

# *Essentials*

for students



PLASTIC SURGERY  
EDUCATIONAL FOUNDATION

**plastic surgery**

The Plastic Surgery Educational Foundation (PSEF) is the educational arm of the American Society of Plastic Surgeons. The Foundation is proud to display the symbol of excellence of ASPS signifying the professional expertise of plastic surgeons certified by The American Board of Plastic Surgery or by The Royal College of Physicians and Surgeons, Canada.

The mission of the PSEF is to develop and support the domestic and international education, research and public service activities of plastic surgeons.

Additional copies of this book may be obtained by calling PSEF at 800-766-4955, press 7.



# *Essentials*

for students



PLASTIC SURGERY  
EDUCATIONAL FOUNDATION

plastic surgery

*Printing made possible by an educational grant from*

**ETHICON**  
a *Johnson & Johnson* company

**UNDERGRADUATE EDUCATION COMMITTEE OF  
THE PLASTIC SURGERY EDUCATIONAL FOUNDATION**

**Sixth Edition 2002**

Charles N. Verheyden, MD, PhD, Chair  
Joseph Losee, MD  
Michael J. Miller, MD  
W. Bradford Rockwell, MD  
Sheri Slezak, MD

**First Edition 1979**

Ruedi P. Gingrass, MD, Chairman  
Martin C. Robson, MD  
Lewis W. Thompson, MD  
John E. Woods, MD  
Elvin G. Zook, MD

Copyright © 1979 by the

Plastic Surgery Educational Foundation  
444 East Algonquin Road  
Arlington Heights, IL 60005

13th Printing 2002

All rights reserved.

Printed in the United States of America

**INTRODUCTION**

This book has been written primarily for medical students, with constant attention to the thought, "Is this something a student should know when he or she finishes medical school?" It is not designed to be a comprehensive text, but rather an outline that can be read in the limited time available in a burgeoning curriculum. It is designed to be read from beginning to end.

Plastic surgery had its beginning thousands of years ago, when clever surgeons in India reconstructed the nose by transferring a flap of forehead skin. It is a modern field, stimulated by the challenging reconstructive problems of the unfortunate victims of the World Wars. The advent of the operating microscope has thrust the plastic surgeon of today into the forefront of advances in small vessel and nerve repair, culminating in the successful replantation of amputated parts as small as distal fingers. The field is broad and varied and this book covers the many areas of involvement and training of today's plastic surgeons.

The Plastic Surgery Educational Foundation is proud to provide complimentary copies of the Plastic Surgery *Essentials for Students* handbook to all third year medical students in the United States and Canada.

**Continually updated information about various procedures in plastic surgery and other medical information of use to medical students and other physicians can be found at the ASPS/PSEF Web site at [www.plasticsurgery.org](http://www.plasticsurgery.org).**

## TABLE OF CONTENTS

Preface: A Career in Plastic Surgery . . . . .	i
Chapter 1: Wounds . . . . .	1
Chapter 2: Grafts and Flaps . . . . .	10
Chapter 3: Skin and Subcutaneous Lesions . . . . .	18
Chapter 4: Head and Neck . . . . .	30
Chapter 5: Trunk and External Genitalia . . . . .	46
Chapter 6: Upper Extremity . . . . .	54
Chapter 7: Lower Extremity . . . . .	67
Chapter 8: Thermal Injuries . . . . .	75
Chapter 9: Aesthetic Surgery . . . . .	93

## PREFACE

### A CAREER IN PLASTIC SURGERY

Originally derived from the Greek “plastikos” meaning to mold and reshape, plastic surgery is a specialty which adapts surgical principles to the unique needs of the individual patient by remolding and reshaping tissue. Not concerned with a given organ system, region of the body, or age group, it is best described as a specialty devoted to the solution of difficult wound healing problems, having as its ultimate goal the restoration or creation of the best function of a part of the body with a superior aesthetic appearance.

Plastic surgeons emphasize the importance of treating the patient as a whole. Whether reconstructing patients with injuries, disfigurements or scarring, or performing cosmetic procedures to recontour facial and body features not pleasing to the patient, plastic surgeons are concerned with the effect of the outcome on the entire patient. Exposure to a wide variety of surgical problems enhances the ability of the plastic surgeon to care for patients.

