the CT scan. Improved muscle function has been demonstrated with earlier surgical correction.

Hyphema represents blood from hemorrhage in the anterior chamber of the eye. Ocular injury is a contraindication to early surgical intervention. Orbital manipulation increases the risks of secondary bleed into the anterior chamber and the development of acute closed-angle glaucoma.

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2. Grant J, Patrinely JR, Weiss AH, et al. Trapdoor fracture of the orbit in a pediatric population. *Plast Reconstr Surg*. 2002;109:482-489.
3. Matteini C, Renzi G, Becelli R, et al. Surgical timing in orbital fracture treatment: experience with 108 consecutive cases. *J Craniofac Surg*. 2004;15:145-150.

117. The firstborn child of a Caucasian couple with no abnormalities has bilateral cleft lip and palate. Which of the following percentages best represents the possibility that this couple's next child will have cleft lip, with or without cleft palate?

- A) 2%
- B) 4%
- C) 10%
- D) 16%
- E) 32%

The correct response is Option B.

The correct answer for the sibling of a child with bilateral cleft lip and palate is approximately 4%, depending on the reference. Regardless, the risk decreases if there is no cleft palate in the proband and/or if the condition is unilateral. The incidence of cleft lip with or without cleft palate for the sibling of a child with bilateral cleft lip but no cleft palate is 6.7%, for the sibling of a child with unilateral cleft lip and palate is 4.9%, and for the sibling of a child with unilateral cleft lip but no cleft palate is 4.0%. If there are two affected children with cleft lip with or without cleft palate, the risk for a third child would be at least 9%.

The overall risk of cleft lip with or without cleft palate in a Caucasian population is 1:1000. In a first-degree relative, that risk is multiplied by 40; in a second-degree relative, the risk is multiplied by 7; and in a third-degree relative, the risk is multiplied by 3. However, the risk is increased when more than one relative is affected, if the family member has a severe form of the disorder, if the family member is of the sex least likely to be affected, or if the parents are consanguineous. For one affected parent, the risk of having one child with cleft lip with or without cleft palate is 4%, and the risk for a second child increases to 17%.

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118. A 12-year-old boy is brought to the emergency department after he fell while riding his bike and landed on the chin. Panorax radiographs show a minimally displaced fracture of the high right condylar neck and an open left parasymphiseal fracture. Which of the following is the most effective management?
- A) Observation with serial radiographs and restriction to soft diet
 - B) Intermaxillary fixation with infraorbital and circummandibular wires for four weeks
 - C) Intermaxillary fixation with arch bars for four weeks
 - D) Open reduction with internal fixation of the parasymphiseal fracture and arch bars for two weeks
 - E) Open reduction with internal fixation of both the parasymphiseal fracture and the fracture of the high condylar neck

The correct response is Option D.

Observation alone is inadequate management of the parasymphiseal fracture. This child presents in the late phase of the mixed dentition and should have enough adult dentition in place to secure the arch bars. Wires to reduce the fractures will not provide as much stability as arch bars. This technique, however, is useful in the child who does not yet have enough adult dentition to secure the arch bars.

Immobilization for a short period (i.e., two weeks) is the appropriate management of the condylar neck fracture. This will help to allow the fractures to become stable enough to maintain the reduction once movement is instituted. Early movement helps to decrease the risk of ankylosis of the temporal mandibular joint. Extended immobilization to allow for healing of the parasymphiseal fracture will increase the risk of ankylosis of the temporomandibular joint. Open reduction and internal fixation (ORIF) of the parasymphiseal fracture will ensure an anatomic reduction of a stable skeletal unit. This, in turn, will decrease the risk of infection and nonunion.

ORIF of the condylar neck fracture is not indicated because the fracture is minimally displaced. Conservative management of these fractures is well accepted and has stood the test of time. Open reduction would incur the risks of injury of the facial nerve.

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119. A 6-year-old boy who underwent repair of a unilateral cleft lip and palate in infancy is brought to the office by his parents because he has had a sensation of numbness in the left anterior mobile tongue for the past two days, since he underwent repair of a palatal fistula during orotracheal intubation. During that procedure, the oral cavity and palate were retracted for two hours with a Dingman retractor. Which of the following nerves was most likely damaged during the procedure?

- A) Glossopharyngeal (IX)
- B) Lingual
- C) Mental
- D) Recurrent laryngeal
- E) Superior laryngeal

The correct response is Option B.

The lingual nerve provides sensation to the anterior two thirds of the tongue. Injury to the lingual nerve is a rare complication of airway manipulation. Virtually all equipment associated with airway management and/or oral cavity retraction has been implicated in its damage. Examples include direct laryngoscopy, tracheal intubation, laryngeal mask airway, and tonsillectomy. The etiology of lingual nerve damage is likely compression of the nerve in the floor of mouth against the mandible caused by forceful compression of the floor of mouth. The mental nerve exits the mental foramen just below the first or second premolar and supplies sensation to the lower lip and chin. The superior laryngeal nerve provides sensory innervation to the supraglottis. The glossopharyngeal nerve provides sensory innervation and taste sensation to the base of the tongue. The recurrent laryngeal nerve provides motor innervation to the laryngeal musculature.

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120. A 1-month-old infant is brought to the office by her parents for evaluation of a skull deformity. CT scan of the head is shown above. Which of the following cranial dysmorphologies is the most likely diagnosis?

- A) Dolichocephaly
- B) Plagiocephaly
- C) Scaphocephaly
- D) Trigonocephaly
- E) Turricephaly

The correct response is Option D.

The CT scan demonstrates an infant with a narrowed forehead and decreased bitemporal distance. There is also evidence of orbital hypotelorism and an obliterated or fused metopic suture. These findings are consistent with trigonocephaly.

Scaphocephaly is a cranial shape excessive in the anterior-posterior dimension and narrow in the bitemporal dimension. This results in a long and narrow (boat-like) shape of the head. This results from premature fusion of the sagittal suture.

Dolichocephaly is another term for scaphocephaly.

Plagiocephaly or “twisted head” is used to describe anterior or posterior deformities. Plagiocephaly is classified as anterior or posterior as well as synostotic and nonsynostotic or deformational. Anterior synostotic plagiocephaly refers to coronal craniosynostosis and posterior synostotic plagiocephaly refers to lambdoid craniosynostosis. Anterior or posterior nonsynostotic plagiocephaly refers to deformational plagiocephaly or skull molding from a persistent sleep position.

Turricephaly or oxycephaly is used to describe vertically tall head shapes that are usually associated with the brachycephaly (short in the anterior-posterior dimension) of bicoronal syndromic craniosynostosis.

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121. A 34-year-old woman undergoes a down-fracture of the maxilla during Le Fort I osteotomy. Profuse bleeding is noted in the posterior aspect of the lateral nasal wall. Injury to which of the following arteries is most likely?

- A) Anterior ethmoidal
- B) Descending palatine
- C) Greater palatine
- D) Infraorbital
- E) Nasopalatine

The correct response is Option B.

The descending palatine artery is a branch of the third portion of the internal maxillary artery. It descends vertically within the perpendicular portion of the palatine bone. Injury to this vessel is not uncommon while performing a Le Fort I osteotomy. Division of this artery has been shown not to expose the maxilla to necrosis.

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122. A 6-month-old boy undergoes excision of a midline nasal mass. Operative findings include neural tissue without evidence of a dural covering. No underlying defect of the bone is noted. The mass in this patient is most likely which of the following types of lesions?

- A) Dermoid
- B) Encephalocele
- C) Glioma
- D) Neurilemoma
- E) Neurofibroma

The correct response is Option C.

Based on the operative findings, this mass is a glioma. A congenital midline nasal mass is most likely to be a dermoid cyst, an encephalocele, or a glioma. Diagnosis can be facilitated by preoperative imaging studies. A dermoid cyst, which is the most common congenital nasal mass, typically contains sebaceous material and may communicate with the intracranial space. An encephalocele, which is a protrusion of the brain through an embryologic defect in the skull, is always covered by the dura. However, the content of the dural sac may vary. Gliomas consist of glial neural tissue and are not surrounded by dura. However, they may maintain a connection to it. Gliomas require thorough resection because of the risk of recurrence.

A neurilemoma or neurofibroma is not likely to arise as a midline nasal mass in a 6-month-old infant.

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123. Which of the following best describes the pathway of the accessory (XI) nerve after it enters the posterior triangle of the neck?

- A) Within the subcutaneous fat
- B) Within the carotid sheath
- C) Within the inferior portion of the sternocleidomastoid muscle
- D) Deep to the investing fascia
- E) Deep to the prevertebral fascia

The correct response is Option D.

The accessory nerve descends through the jugular foramen into the neck between the internal carotid and internal jugular vein. It crosses the internal jugular vein and is joined by fibers from the ventral ramus of C2. It gives off a motor branch to the sternocleidomastoid muscle before passing deep to or through this muscle. It emerges on the posterior border of the sternocleidomastoid muscle always in the upper half of this muscle. It enters the posterior triangle of the neck passing obliquely across the floor over the levator scapulae just deep to the investing fascia and superficial to the prevertebral fascia. It supplies motor fibers to the trapezius.

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

124. A 3-month-old infant has bifacial microsomia and mandibular hypoplasia (shown). Which of the following is the best rationale for performing tongue-lip adhesion in this patient?

- A) Improve maxillary dentition
- B) Optimize airway patency
- C) Promote mandibular growth
- D) Promote maxillary growth
- E) Protect mandibular dentition

The correct response is Option B.

Tongue-lip adhesion is performed in patients with retrognathia and glossoptosis to improve the airway. Pierre Robin sequence describes the clinical triad of microretrognathia, glossoptosis, and upper airway obstruction. Patients may present with airway obstruction, feeding difficulties, or both immediately after birth or during the following weeks of life. If left untreated, many of

these infants experience failure to thrive, chronic hypoxemia, and cor pulmonale. Pierre Robin sequence may be nonsyndromic or associated with syndromes such as bifacial or hemifacial microsomia. Tongue-lip adhesion was first described as a treatment of upper airway obstruction in Pierre Robin sequence by Douglas in 1946. There has been a recent trend toward distraction osteogenesis of the infant mandible in patients who present with microretrognathia and airway obstruction. However, the long-term effects of distraction on the infant mandible have not been well studied. The efficacy of tongue-lip adhesion in improving airway obstruction with minimal sequelae has been documented and should be considered before distraction.

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

125. A 13-year-old boy who underwent repair of bilateral cleft lip at 3 months of age and repair of cleft palate at 9 months of age is being evaluated after alveolar bone grafting. He has undergone orthodontic treatment, but a 12-mm negative overjet remains. A photograph is shown. Which of the following operative procedures is most appropriate?

- A) Le Fort I osteotomy with distraction
- B) Le Fort I osteotomy with immediate advancement
- C) Le Fort III osteotomy with distraction
- D) Le Fort II osteotomy with immediate advancement

The correct response is Option A.

This patient has severe maxillary retrusion associated with bilateral cleft lip and palate. He has undergone bone grafting and orthodontic treatment, and his deformity is at the Le Fort I level, involving the tooth-bearing maxilla. Distraction osteogenesis at the Le Fort I level has become the mainstay for managing severe maxillary retrusion associated with cleft lip and palate. Before the advent of distraction, traditional Le Fort I advancement would give inadequate advancement due to palatal scarring, and many surgeons simultaneously performed mandibular setbacks to obtain class I occlusion at the expense of facial aesthetics. With distraction, significant

advancements can be accomplished. If the osteotomy is performed at the Le Fort III level, vertical elongation of the orbit and resultant enophthalmos occur.

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126. In neonates with submucous cleft palate, the zona pellucida results from abnormal morphology of which of the following muscles?

- A) Levator veli palatini
- B) Muscularis uvulae
- C) Palatopharyngeus
- D) Pharyngeal constrictor
- E) Tensor veli palatini

The correct response is Option A.

The zona pellucida is formed by parallel bulges of anterior-posterior muscle on either side of the soft palate in the midline. Between these paired and cleft levator veli palatini muscles is a bluish two-layered mucosal bridge, which is the submucous cleft palate. With abnormal morphology, the levator veli palatini muscles insert into the posterior edge of the hard palate, causing Veau's cleft muscle as is seen in the typical cleft palate. The levator veli palatini muscles originate from the petrous portion of the temporal bone and the medial surface of the auditory tube and insert in the middle soft palate. Inferiorly, they form a V-shaped sling that suspends the velum from the base of the cranium and pull the soft palate up and back.

The other muscles listed are unrelated to submucous cleft palate. The muscularis uvulae runs longitudinally along the medial palate from the tensor aponeurosis to the uvula. During speech, it functions as a flexible beam, lifting and bending the palate back and modifying the stiffness of the palate.

The palatopharyngeus muscle originates from the palatal aponeurosis and runs to the posterior pharyngeal pillar. It functions to depress the palate and displace it backward. It is used to perform the sphincter pharyngoplasty.

The superior pharyngeal constrictor muscle is a continuation of the posterior buccinator and tongue. This muscle curves back and up, ending in a tendinous median raphe attached to the occipital bone. It serves to pull the lateral and posterior pharyngeal walls medially, narrowing the pharynx. In patients with velopharyngeal insufficiency, a horizontal bend in this muscle elevates the mucosa to form a ridge at the junction of the nasopharynx and oropharynx. In patients with cleft palate, this hypertrophied area is called Passavant ridge.

The tensor veli palatini muscle originates from the scaphoid fossa, medial pterygoid plate, and spine of the sphenoid. It courses inferiorly around the hamulus to form the palatal aponeurosis. It acts to tighten the palate so the tongue has a firm surface against which to create a bolus of food. It is primarily involved in swallowing, rather than in speaking.

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127. Which of the following percentages best represents the incidence of paresthesia of the lower lip immediately after bilateral sagittal split osteotomy?

- A) 10%
- B) 30%
- C) 50%
- D) 70%
- E) 90%

The correct response is Option E.

Paresthesia of the lower lip is the most common immediate postoperative finding following a bilateral sagittal split osteotomy. It is generally bilateral and is due to neurapraxia resulting from stretch and compression of the inferior alveolar nerve as the mandible is mobilized and fixed into its new position. Studies have shown that the incidence of this finding ranges from 85% to 97% in the immediate postoperative period. In one study, 55% of the patients reported some degree of paresthesia at one month, which was further reduced to 12.5% at one year. The older the patient, the more protracted the sensory deficit.

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128. A 36-year-old man has fever and headache six months after sustaining a frontal sinus fracture involving the frontonasal duct in a motor vehicle collision. At the time of injury, he underwent open reduction and internal fixation of the anterior wall of the sinus using microplates and obliteration of the sinus with fat grafts. Current CT scan shows a mucocele. Which of the following is the most likely cause of this finding?
- A) Fat necrosis
 - B) Hardware failure
 - C) Osteomyelitis
 - D) Retained sinus mucosa
 - E) Undiagnosed fracture of the posterior wall

The correct response is Option D.

Retained sinus mucosa is most likely to cause a mucocele or mucopyocele. Although they typically occur in patients with untreated fractures of the frontal sinus, mucocèles can also develop if all of the mucosal lining is not removed during obliteration of the sinus. A mucocele is generally sterile and filled with secretions; if it becomes infected by bacteria, it is referred to as a mucopyocele.

Because a mucocele will continue to expand and cause pressure symptoms if left untreated, complete removal of all mucosal elements using a diamond-cut rotational burr is advocated. In addition, the duct and sinus should be obliterated using free cancellous bone grafts or vascularized soft-tissue flaps (i.e., a galeal flap), and the sinus wall should then be reconstructed. Any infection should be treated initially and allowed to resolve before the cavity is filled with graft material.

Osteomyelitis may result from extension of an infected external wound, mobilization of bone fragments, or devascularization of soft tissue. This condition may also occur in conjunction with a bone-eroding mucopyocele, but would by itself not lead to development of mucocele.

Fractures of the posterior wall of the frontal sinus can lead to meningeal tears and subsequent cerebrospinal fluid leak. The fracture fragments may entrap the torn edges of the mucosa from within the sinus, leading to meningitis or development of an abscess resulting from transmission of contaminated sinus secretions.

Cancellous bone and vascularized soft-tissue flaps are the preferred fill materials for sinus obliteration procedures. Free fat and muscle grafts are associated with necrosis and potential resorption. Use of hydroxyapatite cement has produced results inferior to cancellous bone. Likewise, devascularized soft-tissue grafts are not recommended.

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129. During normal development of the secondary palate, elevation of the palatal shelf occurs at approximately how many weeks' gestation?

- A) 4
- B) 8
- C) 12
- D) 16
- E) 20

The correct response is Option B.

In the 7-week-old embryo, the two palatal shelves lie vertically. Starting with the eighth week, the neck straightens from its flexed position, the tongue drops posteriorly, and the shelves rotate superiorly to a horizontal position as they fuse from an anterior to posterior direction.

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130. A 24-year-old woman is referred to the office by her orthodontist for evaluation of facial disharmony. The following angles are obtained on cephalometric analysis:

SNA	70 (normal = 81.2)
SNB	77 (normal = 77.3)
SN-pogonion	87 (normal = 80)

Which of the following procedures is most effective to achieve facial symmetry in this patient?

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

The correct response is Option B.

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

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

Normal angle values are given in the text. This patient has a relatively retrusive maxilla and a normally positioned mandible. This would represent a class III relation. The pogonion is anteriorly displaced in relation to both the mandible and the maxilla.

Therefore, to establish better facial relationships, the maxilla should be advanced at the Le Fort I level and the chin setback via a genioplasty. The mandible does not need to be moved.

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131. A 31-year-old man undergoes open reduction and internal fixation of a naso-orbital-ethmoid fracture. During the procedure, avulsion of the right medial canthal tendon is noted. Which of the following is the most appropriate management?

- A) No intervention is needed
- B) Application of a long nasal splint
- C) Transnasal canthopexy
- D) Placement of a lacrimal stent
- E) Dacryocystorhinostomy

The correct response is Option C.

During open reduction and internal fixation of the naso-orbital-ethmoid fracture, care must be taken to ensure that the medial canthal tendon is not detached from the bone fragment. If the bone fragment is free but the canthal tendon is intact, the bone fragment can be fixed using transnasal fixation such as a transnasal wire. If the canthal tendon is partially detached, simple observation is likely to lead to complete detachment and telecanthus, which is difficult to treat postoperatively. Therefore, the most appropriate management of partial detachment of the medial canthal tendon is transnasal canthopexy with or without totally detaching the medial canthal tendon. Application of a long nasal splint is unlikely to keep the tendon adherent to the frontal process of the maxilla. Lacrimal stenting or dacryocystorhinostomy may be indicated for other reasons such as lacrimal obstruction; however, this is not necessary for the management of a detached medial canthal tendon.

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

132. A 1-month-old infant has right-sided microtia and hemifacial microsomia (shown). Weakness of which of the following branches of the facial nerve is demonstrated?

