Surgical Anatomy and Technique

Third Edition

Lee John Skandalakis
John E. Skandalakis
Panajiotis N. Skandalakis

Surgical Anatomy and Technique

A Pocket Manual

Third Edition

Springer

Lee J. Skandalakis, MD, FACS
Clinical Professor of Surgical
Anatomy and Technique
Emory University School
of Medicine
Attending Surgeon
Piedmont Hospital
Atlanta, Georgia

John E. Skandalakis, MD, PhD, FACS
Chris Carlos Distinguished
Professor of Surgical Anatomy
and Technique
Director, Centers for Surgical
Anatomy and Technique
Professor of Surgery
Emory University School
of Medicine
Atlanta, Georgia
Clinical Professor of Surgery
Medical College of Georgia,
Augusta, Georgia, and
Mercer University School
of Medicine
Macon, Georgia

Panajiotis N. Skandalakis, MD, MS
Clinical Professor of Surgical
Anatomy and Technique
Emory University School
of Medicine
Atlanta, Georgia
and
Professor and Chairman
Department of Anatomy
University of Athens School
of Medicine
Athens, Greece

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To the medical staff at Piedmont Hospital in Atlanta.
You are truly the sine qua non.

LJS

Preface to the Third Edition

A good surgeon must have an eagle's eye,
a lion's heart and a lady's hand.

—English saying

In this third edition of *Surgical Anatomy and Technique: A Pocket Manual*, we are very pleased to add three new chapters: the vascular system by Drs. Deepak G. Nair and Robert B. Smith III; the uterus, ovaries, and tubes by Dr. Ramon A. Suarez; and microsurgical techniques by Drs. John G. Seiler III and Petros Mirilas.

Drs. Seth D. Force and Daniel L. Miller revised several procedures in the chapter on the esophagus. In the section on hemorrhoidectomies, Dr. Joseph J. Nichols, Jr., provided techniques for stapled hemorrhoidectomy and band ligation. Procedures for laparoscopic left colectomy including sigmoid colectomy and for laparoscopic-assisted right colectomy were added by Dr. Jay Singh in collaboration with Dr. Lee Skandalakis.

As in preceding editions we continue to present only basic ("nuts and bolts") surgical techniques, not advanced procedures such as transplantation and robotics, because we are committed to maintaining this book as a "pocket manual." We hope that the several chapters we reorganized are now easier to use. We want to mention that the sutures specified in the text are those preferred by the authors, but comparable sutures can be used at the surgeon's discretion.

My co-authors and I greatly appreciate the support we have received from Springer and the confidence Springer has had in *Surgical Anatomy and Technique: A Pocket Manual*. The book has been translated into eight languages in addition to being distributed throughout the world in English. We are grateful, also, to the anatomists, surgeons, and by all means, the students for their warm acceptance of this book. In my peripatetic life of lecturing I have found that signing the book for students eager to learn about surgical anatomy is an

emotional and heart-warming experience—even to "a lion's heart"—and sometimes even brings tears to my eyes.

As I wrote recently in a letter published in the *Bulletin of the American College of Surgeons* (BACS 2006;91[8]:48):

I believe it's time the pendulum shifted back to teaching our students the fundamentals of gross human anatomy and instilling a solid foundation on which to build. After all, surgeons can and will make many unnecessary and fatal accidents if they don't know surgical anatomy.

The reader will notice that in this edition my son, Lee, has taken the helm as the senior author, since I am now passing through the springtime of my senility. I am proud and grateful that he is continuing this work.

JES

Acknowledgments

From the initial publication of this book in 1995 through the present edition, we have benefited from the support and expertise of several of Springer's medical editors. The first edition came to fruition thanks to Esther Gumpert's enthusiastic assistance; the second edition was bolstered by the professionalism of Beth Campbell; and the current edition is the product of Paula Callaghan's skilled guidance. We would like, also, to express our gratitude to the members of the production department at Springer for their dedicated assistance in the publishing process. For readying the manuscripts for publication, we are indebted to our authors' editors at Emory University School of Medicine, Phyllis Bazinet and Carol Froman; and to Cynthia Painter, Dr. John E. Skandalakis' secretary. We thank Mark Barbaree, Edie Lacy, Sharon Scott, and Beth Simmons, librarians at Piedmont Hospital, Atlanta, for their research assistance. Special thanks, also, to Brook Fehrenbach Wainwright, Robert Wainwright, Jr., and Eric Grafman for their outstanding illustrations. In addition, the excellent photographic and artistic talents of the late Tom Fletcher have contributed greatly to the usefulness of this book. We acknowledge and appreciate Dr. Adel Bagh's medical expertise and advice on our coverage of the colon and perianal area.

