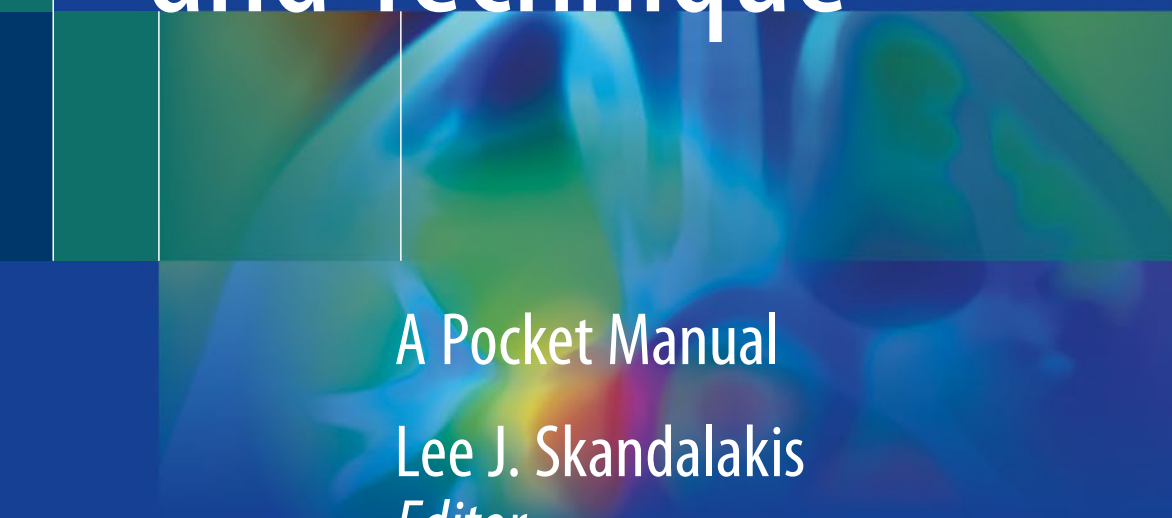
Surgical Anatomy and Technique



A Pocket Manual

Lee J. Skandalakis
Editor

Fifth Edition

Springer

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Editor
Lee J. Skandalakis
Department of Surgery
Piedmont Hospital
Atlanta, GA, USA

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As always, my father's presence is felt. I can feel him breathing down my back saying his mantra "study, study, study." So again I dedicate this book to my father.

Preface to the Fifth Edition

> It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again, because there is no effort without error and shortcoming; but who does actually strive to do the deeds; who knows great enthusiasms, the great devotions; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement, and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who neither know victory nor defeat.
>
> Theodore Roosevelt
> Paris, April 23, 1910

The fifth edition of *Surgical Anatomy and Technique: A Pocket Manual* underwent a major revision with new color illustrations and chapters. Color illustrations make it much easier for the student young and old to follow the technique and better appreciate the anatomy. In the chapter on the abdominal wall and hernias, operating room strategies have been updated again and techniques of historical interest only have been removed. These new illustrations have made the transversus abdominus release technique much easier to follow. I would like to thank my friends at Emory who made tremendous contributions to this fifth edition. Major revisions were done on the stomach and extrahepatic biliary tract by Drs Jaja and Patel and the pancreas by Drs Ramonel and Patel. Dr Elwood made major revisions and updates to the chapter on the duodenum. Dr Marty T. Sellers enhanced the liver chapter which he had revised in the fourth edition.

Dr Feldman of Piedmont Hospital made major revision to the longest chapter in this book, Colon and Anorectum. Piedmont Hospital vascular surgeons Ross, Untzeitig, Chahwala, and Craddock made major revisions as well as a new chapter on ablative techniques for venous disease. Dr Hoadley from Northside Hospital contributed a new chapter on sports hernia. Dr John G. Seiler updated his chapter on carpal tunnel. Dr Procter updated his chapter on bariatric surgery adding technique for the duodenal switch. Dr Roger Eduardo revised the chapters on the small bowel and appendix. Dr C Dan Smith updated the chapters on the esophagus and diaphragm adding the new and novel LINX procedure for reflux.

Dr Feigelson, my old partner whom I sorely miss (not dead, just gone!), revised the chapters on the breast and adrenals. Dr Mullins made sure that treatment of

melanoma of the skin was current and lastly Drs Shah and Muhletaler provided a new chapter on the kidney and ureter. Yes, general surgeons should know their way around those structures!

We have tried again to present what are considered to be basic surgical techniques. However, as I have stated before, what used to be advanced laparoscopic skills have been downgraded to basic laparoscopic skills.

Though the senior and principal author (JES) passed away in 2009, he continues to influence this and future editions of this text. He is sorely missed.

Atlanta, GA, USA Lee J. Skandalakis

Acknowledgments

For some reason it seems that every subsequent edition of this book gets harder to write. We try to cut outdated material and revise to what is currently being taught and done. This project started about 2 years ago so by the time it gets into your hands it may be dated. Unfortunately, that is the case with every surgical text written. Nevertheless, I want to thank all of the surgeons who contributed and made this a much better edition than the previous. So again, I thank the people at Springer including Richard Hruska, Senior Editor of Clinical Medicine, for making this possible. More than halfway into this I had told Richard that I felt we needed to make the transition to colored illustrations. He gladly complied and we have a much better text for it.

In previous editions I had two editorial assistants helping me. This time I had one doing the work of two. Connie Walsh, Developmental Editor for Springer, did a fantastic job of dealing with all the surgeons, reading over the chapters and revisions, and making sure everything was just right. Thank you for your hard work and perseverance.

Finally, I would like to thank Dr Panagiotis G. Skandalakis for his great ideas for this book and the wonderful illustrations that kick-started this entire endeavor many years ago.

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Contributors

Veer Chahwala, MD, RPVI Vascular and Endovascular Surgery, Piedmont Atlanta Vein Center, Piedmont Atlanta Hospital, Atlanta, GA, USA

Garnet Roy Craddock Jr, MD, RPVI, FACS Southern Vein Care, The Piedmont Clinic, Piedmont Newnan Hospital, Newnan, GA, USA

Roger Eduardo, MD Department of Surgery, Beltline Bariatric and Surgical Group, Atlanta, GA, USA

David R. Elwood, MD Division of General and Gastrointestinal Surgery, Department of Surgery, Emory University, Atlanta, GA, USA

Bruce J. Feigelson, MD, FACS Department of General Surgery, Colorado Permanente Medical Group, Denver, CO, USA

Evan N. Feldman, MD ATL Colorectal Surgery, P.C, Atlanta, GA, USA

M. Fred Muhletaler, MD, FACS Robotic and Minimally Invasive Surgery, Department of Surgery, Palms West Hospital and Palm Beach Urology, Wellington, FL, USA