In attempting to solve the unique problems presented by each patient, plastic surgeons apply the basic techniques and principles of surgery rather than relying on a standard repertoire of operations. The challenge of plastic surgery is the wedding of the surgeon’s judgement and problem solving abilities to surgical technique. Because of this approach, the plastic surgeon often acts as a “last resort” surgical consultant to physicians in the treatment of many wound problems and is often called “the surgeon’s surgeon.”

Plastic surgery not only restores body function, but helps to renew or improve a patient’s body image and sense of self-esteem. Along with psychiatrists, plastic surgeons are especially equipped to handle the patient’s problem of body image and to help the patient deal with either real or perceived problems.

Consistent with these far reaching goals, the scope of the operations performed by plastic surgeons is extremely broad. As outlined by The American Board of Plastic Surgery, “the specialty of plastic surgery deals with the repair, replacement, and reconstruction of physical defects of form or function involving the skin, musculoskeletal system, craniomaxillofacial structures, hand, extremities, breast and trunk, and external genitalia. It uses aesthetic

surgical principles not only to improve undesirable qualities of normal structures, but in all reconstructive procedures as well.” Among the problems managed by plastic surgeons are congenital anomalies of the head and neck. Clefts of the lip and palate are the most common, but many other head and neck congenital deformities exist. In addition, the plastic surgeon treats injuries to the face, including fractures of the bone of the jaw and face.

Craniofacial surgery is a discipline developed to reposition and reshape the bones of the face and skull through inconspicuous incisions. Severe deformities of the cranium and face, which previously were uncorrectable or corrected with great difficulty, can now be better reconstructed employing these new techniques. Such deformities may result from a tumor resection, congenital defect, previous surgery, or previous injury. Treatment of tumors of the head and neck and reconstruction of these regions after the removal of these tumors is also within the scope of plastic surgery.

Another area of expertise for the plastic surgeon is hand surgery, including the management of acute hand injuries, the correction of hand deformities and reconstruction of the hand. Microvascular surgery, a technique that allows the surgeon to connect blood vessels of one millimeter or less in diameter, is a necessary skill in hand surgery for re-implanting amputated parts or in moving large pieces of tissue from one part of the body to another.

Defects of the body surface resulting from burns or from injuries, previous surgical treatment, or congenital deformities may also be treated by the plastic surgeon. One of the most common of such procedures is reconstruction of the breast following mastectomy. Breasts may also be reduced in size, increased in size, or changed in shape to improve the final aesthetic appearance. Operations of this type are sometimes cosmetic in purpose, but in cases where the patient has a significant asymmetry or surgical defect, the procedure serves important therapeutic purposes.

The most highly visible area of plastic surgery is aesthetic or cosmetic surgery. Cosmetic surgery includes facelifts, breast enlargements, nasal surgery, body sculpturing, and other similar operations to enhance one’s appearance.

The results of the plastic surgeon’s expertise and ability are highly visible, leading to a high degree of professional and personal satisfaction. The discipline requires meticulous attention to detail,

sound judgment and technical expertise in performing the intricate and complex procedures associated with plastic surgery. In addition, plastic surgeons must possess a flexible approach that will enable them to work on a daily basis with a tremendous variety of surgical problems. Most importantly, the plastic surgeon must have creativity, curiosity, insight, and an understanding of human psychology.

Because of the breadth of the specialty and its ever changing content, opportunities for individuals with varied backgrounds is particularly important. Individuals with undergraduate majors ranging from art to engineering find their skills useful in various areas of plastic surgery. This need for a broad education continues into medical school.

Students should use elective time to acquire the broadest base of medical knowledge. Experience in surgery and psychiatry are of particular value. Clinical rotations in surgical specialties, such as neurosurgery, orthopedics, otolaryngology, pediatric surgery, or urology may prove more valuable than general surgery since most of the early residency experience will be in general surgery.