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Contributors

Seth D. Force, MD
Assistant Professor of Surgery
Division of Cardiothoracic Surgery
Emory University School of Medicine
Surgical Director, Lung Transplantation
Emory University Hospital
Atlanta, Georgia

Daniel L. Miller, MD, FACS
The Kamal A. Mansour Professor of Thoracic Surgery
Emory University School of Medicine
Chief, General Thoracic Surgery
Emory University Healthcare
Atlanta, Georgia

Petros Mirilas, MD, MSurg
Clinical Professor of Surgical Anatomy and Technique
Emory University School of Medicine
Atlanta, Georgia
Lecturer in Pediatric Surgery/Microsurgery
Aristotle University of Thessaloniki
Thessaloniki, Greece

Deepak G. Nair, MD, MS, MHA, RVT
Vascular Surgeon
Sarasota Memorial Hospital
Sarasota, Florida

Joseph J. Nichols, Jr, MD, FASCRS
Colorectal Surgeon
Piedmont Hospital
Atlanta, Georgia

John Gray Seiler, III, MD
Clinical Professor, Orthopedic Surgery
Emory University School of Medicine
Orthopedic Surgeon
Georgia Hand and Microsurgery, PC
Atlanta, Georgia

Jay Singh MD, FACS, FASCRS
Co-Director Surgical Residency
Co-Director Richardson Center
Piedmont Hospital
Associate Professor of Surgery
Emory University School of Medicine
Atlanta, Georgia

Lee J. Skandalakis, MD, FACS
Clinical Professor of Surgical Anatomy and Technique
Emory University School of Medicine
Attending Surgeon
Piedmont Hospital
Atlanta, Georgia

John E. Skandalakis MD, PhD, FACS
Chris Carlos Distinguished Professor of Surgical Anatomy and Technique
Director, Centers for Surgical Anatomy and Technique
Professor of Surgery
Emory University School of Medicine
Atlanta, Georgia
Clinical Professor of Surgery
Medical College of Georgia, Augusta, Georgia, *and*
Mercer University School of Medicine, Macon, Georgia

Panajiotis N. Skandalakis, MD, MS
Clinical Professor of Surgical Anatomy and Technique
Emory University School of Medicine
Atlanta, Georgia
Professor and Chairman, Department of Anatomy
University of Athens School of Medicine
Athens, Greece

C. Daniel Smith, MD, FACS
Chair, Department of Surgery
Mayo Clinic
Jacksonville, Florida
Professor of Surgery
Mayo Clinic College of Medicine

Robert B. Smith III, MD, FACS
John E. Skandalakis Professor of Surgery, Emeritus
Emory University School of Medicine
Atlanta, Georgia

Ramon A. Suarez, MD, FACOG
Medical Director GYN/OB
Graduate Education
Piedmont Hospital
Clinical Professor
Department GYN/OB
Emory University School of Medicine
Atlanta, Georgia

1

Skin, Scalp, and Nail

Anatomy

■ SKIN AND SUBCUTANEOUS TISSUE (Fig. 1.1)

The skin is composed of two layers: the epidermis (superficial) and the dermis (under the epidermis). The thickness of the skin varies from 0.5 to 3.0 mm.

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.

The dermis has a thickness of 0.5–2.5 mm and contains smooth muscles and sebaceous and sweat glands. Hair roots are located in the dermis or subcutaneous tissue.

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.

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.