Jeffrey S. Hoadley, MD Department of Surgery, North Atlanta Surgical Associates, Atlanta, GA, USA

Mohammad Raheel Jajja, MD Department of Surgery, Winship Cancer Institute, Emory University, Atlanta, GA, USA

John David Mullins, MD, FACS Department of Surgery, Piedmont Hospital, Atlanta, GA, USA

Shatul Parikh, MD Northwest Thyroid and Parathyroid Center, Northwest ENT and Allergy Center, Atlanta, GA, USA

Snehal Patel, MD Department of Surgery, Emory University, Atlanta, GA, USA

Charles D. Procter Jr, MD, FACS, FASMBS Department of Surgery, Piedmont Atlanta Hospital, Atlanta, GA, USA

Kimberly M. Ramonell, MD Department of General Surgery, Emory University, Atlanta, GA, USA

Charles B. Ross, MD, RPVI, FACS Vascular and Endovascular Services, Piedmont Heart Institute, Piedmont Atlanta Vein Center, Piedmont Atlanta Hospital, Atlanta, GA, USA

John Gray Seiler III, MD Department of Orthopaedic Surgery, Emory University, Atlanta, GA, USA

Piedmont Hospital, Atlanta, GA, USA

Marty T. Sellers, MD, MPH Department of Surgery, Emory University, Atlanta, GA, USA

Nikhil L. Shah, DO, MPH Minimally Invasive, Minimal Access & Robotic Surgery, Department of Surgery, Piedmont Health Care, Atlanta, GA, USA

Lee J. Skandalakis, MD, FACS Department of Surgery, Piedmont Hospital, Atlanta, GA, USA

C. Daniel Smith, MD Esophageal Institute of Atlanta, Atlanta, GA, USA

Ramon A. Suarez, MD, FACOG Department of Gynecology and Obstetrics, Emory University School of Medicine, Atlanta, GA, USA

Gynecology – Obstetrics, Piedmont Hospital, Atlanta, GA, USA

Andrew Walter Unzeitig, MD Department of Vascular Surgery, Piedmont Atlanta Hospital, Atlanta, GA, USA

Skin, Scalp, and Nail

1

John David Mullins and Lee J. Skandalakis

Anatomy

Skin and Subcutaneous Tissue (Fig. 1.1)

Incisions are necessary but need to be undertaken with respect to the potential complications or long-term effects. Some general considerations can often minimize problems.

The scalpel direction in almost all cases is best performed as a perpendicular division of the tissue through all the dermal layers to the underlying subcutaneous tissue. A "skiving" or angled incision will have more of a tendency to be problematic in healing or scar formation with residual deformity.

An incision that is in proximity to a scar or additional incision should be done with caution. The poor vascular supply between parallel incisions should be considered.

Likewise, converging incisions can create an area of poor vascularization at the apex.

The skin is the largest organ of the body and is composed of two primary layers: the epidermis (superficial) and the dermis (under the epidermis). The thickness of the skin varies from 0.5 to 3.0 mm. There are some references to a hypodermis or adjacent subcutaneous tissue which, although not part of the skin as such, does contain some deeper appendages. In some references this is considered a third layer.

The epidermis is avascular and is composed of stratified squamous epithelium. It has a thickness of 0.04–0.4 mm. The palms of the hands and the soles of the feet are thicker than the skin of other areas of the human body, such as the eyelids. Melanocytes are found in the epidermis.

J. D. Mullins (✉) · L. J. Skandalakis
Department of Surgery, Piedmont Hospital, Atlanta, GA, USA

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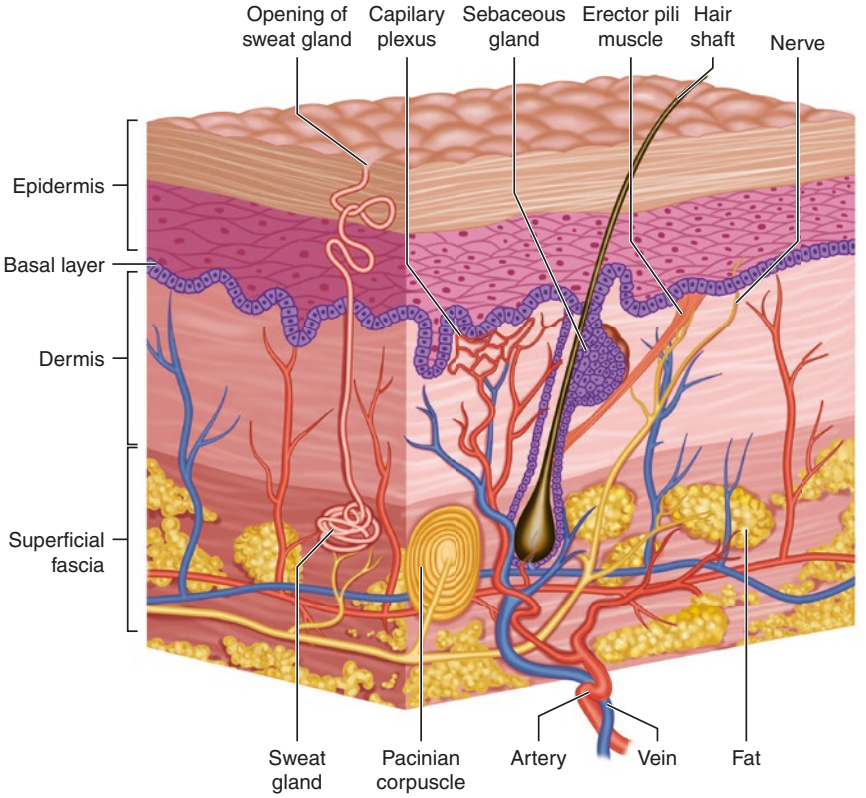


Fig. 1.1 Structures of the skin

The dermis has a thickness of 0.5–2.5 mm and contains smooth muscles and sebaceous and sweat glands. Various mechanoreceptors are found in the dermis. Hair roots are located in the dermis and may extend into the subcutaneous tissue or hypodermis.

Vascular System

There are two arterial plexuses: one close to the subcutaneous fat (subdermal) and the second in the subpapillary area. Venous return is accomplished by a subpapillary plexus to a deep plexus and then to the superficial veins. A lymphatic plexus is situated in the dermis, which drains into the subcutaneous tissue. The lymphatic drainage into anatomic basins of lymph node collections is an important subject to become acquainted.

Nervous System

For innervation of the skin, there is a rich sensory and sympathetic supply.

Remember

- The epidermis is avascular.
- The dermis is tough, strong, and very vascular.
- The superficial fascia is the subcutaneous tissue that blends with the reticular layer of the dermis.
- The principal blood vessels of the skin lie in subdermal areas.
- The basement membrane is the lowest layer of the epidermis.
- The papillary dermis is the upper (superficial) layer of the dermis, just below the basement membrane.
- The reticular dermis is the lower (deep) layer of the dermis, just above the fat.