- A) Buccal
- B) Cervical
- C) Mandibular
- D) Temporal
- E) Zygomatic

The correct response is Option C.

The photograph of this patient demonstrates animation with symmetrical function of all branches of the facial nerve with the exception of the marginal mandibular branch on the right. The marginal mandibular branch is responsible for innervation of the lower lip depressor muscle, which is nonfunctional in this patient.

The second branchial cleft arch gives rise to the facial (VII) nerve. This nerve exits the skull at the stylomastoid foramen and contains motor and sensory fibers. It has six major branches: the temporal, zygomatic, buccal, mandibular, cervical, and auricular branches. The auricular branch

separates before the facial nerve turns to the parotid gland. At the parotid gland, the facial nerve separates into two main divisions, the temporofacial and cervicofacial divisions, which further divide into the temporal, zygomatic, buccal, mandibular, and cervical branches.

Hemifacial microsomia produces anomalies in skeletal, soft tissue, and neuromuscular structures derived from the first and second branchial arches. It is the second most common congenital facial anomaly and is unilateral in 80% of affected patients. Usually, patients have some form of microtia and hypoplasia of the mandibular ramus. They may also have macrostomia, facial paralysis, and hypoplasia of the muscles of mastication.

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133. A 22-year-old man sustains a left subcondylar fracture of the mandible during a motor vehicle collision. On CT scan, the condyle is displaced medially and anteriorly. This displacement is most likely caused by tension from which of the following muscles?

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

The correct response is Option B.

The inferior belly of the lateral pterygoid originates from the lateral pterygoid plate and inserts onto the scaphoid fossa of the condyle and joint capsule. The superior belly of the lateral pterygoid muscle originates from the sphenoid and inserts on the temporomandibular joint. The effect of the lateral pterygoid muscle is to displace the condyle medially and anteriorly in fractures of the condylar neck. It also tends to displace the meniscus anteriorly. The muscles inserting directly on the mandible exert significant forces on fracture fragments. An understanding of their direction of pull and insertions is important in the proper reduction and fixation of mandibular fractures. All the muscles of mastication serve to elevate and protrude the mandible. The elevators include the masseter, medial pterygoid, and temporalis. The temporalis inserts onto the coronoid process and the superior aspect of the external oblique line. The masseter inserts onto the lateral aspect of the mandibular angle while the medial pterygoid inserts on the medial aspect of the mandibular angle. None of these muscles directly affect the condyle. The mylohyoid muscle inserts on the body of the mandible, displacing segmental body fractures medially.

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134. The papilla of the parotid duct is most commonly located adjacent to which of the following maxillary teeth?

- A) First bicuspid
- B) Second bicuspid
- C) First molar
- D) Second molar
- E) Third molar

The correct response is Option D.

The papilla of the parotid is located most frequently adjacent to the maxillary second molar as it empties the secretions of the parotid gland via Stensen's duct.

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

135. A 9-month-old boy has had the midline nasal mass shown since birth. On the basis of the photographic and CT findings, which of the following is the most likely diagnosis?

- A) Dermoid
- B) Encephalocele
- C) Glioma
- D) Rhabdomyosarcoma of the orbit
- E) Untreated obstructive hydrocephalus

The correct response is Option B.

Nasal dermoids, gliomas, and encephaloceles are congenital midline nasal lesions that share a similar embryopathogenesis. Early in development, a small fontanelle, the fonticulus frontalis, is briefly present between the frontal and nasal bones. A second prenasal space is seen at the same time between the nasal bones and the nasal cartilage. The prenasal space is referred to as the foramen cecum when it later becomes surrounded by bone. Inadequate closure of either the fonticulus frontalis or foramen cecum can lead to sinus tracts and/or dermoid formation in this region. Both gliomas and encephaloceles are ectodermal neural tissue of the brain that has

remained in the area of the fonticulus frontalis or foramen cecum. Encephaloceles always maintain a connection to the cerebrospinal fluid and are differentiated from gliomas by the presence of a defect in the cranium that allows herniation to occur (as seen in the CT scan shown). If untreated, obstructive hydrocephalus would not cause an isolated frontoethmoid skull defect but would likely present with macrocephaly. A pediatric rhabdomyosarcoma of the orbit would more likely present as an invasive soft-tissue mass causing proptosis.

References

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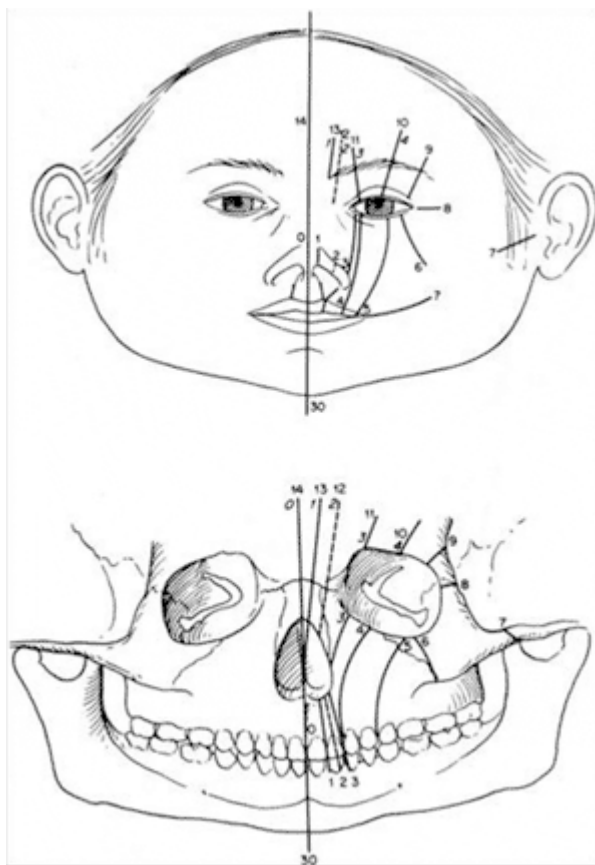
(Please note that this pictorial appears in color in the online examination.)

136. The 2-year-old boy shown is scheduled to undergo cleft repair. Which of the following is the most appropriate Tessier classification of this cleft?
- A) Tessier No. 0
 - B) Tessier No. 3
 - C) Tessier Nos. 6, 7, and 8
 - D) Tessier No. 7
 - E) Tessier No. 14

The correct response is Option D.

The orbit, nose, and mouth are key landmarks through which craniofacial clefts cross. Tessier noted these landmarks and numbered craniofacial clefts from 0 to 14, with lower numbers (0 through 7) representing facial clefts and the higher numbers (8 through 14) representing their

cranial extension. Tessier's numeric system is purely a topographic map of the cleft fault line (see diagram below); it describes the axis of the cleft but does not specifically indicate which structures (soft tissue or bone) may be involved by the cleft. The combination of cranial and facial clefts usually totals 14. Cleft 0 is in the midline of the face, whereas cleft 14 is its cranial midline extension. Clefts 1, 2, and 3 begin at the Cupid's bow, as does the common cleft lip. Treacher Collins syndrome is a combination of clefts 6, 7, and 8. The number 7 cleft is the most common of the craniofacial clefts and is more commonly referred to as hemifacial microsomia. The clinical expression of number 7 cleft is highly variable. In the photograph, this number 7 cleft is expressed only by macrostomia at the oral commissure.



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137. A 12-week-old girl has a cleft of the soft palate, symptoms of respiratory obstruction when lying supine, and history of poor weight gain. Which of the following is the most likely diagnosis?

- A) Hemifacial microsomia
- B) Isolated cleft palate
- C) Pierre Robin sequence
- D) Van der Woude syndrome
- E) Velocardiofacial syndrome

The correct response is Option C.

The child described has Pierre Robin sequence, which is associated with the symptoms of micrognathia, glossoptosis, and respiratory distress. Children with this condition often have difficulty with feedings as well. Pierre Robin sequence is believed to result from the tongue coming between the palatal shelves in the developing fetus. These patients are managed conservatively with positioning and tube feedings if necessary. If, however, the airway cannot be protected with positioning, then surgical management includes lip-tongue adhesion, distraction osteogenesis, and if necessary, tracheostomy.

Hemifacial microsomia is manifest by underdevelopment of the middle and external ear, zygoma, maxilla, and facial muscles and often is associated with a Tessier No. 7 cleft (macrostomia).

Isolated cleft palate does not cause airway obstruction or micrognathia but can be associated with slow weight gain and difficulty feeding.

Van der Woude syndrome is associated with cleft lip and palate and lower lip pits from accessory salivary glands.

Velocardiofacial syndrome is the most common syndrome seen in association with cleft lip and palate. Other clinical manifestations associated with this syndrome include velopharyngeal insufficiency, facial and cardiac anomalies, and absence of the thymus and parathyroid glands.

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138. Which of the following structures travels through the foramen rotundum?

- A) First division of the trigeminal (V) nerve
- B) Second division of the trigeminal (V) nerve
- C) Third division of the trigeminal (V) nerve
- D) Optic (II) nerve
- E) Middle meningeal artery

The correct response is Option B.

The maxillary division of the trigeminal nerve travels through the foramen rotundum. The ophthalmic division of the trigeminal nerve travels through the superior orbital fissure. The mandibular division of the trigeminal nerve travels through the foramen ovale. The foramen spinosum carries the middle meningeal artery. The optic nerve travels through the optic foramen.

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139. A 6-year-old boy is brought to the office by his parents for consultation regarding bilateral congenital facial palsy and syndactyly of the hands. He underwent surgical correction of strabismus five years ago. Which of the following conditions is the most likely cause of this patient's symptoms?

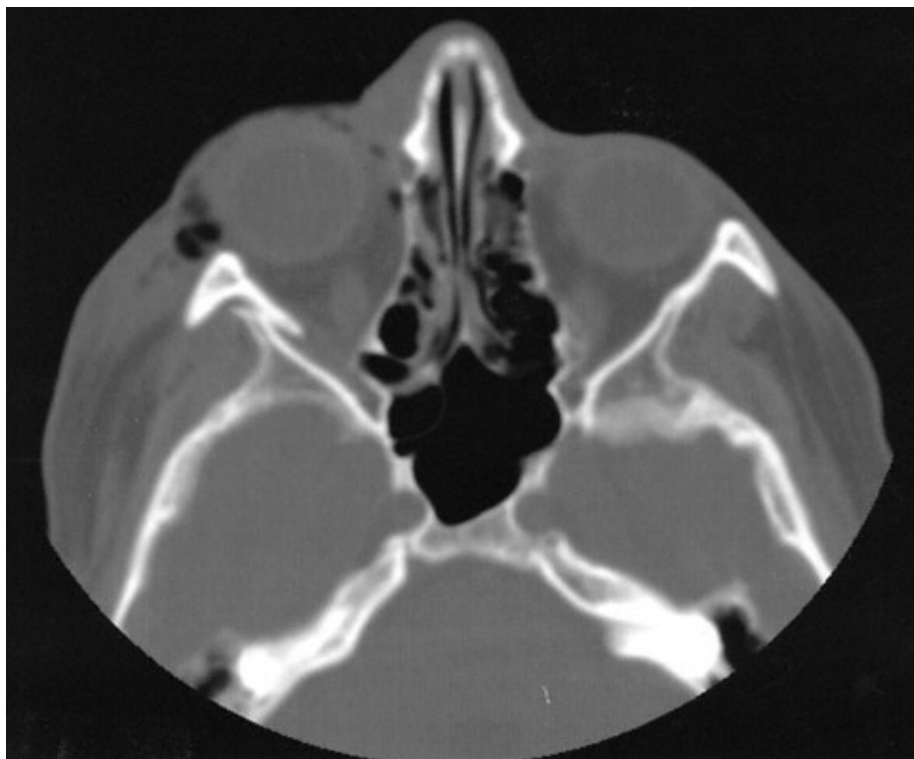
- A) Apert syndrome
- B) Bell palsy
- C) Goldenhar syndrome
- D) Hemifacial microsomia
- E) Möbius syndrome

The correct response is Option E.

Möbius syndrome is a developmental disorder characterized by bilateral facial palsy and abducens nerve paralysis. Strabismus surgery is performed to correct paralysis of lateral gaze. Limb abnormalities, including clubfeet, syndactyly, and rudimentary fingers or toes, have been reported in 25% of cases. Additional cranial nerves (III, V, IX, XI, and XII) may be involved in Möbius syndrome, and some patients may present with congenital unilateral or partial facial paralysis. Hemifacial microsomia is a morphogenetic anomaly that can affect the skeletal, soft tissue, and neuromuscular structures derived from the first and second branchial arches. Typical cases have hypoplasia of the mandible that may be accompanied by hypoplasia of the zygoma and maxilla. Because the facial nerve is derived from the second branchial arch, patients with hemifacial microsomia can present with a congenital facial palsy. Goldenhar syndrome is hemifacial microsomia with epibulbar dermoids and vertebral anomalies. Apert syndrome is characterized by coronal craniosynostosis, syndactyly, and retardation. Bell palsy is a demyelinating inflammatory process of the facial nerve that classically presents as an acute unilateral facial paralysis and is believed to be caused by the herpes simplex virus.

References

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2. Lenert JJ, Viterbo F, Johnson PC. Pediatric facial paralysis. In: Bentz ML, ed. *Pediatric Plastic Surgery*. Stamford, CT: Appleton & Lange; 1998:427-462.



140. The CT scan shown demonstrates a fracture of which of the following bones?

- A) Ethmoid
- B) Maxillary
- C) Palatine
- D) Parietal
- E) Sphenoid

The correct response is Option E.

In the CT scan, the lateral orbital wall is fractured. The lateral orbital wall is made up of the zygoma and the greater wing of the sphenoid. The medial orbital wall is made up of the ethmoid and palatine bones, and no fracture of these is demonstrated. The parietal bone largely is a cranial bone, which is not fractured in this CT scan. The maxillary bone, making up the buttresses and walls of the maxillary sinus, a portion of the orbital floor, and the medial aspect of the inferior orbital rim, is not fractured in this CT scan.

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

141. A 70-year-old man is referred for evaluation of a 2.2×1.3 -cm pigmented lesion on the right side of the neck over the midsection of the sternocleidomastoid muscle. Punch biopsy shows lentigo maligna melanoma with a Breslow thickness of 0.6 mm. Wide surgical excision with a 1-cm margin is performed. A photograph is shown above. The specimen report upgrades the Breslow thickness to 1.2 mm. Further evaluation, including CT scan of the head, neck, chest, and abdomen, shows no associated metastases. Which of the following represents the amount of additional margin of excision that is needed for adequate local management of this lesion?

- A) No additional margin is necessary
- B) 0.5 cm
- C) 2 cm
- D) 3 cm
- E) 5 cm

The correct response is Option A.

Breslow thickness measured from the top of the granular layer to the deepest level of tumor is the single most important factor in the prognosis of melanoma. Sampling error failing to reveal the deepest point of a lesion during incisional biopsy techniques is quite common, even in experienced hands. This leads to possible need for reexcision and sometimes lymph node management. The punch biopsy either picked up a thinner area or did not include the full thickness of skin. Because of the surface extent of the lesion, a punch biopsy is still appropriate

as the initial diagnostic method; however, when the entire lesion is analyzed, the thicker areas may be revealed and call into question the adequacy of the original margin of excision. In this case, no additional margin is necessary. A study performed by the World Health Organization has shown that for melanomas less than 2 mm, a surgical margin of 1 cm is just as effective as a 3-cm margin, and there is no difference in locoregional recurrence, in-transit metastases, or five-year survival rates.

Current practice recommendations advise a margin of excision of 0.5 to 1 cm for in situ melanoma. Invasive lesions with a Breslow thickness between 0 and 1 mm should have a 1-cm margin of excision. For lesions between 1 and 2 mm, a 1- to 2-cm margin is acceptable, using closer to 2 cm when the anatomic area is more forgiving, such as the trunk, or when the thickness is closer to 2 mm. Lesions between 2.1 and 4 mm should have a 2-cm margin. For lesions thicker than 4 mm, a margin of at least 2 cm should be used, but a 3-cm margin should be considered if ulceration of the tumor is present.

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142. The harlequin deformity occurs most commonly in patients with which of the following craniosynostoses?

- A) Coronal
- B) Crouzon syndrome
- C) Lambdoidal
- D) Metopic
- E) Sagittal

The correct response is Option A.

The harlequin deformity is a radiographic appearance characterized by an oblique opacity extending from inferior and medial to superior and lateral through the orbital aperture. This is caused by superior displacement of the lesser wing of the sphenoid secondary to synostosis of the coronal suture on the side of the harlequin appearance.

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143. A 22-year-old man sustains a transverse, noncomminuted fracture of the right mandibular angle when he is struck in the face during a fistfight. Which of the following interventions best adheres to Champy's principle for management of this fracture?

- A) Dynamic compression plate with bicortical screws on the inferior edge of the mandible and a superior tension band
- B) Dynamic compression plate with bicortical screws and a mandibular arch bar
- C) Lag screw
- D) Miniplate with monocortical screws along the external oblique ridge
- E) Reconstruction plate with bicortical screws

The correct response is Option D.

Champy's principles for fracture management call for placement of miniplates along the lines of tension in the mandible at the site of the fracture. Because compression is not necessary, the miniplates can be anchored with monocortical screws. Based on the muscular forces pulling on the mandible, Champy determined that, anterior to the canine tooth, two miniplates are needed to control the rotational forces of the genial and digastric muscles; posterior to the canine tooth, just one miniplate is required.

In a 10-year review examining various methods for treating fractures of the mandibular angle, Ellis concluded that use of a single 2.0-mm noncompression miniplate was associated with fewer complications than a double-plate system (one using two compression or noncompression plates) or a reconstruction plate.

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144. In patients with vertical maxillary excess undergoing Le Fort osteotomy with maxillary impaction, which of the following findings is most likely postoperatively?

- A) Increased mentalis strain
- B) Increased upper incisal show
- C) More obtuse nasolabial angle
- D) Retrogenia
- E) Widened alar base

The correct response is Option E.

Patients with vertical maxillary excess, or long face syndrome, have a narrow alar base, an obtuse nasolabial angle, and an anterior open bite. Mentalis muscle strain and labial incompetence are increased, and there is excess gingival show and exposure of the upper incisors.

Appropriate management is Le Fort I osteotomy with maxillary impaction; osseous genioplasty is also performed in some patients. These procedures will correct many of the findings associated with this condition, including decreasing the mentalis muscle strain and incisal show and creating a more acute nasolabial angle. The alar base will be widened. Le Fort I osteotomy also rotates the mandible forward and upward, resolving the retrogenia associated with long face syndrome. Postoperative lateral cephalograms will show forward autorotation of the mandible with counterclockwise rotation.

References

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145. The C flap in the Millard rotation advancement repair of unilateral cleft lip is used to achieve which of the following?