L.J. Skandalakis et al., *Surgical Anatomy and Technique*,
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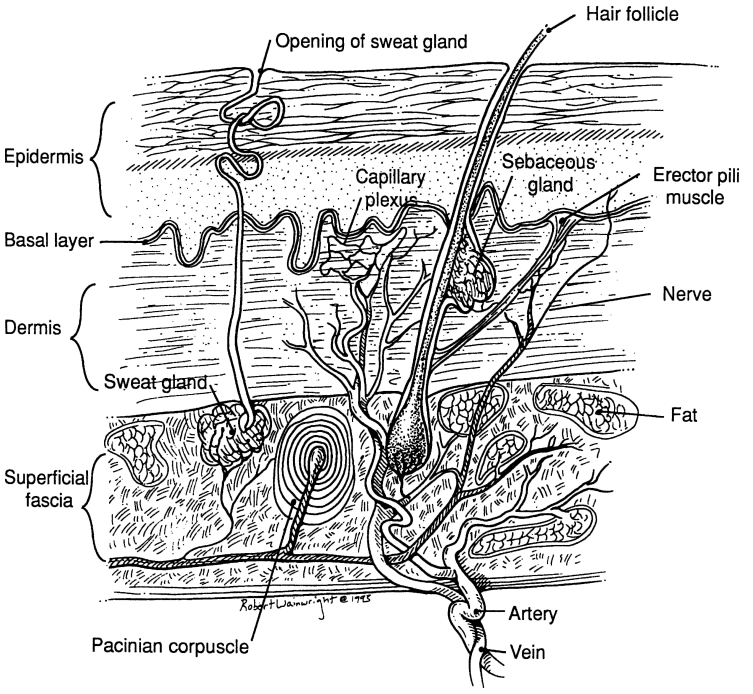


Figure 1.1.

- ✔ 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.)

	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

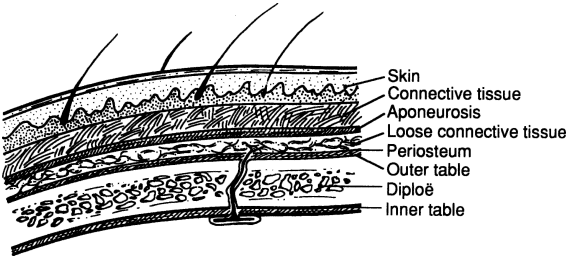


Figure 1.2.

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.

Venous Drainage

Veins follow the arteries.

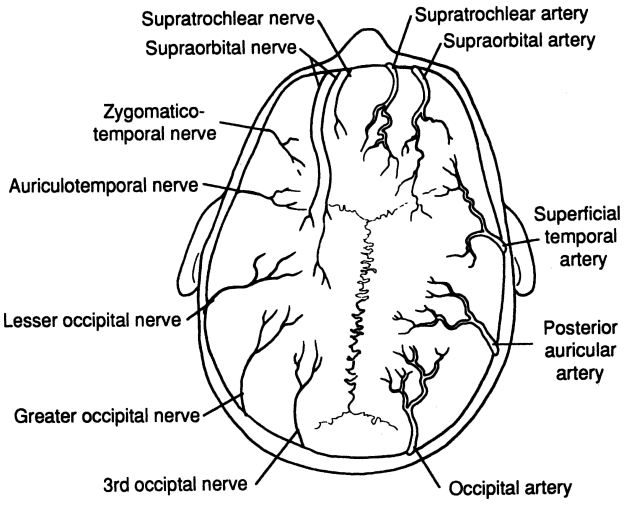


Figure 1.3. Arterial blood supply shown on right. Nerve distribution shown on left. Veins are not shown, but follow the arteries.