Scalp

The following mnemonic device will serve as an aid in remembering the structure of the scalp (see also Fig. 1.2).

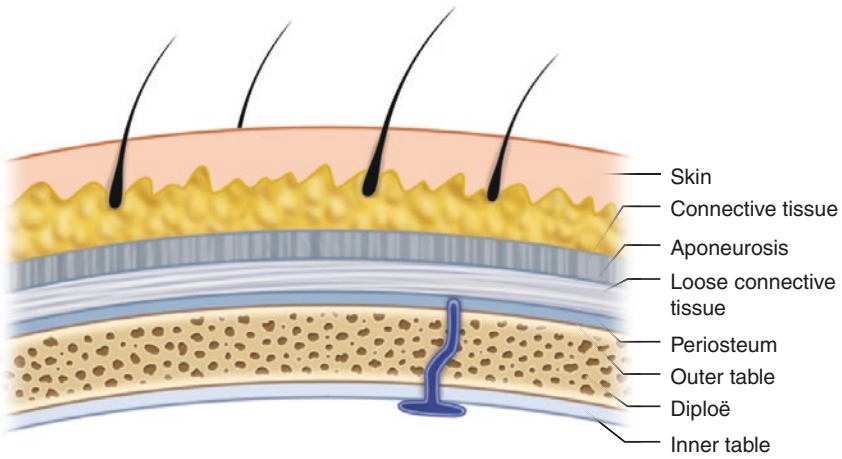


Fig. 1.2 Structures of the scalp

	Layers	*Description*	*Observations*
S	Skin	Hair, sebaceous glands	
C	Connective close subcutaneous tissue	Superficial layer avascular deep layer vascular (internal and external carotid lymphatic network). Nerves are present (cervical, trigeminal)	Bleeding due to gap and nonvascular contraction
A	Aponeurosis epicranial, galea	Aponeurosis of the occipitofrontalis muscle	Sensation present
L	Loose connective tissue	Emissary veins	Dangerous zone = extracranial and intracranial infections
P	Pericranium–periosteum		No sensation. Heavy fixation at the suture lines, so infection is limited

Vascular System

Arterial Supply

The arteries of the scalp are branches of the internal and external carotid arteries. The internal carotid in this area becomes the supratrochlear and supraorbital arteries (Fig. 1.3), both of which are terminal branches of the ophthalmic artery. The external carotid becomes a large occipital artery and two small arteries: the superficial temporal and the posterior auricular (see Fig. 1.3). Abundant anastomosis takes place among all these arteries. All are superficial to the epicranial aponeurosis.

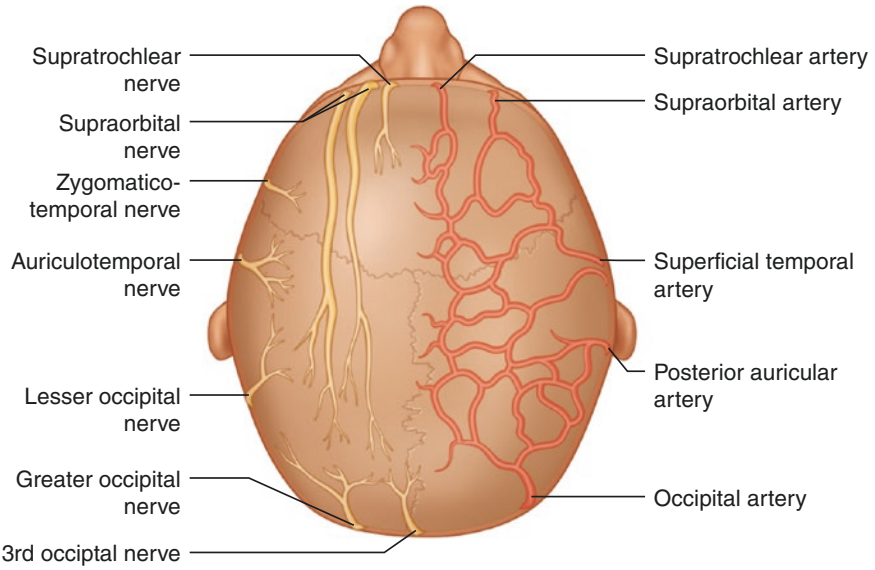


Fig. 1.3 Arterial blood supply shown on *right*. Nerve distribution shown on *left*. Veins are not shown, but follow the arteries

Venous Drainage
Veins follow the arteries.

Lymphatic Drainage
The lymphatic network of the scalp is located at the deep layer of the dense connective subcutaneous tissue just above the aponeurosis (between the connective tissue and aponeurosis). The complex network has frequent anastomoses. The three principal zones are the frontal, parietal, and occipital.

Note
- The blood supply of the scalp is rich. Arteries are anastomosed very freely.
- The arteries and veins travel together in a longitudinal fashion.
- A transverse incision or laceration will produce a gap. Dangerous bleeding will take place from both vascular ends due to nonretraction of the arteries by the close, dense, connective layer.
- Always repair the aponeurotic galea to avoid hematoma under it.
- With elective cases (excision of sebaceous cysts, etc.), whenever possible, make a longitudinal incision.
- Drain infections of the scalp and face promptly. Use antibiotics to prevent intracranial infections via the emissary veins.
- After cleansing the partially avulsed scalp, replace it and débride the wound; then suture with nonabsorbable sutures.
- Use pressure dressing as required. Sutures may be removed in 3–10 days.
- Be sure about the diagnosis. A very common sebaceous cyst could be an epidermoid cyst of the skull involving the outer or inner table, or both, with extension to the cerebral cortex. In such a case, call for a neurosurgeon. The best diagnostic procedure is an AP and lateral film of the skull to rule out bony involvement.
- Because the skin, connective tissue, and aponeurosis are so firmly interconnected, for practical purposes, they form one layer: the surgical zone of the scalp.

Nerves (Figs. 1.3 and 1.4)
The following nerves innervate the scalp (their origins are in parentheses):
- Lesser occipital (second and third ventral nerves)
- Greater occipital (second and third dorsal nerves)
- Auriculotemporal (mandibular nerve)
- Zygomaticotemporal and zygomaticofacial (zygomatic [maxillary] nerve)
- Supraorbital (ophthalmic nerve)
- Supratrochlear (ophthalmic nerve)

Nail

The anatomy of the nail may be appreciated from Figs. 1.5 and 1.6.