- A) Lengthening of the columella
- B) Lengthening of the lip
- C) Reduction of alar flare
- D) Shortening of the lip
- E) Symmetry in the philtral column

The correct response is Option A.

One of the characteristic findings in the unilateral cleft deformity is a shortened columella. The C flap is designed to lengthen the columella. Other findings in the unilateral cleft nose include deviation and distortion of the septum (corrected with presurgical orthodontics), dislocation and slumping of the alar cartilage (corrected by dissecting the medial part of the cartilage and constructing a medial crus by suturing to the normal side), and flaring of the alar base (corrected with the alar cinch procedure).

References

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146. A 26-year-old man comes to the office because he has pain in the mandible seven days after undergoing open reduction and internal fixation of a fracture of the mandible. Physical examination shows infection in the submandibular space. Which of the following teeth are the most likely source of this infection?

- A) Mandibular canines
- B) Mandibular central incisors
- C) Mandibular first and second premolars
- D) Mandibular second and third molars
- E) Maxillary second and third molars

The correct response is Option D.

The submandibular space is located inferolateral to the mylohyoid muscle and superior to the hyoid bone. The contents of the submandibular space include the submandibular gland, lymph nodes, the facial vein and artery, and the inferior loop of the hypoglossal (XII) nerve. Anteriorly, the submandibular space communicates with the submental space and posteriorly with the pharyngeal space. The sublingual space is located superomedial to the mylohyoid muscle. Involvement of the submandibular space is produced principally by infections of the second and third mandibular molars because of the more superior position of the mylohyoid ridge on the mandible posteriorly, which places the root apices of the second and third molars beneath the mylohyoid muscle. Infections of the maxillary molars, when they extend through the buccal cortical plates above the attachments of the buccinator muscle, can present as infections of the buccal space. Infections from the anterior mandibular teeth (anterior to the second molar) usually drain above the mylohyoid muscle into the sublingual space.

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147. A 48-year-old man is brought to the emergency department one hour after he sustained injuries to the face in a motor vehicle collision. Radiographs show an orbital zygomatic fracture. Which of the following is the single most important landmark for proper alignment of this fracture?

- A) Infraorbital rim
- B) Zygomaticofrontal buttress
- C) Zygomaticomaxillary buttress
- D) Zygomaticosphenoid articulation
- E) Zygomaticotemporal buttress

The correct response is Option D.

Seven bones comprise the orbit: ethmoid, frontal, lacrimal, maxilla, palatine, and greater and lesser wings of the sphenoid. The orbital wall is formed primarily by the orbital surface of the zygomatic bone and the greater wing of the sphenoid bone. The sphenoid portion of the lateral orbit is separated from the roof of the orbit by the superior orbital fissure and from the floor by the inferior orbital fissure. A classic orbital zygomatic fracture requires a fracture through the lateral orbital wall, which represents articulation of the zygoma with the greater wing of the sphenoid. Because this is a broad articulation, it provides a good location to assess the degree of displacement and malposition of the fracture fragment. Anatomic reduction of the greater wing of the sphenoid and lateral wall of the orbit is critical to proper reduction for an orbital zygomatic fracture. Although the infraorbital rim, zygomaticofrontal buttress, zygomaticomaxillary buttress, and zygomaticotemporal buttress are all important landmarks and need to be assessed for degree of fracture comminution, it is possible to reduce these segments while the zygoma and sphenoid articulation is out of alignment.

References

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148. A 40-year-old man has swelling of the face and bleeding from the nose after he was kicked by a horse. Physical examination shows fracture of the frontal sinus. CT scan of the head shows pneumocephalus and displacement of the anterior and posterior walls of the frontal sinus secondary to comminuted fractures of both sinuses. Which of the following is the most appropriate management?

- A) Ablation of the frontal sinus
- B) Cranialization of the frontal sinus
- C) Enlargement of the frontonasal duct
- D) Exenteration of the frontal sinus
- E) Obliteration of the frontal sinus

The correct response is Option B.

Cranialization of the frontal sinus is the most appropriate management of a patient with significant displacement of both the anterior and posterior tables of the sinus. This procedure allows close inspection of the dura for possible tear as well as dealing with possible injury of the nasofrontal duct. Craniotomy via a bicoronal approach is used to expose the fracture, and then the posterior table and sinus mucosa are removed. The nasofrontal duct is occluded with a pericranial flap to disrupt the communication of the duct.

Ablation involves removing the frontal sinus in its entirety and is no longer done because of the secondary cosmetic defects.

Enlargement of the frontonasal duct via stenting or dilation to ensure adequate drainage of the sinus is used in isolated fractures around the duct and would not address the problem of the posterior and anterior tables.

Exenteration is removal of the anterior table of the sinus alone and is used in isolated cases of anterior wall fracture when reconstruction is not an option at the time, i.e., due to infection.

Obliteration of the sinus is done by removing all the mucosa within the frontal sinus and allowing the nasofrontal duct to occlude. Frequently, graft material is used to fill this space. This technique is used in patients in whom the patency of the nasofrontal duct is questioned.

References

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149. The application of a locking reconstruction plate to a comminuted mandibular fracture is LEAST likely to cause which of the following?

- A) Decreased bone resorption
- B) More difficulty in contouring the plate
- C) Hardware failure
- D) Hardware-related infection
- E) Malocclusion

The correct response is Option E.

Use of a locking reconstruction bone plate has been shown to decrease postoperative malocclusion after a comminuted fracture of the mandible. A conventional (nonlocking) bone plate requires precise adaptation of the plate to the underlying bone. Without intimate contact, the bone is drawn toward the plate when the screws are tightened, altering the position of the osseous segments and the occlusal relationship. However, a locking bone plate does not require intimate contact of plate to bone because the bony segments are secured by screws that are locked to the plate. This makes it less likely for screw insertion to alter the reduction and, ultimately, the occlusion.

Cortical compression, blood supply disruption, and associated bone resorption occur less frequently with locking plates than with standard reconstruction plates. Difficulty in plate contouring is less likely to occur with locking plates because they require less precise bending than do conventional plates, which depend on intimate bony contact for stability. No increase in hardware failure has been noted with locking plates. In fact, screws in locking plates are less likely to become loose than those in standard reconstruction plates. The rate of hardware-related infection with locking plates is similar to the rate with standard reconstruction plates.

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150. A 12-year-old girl is scheduled to undergo surgically assisted maxillary expansion for correction of transverse maxillary deficiency. During this subtotal Le Fort I procedure, completion of each of the following osteotomies is appropriate EXCEPT

- A) lateral nasal walls bilaterally
- B) anterior and lateral antral walls bilaterally
- C) pterygoid plates bilaterally
- D) palatal midline
- E) nasal septum

The correct response is Option A.

Complete osteotomy of the thin lateral nasal walls is unnecessary. This structure offers little resistance to transverse expansion. Additionally, the lateral nasal walls help maintain the spatial relationship of the mobilized maxilla.

Completion osteotomies of the anterior antral walls, the lateral antral walls, and the pterygoid plates bilaterally as well as the midpalatal suture and the nasal septum are necessary for unhindered symmetric expansion of the maxillary halves.

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Section 4: Hand

151. A 1-year-old boy is brought to the office by his parents for consultation of a flexion deformity of the right thumb. Physical examination shows fixed flexion of the thumb at the interphalangeal joint. No other abnormalities are noted. Which of the following is the most likely diagnosis?

- A) Camptodactyly
- B) Clinodactyly
- C) Delta phalanx
- D) Macrodactyly
- E) Trigger thumb

The correct response is Option E.

Trigger digit reportedly occurs with an incidence of 1 in 2000 to 3 in 1000 births. Whereas most authorities believe this deformity is a congenital abnormality, there is debate whether trigger digit is an acquired deformity. The congenital trigger finger presents as a flexed digit either at birth or up to 3 years of age. Often it may not be recognized early because of the tendencies of infants to hold their fingers in a flexed position. Before 12 months of age, observation is the standard treatment. After 3 years of age, surgical release is generally recommended. The results of conservative nonoperative treatment and spontaneous recovery have been reported as between 0% and 30%.

Trigger digit can be confused with the diagnosis of camptodactyly, which is a congenital flexion posture most often found in the small finger. Although congenital trigger thumb is related to a nodule in the tendon, the etiology of camptodactyly is less clear, with various etiologies related to skin deficit, volar plate abnormalities, and abnormalities of the lumbrical and superficialis tendons.

Abnormally angulated digits in the radial ulnar plane is clinodactyly. Clinodactyly may be associated with a delta phalanx, which is an abnormally shaped, short tubular bone within the digit.

Macrodactyly refers to an abnormal enlargement of the digit. In true macrodactyly, all structures of the digits are enlarged.

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152. A 13-year-old girl comes to the office for consultation regarding a volar defect of the right thumb she sustained two months ago from an electrical burn to the right arm. On physical examination, bone and tendon are exposed from the metacarpophalangeal crease to the pad. Healed burn scar wounds are noted on the dorsum of the index finger along with most of the skin below the elbow. Which of the following is the most appropriate method of reconstructing this patient's thumb?
- A) First dorsal metacarpal artery flap
 - B) Free innervated, first web space flap
 - C) Moberg flap
 - D) Skin graft
 - E) Groin flap

The correct response is Option B.

This defect is too large for reconstruction with a Moberg flap. Typically, the Moberg flap is suitable for 1- to 1.5-cm defects. A skin graft would be inappropriate because bone is exposed along the wound. Because the index finger is burned, the first dorsal metacarpal artery flap, which would usually be the first choice for this type of defect, is not available. The groin flap would be insensate and unstable and, therefore, is a poor option for reconstruction of the thumb. In the thumb, sensory restoration is crucial for hand function; therefore, an innervated flap is preferred.

The gold standard neurosensory flap is the first web space flap. The first web space flap is harvested from the lateral aspect of the great toe and the medial aspect of the second toe. The general dimensions of the flap are 6 cm transversely and 3 cm longitudinally. This flap usually is based on the first dorsal metatarsal artery, which is a branch of the dorsalis pedis artery. It also can be based on the first plantar metatarsal artery, but the dorsal branch usually is used because of difficulty with exposure of the first plantar metatarsal artery. If more pedicle length is required, the arterial dissection can be extended to include the dorsalis pedis artery. The venous drainage of the first web space flap is reliable because either or both the venae comitantes and the saphenous system can be used. Usually, the flap is harvested with the saphenous vein system because of its large caliber and easier dissection. There are several advantages to the use of the first web space flap for sensory restoration of the hand. The first web space flap provides a sensate glabrous surface similar to sensate glabrous defects of the hand. The flap has a relatively constant vascular and neural anatomy. The donor site usually can be covered with a split-thickness skin graft with minimal donor morbidity and minimal disturbance of foot

mechanics. Studies have demonstrated a recovery of two-point discrimination of 3 to 8 mm with this flap for the thumb.

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

153. A 25-year-old woman comes to the office for consultation regarding an injury to the left thumb (shown). During surgical repair of this injury, which of the following is the sequence in which anatomic structures will be encountered?

- A) Abductor pollicis, flexor pollicis longus, volar plate
- B) First dorsal interosseous, oblique pulley, volar plate
- C) Juntura tendineum, extensor pollicis longus, collateral ligament
- D) Sagittal bands, adductor aponeurosis, collateral ligament
- E) Skin, ulnar collateral ligament, volar plate

The correct response is Option D.

This patient has an ulnar collateral ligament injury of the thumb metacarpophalangeal (MP) joint. Although the indications for surgical repair are controversial, the pertinent anatomy is consistent. After the skin and subcutaneous tissue are divided, the sagittal bands are encountered. The sagittal bands stabilize the extensor pollicis longus over the MP joints of the thumb and travel

from the lateral aspects of the tendon towards the flexor digital sheath. Repair of this structure is important to prevent subluxation of the tendon with thumb motion.

The adductor for aponeurosis is readily visible under the sagittal bands. This structure should also be tagged before division to facilitate accurate surgical repair. Once the adductor aponeurosis is divided, the ulnar collateral ligament is readily visible and amenable to repair.

The juncturae tendineum are extensor tendon connections on the dorsum of the hand and are not involved with the regional anatomy of the thumb. The extensor pollicis longus is usually dorsal to the area of dissection and does not require surgical manipulation.

The ulnar collateral ligament does not exist under the skin. The volar plate may be injured in a gamekeeper's type of injury and should be assessed. A clue to a significant volar plate injury requiring repair is volar subluxation of the proximal phalanx in relation to the metacarpal.

The abductor pollicis, flexor pollicis longus, and first dorsal interosseous are out of the zone of injury and should not be surgically disturbed.

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154. A 62-year-old man with type 2 diabetes mellitus has a nonhealing wound on the right foot six months after he sustained a degloving injury of the dorsal surface of the right foot. Radiographs obtained at the time of injury showed no abnormalities. Physical examination shows a 6 × 8-cm wound on the dorsal aspect of the foot with minimal granulation tissue, exposed tendons, and intact sensation to the sole. Which of the following is the most appropriate diagnostic study?
- A) Semmes-Weinstein monofilament test
 - B) MRI of the foot
 - C) Bone scan
 - D) Determination of ankle-brachial index
 - E) Measurement of transcutaneous oxygen

The correct response is Option E.

Not all wounds are capable of spontaneous healing. Patients with arterial insufficiency can experience delayed wound healing. The possibility of spontaneous healing of a wound can be assessed objectively. For a wound to heal spontaneously, the ankle pressure should exceed 40 mmHg, the great toe pressure should be greater than 40 mmHg, and the patient should have pulsatile plethysmography and a transcutaneous oxygen higher than 30 torr. If one of these criteria is not met, the patient can be expected to have difficulty healing and further vascular assessment with angiography. Sometimes, these patients require revascularization to heal a wound. A flap reconstruction should not be performed on a patient with arterial insufficiency because this could result in an ischemic flap and nonhealing donor site or recipient vessel site wounds.

Semmes-Weinstein monofilament test will document qualitative sensory function. MRI will demonstrate the volume of soft tissue and bone involvement; a bone scan would indicate possible involvement of osteitis. None of these are determinants of healing. In a diabetic patient with noncompliant arteries, ankle-brachial index probably would be falsely normal.

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

155. A 14-year-old boy is brought to the emergency department 30 minutes after he sustained traumatic amputation of the index, long, and ring fingers of the dominant right hand (shown) when his hand was caught in an elevator door. Which of the following is the most appropriate method of replantation?
- A) Digit by digit → index finger, long finger, ring finger
 - B) Digit by digit → long finger, ring finger, index finger
 - C) Digit by digit → ring finger, long finger, index finger
 - D) Part by part → bone, flexor tendons, extensor tendons, nerves, arteries, veins
 - E) Part by part → flexor tendons, extensor tendons, bone, arteries, veins, nerves

The correct response is Option D.

The most appropriate method of replantation in this case is part by part → bone, flexor tendons, extensor tendons, nerves, arteries, veins. This patient has acute amputations and has

presented promptly to the emergency department. In addition, all amputated parts have been approximately equally well preserved. In this scenario, the longer ischemia times tolerated by digital amputations allow for increased operative efficiencies by group repair of similar parts.

Because all three digits have been equally preserved, replantation should proceed by group repair of similar parts. Therefore, the digit-by-digit options are incorrect. If the digits were in different states of preservation, with one or more digits being more mutilated than the others, then replantation would proceed digit by digit. In that scenario, the digit in the best condition would be replanted first and might be orthotopically replanted based on the clinical circumstance. In this particular instance, if the index digit were the only well preserved digit, then consideration would be given to replanting that digit in the ring position because ulnar-sided hand function is more important than index function radially.

Skeletal stability must always be restored before any soft-tissue repairs. This is usually performed with crossed K-wires. Therefore, replantation part by part → flexor tendons, extensor tendons, bone, arteries, veins, nerves is incorrect. The exact sequence of part-by-part repair thereafter is somewhat controversial; however, the heavier structures (flexor and extensor tendons) should be repaired first, followed by microsurgery. Arterial repair usually precedes venous repair, because the venous efflux assists with identification of the most desirable veins for anastomosis or grafting. The timing of the repairs often depends on tourniquet time but may be done either before the arterial repairs or after the venous repairs.

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156. A 30-year-old man who works as a brick mason comes to the emergency department one hour after he sustained an injury to the right wrist when he fell backward off a 10-foot-high wall. He has severe pain in the wrist as well as numbness in the fingers and thumb. Radiographs of the wrist are shown. Which of the following is the most appropriate management?

- A) Elevation of the hand and monitoring of compartment pressures with a wick catheter
- B) Carpal tunnel release only
- C) Carpal tunnel release and proximal row carpectomy
- D) Carpal tunnel release and scapholunate arthrodesis
- E) Carpal tunnel release, relocation of the lunate, and repair of the volar radiocarpal ligaments

The correct response is Option E.

This patient has sustained a trans-scaphoid, dorsal perilunate, volar lunate fracture dislocation. In addition to pain in the wrist, this injury often presents with acute carpal tunnel syndrome,

which must be recognized promptly and treated emergently. The lunate must be relocated from the carpal canal to the carpus, and the associated hematoma must be evacuated. After the lunate has been relocated, the volar radiocarpal ligaments must be repaired. Correct carpal alignment usually requires dorsal and volar approaches using a Kirschner wire in the lunate to function as a joystick. Reduction and fixation of the scaphoid are also required.

Acute carpal tunnel syndrome indicates ongoing compression and ischemia of the median nerve. Conservative measures such as elevation of the hand and serial measurement of compartment pressures are contraindicated. Proximal row carpectomy and scapholunate arthrodesis are options for treatment of degenerative arthritis of the wrist but should not be used as primary treatment of a fracture dislocation.

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157. A 30-year-old man is brought to the operating room for removal of a grade 2 fibrosarcoma on the right hand. He is otherwise healthy and currently takes no medications. Physical examination shows a 4 x 5-cm lesion on the dorsal aspect of the hand. Which of the following interventions is the most appropriate preparation for dissection of the lesion?
- A) Elevation of the arm for one minute and application of tourniquet pressure to 250 mmHg
 - B) Exsanguination with an elastic bandage and application of tourniquet pressure to 200 mmHg
 - C) Exsanguination with an elastic bandage and application of tourniquet pressure to 250 mmHg
 - D) Compression of the brachial artery, elevation of the arm for one minute, and application of tourniquet pressure to 250 mmHg
 - E) Compression of the radial and ulnar arteries, elevation of the arm for one minute, and application of tourniquet pressure to 250 mmHg

The correct response is Option D.

Exsanguination of the arm in patients with neoplastic tumors is not recommended due to the possibility of dissemination of tumor cells to other sites. The arm may be partially exsanguinated through elevation and compression of the brachial artery above the elbow for one minute. The tourniquet may then be inflated so dissection can proceed in a relatively bloodless field. Elevation of the arm alone has been found to be the least effective mechanism of exsanguination.