While there are several approved types of prerequisite surgical education, most candidates for the traditional plastic surgery residency programs have had from three to five years of training in general surgery after graduating from medical school. Applicants may also apply for a plastic surgery residency after completing a residency in otolaryngology, orthopedics, neurosurgery, or urology. Plastic surgery residency in the traditional format is generally for two or three years. Recently, a new residency in plastic surgery has been developed called the Integrated Residency. Applicants apply to start immediately following graduation from medical school and will have either five or six years of training under the leadership of the program director of plastic surgery. Following residency training, many physicians spend an additional six to twelve months of fellowship training in a particular area of plastic surgery such as craniofacial surgery, aesthetic surgery, hand surgery, or microsurgery.

The American Board of Plastic Surgery (ABPS) issues a Booklet of Information each year which outlines the training and requirements for eligibility to take the examinations offered by the board. You may request information from ABPS at:

**The American Board of Plastic Surgery, Inc.**  
**Seven Penn Center, Suite 400**  
**1635 Market Street**  
**Philadelphia, PA 19103-2204**  
**Phone: 215-587-9322**  
**Fax: 215-587-9622**

Traditionally, plastic surgeons have established their practices in large urban settings. However, there is an increasing need for more plastic surgeons in the smaller communities and rural areas of this country — many metropolitan areas with populations of 65,000 to 268,000 have no plastic surgeons, leaving a large number of areas needing plastic surgery expertise. There are approximately 5,000 board certified plastic surgeons in the United States; many of those currently certified by The American Board of Plastic Surgery received certification in the past ten years. Despite this recent rapid growth, there are opportunities for plastic surgeons in community and academic practice.

Plastic surgery is an old specialty with references that date back thousands of years. It has survived and flourished because it is a changing specialty built by imaginative, creative and artistic surgeons with a broad background and education.

The limit of the specialty is bound only by the imagination and expertise of those in its practice. The opportunities for the future are open to those who wish to be challenged.

## **ADDITIONAL RESOURCES ON THE SPECIALTY OF PLASTIC SURGERY**

- I. Plastic Surgery Educational Foundation**  
444 East Algonquin Road  
Arlington Heights, IL 60005-4664  
Phone: 847-228-9900  
Fax: 847-228-9131  
[www.plasticsurgery.org](http://www.plasticsurgery.org)
- II. Plastic Surgery Research Council**  
Suite 304  
45 Lyme Road  
Hanover, NH 03755  
Phone: 603-643-2325  
[www.ps-rc.org](http://www.ps-rc.org)
- III. Residency Review Committee for Plastic Surgery**  
515 North State Street, Suite 2000  
Chicago, IL 60610  
Phone: 312-464-5586  
Fax: 312-464-4098

## CHAPTER 1

### WOUNDS

A wound can be defined as a disruption of the normal anatomical relationships of tissues as a result of injury. The injury may be intentional such as a surgical incision or accidental following trauma. Immediately following wounding, the healing process begins.

#### I. STAGES OR PHASES OF WOUND HEALING

Regardless of type of wound healing, stages or phases are the same except that the time required for each stage depends on the type of healing.

- A. *Substrate* phase (inflammatory, lag or exudative stage or phase — days 1-4)
  1. Symptoms and signs of inflammation
    - a. Redness, heat, swelling, pain, and loss of function
  2. Physiology of inflammation
    - a. Leukocyte margination, sticking, emigration through vessel walls
    - b. Venule dilation and lymphatic blockade
    - c. Neutrophil chemotaxis and phagocytosis
  3. Removal of clot, debris, bacteria, and other impediments of wound healing
  4. Lasts finite length of time (approximately four days) in primary intention healing
  5. Continues until wound is closed (unspecified time) in secondary and tertiary intention healing
- B. *Proliferative* phase (collagen and fibroblastic stage or phase — approximately days 4-42)
  1. Synthesis of collagen tissue from fibroblasts
  2. Increased rate of collagen synthesis for 42-60 days
  3. Rapid gain of tensile strength in the wound (Fig. 1-1)
- C. *Remodeling* phase (maturation stage or phase — from approximately three weeks onward)
  1. Maturation by intermolecular cross-linking of collagen leads to flattening of scar
  2. Requires approximately 9 months in an adult - longer in children
  3. Dynamic, ongoing