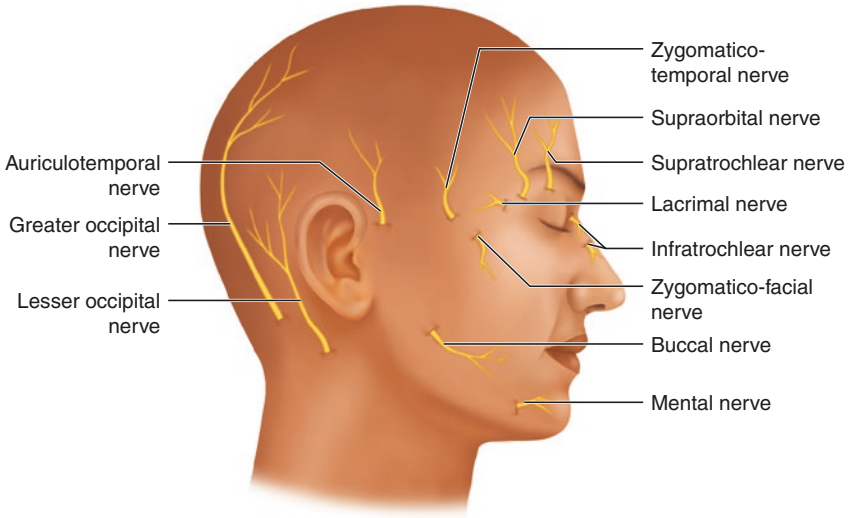


Fig. 1.4 Sensory Nerves of the scalp and face

Fig. 1.5 Structures of the nail

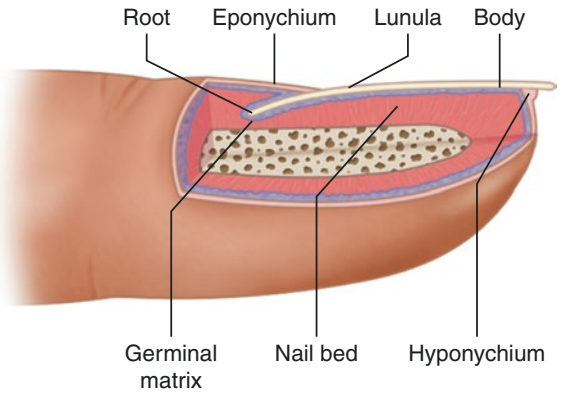
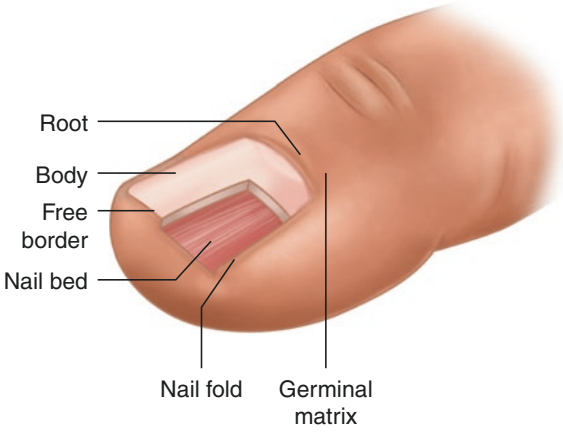


Fig. 1.6 Nail bed



Technique

Benign Skin Lesions (Figs. 1.7, 1.8, and 1.9)

Benign skin lesions fall into several groups. Cystic lesions include epidermal inclusion cysts, sebaceous cysts, pilonidal cysts, and ganglia. Another group includes warts, keratoses, keloids, hemangiomatas, arteriovenous malformations, glomus tumors, and capillary malformations.

A third group includes decubitus ulcers, hidradenitis suppurativa, and burns. Junctional, compound, and intradermal nevi and malignant lentigos compose another group.

- **Step 1.** For a cyst, make an elliptical incision. An infected sebaceous cyst may best be treated in 2 stages. The first will be to incise and drain the contents until the inflammatory response has resolved. A loose pack or drain may be placed until this can be achieved. Closure of an infected wound will likely require a subsequent drainage procedure. For a noncystic lesion, be sure to include approximately 2.0 mm of tissue beyond the lesion when making the elliptical incision.