Tourniquet pressures have been shown to be adequate for dissection when they are approximately 50 to 75 mmHg greater than systolic pressure. Unnecessarily high tourniquet pressures may result in nerve injury and post-tourniquet paralysis. As a general rule in adults, most procedures can be performed with tourniquet pressures of 250 mmHg. In obese patients or in patients with significant hypertension or atherosclerotic disease, this may need to be increased to 300 mmHg. In this young patient, a pressure of 250 mmHg would suffice for surgery.

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158. A 24-year-old man is brought to the emergency department by ambulance because of injuries to the right leg he sustained in a motorcycle collision. Physical examination shows fracture of the tibia and fibula, thrombosis of the anterior and posterior tibial arteries, and transection of the posterior tibial and peroneal nerves just below the knee. Which of the following is the most appropriate management?

- A) External fixation
- B) Skeletal traction and vacuum-assisted closure of the wound
- C) Revascularization and coverage with a gastrocnemius flap
- D) Revascularization and coverage with a latissimus dorsi flap
- E) Below-the-knee amputation

The correct response is Option E.

This patient has sustained multiple traumas including injury to the skin, bone, arteries, and nerves. Using the injury severity scale, the prognosis of this injury is very poor. In an adult, there is little chance of regaining useful protective sensation or motor function after nerve repair in light of the open fractures and vascular injury. The best immediate management is amputation. Additionally, the return to weight-bearing and work is significantly shorter with amputation.

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159. A 52-year-old man who works as a watchmaker comes to the emergency department 30 minutes after he sustained avulsion of the volar skin of the dominant right thumb and index finger while using a bandsaw. Physical examination shows 2 × 2-cm wounds involving the distal phalanx of each affected digit. There is no exposed tendon or bone, and no involvement of the joints is noted. The patient requests a treatment option that will retain the most sensation. Which of the following is the most appropriate management of this patient's wounds?

- A) Radial forearm flap
- B) Coverage with cross-finger flaps
- C) Coverage with a thenar flap for the index finger and a cross-finger flap for the thumb
- D) Split-thickness skin grafting
- E) Full-thickness skin grafting

The correct response is Option E.

Because of his occupation, this patient requires the best sensation and the most rapid treatment possible. Local flaps such as cross-finger and thenar flaps are good options but require at least two operations (inset then division) and can result in stiffness. Local flaps also have lesser return of sensibility than the other techniques listed.

Return of tactile sensibility is excellent after treatment with application of dressings. However, dressing changes for wounds that measure a total of 2 cm² require a lengthy recovery time. This patient would undergo two to three months of dressing changes.

Skin grafting would be the next available option with acceptable sensory return. It is an operation that can be performed during local anesthesia, requires only one operation, and would allow for early motion. Interestingly, classic studies have shown that full-thickness skin grafts recover sensation better than split-thickness skin grafts.

A radial forearm flap will be excessively bulky and is not warranted. This procedure will result in inadequate sensory recovery.

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160. A 65-year-old woman comes to the office because she has had recurrent swelling of the right wrist over the past six months. She has also had some associated numbness of the index and long fingers of the right hand. Physical examination shows swelling of the palmar aspect of the wrist. Radiographs of the hand and wrist show no abnormalities. During surgical exploration, rice bodies are identified within the carpal canal as well as granuloma formation around the flexor tendons. Which of the following is the most appropriate next step?

- A) Acid-fast cultures of the tenosynovium
- B) CT scan of the abdomen
- C) Initiation of a course of allopurinol
- D) Potassium hydroxide preparation of tenosynovium
- E) Sampling of tenosynovium for amyloid

The correct response is Option A.

Tuberculous tenosynovitis is the most frequent tuberculous infection in the hand. It may clinically simulate rheumatoid tenosynovitis. The most common pathogen is *Mycobacterium marinum*. Radiographs often show no abnormalities and pathology alone will often show only nonspecific tenosynovitis, but granulomas may be present. Cultures must be requested at 30 degrees Celsius to identify *M. marinum*.

There are several diagnostic clues for tuberculous tenosynovitis, such as proliferative synovitis occurring in the absence of a known rheumatoid or collagen vascular disease as well as the presence of rice bodies during surgical exploration. Rice bodies are infected villous bodies on the synovial surface that break off and become trapped within the inflammatory mass.

CT scan of the abdomen is sometimes recommended for women with palmar fibromatosis and arthritis because this condition may be associated with ovarian cancer. Amyloidosis can cause tenosynovitis and carpal tunnel syndrome but does not commonly produce rice bodies. Allopurinol is a treatment for gout, and potassium hydroxide stains are used to identify fungus.

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161. A 13-year-old girl with cerebral palsy is brought to the office by her parents because she has had inability to voluntarily extend the dominant right wrist as well as weak grasp of the right hand since birth. On physical examination, when the fingers are held straight, the wrist can be brought to neutral. During grasp, there is ulnar deviation of the hand, and during extension of the fingers, there is radial deviation of the hand. Active extension of the fingers is intact, but active extension of the wrist is diminished. Dynamic electromyography confirms that function of the flexor carpi ulnaris (FCU) and flexor carpi radialis (FCR) tendons is intact. Which of the following is the most appropriate intervention for improvement in function of the hand?
- A) Fusion of the wrist
 - B) Proximal row carpectomy
 - C) Transfer of the superficialis tendon to the profundus tendon
 - D) Transfer of the FCR tendon to the extensor carpi radialis brevis tendon
 - E) Transfer of the FCU tendon to the extensor carpi radialis brevis tendon

The correct response is Option E.

In this patient, there is a lack of wrist extension, which severely limits grip strength and hand function. In patients with cerebral palsy, poor grasp is often secondary to weak or absent wrist extension. Returning active wrist extension will increase the mechanical advantage of the digital flexor tendons and increase grasp strength. Active wrist extension may be created with a tendon transfer.

During grasp, this patient's hand deviates to the ulnar aspect, suggesting a functioning flexor carpi ulnaris (FCU) tendon. Therefore, this tendon may be transferred to augment wrist extension. Muscles that fire during grasp work well when transferred for wrist extension, whereas muscles that act while the patient attempts to release objects work better for finger extension. Because this patient's wrist tends to deviate radially with finger release, the flexor carpi radialis (FCR) would be better transferred as a finger extensor. It is important to ensure that the FCR is working, if the FCU is going to be transferred.

Evaluation of the fingers and wrist is important before any tendon transfer. If the proximal interphalangeal and distal interphalangeal joints are passively extendable with wrist extension, then the digital flexors are relatively loose and do not require release before transfer. If the finger flexors were very tight, a transfer of the superficialis to the profundus tendon may be required to improve finger function. In cases of severe wrist contracture, a proximal row carpectomy may be necessary to allow extension of the wrist to neutral before tendon transfer. Wrist fusion may be an option in cases in which hygiene or cosmesis are the main concern or

when no other tendons are available for transfer, but it must be remembered that this will remove any tenodesis effect obtained by flexing or extending the wrist.

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

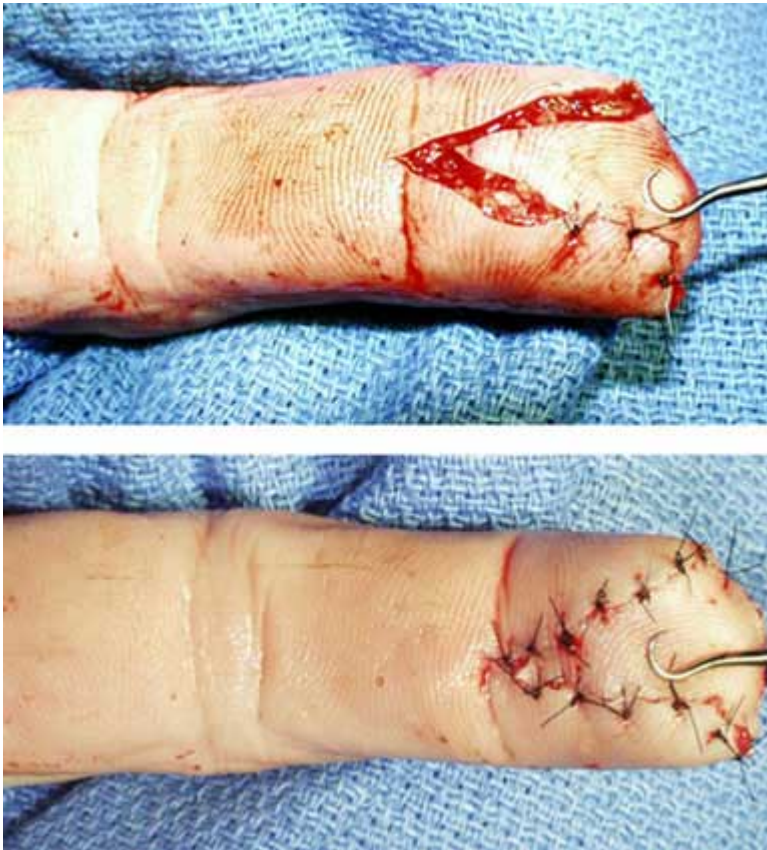
162. A 42-year-old man comes to the emergency department 45 minutes after he sustained an amputation injury to the long finger of the right hand (shown) when the hand was crushed in a truck tailgate as it was being closed. Physical examination shows exposed bone. No fractures are noted on radiographs of the hand. The most appropriate management of this patient's injury is reconstruction using which of the following techniques?

- A) Atasoy-Kleinert flap
- B) Cross-finger flap
- C) Moberg flap
- D) Split-thickness skin grafting
- E) Thenar flap

The correct response is Option A.

Goals in management of fingertip amputations include wound closure, maximizing sensory return, maintaining joint function, obtaining satisfactory cosmesis, and preservation of length, especially in the thumb. Split-thickness grafting would not be appropriate to cover with exposed bone. The cross-finger flap is a pedicled, heterodigital flap that brings in durable cover from the dorsal middle phalanx skin from an adjacent finger. The donor site requires a split-thickness skin graft for coverage. The thenar flap is a regional pedicled flap based on the soft tissue of the thenar eminence. Both the cross-finger flap and the thenar flap reconstructions have the

disadvantages of requiring a second stage for division and inset as well as problems with joint stiffness secondary to immobilization while awaiting vascular ingrowth from the recipient bed. The Atasoy-Kleinert flap is a homodigital V-Y advancement flap of the volar pulp tissue useful in transverse or oblique fingertip injuries with greater soft tissue on the volar aspect. The Atasoy-Kleinert flap is the best choice because it is a one-stage repair that allows primary closure of its donor site. The Moberg flap is a volar advancement flap used in thumb tip amputation coverage.



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

163. A 65-year-old man comes to the office because he has had worsening pain and stiffness in the right ring finger (shown) for the past five years. Which of the following additional findings will have the greatest impact on the decision to manage this patient's condition surgically?
- A) Loss of flexion of the metacarpophalangeal joint
 - B) Loss of flexion of the proximal interphalangeal joint
 - C) Loss of extension of the metacarpophalangeal joint
 - D) Loss of extension of the proximal interphalangeal joint
 - E) Palmar nodule

The correct response is Option D.

This patient has a Dupuytren's contracture of the hand. Dupuytren's disease is a benign fibroproliferative disorder of the palmar fascia that may result in disabling finger contractures.

This condition has been associated with epilepsy, alcoholism, chronic pulmonary disease, diabetes, and northern European ancestry. There is no cause-and-effect relationship between the existence of one of the comorbidities listed above and the development of Dupuytren's disease.

Because the risk of complications with this disease is significant, there are narrow indications that must be met to justify surgery for this condition. The surgery involves direct excision of the involved fascia. This can be performed through zig-zag (Brunner), midlateral, Y-to-V incisions, and longitudinal with zig-zag rearrangement incisions. The complications of Dupuytren's fasciectomy include recurrence, hematoma, skin loss, infection, nerve and arterial division, loss of flexion, reflex sympathetic dystrophy, and digital loss. Threshold indications concerning contractures are 30 degrees at the metacarpophalangeal (MP) joint and any at the interphalangeal (IP) joints, specifically the proximal interphalangeal (PIP) joint. Some studies have shown that when surgery was performed for patients with less than 30-degree MP joint contracture, surgery outcome was worse for some patients after fasciectomy. PIP joint contracture is not improved with joint release. Additionally, with or without PIP joint release, long-term improved motion is approximately 37% of the short-term improved motion.

The general indications for Dupuytren's fasciectomy include loss of 30 degrees of MP joint extension, any loss of proximal phalangeal joint extension, and neurovascular compromise. Spiral cords can wrap around the neurovascular bundles and cause neurovascular compromise. Solitary asymptomatic palmar nodules are observed. Tender nodules can be injected with corticosteroids or collagenase. Pain in the hand is not an indication for Dupuytren's surgery. The most commonly involved finger is the ring finger. The anatomic structures that are involved with Dupuytren's include pretendinous bands, spiral bands, lateral digital sheet, Grayson's ligament lateral digital sheet, and natatory ligament. The superficial transverse ligament, deep transverse ligaments, Cleland's ligament, and Landsmeer's ligament usually are not involved.

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164. A 25-year-old man who operates a jackhammer has had gradual onset of numbness and tingling for the past year. He says the discomfort awakens him every night and he is often clumsy when handling objects. Physical examination shows decreased sensation in the thumb, index finger, long finger, and radial ring finger. Weakness of thumb opposition and weakness of flexion of the thumb, index finger, and long finger are also noted. Which of the following is the most likely diagnosis?

- A) Anterior interosseous nerve palsy
- B) Carpal tunnel syndrome
- C) Cubital tunnel syndrome
- D) Posterior interosseous nerve palsy
- E) Pronator syndrome

The correct response is Option E.

Carpal tunnel syndrome, compression of the median nerve at the wrist, is the most common compression neuropathy of the upper extremity. It presents with pain and paresthesias in the cutaneous distribution of the median nerve, i.e., the thumb, index finger, long finger, and radial half of the ring finger, often worse at night and commonly exacerbated by repetitive use of the hand.

Median nerve compression neuropathies of the distal arm and proximal forearm are uncommon compared with carpal tunnel syndrome. The two most common problems of compression of the median nerve in the proximal forearm are anterior interosseous syndrome and pronator syndrome. Compression within different areas of the pronator teres results in either a pure motor deficit (anterior interosseous syndrome) or a mixed sensory and motor loss pattern (pronator syndrome). Forearm pain and numbness in the radial palm along with the thumb, index finger, long finger, and radial ring finger are common symptoms. Median intrinsic and extrinsic motor weakness also can be demonstrated on examination in pronator syndrome. The anterior interosseous nerve innervates the radial half of the flexor digitorum profundus (FDP), the flexor pollicis longus (FPL), and the pronator quadratus with sensory fibers to the radiocarpal, intercarpal, carpometacarpal, and radioulnar joints. Anterior interosseous nerve syndrome is characterized by impaired function of the FPL and FDP of the index finger with occasional involvement of the long finger and pronator quadratus. The thumb and index finger assume a classic position during pinch, with the distal interphalangeal (DIP) joint of the index finger extended and the proximal interphalangeal (PIP) joint of the index finger in compensatory flexion while the interphalangeal (IP) joint of the thumb is hyperextended.

Pronator syndrome presents with pain in the forearm as well as paresthesia and hypoesthesia in the cutaneous distribution of the median nerve. Patients may also complain of extremity

weakness secondary to pain. On physical examination, pain is noted on palpation over the proximal forearm and the pronator muscle may be tender, firm, or enlarged.

Cubital tunnel syndrome is caused by compression of the ulnar nerve at the elbow that manifests as numbness along the small and ulnar half of the ring fingers, often accompanied by weak grip, especially in activities in which torque is applied to a tool. On physical examination, percussion test at the cubital tunnel is positive or symptoms are exacerbated by full flexion of the elbow.

Posterior interosseous nerve palsy is caused by compression of the nerve after the radial nerve bifurcates just proximal to the elbow and involves weakness and pain without a sensory component. Onset is often insidious and may not be noticed by the patient until late weakness of finger and wrist extension or a radial drift of the hand with wrist extension develops.

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165. A 20-year-old woman who is a competitive gymnast comes to the office for evaluation of a soft, subcutaneous mass on the volar-radial aspect of the right wrist (shown). She says the mass fluctuated in size until one month ago; since then, the mass has remained persistently prominent and associated with achy, intermittent discomfort in the wrist. Which of the following interventions is most likely to result in the lowest risk of recurrence of the mass?
- A) Rupture
 - B) Injection
 - C) Aspiration
 - D) Incision
 - E) Excision

The correct response is Option E.

This patient has a ganglion, the most common soft-tissue tumor of the hand, which is prevalent in women between the second and fourth decades of life. Volar wrist ganglia usually arise from either the radiocarpal joint or the capsule of the scaphotrapezial joint and are the second most common ganglion of the hand, representing approximately 20%; dorsal wrist ganglia account for 60% to 70% of hand and wrist ganglia and most often originate at the scapholunate ligament. Treatments are categorized as nonoperative and operative. The lowest recurrence rates are associated with complete surgical excision of the ganglion.

Nonoperative treatments include needle decompression or aspiration, rupture by digital pressure or other blunt external force (striking the mass with a large book, for example), and injection with corticosteroids, sclerosing agents, local anesthetics, or combinations of these solutions. These techniques may reduce the mass and alleviate symptoms with limited success

for varying periods of time but are associated with higher rates of recurrence than surgical excision.

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3. Nahra ME, Bucchieri JS. Ganglion cysts and other tumor related conditions of the hand and wrist. *Hand Clin*. 2004;20:249-260.

166. A 42-year-old man is brought to the emergency department after he sustained major injuries when he fell from a ladder. In addition to abdominal trauma, he sustained lacerations of the flexor carpi ulnaris tendons, ulnar artery, ulnar nerve, flexor digitorum profundus tendons, flexor digitorum superficialis tendons, flexor pollicis longus muscles, palmaris longus tendon, median nerve, radial artery, and flexor carpi radialis tendon of the right arm. During emergent exploratory laparotomy with general anesthesia, an upper arm tourniquet is inflated to 250 mmHg. Two hours later, when the laparotomy is completed, the tourniquet is still in place and the patient is asleep. Which of the following is the most appropriate management of the injuries to this patient's hand?
- A) Release the tourniquet, close the skin, and repair the severed structures electively
 - B) Release the tourniquet and repair the severed structures immediately
 - C) Leave the tourniquet in place and repair the severed structures immediately
 - D) Release the tourniquet for five minutes, reinflate the tourniquet, and repair the severed structures
 - E) Release the tourniquet for 20 minutes, reinflate the tourniquet, and repair the severed structures

The correct response is Option E.