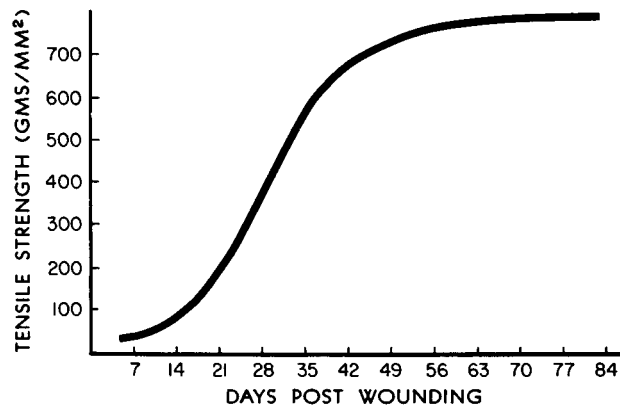


Fig. 1-1

## II. WOUND CLOSURE

- A. *Primary* healing (by first intention) — wound closure by direct approximation, pedicle flap or skin graft
  1. Debridement and irrigation minimize inflammation
  2. Dermis should be accurately approximated with sutures (see chart at end of chapter) or skin glue (i.e., Dermabond)
  3. Scar red, raised, pruritic, and angry-looking at peak of collagen synthesis
  4. Thinning, flattening and blanching of scar occurs over approximately 9 months in adults, as collagen maturation occurs (may take longer in children)
  5. Final result of scar depends largely on how the dermis was approximated
- B. *Spontaneous* healing (by secondary intention) — wound left open to heal spontaneously — maintained in inflammatory phase until wound closed
  1. Spontaneous wound closure depends on contraction and epithelialization
  2. Contraction results from centripetal force in wound margin probably provided by myofibroblasts
  3. Epithelialization proceeds from wound margins towards center at 1 mm/day

4. Although contraction (the process of contracting) is normal in wound healing, one must beware of contracture (an end result — may be caused by contraction of scar and is a pathological deformity)
  5. Secondary healing beneficial in some wounds, e.g. perineum, heavily contaminated wounds, scalp
- C. *Tertiary* healing (by third intention) — delayed wound closure after several days
1. Distinguishing feature of this type of healing is the intentional interruption of healing begun as secondary intention
  2. Can occur any time after granulation tissue has formed in wound
  3. Delayed closure should be performed when wound is not infected (usually  $10^5$  or fewer bacteria/gram of tissue except with beta-STREP)

## III. FACTORS INFLUENCING WOUND HEALING

- A. Local factors most important because we can control them
  1. Tissue trauma — must be kept at a minimum
  2. Hematoma — associated with higher infection rate
  3. Blood supply
  4. Temperature
  5. Infection
  6. Technique and suture materials — only important when factors 1-5 have been controlled
- B. General factors — cannot be readily controlled by surgeon; systemic effects of steroids, nutrition, chemotherapy, chronic illness, etc., contribute to wound healing

## IV. MANAGEMENT OF THE CLEAN WOUND

- A. Goal — obtain a closed wound as soon as possible to prevent infection, fibrosis and secondary deformity
- B. General principles
  1. Immunization — use American College of Surgeons Committee on Trauma recommendation for tetanus immunization
  2. If necessary, use pre-anesthetic medication to reduce anxiety