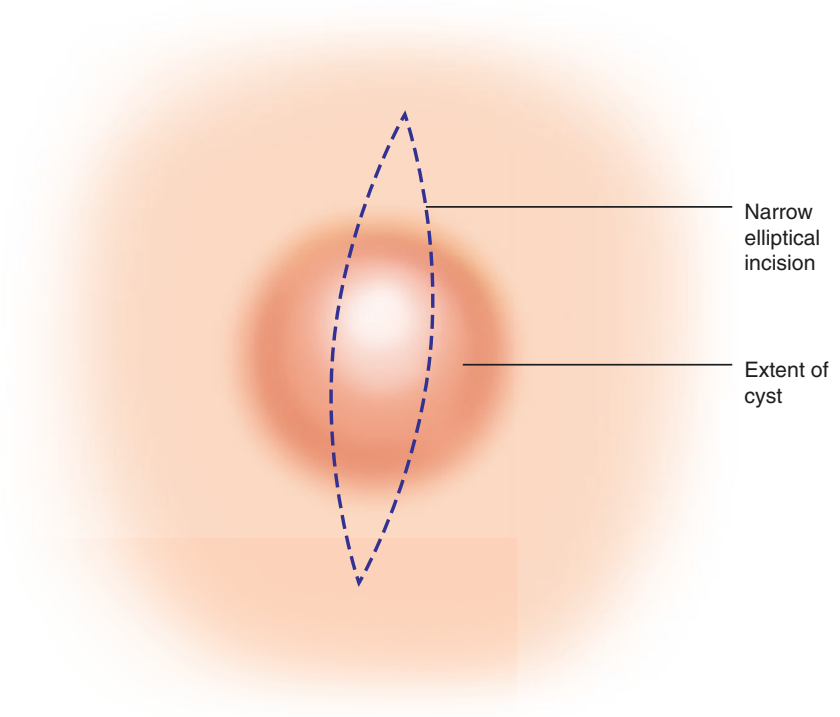


Fig. 1.7 Incision for cyst removal

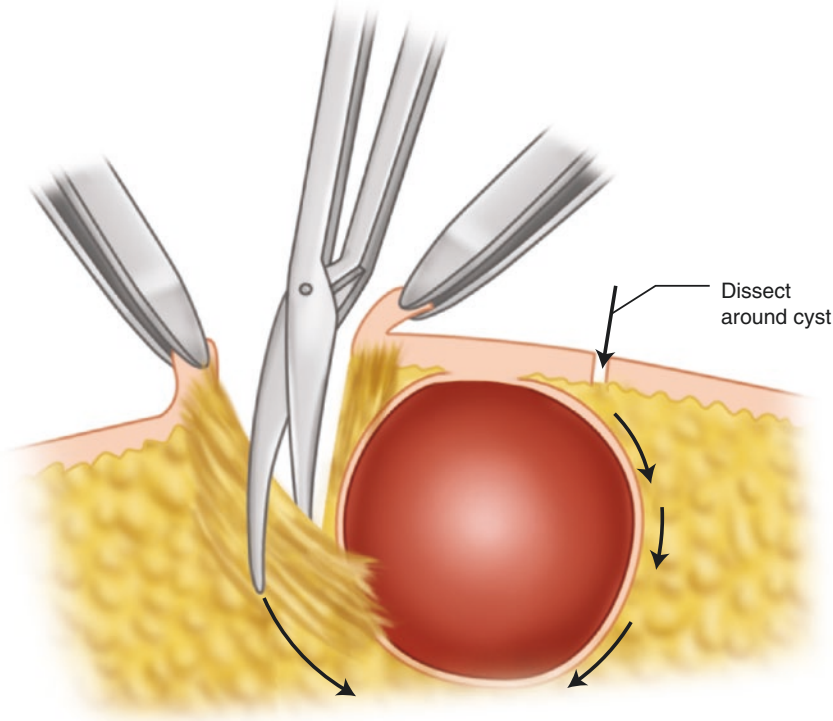


Fig. 1.8 Dissection to subcutaneous tissue

- **Step 2.** Place the incision along Langer's lines (Kraissl's) and perpendicular to the underlying muscles, but seldom parallel to the underlying muscle fibers.
- **Step 3.** Dissect down to the subcutaneous tissue but not to the fascia. Avoid breaking the cyst, if possible.
- **Step 4.** Handle the specimen with care by not crushing the skin or the lesion.
- **Step 5.** Close in two layers only in the absence of infection. Undermine the skin as required. Remember that the dermis is the strongest layer. For the dermis, use absorbable synthetic interrupted suture 3–0 (undyed Vicryl); for the epidermis, use 5–0 Vicryl subcuticular continuous and reinforce with Steri-strips or skin glue. It is acceptable to use 6–0 interrupted nylon sutures very close to the edges of the skin and close to each other.
- **Step 6.** Remove interrupted sutures in 8–10 days and again reinforce with Steri-strips, especially if the wound is located close to a joint. For most cases, a nylon epidermal continuous suture may be left in for 2 weeks without any problems.

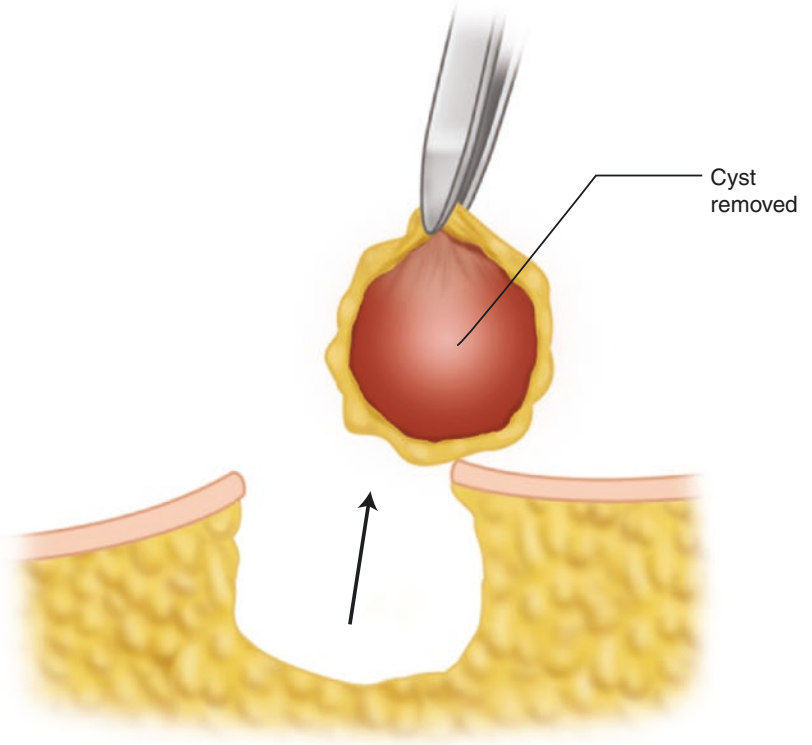


Fig. 1.9 Excision of cyst

Malignant Skin Lesions (Figs. 1.10 and 1.11)

Malignant skin lesions include melanoma, basal cell carcinoma, squamous cell carcinoma, sweat gland carcinoma, fibrosarcoma, hemangiopericytoma, Kaposi's sarcoma, and dermatofibrosarcoma protuberans.

When removing the lesion, 1.0 cm of healthy skin around it must also be removed, as well as the subcutaneous layer.

Remember

- Send specimen to the lab for frozen section of the lesion and margins. Not recommended for melanoma. Many labs prefer permanent fixation for histologic diagnosis.
- Prior to surgery explain to the patient about scarring, recurrence, margins, etc.
- If the case involves a large facial lesion, obtain the advice of a plastic surgeon.

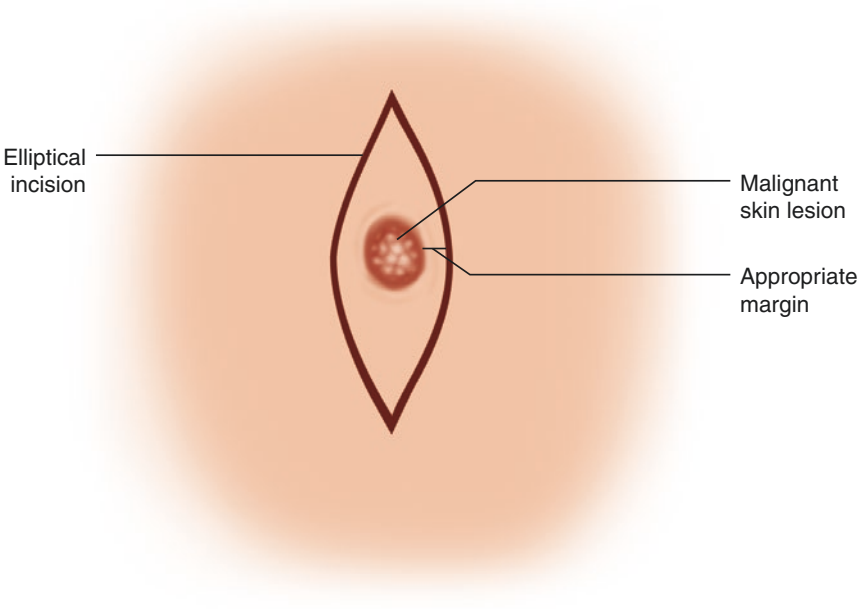


Fig. 1.10 Incision for removal of malignant skin lesion

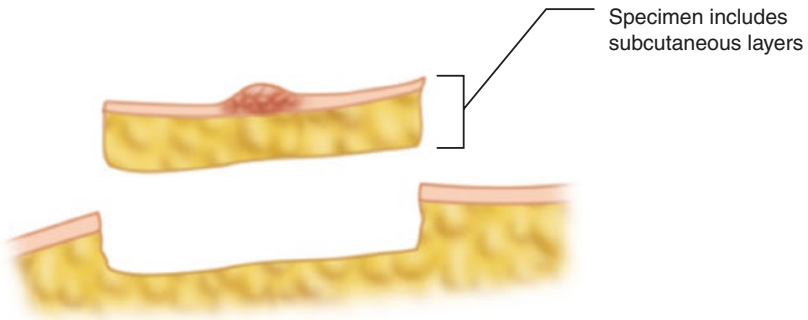


Fig. 1.11 Resection of malignant skin lesion

Melanoma

The Clark classification has fallen out of favor due to the levels varying based on location on the body. This led to less of a correlation of metastasis compared to the Breslow classification.