Difficult situations such as these often arise, especially in patients who have sustained multiple traumas. This patient has had a delay in the care of a cold hand because of a limb-threatening injury. Because of the threatened limb, closing the skin and performing the repairs on another day is not an option. Continuation of the tourniquet would be dangerous to this patient; the upper limit of time for tourniquet use in the upper extremity is most frequently defined as two hours, after which muscle and nerve damage begins. Performing the surgery without tourniquet control is an option but is not the best option in a true spaghetti-like wrist, for which a bloodless field is best for meticulous preparation and identification of structures. Of the options listed, the best choice is to release the tourniquet for 20 minutes (5 minutes for every 30 minutes the tourniquet was in use) and to finish the case immediately. Release of the tourniquet for only five minutes is not adequate after two hours of tourniquet use. Indeed, revascularization of the hand with closure of the wound, opting to finish the case on another day is an option, but was not offered as a choice for this item.

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

167. A 35-year-old man is brought to the emergency department because of deep burn injury to the dorsum of the index, middle, and ring fingers of the dominant left hand (shown) resulting from direct contact with a hot motorcycle engine during a motor vehicle collision. On tangential excision, tendons are exposed in each finger and loss of the paratenon is noted. Which of the following is the most appropriate surgical management?

- A) Split-thickness skin grafting
- B) Dorsal metacarpal artery flaps
- C) Cross-finger flaps
- D) Reverse radial forearm flap
- E) Groin flap

The correct response is Option D.

Because the paratenon has been removed, immediate split-thickness skin grafting will result in areas of graft loss. Dressing changes could be performed followed by grafting on a granulated bed. This method of treatment risks tendon desiccation while awaiting granulation tissue.

Dorsal metacarpal artery flaps can be useful in reconstructing dorsal hand and proximal finger defects. To repair a dorsal finger defect more distally, a reverse dorsal metacarpal artery flap could be used.

Cross-finger flaps use dorsal skin of adjacent fingers to resurface palmar defects. A variation of the cross-finger flap can be used to resurface a dorsal defect. This requires de-epithelialization of the flap and then skin grafting of the deeper surface of the flap.

The groin flap is a pedicled flap based on either the superficial circumflex iliac artery or the superficial inferior epigastric artery that can resurface wounds of the upper extremity. It has the disadvantages of requiring two surgical stages and the hand remaining dependent during the initial period of flap attachment, which can encourage edema and stiffness. In addition, groin flaps are bulky and require revisional surgery on the dorsal hand.

A reverse radial forearm flap would be the best choice for resurfacing the dorsal hand and fingers because it is soft, thin, and compliant. This may be most safely accomplished in stages with syndactylization performed at a second stage. This flap, however, has been longitudinally split to simultaneously resurface two areas of the hand. The two main disadvantages of this flap include the sacrifice of a major artery and an unaesthetic and potentially unstable grafted donor site.

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168. A 10-year-old girl who sustained an electrical burn to the right upper extremity 10 days ago has undergone multiple debridements of the distal volar forearm since that time. The residual volar forearm wound is clean and measures 4 × 8 cm. Full-thickness skin loss is noted, as well as segmental loss of the flexor carpi ulnaris tendon. The ulnar nerve is exposed but appears in continuity. The patient has sensory loss in the ulnar nerve distribution and no ulnar intrinsic hand function. Which of the following is the most appropriate management?

- A) Daily whirlpool therapy and dressing changes
- B) Full-thickness skin grafting
- C) Resection of the exposed ulnar nerve and sural nerve grafting
- D) Flap coverage
- E) Tendon transfers and flap coverage of the wound

The correct response is Option D.

This child's wound requires flap coverage. Vascularized tissue in the form of local or distant flaps is recommended for coverage of exposed vital structures such as nerves, blood vessels, tendons, and bone. Therefore, wound care regimens alone and skin grafting are inadequate treatment options.

Early repair or grafting of the ulnar nerve is not indicated due to the inability to predict the amount of recovery at this early stage. Children also heal significantly better than adults, particularly in cases of nerve injury. For the same reason, tendon transfer is not indicated at this early juncture. However, appropriate splinting and therapy should be used while awaiting recovery of the nerve to prevent the claw deformity associated with low ulnar nerve palsy.

True electrical burns are completely different from thermal burns. Entrance and exit wounds can usually be identified and can be widely separated. The damage to underlying structures such as musculature and neurovascular structures typically far exceeds the visible cutaneous injury. Most patients will require decompression with fasciotomies and multiple debridements.

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169. A healthy, active 75-year-old man of Northern European descent comes to the office because he has had “tightness” in the ring and small fingers of the nondominant left hand for the past 15 years. He is able to work and play golf without difficulty. Physical examination shows a thick band of tissue in the palm extending into the involved digits. Fixed flexion deformities of 20 degrees in the metacarpophalangeal joints and no contractures in the proximal interphalangeal joints are noted. Which of the following is the most appropriate initial step in management?

- A) Observation
- B) Splinting
- C) Injection
- D) Fasciectomy
- E) Fasciotomy

The correct response is Option A.

Palmar bands in an older man of Northern European descent without a history of trauma is most likely Dupuytren's disease. Because the patient is entirely functional and has a history of slow progression, observation would be the best course of management at this time. Threshold indications for surgery include a 30-degree contracture of the metacarpophalangeal joint or any contracture of the proximal interphalangeal joint. In a fully functioning patient with slow progression of disease, immediate surgery would not be necessary. Corticosteroid injections are useful for painful Dupuytren's nodules but are generally ineffective for the extensive bands described. Finally, although therapy is a routine part of the postoperative management of this problem, it is unlikely to be of benefit in preventing the progression of disease. Stretching the joint contractures with splints and external fixators has shown limited long-term improvement.

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170. A 36-year-old man comes to the office because he has had chronic aching pain in the right wrist for the past four months. Physical examination shows tenderness just distal to Lister's tubercle and positive Watson sign. Radiographs are shown. This patient has most likely sustained an injury to which of the following structures?

- A) Dorsal wrist capsule
- B) Ligament of Testut
- C) Lunotriquetral interosseous ligament
- D) Scapholunate interosseous ligament
- E) Triangular fibrocartilage complex

The correct response is Option D.

This patient's radiocarpal angles suggest scapholunate instability and secondary dorsal intercalated segment instability. Scapholunate instability is a result of an injury to the scapholunate interosseous ligament and is the most common form of wrist instability. The scapholunate interosseous ligament is the primary stabilizer of scaphoid motion in linked carpal motion. A normal scapholunate angle is approximately 46 degrees with a range of 30 to 60 degrees. Scapholunate angles greater than 60 degrees tend to imply a scapholunate interosseous ligament injury, whereas angles less than 30 degrees tend to imply a lunotriquetral interosseous ligament injury.

The radiolunate angle is normally 0 to 11 degrees. The lunate can be thought of as a balanced cup on the lateral radiograph, and its articular surface should point straight vertical. The scaphoid acting through the scapholunate interosseous ligament tends to pull the lunate

forward, whereas the lunotriquetral interosseous ligament tends to pull the lunate dorsally. Therefore, an injury to the scapholunate ligament allows the triquetrum to exert an extension force on the lunate, pulling it into a dorsally tipped position, which is referred to as a dorsal intercalated segment instability (DISI) deformity. The scapholunate gap is normally 2 mm; a gap greater than or equal to 3 mm is believed to be abnormal and may or may not be present in cases of scapholunate instability.

The dorsal capsule is believed to be one of several secondary stabilizers of the scaphoid and may or may not be injured in this scenario. The ligament of Testut, also known as the radioscapholunate ligament, and the triangular fibrocartilage complex are not believed to contribute to carpal stability.

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171. A 28-year-old man comes to the office for evaluation of the nondominant left arm 12 weeks after he sustained a traction injury while working with heavy farm machinery. Physical examination shows complete loss of motor function in the ulnar nerve distribution, loss of sensation at the medial arm and forearm, and mild weakness of the left pectoralis major muscle. Nerve conduction testing of the ulnar nerve shows loss of motor conduction, but sensory conduction is intact. Which of the following is the most likely level of brachial plexus injury?
- A) Anterior cord
 - B) Posterior cord
 - C) Postganglionic root
 - D) Preganglionic root
 - E) Terminal branch

The correct response is Option D.

This patient has an avulsion injury to the lower roots of the brachial plexus. From proximal to distal, the levels of the brachial plexus are determined by its branching pattern and progress from spinal nerve roots (C5-T1), to trunks, to divisions, to cords, and to terminal branches. Loss of ulnar nerve function indicates damage to the ulnar nerve itself, the medial cord, or the contributing C7, C8, and T1 roots. Loss of medial arm and forearm sensation indicates loss of the medial brachial and medial antebrachial cutaneous nerves, and weakness of the pectoralis muscle indicates loss of the medial pectoral nerve, which innervates the sternocostal head. The lateral pectoral nerve, which is intact in this case, innervates both the clavicular and sternocostal heads and maintains function of the pectoralis major muscle. Loss of motor conductivity with maintenance of sensory conductivity on nerve conduction testing indicates a disruption at the preganglionic nerve root level, with preservation of continuity between the sensory cell bodies in the dorsal root ganglion, the peripheral axons and the peripheral sensory organs, thus preventing Wallerian degeneration of the sensory neurons. The motor neuron cell bodies, however, are located in the ventral horn of the spinal cord, and are separated from their peripheral axons, leading to degeneration and loss of conductivity.

Disruption at the postganglionic nerve root level would result in separation of both sensory and motor cell bodies from their respective peripheral axons and subsequent degeneration. This would lead to loss of both motor and sensory conductivity on nerve conduction testing. Disruptions at the trunk level, cord level, or branch level would also lead to the same results. In addition, loss at the terminal branch level (ulnar nerve in this case), distal to the cord level, would preserve the medial brachial nerve and medial antebrachial nerve, and thus, sensation at the medial arm and forearm.

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172. A 50-year-old auto mechanic comes to the office for consultation because he has had cold intolerance and numbness of the ring and small fingers of the dominant right hand for the past nine months. He has smoked one pack of cigarettes daily for the past 25 years. He is otherwise healthy and currently takes no medications. Vital signs are within normal limits. Physical examination shows no visible signs of skin breakdown or infection. Angiography shows evidence of an occluded ulnar artery at the level of the wrist and palm. Which of the following is the most appropriate management of this patient's condition?

- A) Smoking cessation
- B) Biofeedback therapy
- C) Calcium channel blocker therapy
- D) Ligation of the ulnar artery
- E) Resection of thrombosed segment and grafting

The correct response is Option E.

The clinical and angiographic findings are most consistent with hypothenar hammer syndrome, which is thrombosis of the ulnar artery and proximal superficial arch. This syndrome is the most common type of post-traumatic upper extremity arterial occlusion and results from repetitive injury to the hypothenar region of the hand. Symptoms of pain, cold sensitivity, and numbness are common after thrombosis of the artery within Guyon's canal. The syndrome occurs most commonly in male laborers who usually use the palm of the hand as a hammer, resulting in injury to the ulnar artery as it is crushed between the roof of Guyon's canal and the hook of the hamate and pisiform. Patients with this condition are often smokers.

Treatment consists of resection of the thrombosed segment followed by vein grafting. Previous treatments include ligation of the artery alone. Smoking cessation, calcium channel blocker therapy, and biofeedback have all been used to treat vasospastic conditions of the hand and would not be effective in this situation.

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2. Koman LA, Ruch DS, Smith BP, et al. Vascular disorders. In: Green DP, Hotchkiss RN, Pederson WC, eds. *Green's Operative Hand Surgery*. Philadelphia: Churchill Livingstone; 1999:2254-2302.

173. A 12-year-old boy is brought to the emergency department because he has had episodes of syncope for the past week. Physical examination of the hands shows hypoplasia of the left thumb. Electrocardiography shows atrial fibrillation. Which of the following is the most likely diagnosis?

- A) Holt-Oram syndrome
- B) Fanconi anemia
- C) Robert syndrome
- D) TAR syndrome
- E) VATER association

The correct response is Option A.

Holt-Oram syndrome is an autosomal-dominant disorder involving cardiac defects and upper limb anomalies. Common cardiac defects include atrial or ventricular septal defects and conduction abnormalities or blocks. Upper limb anomalies are variable in type and severity, ranging from subtle pre-axial carpal abnormalities to absent thumbs or radial club hand. The disorder is due to a mutation in a gene encoding a transcription factor involved in both cardiac and upper limb development.

Fanconi anemia is primarily characterized by bone marrow failure. It is an autosomal-recessive disease due to mutations in a series of genes believed to be involved in DNA repair. Many patients are born with a variety of radial limb anomalies, including hypoplastic thumbs or absent radii. Other common anomalies include café au lait spots, short stature, genital abnormalities, and microcephaly. Patients usually die of complications from pancytopenia, with a life expectancy of 20-30 years.

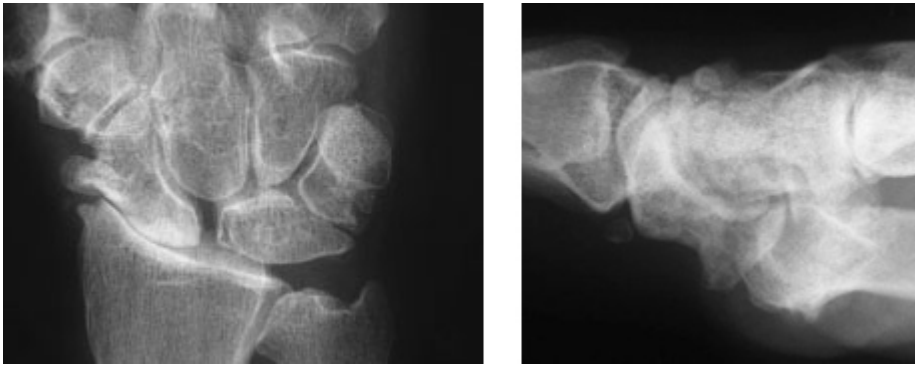
TAR syndrome involves thrombocytopenia and absent radii. It can be distinguished from Fanconi anemia by the neonatal onset of thrombocytopenia, which is typically seen later in life with Fanconi anemia, and the absence of pancytopenia.

Robert syndrome is a very rare disorder characterized by tetraphocomelia, similar to that seen with thalidomide embryopathy, as well as brain and craniofacial abnormalities.

VATER is an acronym for vertebral/vascular anomalies, anal atresia, tracheo-esophageal fistula, esophageal atresia, and renal/radial anomalies. Cardiac defects, other limb anomalies, and a single umbilical artery are also associated with this complex, giving rise to the alternative acronym VACTERLS.

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174. A 60-year-old man who is retired comes to the office because he has had pain and stiffness of the left wrist for six months after he sustained a traumatic injury when he fell from a ladder. Radiographs of the wrist are shown. Which of the following is the most appropriate management?

- A) Arthrodesis of the wrist
- B) Dorsal capsulodesis
- C) Open reduction and internal fixation of the scaphoid
- D) Proximal row carpectomy
- E) Surgical repair of the scapholunate

The correct response is Option D.

This patient has sustained an injury to the scapholunate ligament. His injury is not recent, as evidenced by the arthritis that is involving the radiocarpal joint and radial styloid. The radiograph suggests a scapholunate injury because of the widened gap between the scaphoid and lunate bones and the widened scapholunate angle (greater than 60 degrees on lateral view). When patients present early, for example within three months of injury, the scapholunate ligament can be repaired and a dorsal capsulodesis procedure can be performed to strengthen the repair. However, when they present later, especially after developing arthritis, the edges of the scapholunate ligament usually cannot be reapproximated and the pain elicited by the arthritis will not be relieved. A wrist arthrodesis may be an option if the lunate fossa of the radius or capitate head are involved with arthritis. However, in this patient, proximal row carpectomy would be the most appropriate management. Patients who undergo proximal row carpectomy usually recover 70% to 80% grip strength and 50% to 60% range of motion. Most patients who undergo proximal row carpectomy have resolution of pain. The scapholunate ligament can be reconstructed with the flexor carpi radialis tendon, AlloDerm, or bone ligament bone construct, but this is not an alternative in an individual who already has arthritis. The scaphoid has not been fractured; therefore, open reduction and internal fixation is not needed.

Postoperative radiographs are shown.



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175. A 62-year-old woman with rheumatoid arthritis comes to the office because she is unable to extend the fingers and thumb of her nondominant left hand. The metacarpophalangeal (MP) joints can be extended passively, but the patient is unable to hold the fingers in extension after they are passively straightened. With passive wrist flexion, the MP joints and proximal interphalangeal (PIP) joints extend. Which of the following is the most likely cause of these findings?

- A) Arthritis of the MP joints
- B) Intrinsic tightness
- C) Posterior interosseous nerve palsy
- D) Rupture of the extensor tendons
- E) Subluxation of the extensor tendons

The correct response is Option C.

Rheumatoid arthritis can create several problems related to extensor tendon function.

Posterior interosseous nerve palsy is often the result of inflammation and synovitis surrounding the elbow. In such cases, patients lack active extension of all fingers, but the tenodesis effect would remain in place as the tendons are still in continuity. Subluxation of the extensor tendons usually occurs following the rupture of the radial sagittal band overlying the metacarpal heads. Rupture of the radial sagittal band results in subluxation of the extensor tendons into the metacarpal valleys. This prevents finger extension. If the fingers are extended passively, the extensor tendons will be relocated centrally over the metacarpal head. The patient will be able to maintain extension of the fingers if passively positioned.

Recurrent synovitis at the metacarpophalangeal (MP) joint can cause subluxation of the proximal phalanx with eventual development of destructive arthritis. In such cases, the MP joints are difficult to extend. Extensor tendon rupture is also common and is usually the result of destructive synovitis over the dorsum of the wrist and ulnar head. Such ruptures tend to occur in an ulnar to radial direction, starting with the extensor carpi ulnaris and extensor digiti minimi, and may extend to the first or second compartment tendons in severe cases. Extensor tendon rupture would lead to a lack of tenodesis effect when the wrist is flexed.

Intrinsic tightness results from shortening or contracture of the intrinsic muscles of the hand. This results in extension of the proximal interphalangeal (PIP) joints with attempts at MP extension.

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2. Millender LH, Nalebuff EA, Holdsworth DE. Posterior interosseous nerve syndrome secondary to rheumatoid synovitis. *J Bone Joint Surg*. 1973;55A:753-757.

176. A 66-year-old woman with symptomatic arthritis of the trapezial metacarpal joint of the thumb is scheduled to undergo trapezial excision. Compared with silicone joint replacement, trapezial excision with ligament reconstruction and tendon interposition is most likely to have which of the following results in this patient?

- | <u>Pain relief</u> | <u>Pinch strength</u> |
|--------------------|-----------------------|
| A) Decreased | Decreased |
| B) Equal | Decreased |
| C) Equal | Equal |
| D) Increased | Decreased |
| E) Increased | Increased |

The correct response is Option C.