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:

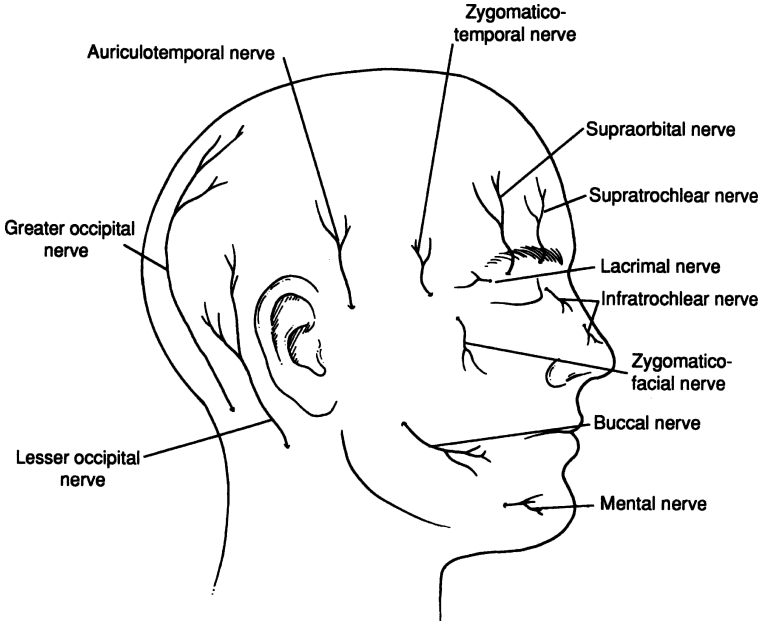
- ✔ The blood supply of the scalp is rich. Arteries are anastomosed very freely.
- ✔ The arteries and veins travel together in a longitudinal fashion.
- ✔ A transverse incision or laceration will produce a gap. Dangerous bleeding will take place from both vascular ends due to nonretraction of the arteries 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 promptly. Use antibiotics to prevent intracranial infections via the emissary veins.
- ✔ Shave 1–2 cm around the site of the incision or laceration.
- ✔ 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 3–5 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 Fig. 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, zygomaticofacial (zygomatic [maxillary] nerve)



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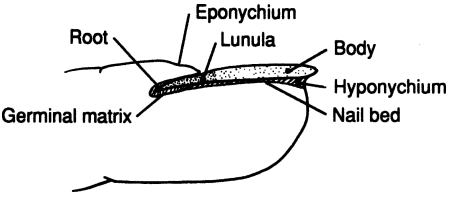

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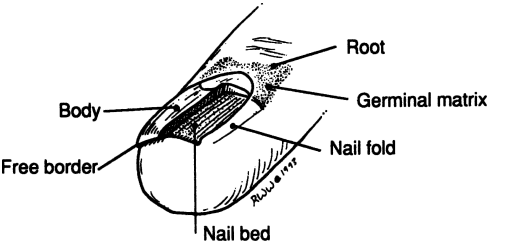


Figure 1.6.

- Supraorbital (ophthalmic nerve)
- Supratrochlear (ophthalmic nerve)

■ NAIL

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

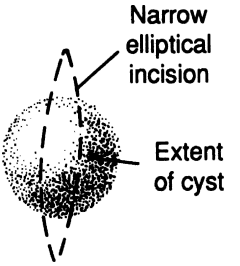
TECHNIQUE

■ BENIGN SKIN LESIONS (Figs. 1.7–1.9)

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 suppurativae, and burns. Junctional, compound, and intradermal nevi and malignant lentigos compose another group.

Step 1. For a cyst, make an elliptical incision. For a noncystic lesion, be sure to include approximately 0.5 cm of tissue beyond the lesion when making the elliptical incision.



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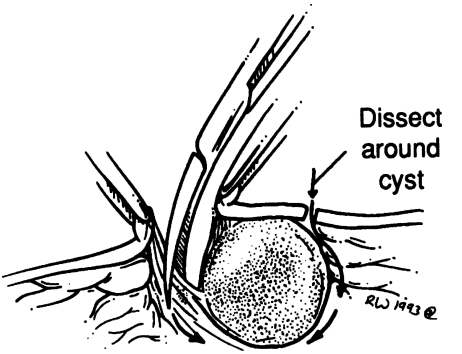

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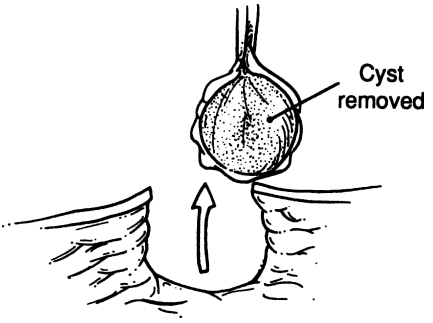

Figure 1.9.