Staging of Malignant Melanoma (After Clark)

Level I. Malignant cells are found above the basement membrane.
Level II. Malignant cells infiltrate into the papillary dermis.
Level III. Malignant cells fill the papillary layer and extend to the junction of the papillary and reticular layers but do not enter the reticular layer.

Level IV. Malignant cells extend into the reticular layer of the dermis.
Level V. Malignant cells extend into the subcutaneous tissue.

Tumor Thickness (After Breslow)

Level I. Tumor thickness less than 0.76 mm
Level II. Tumor thickness 0.76–1.5 mm
Level III. Tumor thickness 1.51–2.25 mm
Level IV. Tumor thickness 2.26–3 mm
Level V. Tumor thickness greater than 3 mm

Remember

- Perform a sentinel lymph node biopsy, and, if positive, follow up with a complete lymph node dissection. Management with consultation of an oncologist is always encouraged if possible. Amputate a digit if melanoma is present. Be sure to consider the size, depth, and topography of the defect.
- For all pigmented nevi, ask for a second opinion. Remember that the depth of invasion is critical and full-thickness biopsy will be necessary for determination.

Margins

Tumor thickness	Margins
In situ lesions	0.5–1.0 cm
≤ 1.0 mm	1.0 cm
1.01–2.0 mm	1.0–2.0 cm
≥2.01	2.0 cm

Lesion Thickness and Regional Lymph Node Staging

For Breslow's levels 1 and 5, very few lymphadenectomies are performed. The philosophy is that with a level 1 lesion, the chance of metastasis is remote; hence, a lymph node dissection is not warranted. The level 5 lesion is so advanced that a lymph node dissection will not alter the outcome. For intermediate levels 2–4, lymphadenectomy can be therapeutic. In recent large studies the breakpoint for indicated sentinel lymph node biopsy is 0.86 mm thickness for the melanoma. A sentinel lymph node biopsy is done first and, if positive, is followed by a complete lymphadenectomy. If there are palpable lymph nodes, then a radical lymphadenectomy is performed.

Sentinel Lymph Node Biopsy

- **Step 1.** Radiologist have localized sentinel lymph node preoperatively by injecting radioisotope and blue dye around the lesion (on breast: around nipple).
- **Step 2.** In the operating room, an incision is made over the area with the highest radioactivity count.

- **Step 3.** Dissect down to lymph node.
- **Step 4.** Using Geiger counter device as well as looking for the blue lymph node, identify and remove the sentinel lymph node.
- **Step 5.** If frozen section of sentinel lymph node is found to be positive, consider proceeding to a full lymph node dissection if staging information has been completed and indication has been confirmed.

Excision of Malignant Lesion (Melanoma, Squamous Cell Epithelioma)

The procedure is similar to that for a benign lesion. For melanoma, make a wide excision depending upon the thickness of the lesion as reported by the pathologist. Scalp melanomas metastasize, and sentinel lymph node biopsy may be performed, regardless of depth: if radical neck surgery is done for frontal lesions, include the superficial lobe of the parotid; for temporal and occipital lesions, include the postauricular and occipital nodes. When a posterior scalp melanoma is present, a posterior neck dissection may be performed. See details on malignant skin lesions earlier in this chapter.

For squamous cell epitheliomas, wide excision is the procedure of choice. If the bone is involved, plastic and neurosurgical procedures should follow.

Skin Grafts

Free skin grafts include split-thickness grafts, postage-stamp grafts (a type of split-thickness graft), full-thickness grafts, and pinch grafts (not described here due to space limitations). Another classification, pedicle grafts, also is not described because a general surgeon who lacks the proper training to perform pedicle grafts should refer such cases to a plastic surgeon.

Split-Thickness Graft (Epidermis Plus Partial Dermis)

Definition: Large pieces of skin including part of the dermis but leaving deeper dermal elements to allow healing of the donor site.

Indications: Non-infected area that has adequate granulation to support a split-thickness graft. It is not uncommon for the initial role of the surgeon is to prepare the recipient site. Negative pressure wound therapy as well as topical wound care therapies have been advanced in the past few years to facilitate a proper "wound bed."

Contraindications: Infection, exposed bone without periosteum, exposed cartilage without perichondrium, and exposed tendon without sheath. Coverage over a joint is often discouraged due to the reduced elasticity of a healed split-thickness graft. Consider a full-thickness graft in this setting. Radiated tissue is considered a relative contraindication for grafting with a significant failure rate.

Donor Area: Consider the size of the graft to be harvested. Also consider the need for the donor site to heal without trauma or disruptive motion. The lateral thighs are often used as donor sites as occlusive dressings can be maintained without the problems of restrictive positioning.

Complications: Infection, failure to take, contractures and donor site failure to heal.

The progression or conversion of a split-thickness donor site to a full-thickness wound should be a complication to keep in mind and avoid by all means.

- **Step 1.** Prepare both areas. Prepare the donor site first as this is the "clean" site and must not be contaminated. Skin of the donor area must be kept taut by applying hand or board pressure. The motion of the dermatome may be facilitated by application of oil or saline.
- **Step 2.** Remove estimated skin. We use a Zimmer dermatome set at a thickness of 0.026 cm for harvesting of skin. In most cases, we mesh the skin using a 1.5:1 mesh ratio.
- **Step 3.** Place the graft over the receiving area.
- **Step 4.** Suture or staple the graft to the skin. If the graft was not meshed, perforate it for drainage.
- **Step 5.** Dress using Xeroform gauze covered by moist 4 × 4 s or cotton balls. Then cover with roll gauze of appropriate size circumferentially. A tie-over bolster may be used to prevent shifting of the graft.
- **Step 6.** Change dressing in 3 days.
- Alternative procedure: Place a wound VAC white gauze over the graft. Change in 5–7 days.

Full-Thickness Graft (Fig. 1.12)

Definition: The skin in toto, but not the subcutaneous tissue.