In patients with symptomatic arthritis of the trapezial metacarpal joint of the thumb, initial conservative treatment includes nonsteroidal anti-inflammatory drugs, splinting, and injection of corticosteroids. If conservative treatment fails, surgery is a good option for pain relief. The standard surgical treatment is trapezial excision. Trapezial excision can be performed alone or along with ligament reconstruction and tendon interposition using the flexor carpal radialis tendon or the abductor pollicis longus tendon. Trapezial excision may also be combined with silicone joint replacement. Several studies have been performed comparing all three of these options with the conclusion that there is no significant difference between any of the surgical options in regard to relief of pain or pinch strength. Silicone prostheses have the potential problems of displacement and silicone synovitis.

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177. A 30-year-old woman at 10 weeks' gestation is brought to the emergency department 30 minutes after she sustained injuries to the right hand during a motor vehicle collision. Physical examination shows an open, volarly displaced, and rotated fracture of the fifth metacarpal. Emergency surgery for reduction of the fracture and closure of the wound is planned. Administration of which of the following drugs should be avoided in this patient?

- A) Bupivacaine
- B) Chloroprocaine
- C) Diazepam
- D) Fentanyl
- E) Morphine

The correct response is Option C.

The U.S. Food & Drug Administration (FDA) has classified drugs according to their risk during pregnancy. The classifications are as follows:

Category A: Controlled studies in women fail to demonstrate a risk to the fetus in the first trimester (and there is no evidence of a risk in later trimesters). The possibility of harm to the fetus seems remote.

Category B: Either animal-reproduction studies have not demonstrated a risk to the fetus but there are no controlled studies in pregnant women, or animal-reproduction studies have shown an adverse effect (other than a decrease in fertility) that was not confirmed in controlled studies in women in the first trimester (and there is no evidence of a risk in later trimesters).

Category C: Either studies in animals have shown adverse effects on the fetus (teratogenic or embryocidal or other) and there are no controlled studies in women, or studies in women and animals are not available. Drugs should be given only if the potential benefit justifies the potential risk to the fetus.

Category D: There is positive evidence of risk to the fetus in humans, but the benefits from use in pregnant women may be acceptable despite the risk (e.g., if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective).

Category X: Studies in animals or humans have demonstrated fetal abnormalities or there is evidence of risk to the fetus based on human experience, or both, and the risk of the use of the drug in pregnant women clearly outweighs any possible benefit. The drug is contraindicated in women who are or may become pregnant.

There is some evidence that diazepam and other benzodiazepines are teratogenic in humans, increasing the risk of congenital malformations when ingested by the mother during the first trimester of pregnancy. Diazepam is in the FDA pregnancy category D; the other drugs listed are not.

Emergency surgery that requires anesthesia must be taken into consideration because there is a likelihood of initiating labor due to stress and because there is also a risk of drug-induced fetal defects, especially during the first trimester. The anesthetic technique of choice is regional anesthesia. Chloroprocaine is hydrolyzed quickly and, therefore, becomes unavailable for transfer across the placenta. Bupivacaine is strongly bound to protein and, therefore, very little drug is available for transfer across the placenta. If systemic drugs need to be given, morphine and fentanyl are preferred.

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178. A 35-year-old man who works in a poultry plant comes to the emergency department six hours after he sustained an amputation injury of the dominant long finger through the proximal phalanx while using a knife at work. Warm ischemia time is four hours. The finger has been wrapped in a moist, saline-soaked sponge and placed on ice since then. Physical examination shows a relatively clean amputated stump. Which of the following is a relative contraindication for replanting the finger at this time?

- A) Cold ischemia time
- B) Location of injury
- C) Mechanism of injury
- D) Possibility of infection
- E) Warm ischemia time

The correct response is Option B.

In general, isolated amputations proximal to the flexor digitorum superficialis (FDS) insertion should not be replanted because of poor long-term function. Often these fingers are bypassed by the other uninjured digits and are perceived by the patient as a nuisance. Certain situations warrant attempts at single finger replantation, such as in musicians and children, but this clinical scenario is not one.

Amputated digits in which the warm ischemia time has exceeded 12 hours are usually poor candidates for replantation; however, fingers have been reimplanted after 54 hours of cold ischemia time. Infection is a risk in any case of replantation, but the risk may be kept to a minimum by appropriate use of antibiotics and thorough surgical debridement. Patients with sharp injuries such as this one are the best candidates for replantation.

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2. Urbaniak JR, Roth JH, Nunley JA, et al. The results of replantation after amputation of a single finger. *J Bone Joint Surg*. 1985;67A:611-619.



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

179. A 28-year-old woman comes to the office for follow-up examination after six weeks of splinting to correct a closed injury without fracture of the right index finger (shown). Despite instructions to wear the splint at all times, the patient says she has been taking it off when she showers and when she types at work because it gets in the way. Which of the following is the most appropriate next step in management?
- A) Splinting for an additional six weeks
 - B) Transarticular fixation with Kirschner wires
 - C) Central slip tenotomy
 - D) Open repair with direct suturing of the terminal tendon
 - E) Fusion of the distal interphalangeal joint

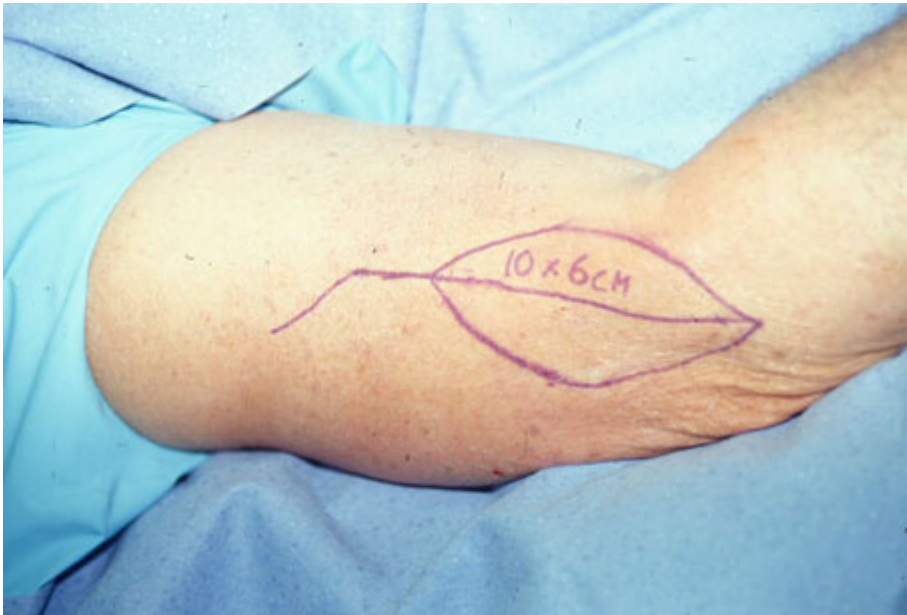
The correct response is Option B.

This patient has a mallet finger deformity. No fracture was involved; therefore, it is considered a Type I mallet injury. Patients are sometimes noncompliant or not well instructed regarding how the splint is to be used. Both the Fowler tenotomy and open repair should be reserved for chronic cases of mallet finger. In fact, open repair with direct suture of the terminal tendon has shown poor results. Fusion of the distal interphalangeal joint is an extreme method of treating this condition and would not be indicated at this time. An additional six-week period of splinting

would be appropriate in a compliant patient. One author has shown that mallet fingers that remain untreated for up to 12 weeks can be treated conservatively with six weeks of splinting. However, a noncompliant patient would benefit from transarticular fixation with Kirschner wires, which would be more difficult to manipulate versus splinting alone.

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

180. The direct vascular supply to the arm flap shown is which of the following arteries?

- A) Posterior interosseous
- B) Posterior radial collateral
- C) Profunda brachial
- D) Recurrent radial
- E) Superior ulnar collateral

Please note: The answer for question 180 is incorrectly designated as Option A. The correct response is Option B.

The correct response is Option A.

Flaps require preservation of the defined arterial and venous supply. Regional flaps can be based distally or proximally. The lateral arm flap was initially described by Song and popularized by Matloub, et al. and Katsaros, et al. This flap has considerable application in reconstruction of the upper extremity. It can be harvested from the same extremity; it has thin, pliable skin; and it can be innervated. The lateral arm flap can also include a segment of vascularized humerus or a segment of vascularized triceps tendon. The flap can also be segmentally contoured for hand defects. The lateral arm free flap is based on the posterior radial collateral artery, which is a branch of the profunda brachial artery. A reversed pedicled lateral arm flap can also be performed. This reverse flap is based on the radial recurrent artery. The superior ulnar collateral

artery is the dominant pedicle of the medial arm flap. The medial arm flap is also useful for upper extremity coverage, but there are significant variations in the superior ulnar collateral artery which makes this flap a less-than-optimal choice for microvascular surgical reconstruction. The posterior interosseous artery is the dominant blood supply of the posterior interosseous artery flap. The posterior interosseous artery flap is also used for reconstruction of the hand because it has thin, pliable skin. As a pedicle flap, it can cover the wrist and extend to the first web space. Use of the posterior interosseous flap can compromise motor nerves to the extensor carpi ulnaris or extensor digiti quinti.

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181. A 25-year-old man comes to clinic because he has increasing severe pain in the hand three days after undergoing open reduction of a fracture of the distal radius. Physical examination shows extreme swelling of the hand. Which of the following clinical findings is most likely to confirm the suspected diagnosis of compartment syndrome in the hand of this patient?
- A) Diminished sensation on the dorsum of the hand
 - B) Pain on active flexion and extension of the fingers
 - C) Pain on passive adduction and abduction of the fingers
 - D) Pain on passive extension and flexion of the wrist
 - E) Pain on passive flexion and extension of the fingers

The correct response is Option C.

The diagnosis of compartment syndrome is primarily a clinical one based on muscle and nerve ischemia. It is possible to measure intracompartment pressure, but the decision to perform a fasciotomy should be based on a high degree of suspicion, close observation of the patient, and clear understanding of the etiology.

Compartment syndrome ischemia may be severe and still not affect the color and temperature of the fingers. The distal pulses are rarely obliterated by compartment swelling, even though muscle and nerve circulation is minimal. The hallmark of muscle and nerve ischemia is pain. The pain is persistent, progressive, and unrelieved by immobilization. Accentuation of the pain by passive muscle stretching is the most reliable clinical test for making the diagnosis of compartment syndrome.

In performing the passive stretch test, one simply stretches the muscle or muscles in the compartment in question, and this should cause severe pain. There are ten compartments of the hand. The intrinsic compartments of the hand are tested by passively abducting and adducting the fingers while keeping the metacarpophalangeal joints in full extension and the proximal interphalangeal joints in flexion. If this maneuver causes a marked increase in pain, the test is diagnostically significant. The adductor compartment to the thumb can be tested by simply pulling the thumb into palmar abduction and thereby stretching the adductor muscle. The thenar muscles are tested by radial abduction of the thumb and the hypothenar muscles by adducting the little finger. Passive or active finger motion can elicit pain seen with other conditions such as flexor tendon infections or injuries, and this is a later and less specific finding.

Diminished sensation is the second most important finding and indicates nerve ischemia as it passes through the affected compartment. The third most important finding is weakness and/or

diminished muscle function. Also, palpation of the closed compartments in the hand for tenseness and tenderness should confirm the diagnosis.

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182. A 53-year-old man comes to the office for evaluation of a flexion contracture at the proximal interphalangeal (PIP) joint of the left long finger three months after he sustained a volar dislocation. Immobilization immediately after the injury and a subsequent trial of aggressive hand therapy were unsuccessful in restoring passive extension of the joint. On physical examination, the PIP joint is in 40 degrees of flexion and cannot be passively extended. Surgical release of the PIP joint is performed with release of the checkrein ligaments and tenolysis of the flexor tendons. Postoperative examination shows a mild flexion deformity of the PIP joint and slight hyperextension of the distal interphalangeal joint. Which of the following is the most likely cause of these findings?

- A) Adhesions of the flexor digitorum profundus tendon
- B) Adhesions of the flexor digitorum superficialis tendon
- C) Inadequate release of the checkrein ligaments
- D) Laxity of the extensor tendon
- E) Tightness of the ligament of Landsmeer

The correct response is Option E.

The oblique retinacular ligament of Landsmeer passes volar to the axis of rotation of the proximal interphalangeal (PIP) joint, and when it is involved in a fibrotic process, it may produce hyperextension of the distal interphalangeal (DIP) joint. Tightness of this ligament can result in contractural deformity resulting in a boutonnière deformity. Inadequate checkrein release would result in persistent flexion deformity at the PIP joint but would not impact the position of the DIP joint. Scar adhesions of the flexor tendons would limit active range of motion of the digit but would not create a hyperextension deformity at the DIP joint. Extensor tendon laxity would limit active extension at the DIP joint, creating a flexion deformity rather than a hyperextension deformity.

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183. A 14-year-old girl comes to the office for follow-up examination seven days after undergoing intramedullary nail fixation of a fracture of the right tibia. Along with bony stabilization, the degloved skin from the posterior middle and distal third of the leg was tacked back in place. On physical examination, necrosis of the replaced skin is noted. After debridement, the tibia is exposed in the middle to distal third of the leg. Which of the following is the most appropriate management?
- A) Split-thickness skin graft
 - B) Sural artery flap
 - C) Soleus flap
 - D) Free latissimus flap
 - E) Amputation

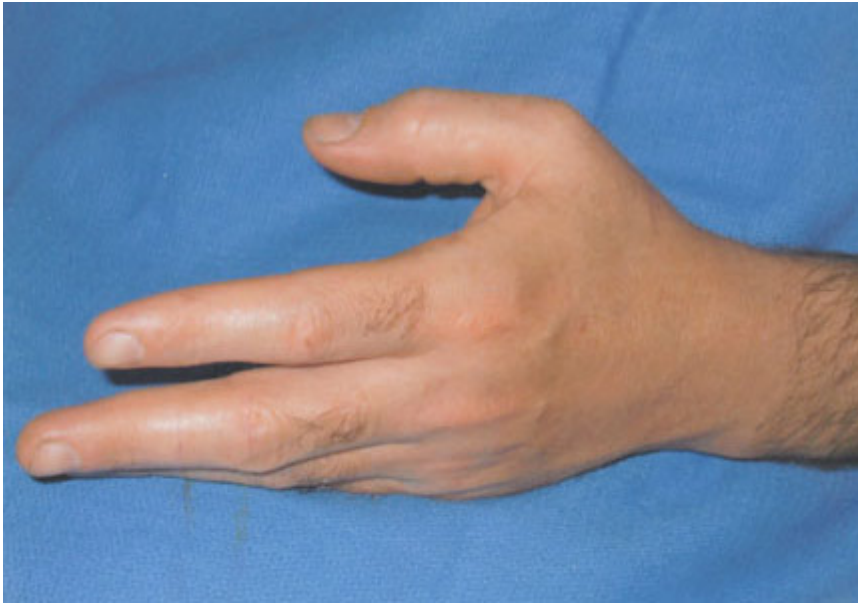
The correct response is Option D.

This Gustilo IIIB wound is best covered with a free muscle flap. The latissimus muscle flap is an effective and frequently used flap for large wounds. This flap also has the advantage of large vessels and a long pedicle length.

Dressing changes followed by a skin graft will not provide durable coverage over the tibia, is not appropriate in a healthy teenager who is not at surgical risk, and the time delay to coverage may predispose the patient to the development of osteomyelitis. A neuroadipofascial flap based on the vessels accompanying the sural nerve would be a poor choice, as this would be harvested from the zone of injury. The soleus flap is traditionally used for middle third defects of the leg and also is within the zone of injury. This is a salvageable extremity in a young teenager, which makes amputation inappropriate.

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

184. A 40-year-old construction worker comes to the office because he is unable to extend the left thumb (shown) six months after he sustained a saw injury to the dorsal aspect of the left mid forearm. At the time of the injury, the wound was washed and the skin was repaired in the emergency department. On physical examination, the patient is able to extend the wrist and fingers. No contractures are noted and all joints are supple. Which of the following is the most appropriate management at this time?
- A) Direct repair of the extensor pollicis longus tendon
 - B) Transfer of the brachioradialis tendon to the extensor pollicis longus tendon
 - C) Transfer of the extensor indicis proprius tendon to the extensor pollicis longus tendon
 - D) Tenodesis of the extensor pollicis longus tendon to the extensor digitorum communis of the index finger
 - E) Repair of the extensor pollicis longus tendon with intercalated tendon grafting

The correct response is Option C.

The extensor indicis proprius (EIP) is an independent extensor tendon to the index finger, which provides overlapping function with the extensor digitorum communis (EDC). The EIP can be transferred to provide independent thumb extension. Proximity of the EIP to the extensor pollicis longus (EPL) in addition to tendon length, which allows for a strong Pulvertaft weave, also favors the EIP-to-EPL tendon transfer. The EIP is located ulnar to the EDC of the index finger at the metacarpophalangeal (MP) joint. Its integrity must be verified before transfer by having the patient extend the index finger while holding the adjacent digits in flexion.

Direct repair with an intercalated tendon graft is not possible because of longstanding contracture, fibrosis, and foreshortening of the proximal muscle belly six months after injury. Therefore, direct repair of the EPL tendon and repair of the EPL tendon with intercalated tendon grafting are incorrect.

Tenodesis of the EPL to EDC of the index finger would improve thumb extension; however, thumb extension would not be independent of finger extension. This makes tenodesis of the EPL tendon to the EDC of the index finger less desirable than EIP-to-EPL tendon transfer.

Brachioradialis-to-EPL tendon transfer would also improve thumb extension; however, range of motion would be lost because the excursion of the brachioradialis is only 1 to 2 cm compared with an excursion of 3 to 5 cm for the EIP. This makes transfer of the brachioradialis tendon to the PEL tendon less desirable than EIP-to-EPL tendon transfer.

References

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185. A 32-year-old man undergoes surgical repair of a deep, contaminated laceration of the dorsum of the left hand with general anesthesia and an upper arm tourniquet. Exploration shows laceration of the extensor tendons. Thirty minutes into the procedure, the anesthesiologist reports that prophylactic antibiotics have not been administered. To decrease risk of infection without adversely affecting the healing of the tendons, the most appropriate intervention is initiation of intravenous administration of antibiotics, debridement, and cleansing/irrigation of the wound with a 1:1000 dilution of which of the following solutions?

- A) 0.25% Acetic acid
- B) Normal saline
- C) 3% Hydrogen peroxide
- D) 1% Povidone-iodine
- E) 0.05% Sodium hypochlorite

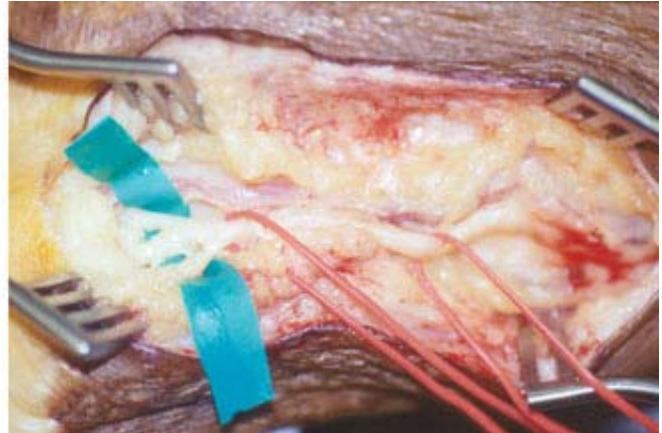
The correct response is Option D.