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. 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. 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. A nylon epidermal continuous suture may be left in for 2 weeks without any problems in most cases.

■ 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, 0.5–1.0 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.

✔ Prior to surgery explain to the patient about scarring, recurrence, etc.

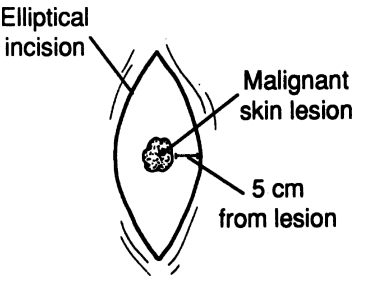

Figure 1.10.

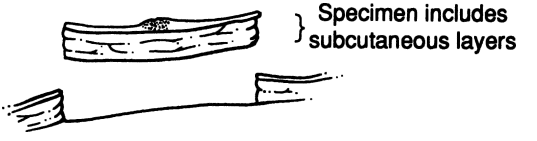

Figure 1.11.

✔ Consider the medicolegal aspects of the case. If the case involves a large facial lesion, obtain the advice of a plastic surgeon.

Melanoma

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

Controversy

Surgical oncologists differ in their approach to treatment. Some advocate regional lymphadenectomy when there is clinical adenopathy and no distal metastasis. Others believe in prophylactic lymph node excision.

Remember:

- ✔ Perform a sentinel lymph node biopsy and, if positive, follow up with a complete lymph node dissection. 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 from another pathologist.

Lesion Thickness and Regional Lymph Node Staging

Most surgeons today do not excise more than 1.5 cm around the lesion on the face or 3 cm elsewhere. 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 does no good. For intermediate levels 2, 3, and 4, lymphadenectomy can be therapeutic. In our practice, a sentinel lymph node biopsy is done first and, if positive, is followed by a complete lymphadenectomy.

■ SENTINEL LYMPH NODE BIOPSY

Step 1. Radiologist has localized sentinel lymph node preoperatively by injecting radioisotope around the lesion (on breast: around nipple).

Step 2. In operating room incision is made over the area with the highest radioactivity count.

Step 3. Dissect down to lymph node.

Step 4. Using Geiger counter, identify and remove the sentinel lymph node.

Step 5. If frozen section of sentinel lymph node is found to be positive, proceed to full lymph node dissection.

■ 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
INDICATIONS: Noninfected area
CONTRAINDICATIONS: Infection, exposed bone without periosteum, exposed cartilage without perichondrium, exposed tendon without sheath
DONOR AREA: Abdomen, thigh, arm
COMPLICATIONS: Infection, failure to take, contractures

Step 1. Prepare both areas. Skin of donor area must be kept taut by applying hand or board pressure.

Step 2. Remove estimated skin. We use a Zimmer dermatome set at a thickness of 0.03 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 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 × 4s or cotton balls. Then cover with roll gauze of appropriate size circumferentially.

Step 6. Change dressing in 3 days.

Alternative procedure: After step 3, do not cut sutures. Instead, tie them above a nonadherent gauze supported by a moist gauze to ensure maximum pressure to the graft.

Postage-Stamp Graft

In this procedure, multiple grafts are placed 3–5 mm from each other.

Full-Thickness Graft

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
CONTRAINDICATIONS: Infections
DONOR AREA: Same as in split thickness grafts; also postauricular, supraclavicular, or nasolabial
TECHNIQUE: Same as in split thickness skin grafts

■ SCALP SURGERY

Excision of Benign Lesion

Step 1. Cut hair with scissors. With razor, shave hair 1 cm around the lesion.

Step 2. Make longitudinal or elliptical incision, removing small ovoid piece of skin.

Step 3. Elevate flaps.

Step 4. Obtain hemostasis.

Step 5. Remove cyst.

Step 6. Close skin.

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 should 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 should be done.

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.