Indications: Facial defects, fresh wounds, covering of defects after removal of large benign or malignant tumors. Coverage over joints or tissues requiring flexibility such as "web" sites.

Contraindications: Infections. Poor recipient site vascularity or granulation tissue. The full-thickness grafts require better vascularity in general.

Donor Area: The full-thickness graft will require closure of the defect or a possible lengthy course for healing by secondary intention. Previous incisions may

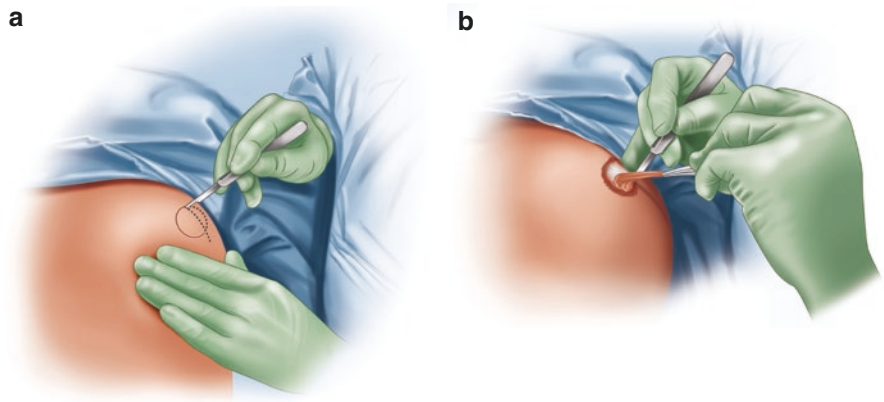


Fig. 1.12 How to prepare a "full-thickness skin graft". The first step is skin excision (**a**, **b**)... can be anywhere anatomically. Then placement of the hemostats (**c**), inversion of the skin over a fingertip (**d**), and then tangential thinning with surgical scissors (**e**)

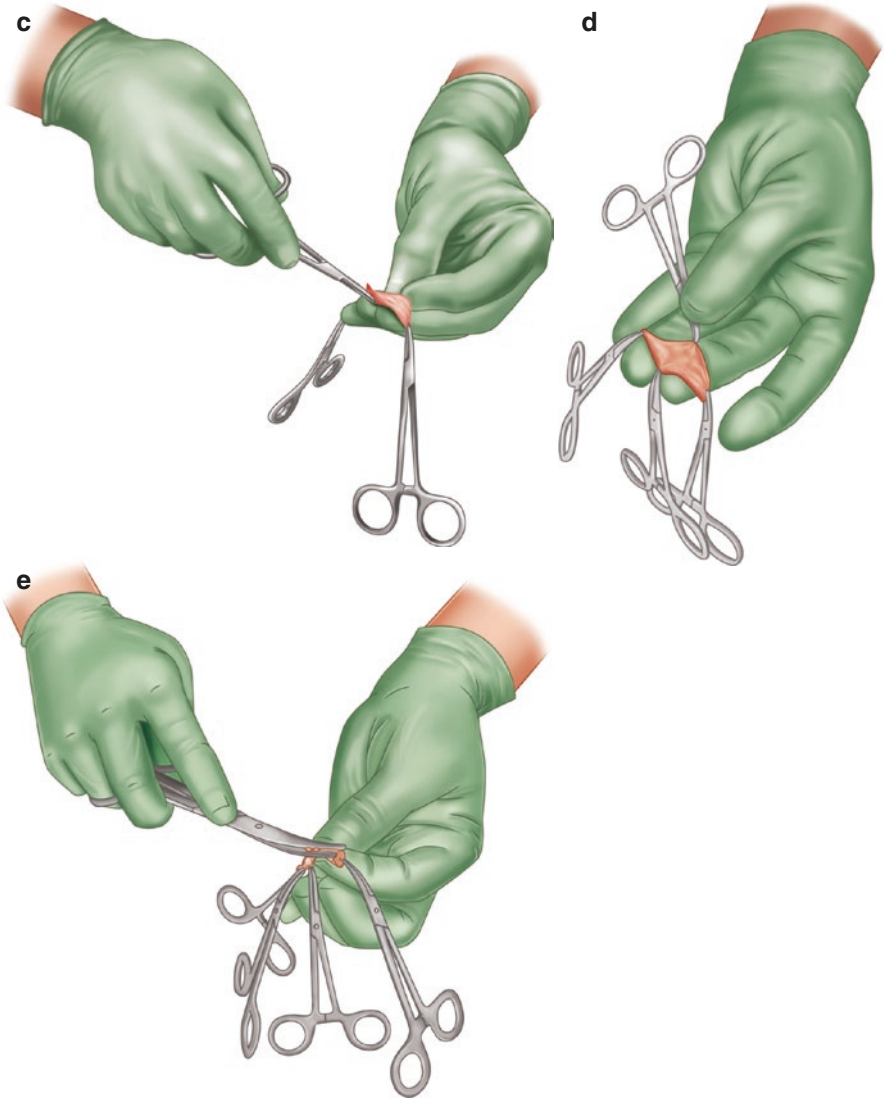


Fig. 1.12 (continued)

allow additional ellipses of skin to be removed and re-closed primarily. Also post-auricular, supraclavicular, or nasolabial tissues may be considered if color match is desired.

Technique: Excise the skin sharply to be transferred. Undermine as necessary to close the donor defect. Prepare the graft by thinning the underside, often with curved iris or Mayo scissors.

Fenestration may be needed to prevent accumulation of fluid beneath the graft. Fixation of the graft is the same as with the split graft although a longer period of time may be required before dressing removal and inspection.

Scalp Surgery

Excision of Benign Lesion

- **Step 1. Consider cutting** hair with scissors, but shaving has shown to be unnecessary.
- **Step 2.** Make longitudinal or elliptical incision, removing an elliptical piece of skin to include the lesion if dermal, overlying the cystic lesion if in the subcutaneous tissue.
- **Step 3.** Elevate limited flaps in the subcutaneous plane if necessary.
- **Step 4.** Obtain hemostasis if identifiable blood vessels, but compression against the underlying bone may be effective.
- **Step 5.** Remove cyst.
- **Step 6.** Close skin with a continuous suture to compress the wound edges. Alternatively, staples can provide a hemostatic closure.

Biopsy of Temporal Artery

Temporal artery biopsy is used to diagnose patients with symptoms such as fever, weight loss, or malaise and more specifically headaches, loss of visual acuity, diplopia, and temporal artery tenderness.

Step 1. Shave hair at the point of maximal pulsation at the preauricular area or above the zygomatic process.

Step 2. Make a longitudinal incision (Fig. 1.13).

Step 3. Carefully incise the aponeurosis (Fig. 1.14).

Step 4. After proximal and distal ligation with 2–0 silk, remove arterial segment at least 2 cm long (Fig. 1.15).