The mainstay of treatment for contaminated wounds includes the use of prophylactic intravenous antibiotics and mechanical debridement. Prophylactic antibiotics should be administered before inflation of a tourniquet for obvious reasons. In this case, which is an unfortunately common scenario, tissue levels of antibiotics in the hand will be nonexistent during the surgery with the tourniquet inflated. Although antibiotic levels in the wound will increase upon release of the tourniquet, merely ignoring the need for antibiotics in a contaminated wound is not appropriate and administering only antibiotics with the tourniquet inflated is not adequate. Irrigation of wounds with topical antimicrobials has shown efficacy over irrigation with saline alone. However, the concentration of the topical antimicrobial impacts fibroblast toxicity (undesired) and bactericidal activity (desired).

In the choices listed, only irrigation with a 1:1000 solution of 1% povidone-iodine (0.001% povidone-iodine) will provide full bactericidal activity without significant fibroblast toxicity. A 1:1000 solution of 3% hydrogen peroxide or 0.25% acetic acid would be more damaging to fibroblasts than to bacteria. 0.05% Sodium hypochlorite at a 1:1000 dilution is too dilute (1:1000 dilution of 0.05% is 0.00005%). While nontoxic to fibroblasts, 0.00005% sodium hypochlorite is no longer effectively bactericidal. Therefore, in this scenario, the most appropriate management would be to initiate intravenous administration of antibiotics, debride the wound, and irrigate the wound with 0.001% povidone-iodine. Many wound solutions are used; only 0.001% povidone-iodine and 0.005% sodium hypochlorite are toxic to common gram-negative and -positive bacteria and nontoxic to fibroblasts.

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

186. A 69-year-old woman with type 2 diabetes mellitus is referred to the office because she has compression of the ulnar nerve at the right wrist secondary to an extrinsic burn scar contracture (shown). Physical examination shows weakness of the first dorsal interosseous muscle. Allen test shows perfusion of the hand predominantly by the radial artery. Surgical management includes neurolysis of the ulnar nerve at Guyon's canal, with identification of the sensory and deep motor branches as shown. Which of the following is the most appropriate technique for coverage of the exposed ulnar nerve?

- A) Adjacent tissue rearrangement of the previously grafted skin
- B) Adipofascial turnover flap with repeat skin grafting
- C) Reverse posterior interosseous fasciocutaneous flap
- D) Reverse radial forearm fasciocutaneous flap
- E) Staged, pedicled groin flap

The correct response is Option C.

In this patient who is undergoing ulnar nerve decompression in the distal forearm and wrist, coverage with supple, vascularized tissue will decrease the risk of recurrent contracture and nerve compression.

Adjacent tissue rearrangement of the previously grafted skin will not address the underlying pathophysiology of the scar contracture. An adipofascial turnover flap based on the ulnar artery is not technically possible (because of perforator disruption from the neurolysis), whereas an adipofascial turnover flap based on the radial artery would not be reliable because of the zone of injury in the distal forearm. A staged, pedicled groin flap is relatively contraindicated, given the patient's age and the potential development of severe stiffness of the hand. A reverse radial forearm flap requires sacrifice of the radial artery, jeopardizing perfusion of the hand.

The photographs shown below depict a reverse posterior interosseous flap. Based on the posterior interosseous vessels between the fifth and sixth dorsal compartments of the forearm, a reverse posterior interosseous flap can support a large skin paddle (18 × 8 cm), easily reach the distal metacarpals, and include muscle and bone if needed. Donor site morbidity is negligible. In a clinical series of 80 patients who underwent distal coverage of hand and wrist defects with a reverse posterior interosseous flap, only four flaps were unsuccessful due to ischemia.

Free tissue transfer would be an acceptable alternative to a pedicled flap, but this was not listed as a possible option.



References

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187. An 8-year-old boy is brought to the emergency department 13 hours after he sustained an amputation injury of the index finger of the dominant right hand when he became tangled in a water-ski tow rope. Physical examination shows amputation through the proximal interphalangeal joint. The patient's finger was brought to the hospital wrapped in a dry towel. Which of the following is the primary indication for replantation in this patient?

- A) Age of the patient
- B) Amputation distal to the flexor digitorum superficialis tendon insertion
- C) Method of amputation
- D) Single-digit amputation of the dominant hand
- E) Warm ischemia time less than 12 hours

The correct response is Option A.

In this patient, age is the primary indication for replantation. In the pediatric population, replantation is indicated for any amputation. Other indications for replantation include thumb amputations, multiple-digit amputations, and single-digit amputations distal to the flexor digitorum superficialis (FDS) tendon insertion.

This patient's injury is through the proximal interphalangeal joint and, therefore, is proximal to the FDS insertion.

The duration of tissue ischemia can have a profound effect on the outcome of replantation, depending on the amount of muscle involved. Warm ischemia time should not exceed 12 hours for digits and should not exceed six hours for any amputation proximal to the wrist. Ischemia time is significantly prolonged by cooling the amputated part to 10 degrees Celsius. Ischemia time for digits is extended to 24 hours, whereas major limbs can survive 12 hours. Warm ischemia time less than 12 hours is favorable.

Method of injury often dictates whether the amputation is salvageable. Guillotine-type amputations are very good candidates for replantation. Injuries that cause additional local trauma (such as from table saws), avulsion injuries, and crush-type injuries generally create amputations that are difficult to replant.

Single-digit amputation, in itself, is not an indication for replantation even if it involves the dominant extremity.

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

188. A 37-year-old man is brought to the emergency department five hours after he sustained the injury to the right forearm (shown) when he was mauled by a dog. Physical examination shows complete transection of the median nerve and radial and ulnar arteries. After revascularization, which of the following is the most appropriate management?

- A) Placement of a vacuum-assisted closure device
- B) Escharotomy
- C) Epimysiotomy
- D) Fasciotomy
- E) Split-thickness skin grafting

The correct response is Option D.

The photograph above shows a severe injury of the forearm to the radial and ulnar arteries and the median nerve. The most urgent care needed for this patient is to reestablish the blood supply to the extremity. Muscles can tolerate ischemia for up to four hours, but after six hours, the effect becomes irreversible and tissue loss is greater. With this level of arterial occlusion, restoration of the circulation may produce post-ischemia swelling and initiate a compartment syndrome. Prophylactic fasciotomy is recommended if ischemia time of four to six hours is present before arterial repair. Although compartment pressures can be measured with a commercially available tissue pressure monitor or an infusion technique, these monitoring

techniques do not replace the need for fasciotomy with prolonged ischemia. The goal of management is to limit reperfusion injury — not to document compartment pressures. Fasciotomies should be performed in the forearm and over the intrinsic muscles of the hand. The serpentine incision starting from the carpal tunnel running proximally is generally made over the volar forearm with a straight-line incision over the dorsal forearm. Four incisions are generally necessary to release the intrinsic muscles and the thenar and hypothenar muscles. Digital fasciotomies are generally not necessary; however, if there is a significant degree of clinical swelling, fasciotomies are performed along the midaxial line of the fingers and thumb. Epimysiotomy is a procedure during which the muscle covering is stripped from the muscle. This is generally not required. Escharotomy is a procedure during which the skin is incised after a burn injury; it has no role in the treatment of vascular compartment syndrome.

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2. Abouezzi Z, Nassoura Z, Ivatury RR, et al. A critical reappraisal of indications for fasciotomy after extremity vascular trauma. *Arch Surg*. 1998;133:547-551.



189. A 35-year-old man who works as an air traffic controller comes to the office because he has had numbness in the dominant right wrist that has been worsening over the past year. Twenty years ago, the patient sustained an injury to the wrist while playing football. He received no treatment for this injury. A radiograph is shown. Which of the following is the most likely diagnosis?

- A) Kienbock's disease
- B) Scaphoid nonunion
- C) Scaphoid nonunion advanced collapse (SNAC wrist)
- D) Scapholunate advanced collapse (SLAC wrist)
- E) Scapho-trapezio-trapezoid (STT) arthritis

The correct response is option B.

Proximal pole scaphoid fractures are at increased risk for devascularization. This is visible radiographically with an un-united fracture line and, potentially, sclerosis or whitening of the proximal pole fragment. Left untreated, there is a near 100% incidence of degenerative joint disease, i.e., scaphoid nonunion advanced collapse (SNAC wrist). However, in this case, the

articulations between the radius and scaphoid, scaphoid and capitate, and capitate and lunate are preserved. Therefore, scapholunate advanced collapse (SLAC wrist) and SNAC wrist are incorrect.

SLAC wrist is commonly associated with scapholunate ligament injuries and a dorsal intercalated segmental instability pattern (DISI deformity). In this pattern, the lunate assumes an extended position while the scaphoid flexes. In both SNAC wrist and SLAC wrist, the initial degeneration occurs both in the distal scaphoid and the radial styloid.

Scapho-trapezio-trapezoid (STT) arthritis is incorrect because there are no degenerative joint changes in the STT joint on the radiograph. Kienbock's disease is avascular necrosis of the lunate which is present on the radiograph.

Treatment of un-united proximal pole function of the scaphoid is difficult. Options include simple compression, fixation with a bone graft or bone flap, and excision with or without tendon in position arthroplasty.

References

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

190. A 70-year-old woman comes to the office for evaluation of a painless mass on the left ring finger involving the perionychium (shown) that has been enlarging rapidly over the past three weeks. She says that minor trauma causes the mass to bleed. Physical examination shows a fleshy, reddish, superficially purulent rash. Which of the following is the most likely diagnosis?

- A) Basal cell carcinoma
- B) Hemangioma
- C) Keratoacanthoma
- D) Pyogenic granuloma
- E) Squamous cell carcinoma

The correct answer is Option D.

Pyogenic granuloma is a reactive vascular tumor that rapidly grows in response to minor trauma. These tumors are somewhat friable and bleed easily. Treatment is usually excision with

cauterization of the base. As with any tumor, pathology should be obtained to rule out less common tumors. Management options include chemical cauterization, curettage and cauterization, and formal excision.

Squamous cell carcinoma is not likely in view of the fact that the tumor arose within a three-week time period. Basal cell carcinoma is also unlikely because these are generally more erosive-appearing lesions that require a longer time interval than three weeks to develop to the size shown. Keratoacanthoma is also unlikely because these are keratotic-appearing lesions that usually have a central pore. Although these rapidly proliferate, they are not generally as friable or have the characteristic of easy bleeding. Keratoacanthomas are also sessile appearing. Hemangioma is also incorrect because a hemangioma developing in an elderly patient is unusual. Hemangioma should be included in the differential diagnosis of a rapidly proliferating vascular lesion in the neonatal period.

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191. A 63-year-old man who has been hospitalized for the past week after undergoing coronary artery bypass grafting has a pulsatile mass in the volar aspect of the right wrist. The nurse reports that an arterial catheter was recently removed from the radial artery. Which of the following is the most appropriate management of the mass?

- A) MRI of the wrist
- B) Application of a pressure dressing until the mass resolves
- C) Anticoagulation
- D) Replacement of the radial artery catheter
- E) Exploration and vascular repair

The correct response is Option E.

False or pseudoaneurysms result from an arterial wall penetration. The extravasated hematoma organizes and then recanalizes. The lumen of the false aneurysm will have endothelial lining. False aneurysms result from penetrating injuries and fractures, such as stab wounds, arterial catheterization fractures, or gunshot wounds. The treatment of a pseudoaneurysm is dependent on whether the radial artery is critical to hand perfusion. If the ulnar artery alone is adequate, the aneurysm can be ligated and excised. If the radial artery is critical to distal perfusion, the radial artery can be either directly repaired or reconstructed with a vein graft. Usually, the arterial defect is too large for primary repair of the artery. If the site becomes infected, the risk for arterial hemorrhage is significant.

True aneurysms occur after an injury that allows the vessel to gradually dilate. The true aneurysm is more uniform in shape and has an endothelial lining. True aneurysms result from repeated trauma (i.e., hypothenar hammer syndrome) or vessel diseases that weaken the wall.

MRI would provide detailed imaging of the lesion; Doppler ultrasonography would provide similar information more quickly. In an adult, compressive dressing can control bleeding but is not successful long term in resolving the pseudoaneurysm. One case in a child has been reported using ultrasound-directed compression. Anticoagulation would complicate bleeding from the pseudoaneurysm. Replacement of an arterial catheter could aggravate bleeding, compromise distal flow, or increase infection risk.

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192. A 40-year-old contractor with type 2 diabetes mellitus comes to the clinic because he has been unable to straighten the right ring and small fingers for the past six months. He has been having increasing difficulty straightening the fingers for the past five years. He has not had any pain and cannot recall an injury to the hand or fingers. He says his grandfather had the same problem. Examination shows palmar nodules and pits over the ring and small finger rays, 35-degree flexion contractures of the ring and small finger metacarpophalangeal joints, and a 20-degree flexion contracture of the small finger proximal interphalangeal (PIP) joint. The PIP joint contracture in this patient most likely results from which of the following cords?

- A) Central
- B) Lateral
- C) Pretendinous
- D) Retrovascular
- E) Spiral

The correct response is Option A.

The central cord is the most common cause of contracture of the proximal interphalangeal (PIP) joint in Dupuytren's disease. It has no fascial precursor structure and is the distal continuation of the pretendinous cord.

The spiral cord consists of the spiral band, the lateral digital sheet, and Grayson's ligament. It may arise from the pretendinous cord or de novo at the musculotendinous junction of the intrinsic musculature. The spiral cord displaces the neurovascular bundle toward the midline and may also contribute to contracture of the PIP joint.

The lateral cord is formed by diseased lateral digital sheet and may also displace the neurovascular bundle toward the midline in the small finger.

The retrovascular cord arises from the periosteum of the proximal phalanx and inserts onto the lateral aspect of the distal phalanx. It lies dorsal to the neurovascular bundle and volar to Cleland's ligaments. It may contribute to contracture of the PIP joint but usually causes contracture of the distal interphalangeal joint.

The pretendinous cord is found in the palm and causes contracture of the metacarpophalangeal joint.

Dupuytren's contracture affects Caucasians almost exclusively. It is inherited as an autosomal-dominant disease with incomplete penetrance. Men are more commonly affected than women,

who tend to have a more benign form of the disease. The incidence of Dupuytren's contracture is increased in patients with diabetes mellitus.

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193. A 38-year-old man comes to the office because he has had dorsal erythema and stiffness of the metacarpophalangeal joint of the right long finger since he punched another man in the mouth during a fistfight four days ago. Radiographs of the hand show no focal findings. Which of the following is the most appropriate next step in management?

- A) Splinting and elevation
- B) Oral administration of an antibiotic
- C) Intravenous administration of an antibiotic
- D) Surgical drainage of the subcutaneous abscess
- E) Surgical drainage of the joint

The correct response is Option E.

Bite injuries resulting from fistfights usually occur over the dorsal aspect of the third, fourth, or fifth metacarpophalangeal joint where a tooth penetrates the skin, extensor tendon, potentially the joint capsule, and even bone. When the hand is opened, the inoculating bacteria are dragged proximally by the extensor tendon and soft tissue.

The patient may present acutely before clinical signs of an infection—with what appears to be a simple laceration or abrasion over the metacarpophalangeal joint—but more typically after signs of infection have developed. If there are no signs of infection, it is prudent to explore the wound to rule out injury to the extensor tendon, joint capsule, and cartilage. To do so, the hand must be examined through the entire range of motion, particularly with the fingers flexed as in a clenched fist position. If there is no injury to the deeper structures, the wound can be washed out and the skin left open to heal by second intention. The patient can then be discharged with prophylactic antibiotics to cover the most common bacteria isolated from human bite wounds, i.e., *Staphylococcus aureus*, followed by *Streptococcus* species, *Corynebacterium* species, and *Eikenella corrodens*. Follow-up within 24 to 48 hours is important in outpatient management of these injuries. If injury is noted to the tendon, joint capsule, or joint cartilage, then operative washout and admission for intravenous antibiotics is appropriate.

When the patient presents with a well-developed infection, antibiotic therapy alone is insufficient. Careful exploration must be performed to rule out injury and infection to deeper structures, most importantly the joint. Unrecognized or untreated pyarthrosis can lead to joint destruction and osteomyelitis. Inadequate exploration in the emergency department is usually due to inadequate anesthesia. Formal washout and drainage is sometimes best performed in the operating room.

Elevation and immobilization are important in the management of edema in patients with hand infections. In the clinical scenario presented, however, this alone would be insufficient treatment because surgical drainage of the joint is required.

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194. Five patients are brought to the emergency department by ambulance after sustaining various types of amputations in a bus accident. The amputated extremities have also been transported, and each has a warm ischemia time of eight hours. Replantation is most appropriate in which of the following patients?
- A) 19-year-old man with a sharp amputation through the proximal phalanx of the dominant right index finger
 - B) 21-year-old woman with a total degloving avulsion of the nondominant left ring finger caused by her wedding band
 - C) 24-year-old man with a sharp amputation through the proximal phalanx of the nondominant left thumb
 - D) 52-year-old man with a crushing amputation through the middle third of the right leg
 - E) 65-year-old woman with a sharp amputation through the mid humerus of the nondominant left arm

The correct response is Option C.

Indications for replantation include amputations involving the thumb, multiple digits, the hand between the distal wrist and palm, and any part in a child. These indications for replantation must take into account the mechanism of amputation (crush versus sharp) and overall patient health. Indications are not solely based on potential viability but are also based on function.

Contraindications to replantation include single digits proximal to the flexor digitorum superficialis insertion, severely crushed or mangled parts, multiple-level amputations, and presence of multiple trauma or severe medical problems. These contraindications are more relative than the indications but should be kept in mind.

Major limb replantations for amputations above the elbow and in the distal third of the leg may be indicated in certain situations, i.e., young, healthy patients sustaining sharp amputations. A critical consideration in these replants is the warm ischemia time. Because the amputated parts in major limb replantations contain more ischemia-sensitive muscle, prolonged ischemia times may result in myonecrosis and adversely impact return of muscle function and may lead to renal failure. Amputated digits tolerate warm ischemia times in the range of eight hours, but prompt cooling prolongs the acceptable ischemia times to more than 24 hours, with documented successes over 80 hours. The maximum warm ischemia time for major amputations is in the range of four to six hours and may be prolonged by cooling to the 10- to 12-hour range.