Biopsy of Temporal Artery

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

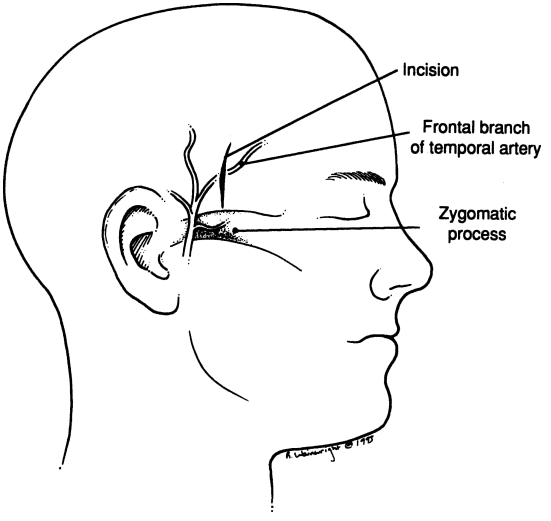

Figure 1.12.

Step 2. Make longitudinal incision (Fig. 1.12).

Step 3. Carefully incise the aponeurosis (Fig. 1.13).

Step 4. After proximal and distal ligation with 2–0 silk, remove arterial segment at least 2 cm long (Fig. 1.14).

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 and is crossed by the temporal and zygomatic branches of the facial nerve.

✔ Perform biopsy above the zygomatic process.

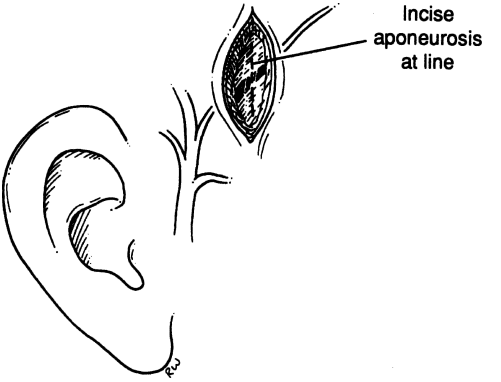

Figure 1.13

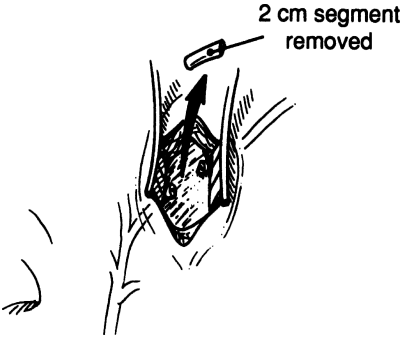

Figure 1.14

■ 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 percent 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. 1.15–1.17)

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.

Radical Excision of Nail and Matrix

Follow the total excision procedure described above, and then continue with steps 4a–4d:

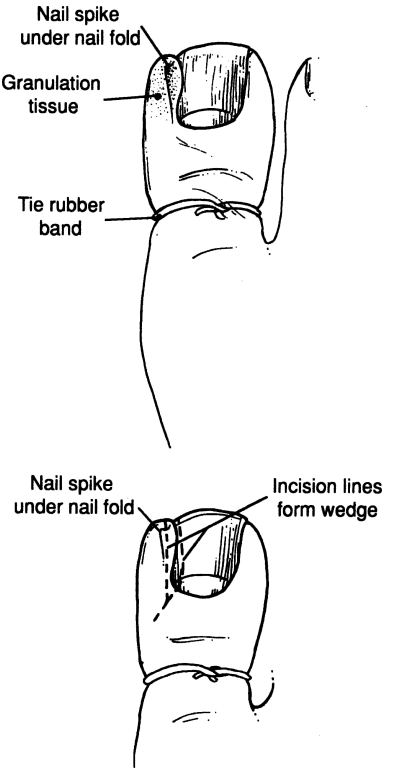

Figure 1.15.

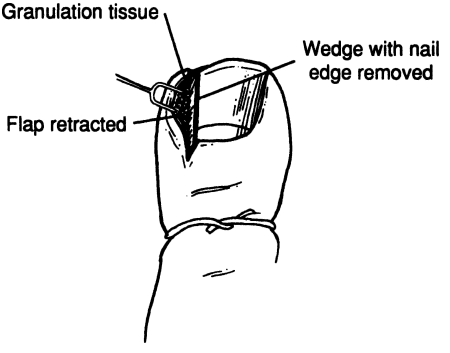

Figure 1.16.