Step 5. Close in layers.

Remember

- The temporal artery is closely associated with the auriculotemporal nerve, which is behind it, and with the superficial temporal vein, which is also behind it, medially or laterally.
- In front of the ear, the temporal artery is subcutaneous. The temporal and zygomatic branches of the facial nerve emerge several centimeters anterior to the tragus but should be considered in danger of injury if the biopsy site is misplaced.
- Perform biopsy above the zygomatic process.

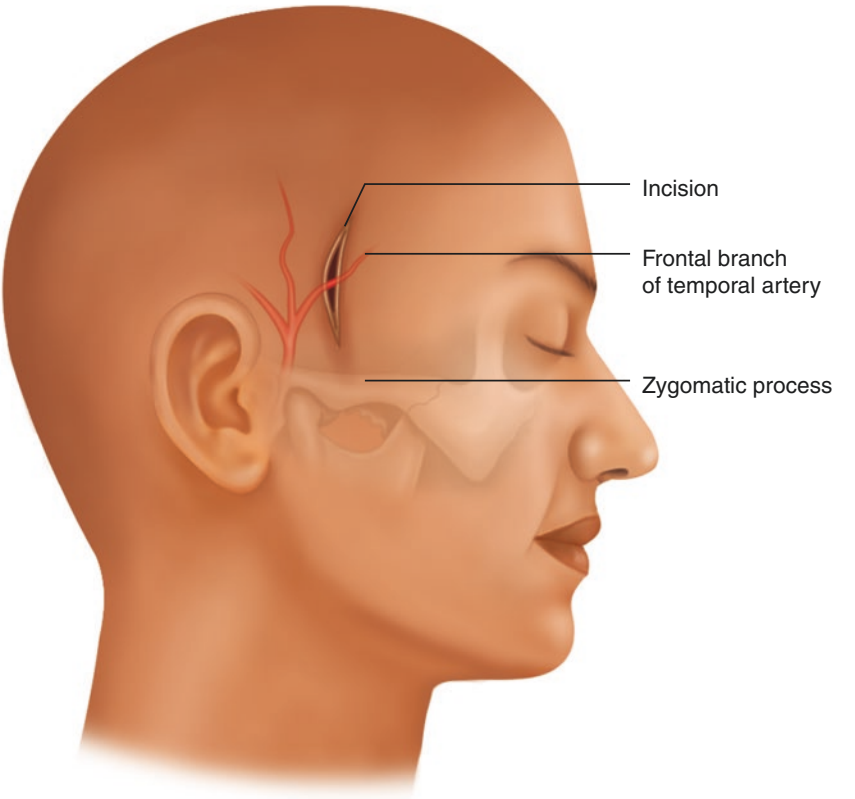
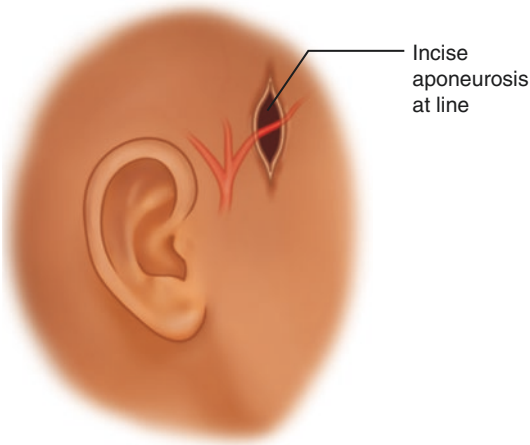


Fig. 1.13 Anatomical landmarks for temporal artery biopsy

Fig. 1.14 Incision for temporal artery biopsy



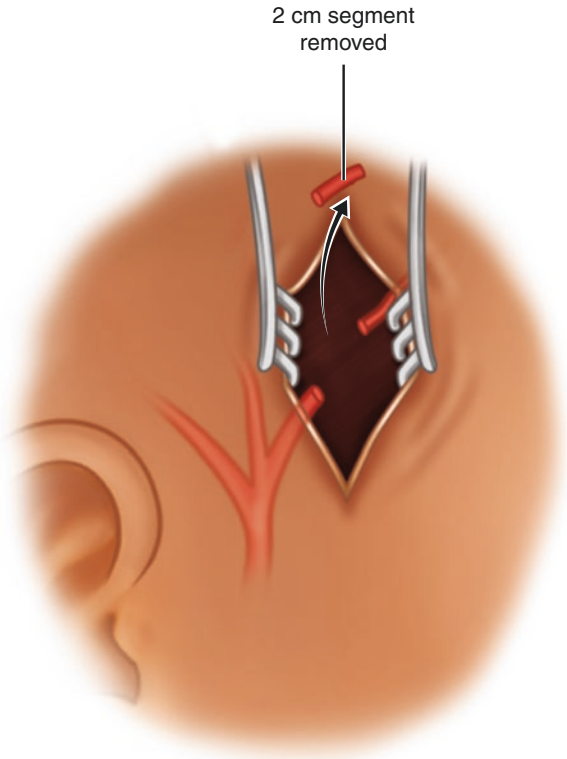


Fig. 1.15 Removal of arterial segment

Ingrown Toenail

Definition: Inflammatory process with or without abscess formation secondary to embedment of the lateral or medial edge of the nail into the nail fold.

Conservative Treatment

Good hygiene requires that the nail be cut in transverse, straight fashion without any trimming of the edges (the square nail-cutting technique). Carefully elevate the embedded edge and insert a piece of cotton between the infected nail fold and the nail. Repeat the procedure until the ingrown nail edge grows above and distal to the nail fold.

Total Excision (Avulsion) of Nail

- **Step 1.** Prepare distal half of foot.
- **Step 2.** Use double rubber band around the proximal phalanx for avascular field. Inject lidocaine, 1–2% without epinephrine, at the lateral and medial aspect of the second phalanx.
- **Step 3.** Insert a straight hemostat under the nail at the area of the inflammatory process until the edge of the instrument reaches the lunula.

- **Step 4.** Roll instrument and nail toward the opposite side for the avulsion of the nail.
- **Step 5.** Occasionally a small fragment of nail remains in situ and should be removed.
- **Step 6.** Excise all granulation tissue.
- **Step 7.** Cover area with antibiotic ointment and apply sterile dressing.

Partial Excision of Nail and Matrix (Figs. 1.16, 1.17, and 1.18)
Proceed as in total excision; except in step 4, remove only the involved side of the nail. Remove all granulation tissue, necrotic skin, matrix, and periosteum.

Remember
- The removal of the matrix in the designated area should be complete. Use curette as required. If in doubt, make a small vertical incision at the area for better exposure of the lateral nail and matrix to aid complete removal of these entities.

Fig. 1.16 Preparation of nail, showing incision lines

Fig. 1.17 Avulsion