Replantation after sharp amputation is more successful than in crush and avulsion-type amputations. Replantation for avulsion injuries to the ring finger is an area of controversy. Some experienced surgeons advocate ray amputation. More recent publications suggest that ring

finger replantations have met with good success and give better results than amputation. Single-digit amputations other than the thumb, especially the index and small fingers, are also controversial.

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195. A 54-year-old carpenter comes to the office because he has had worsening pain and increasingly limited range of motion of the dominant right wrist over the past five years. Physical examination shows wrist flexion to 40 degrees and wrist extension to 35 degrees. Radiographs are shown above. Which of the following is the most appropriate management?

- A) Revascularization of the lunate
- B) Proximal row carpectomy
- C) Scaphoid excision with four-corner arthrodesis
- D) Scaphoid-trapezium-trapezoid arthrodesis (triscaphe fusion)
- E) Radioscapholunate arthrodesis

The correct response is Option C.

This patient has a scapholunate advanced collapse (SLAC) pattern of degenerative wrist arthritis. To achieve the goals of pain relief and maintenance (or improvement) of wrist motion, scaphoid excision with arthrodesis of the capitate-lunate-hamate-triquetrum is the treatment of

choice. If this patient were not concerned about wrist motion, total wrist arthrodesis could be performed.

Revascularization of the lunate is more appropriate for the treatment of Kienbock disease, which is believed to result from microfractures of the lunate that lead to ischemic changes and vascular necrosis.

Proximal row carpectomy will result in the diseased capitate being inserted into the lunate fossa. Resurfacing of the capitate would be required for this to be a viable option.

Neither scaphoid excision alone nor scaphoid-trapezium-trapezoid arthrodesis will treat the diseased capitolunate joint.

Radioscapholunate arthrodesis will also fail to treat the diseased capitolunate joint. This would be a reasonable treatment for joint changes confined to the radiocarpal joint, where the midcarpal joint is normal. If this is done, resection of the distal third of the scaphoid may help minimize impingement and loss of motion in radial deviation and flexion.

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196. A 58-year-old woman comes to the emergency department one hour after she sustained an injury to the left hand when she tripped and fell. Physical examination shows edema and ecchymosis of the left small finger. X-ray study of the wrist is shown. Which of the following is the most appropriate management?

- A) Dynamic traction
- B) Casting
- C) Percutaneous K-wire fixation
- D) Open reduction and internal fixation
- E) Arthrodesis

The correct response is Option A.

When intra-articular fractures of the phalanges are severely comminuted or unstable, traditional methods of operative fracture fixation or immobilization may have an unacceptably high rate of late joint stiffness. Immobilization (splints, casts, or K-wire fixation) can hinder joint mobility by

promoting the formation of intra-articular adhesions and extra-articular joint capsule contractures.

The dynamic traction method, however, combines movement and traction in the treatment of intra-articular fractures. Distal traction reduces and realigns the articular fragments by forces exerted on them through ligamentous attachments (ligamentotaxis). In severely comminuted articular surface fractures, open reduction may be impossible and ligamentotaxis may be the only way to achieve adequate fragment reduction. Movement under continuous traction also helps prevent joint stiffness and contracture. The dynamic traction splint is usually worn for six weeks, but this can vary from four to eight weeks, depending on the severity of the fracture.

Continuous passive motion following intra-articular fractures has shown to improve articular cartilage healing and regeneration. Initiation of continuous passive motion, however, requires prior reduction and stabilization of the fracture site. Pilon fractures of the PIP joint typically involve a comminuted fracture, with problematic late stiffness if standard immobilization techniques are used.

Interphalangeal joint fusion is a salvage procedure to achieve stability and pain relief, particularly in the index and small fingers, where grip strength is of high importance.

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

197. A 27-year-old man comes to the office for consultation regarding correction of a nail deformity of the right long finger (shown) resulting from a crush injury he sustained one year ago. He did not seek treatment at the time of the injury. Physical examination shows a nontender digit with full range of motion. The nail plate is intact but is deviated dorsally over a nonadherent area that extends longitudinally from the lunula in a 5-mm-wide strip. Radiographs of the digit show evidence of a well-healed, nondisplaced fracture of the distal phalanx. In addition to excision of the scarred nail bed, which of the following interventions is most appropriate for correction of this patient's deformity?
- A) Primary closure of the sterile matrix
 - B) Split-thickness sterile matrix grafting
 - C) Split-thickness germinal matrix grafting
 - D) Full-thickness germinal matrix grafting
 - E) Full-thickness skin grafting

The correct response is Option B.

Nonadherence of the nail results from scarring of the sterile matrix; in this case, it results from the crush injury sustained in the past. Distal phalanx fractures are commonly associated and, if displaced, should be reduced to minimize distortion of the overlying matrix. Treatment of the nonadherent nail begins with excision of the scarred sterile matrix. Defects 1 to 2 mm in width can be closed primarily. Larger defects are best covered with a sterile matrix graft, which may be split thickness to minimize donor site morbidity.

Sacrifice of the remaining nail bed is unnecessary because the defect can be corrected with a sterile matrix graft. Complete absence of the nail is associated with significant morbidity, including diminished stability and sensation of the fingertip.

Germinal matrix scarring produces a split nail deformity. Such injuries may be treated with full-thickness germinal matrix grafts from the toe. Germinal matrix grafts must be full-thickness to be successful; therefore, they are typically harvested from the toe.

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198. A 25-year-old man who works as an electrician is brought to the emergency department by ambulance one hour after he fell from a ladder and grabbed a high-tension power line carrying approximately 50 kV with his right hand. Pulse rate is 120/min and blood pressure is 120/70 mmHg. Physical examination shows a burn mark over the right palm and a burn wound over the right scapula. No distal pulses are palpable. Which of the following is the most appropriate initial management of the wound to the upper extremity?

- A) Splinting of the hand and wrist in a position of function and elevation
- B) Topical application of mafenide and an occlusive dressing
- C) Escharotomy
- D) Fasciotomy
- E) Arterial grafting to the radial artery segment

The correct response is Option D.

Clinically, electrical injuries are divided into high- and low-tension injuries based on voltage. High-voltage injuries, as in this scenario, occur with contact of an electrical source greater than 1000 V. Electrical injuries of this magnitude usually result in significant myonecrosis as well as neural injury.

In the presence of such a significant injury, fasciotomy should be performed because continued muscle necrosis and swelling will certainly result in compartment syndrome. Decompression of the median nerve at the wrist should be ensured at the time of forearm fasciotomy. Other mainstays of treatment of electrical injuries to the upper extremity are repeated debridements of necrotic muscle and early flap coverage to decrease the incidence of amputation, infection, and renal failure. Escharotomy is the treatment for full-thickness thermal burns to the hand and arm. Mafenide acetate solution (Sulfamylon) would have efficacy for thermal burns in which penetration of cartilage is required. Arterial grafting may be required if there is evidence of a thrombosed radial artery, but this is not the most appropriate initial treatment. Splinting in a position of function is important but is not the most appropriate initial treatment.

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199. A 51-year-old truck driver comes to the hand clinic because he has had constant burning pain in the left arm since he injured the left wrist while loading a truck two weeks ago. Since the injury, avoiding use of the wrist and wearing an immobilization splint on the wrist have not relieved the pain. On physical examination, the left hand, wrist, and forearm are swollen and mildly mottled. The wrist is extremely sensitive to touch. Range of motion of the left wrist and forearm is significantly decreased. Which of the following findings is most likely on additional evaluation of this patient?
- A) Decreased resting sweat output
 - B) Decreased temperature readings on thermography
 - C) Increased leukocyte count
 - D) Increased uptake on a three-phase bone scan
 - E) Osteoporosis on plain radiographs

The correct response is option D.

This patient's clinical picture is consistent with early complex regional pain syndrome (CRPS) type I, formerly referred to as reflex sympathetic dystrophy (RSD). A reliable adjunctive tool in confirming the clinical diagnosis is the third phase of a three-phase bone scan. For the scan to be considered indicative of CRPS, the third phase typically shows diffuse increased periarticular activity in the involved joints. Increased uptake is variable in children. In time, results of the three-phase bone scan return to normal.

Radiographic evidence of osteoporosis secondary to CRPS, historically referred to as Sudeck atrophy, does not appear until the third to fifth week of the syndrome. Sudeck atrophy typically demonstrates diffuse osteopenia, juxtacortical demineralization, and subchondral erosions or cysts. This Alag@ in radiographic changes is explained by the fact that calcium content must be altered by 30% to 50% before becoming evident on conventional plain radiographs. The radiographic features of rapid bone loss include visible demineralization with patchy, subchondral, or subperiosteal osteoporosis, metaphyseal banding, and profound bone loss. Despite the osteoporosis, fractures are uncommon.

Other available diagnostic tools include thermography and resting sweat output. Thermography is an indirect method of measuring blood flow to an extremity. Patients with CRPS typically show elevated temperature readings on thermography indicative of increased local blood flow. Resting sweat output quantifies abnormal autonomic system activity by measuring the amount of resting sweat that occurs on the extremity. Patients with CRPS have elevated autonomic system activity and, therefore, demonstrate increased resting sweat output.

Leukocyte count is not helpful in confirming the diagnosis of CRPS.

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200. A 20-year-old woman comes to the emergency department 20 minutes after she sustained amputation of the right index finger at the level shown while using a meat slicer. Each of the following local flaps is acceptable for repair of this defect EXCEPT

- A) Atasoy volar V-Y
- B) cross-finger
- C) homodigital island
- D) Kutler lateral V-Y
- E) thenar

The correct response is Option A.

In a volar oblique fingertip injury as depicted above, the main factors leading to the use of flaps are exposed vital structures, a wound not suitable for healing by secondary intention or grafting, or the need for soft tissue padding. A cross-finger and thenar flap would be acceptable choices. However, these would require two operations for transfer, then division and inset.

A Kutler lateral V-Y flap could be used for this wound, but it is more often used in a patient with an injury where there is more tissue on the radial and ulnar margins of the amputation and exposed distal phalanx.

A homodigital island flap is based on the radial or ulnar digital artery of the finger. It is distally based and has been described for the repair of fingertip injuries.

The Atasoy volar V-Y flap is technically contraindicated in volar oblique tip amputations due to a relative lack of adequate tissue.

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Thank you for your participation.

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

1	(A) (B) (C) (D)	26	(A) (B) (C) (D) (E)	51	(A) (B) (C) (D)	76	(A) (B) (C) (D) (E)
2	(A) (B) (C) (D)	27	(A) (B) (C) (D) (E)	52	(A) (B) (C) (D) (E)	77	(A) (B) (C) (D) (E)
3	(A) (B) (C) (D)	28	(A) (B) (C) (D) (E)	53	(A) (B) (C) (D) (E)	78	(A) (B) (C) (D) (E)
4	(A) (B) (C) (D) (E)	29	(A) (B) (C) (D) (E)	54	(A) (B) (C) (D) (E)	79	(A) (B) (C) (D) (E)
5	(A) (B) (C) (D) (E)	30	(A) (B) (C) (D) (E)	55	(A) (B) (C) (D) (E)	80	(A) (B) (C) (D) (E)
6	(A) (B) (C) (D) (E)	31	(A) (B) (C) (D) (E)	56	(A) (B) (C) (D) (E)	81	(A) (B) (C) (D) (E)
7	(A) (B) (C) (D) (E)	32	(A) (B) (C) (D) (E)	57	(A) (B) (C) (D) (E)	82	(A) (B) (C) (D) (E)
8	(A) (B) (C) (D) (E)	33	(A) (B) (C) (D) (E)	58	(A) (B) (C) (D) (E)	83	(A) (B) (C) (D) (E)
9	(A) (B) (C) (D) (E)	34	(A) (B) (C) (D) (E)	59	(A) (B) (C) (D) (E)	84	(A) (B) (C) (D) (E)
10	(A) (B) (C) (D) (E)	35	(A) (B) (C) (D) (E)	60	(A) (B) (C) (D) (E)	85	(A) (B) (C) (D) (E)
11	(A) (B) (C) (D) (E)	36	(A) (B) (C) (D) (E)	61	(A) (B) (C) (D) (E)	86	(A) (B) (C) (D) (E)
12	(A) (B) (C) (D) (E)	37	(A) (B) (C) (D) (E)	62	(A) (B) (C) (D) (E)	87	(A) (B) (C) (D) (E)
13	(A) (B) (C) (D) (E)	38	(A) (B) (C) (D) (E)	63	(A) (B) (C) (D) (E)	88	(A) (B) (C) (D) (E)
14	(A) (B) (C) (D) (E)	39	(A) (B) (C) (D) (E)	64	(A) (B) (C) (D) (E)	89	(A) (B) (C) (D) (E)
15	(A) (B) (C) (D) (E)	40	(A) (B) (C) (D) (E)	65	(A) (B) (C) (D) (E)	90	(A) (B) (C) (D) (E)
16	(A) (B) (C) (D) (E)	41	(A) (B) (C) (D) (E)	66	(A) (B) (C) (D) (E)	91	(A) (B) (C) (D) (E)
17	(A) (B) (C) (D) (E)	42	(A) (B) (C) (D) (E)	67	(A) (B) (C) (D) (E)	92	(A) (B) (C) (D) (E)
18	(A) (B) (C) (D) (E)	43	(A) (B) (C) (D) (E)	68	(A) (B) (C) (D) (E)	93	(A) (B) (C) (D) (E)
19	(A) (B) (C) (D) (E)	44	(A) (B) (C) (D) (E)	69	(A) (B) (C) (D) (E)	94	(A) (B) (C) (D) (E)
20	(A) (B) (C) (D) (E)	45	(A) (B) (C) (D) (E)	70	(A) (B) (C) (D) (E)	95	(A) (B) (C) (D) (E)
21	(A) (B) (C) (D) (E)	46	(A) (B) (C) (D) (E)	71	(A) (B) (C) (D) (E)	96	(A) (B) (C) (D) (E)
22	(A) (B) (C) (D) (E)	47	(A) (B) (C) (D) (E)	72	(A) (B) (C) (D) (E)	97	(A) (B) (C) (D) (E)
23	(A) (B) (C) (D) (E)	48	(A) (B) (C) (D) (E)	73	(A) (B) (C) (D) (E)	98	(A) (B) (C) (D) (E)
24	(A) (B) (C) (D) (E)	49	(A) (B) (C) (D) (E)	74	(A) (B) (C) (D) (E)	99	(A) (B) (C) (D) (E)
25	(A) (B) (C) (D) (E)	50	(A) (B) (C) (D) (E)	75	(A) (B) (C) (D) (E)	100	(A) (B) (C) (D) (E)

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

101	(A) (B) (C) (D)	126	(A) (B) (C) (D) (E)	151	(A) (B) (C) (D) (E)	176	(A) (B) (C) (D) (E)
102	(A) (B) (C) (D)	127	(A) (B) (C) (D) (E)	152	(A) (B) (C) (D) (E)	177	(A) (B) (C) (D) (E)
103	(A) (B) (C) (D)	128	(A) (B) (C) (D) (E)	153	(A) (B) (C) (D) (E)	178	(A) (B) (C) (D) (E)
104	(A) (B) (C) (D)	129	(A) (B) (C) (D) (E)	154	(A) (B) (C) (D) (E)	179	(A) (B) (C) (D) (E)
105	(A) (B) (C) (D)	130	(A) (B) (C) (D) (E)	155	(A) (B) (C) (D) (E)	180	(A) (B) (C) (D) (E)
106	(A) (B) (C) (D)	131	(A) (B) (C) (D) (E)	156	(A) (B) (C) (D) (E)	181	(A) (B) (C) (D) (E)
107	(A) (B) (C) (D)	132	(A) (B) (C) (D) (E)	157	(A) (B) (C) (D) (E)	182	(A) (B) (C) (D) (E)
108	(A) (B) (C) (D) (E)	133	(A) (B) (C) (D) (E)	158	(A) (B) (C) (D) (E)	183	(A) (B) (C) (D) (E)
109	(A) (B) (C) (D) (E)	134	(A) (B) (C) (D) (E)	159	(A) (B) (C) (D) (E)	184	(A) (B) (C) (D) (E)
110	(A) (B) (C) (D) (E)	135	(A) (B) (C) (D) (E)	160	(A) (B) (C) (D) (E)	185	(A) (B) (C) (D) (E)
111	(A) (B) (C) (D) (E)	136	(A) (B) (C) (D) (E)	161	(A) (B) (C) (D) (E)	186	(A) (B) (C) (D) (E)
112	(A) (B) (C) (D) (E)	137	(A) (B) (C) (D) (E)	162	(A) (B) (C) (D) (E)	187	(A) (B) (C) (D) (E)
113	(A) (B) (C) (D) (E)	138	(A) (B) (C) (D) (E)	163	(A) (B) (C) (D) (E)	188	(A) (B) (C) (D) (E)
114	(A) (B) (C) (D) (E)	139	(A) (B) (C) (D) (E)	164	(A) (B) (C) (D) (E)	189	(A) (B) (C) (D) (E)
115	(A) (B) (C) (D) (E)	140	(A) (B) (C) (D) (E)	165	(A) (B) (C) (D) (E)	190	(A) (B) (C) (D) (E)
116	(A) (B) (C) (D) (E)	141	(A) (B) (C) (D) (E)	166	(A) (B) (C) (D) (E)	191	(A) (B) (C) (D) (E)
117	(A) (B) (C) (D) (E)	142	(A) (B) (C) (D) (E)	167	(A) (B) (C) (D) (E)	192	(A) (B) (C) (D) (E)
118	(A) (B) (C) (D) (E)	143	(A) (B) (C) (D) (E)	168	(A) (B) (C) (D) (E)	193	(A) (B) (C) (D) (E)
119	(A) (B) (C) (D) (E)	144	(A) (B) (C) (D) (E)	169	(A) (B) (C) (D) (E)	194	(A) (B) (C) (D) (E)
120	(A) (B) (C) (D) (E)	145	(A) (B) (C) (D) (E)	170	(A) (B) (C) (D) (E)	195	(A) (B) (C) (D) (E)
121	(A) (B) (C) (D) (E)	146	(A) (B) (C) (D) (E)	171	(A) (B) (C) (D) (E)	196	(A) (B) (C) (D) (E)
122	(A) (B) (C) (D) (E)	147	(A) (B) (C) (D) (E)	172	(A) (B) (C) (D) (E)	197	(A) (B) (C) (D) (E)
123	(A) (B) (C) (D) (E)	148	(A) (B) (C) (D) (E)	173	(A) (B) (C) (D) (E)	198	(A) (B) (C) (D) (E)
124	(A) (B) (C) (D) (E)	149	(A) (B) (C) (D) (E)	174	(A) (B) (C) (D) (E)	199	(A) (B) (C) (D) (E)
125	(A) (B) (C) (D)	150	(A) (B) (C) (D) (E)	175	(A) (B) (C) (D) (E)	200	(A) (B) (C) (D) (E)