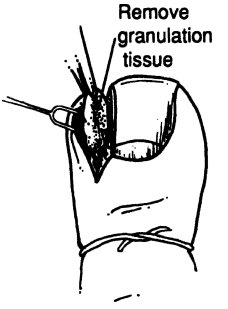

Figure 1.17.

Step 4a. Make vertical incisions medially and laterally.

Step 4b. Elevate flaps for exposure of the matrix.

Step 4c. Remove matrix in toto with knife and, as required, with curette.

Step 4d. Loosely approximate the skin.

Note: This procedure is done only if there is no evidence of inflammatory process.

2

Neck

Anatomy

■ ANTERIOR CERVICAL TRIANGLE (Fig. 2.1)

The boundaries are:

- Lateral: sternocleidomastoid muscle
- Superior: inferior border of the mandible
- Medial: anterior midline of the neck

This large triangle may be subdivided into four more triangles: submandibular, submental, carotid, and muscular.

Submandibular Triangle

The submandibular triangle is demarcated above by the inferior border of the mandible and below by the anterior and posterior bellies of the digastric muscle.

The largest structure in the triangle is the submandibular salivary gland. A number of vessels, nerves, and muscles also are found in the triangle.

For the surgeon, the contents of the triangle are best described in four layers, or surgical planes, starting from the skin. It must be noted that severe inflammation of the submandibular gland can destroy all traces of normal anatomy. When this occurs, identifying the essential nerves becomes a great challenge.

Roof of the Submandibular Triangle

The roof—the first surgical plane—is composed of skin, superficial fascia enclosing platysma muscle and fat, and the mandibular and cervical branches of the facial nerve (VII) (Fig. 2.2).

It is important to remember that: (1) the skin should be incised 4 to 5 cm below the mandibular angle; (2) the platysma and fat compose the superficial fascia; and (3) the cervical branch of the facial nerve (VII) lies just below the angle, superficial to the facial artery (Fig. 2.3).

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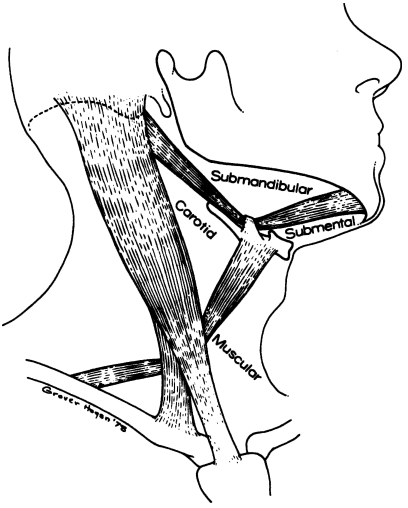

Figure 2.1. The subdivision of the anterior triangle of the neck. (By permission of JE Skandalakis, SW Gray, and JR Rowe. *Am Surg* 45(9):590–596, 1979.)

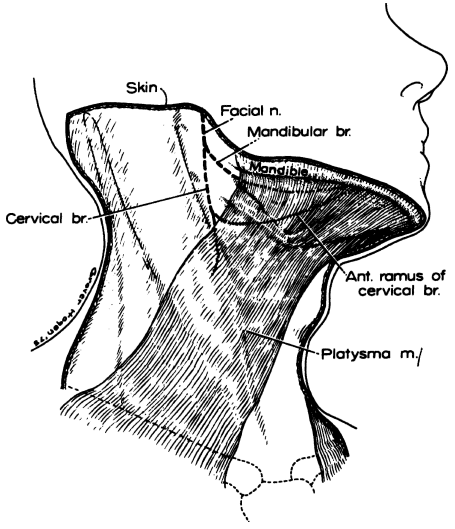

Figure 2.2. The roof of the submandibular triangle (the first surgical plane). The platysma lies over the mandibular and cervical branches of the facial nerve. (By permission of JE Skandalakis, SW Gray, and JR Rowe. *Am Surg* 45(9):590–596, 1979.)