3. Local anesthesia — use Lidocaine with epinephrine unless contraindicated, e.g. tip of penis
  4. Tourniquet to provide bloodless field in extremities
  5. Cleansing of surrounding skin — do **NOT** use strong antiseptic in the wound itself
  6. Debridement
    - a. Remove clot and debris, necrotic tissue
    - b. Copious irrigation good adjunct to sharp debridement
  7. Closure — use atraumatic technique to approximate dermis. Consider undermining of wound edges to relieve tension
  8. Dressing — must provide absorption, protection, immobilization, even compression, and be aesthetically acceptable
- C. Types of wounds and their treatment
1. Abrasion — cleanse to remove foreign material
    - a. Consider scrub brush or dermabrasion to remove dirt buried in dermis to prevent traumatic tattoos (permanent discoloration due to buried dirt beneath new skin surface) — needs to be accomplished within 24 hours of injury
  2. Contusion — consider need to evacuate hematoma if collection is present
    - a. Early — minimize by cooling with ice (24-48 hours)
    - b. Later — warmth to speed absorption of blood
  3. Laceration — trim wound edges if necessary (ragged, contused) and suture
  4. Avulsion
    - a. Partial (creates a flap) — revise and suture if viable
    - b. Total — do not replace totally avulsed tissue except as a skin graft after fat is removed
  5. Puncture wound — evaluate underlying damage, possibly explore wound for foreign body, etc. Animal bites — debride and close primarily or leave open, depending upon anatomic location, time since bite, etc. Use antibiotics

- D. Wounds of face
1. Important to use careful technique
    - a. Urgency should not override judgement
    - b. There is a longer “period of grace” during which the wound may be closed since blood supply to face is excellent
    - c. **Do not** forget about other possible injuries (chest, abdomen, extremities). **Very rare** for patient to die from facial lacerations alone
  2. Facial lacerations of secondary importance to airway problems, hemorrhage or intracranial injury
  3. Beware of overaggressive debridement of questionably viable tissue
  4. Isolate cavities from each other by suturing linings, such as oral and nasal mucosa
  5. Use anatomic landmarks to advantage, e.g. alignment of vermillion border, nostril sill, eyebrow, helical rim
- E. Wounds of the upper extremity (*See Chapter 6*)
- F. Special Wounds
1. Amputation of parts
    - a. Attempt replacement if within six hours of injury
    - b. Place amputated part in saline soaked gauze in a plastic bag and **the bag** in ice
  2. Cheek injury — examine for parotid duct and/or facial nerve injury
  3. Intraoral injuries — tongue, cheek, palate, and lip wounds require suturing
  4. Eyelids — align grey line and close in layers — consider temporary tarsorrhaphy
  5. Ear injuries
    - a. Hematoma — incision and drainage of hematoma and well-molded dressing to prevent cauliflower ear deformity
    - b. Through-and-through laceration requires 3 layer closure including cartilage
  6. Animal bites — debridement, irrigation, antibiotics, and possible wound closure. Be particularly careful of cat bites which can infect with a very small puncture wound

## V. MANAGEMENT OF THE “CONTAMINATED” WOUND

- A. Guidelines for management of contaminated acute wounds
1. Majority of civilian traumatic wounds can be closed primarily after adequate debridement
    - a. Adequate debridement
      - i. Mechanical/sharp
      - ii. Irrigation — copious pulsatile lavage
    - b. Exceptions (may opt to leave wound open)
      - i. Heavy bacterial inoculum (human bites)
      - ii. Long time lapse since wounding (relative)
      - iii. Crushed or ischemic tissue — severe contused avulsion injury
      - iv. Sustained high-level steroid ingestion
  2. Antibiotics — Systemic antibiotics are only of use if a therapeutic tissue level can be reached within four hours of wounding or debridement
  3. Wound closure
    - a. Buried sutures should be used to keep wound edge tension to a minimum; however, each suture is a foreign body which increases the chance of infection (use least number of sutures possible to bring wound together without tension)
    - b. Skin sutures of monofilament material are less apt to become infected
    - c. Porous tape closure may be used for some wounds
  4. Follow up — contaminated traumatic wounds should be checked for infection within 48 hours after closure
  5. If doubt exists, it is always safer to delay closure (revision can be done later)
- B. Guidelines for management of contaminated **chronic** wounds
1. Examples — wounds greater than 24 hours old
    - a. Common ingredient — granulation tissue
  2. Debridement as important as in an acute wound
    - a. Excision (scalpel, scissors)
    - b. Frequent dressing changes
    - c. Enzymatic — seldom indicated
  3. Systemic antibiotics of little use

4. Topical antibacterial creams — silver sulfadiazine (Silvadene®) and mafenide acetate (Sulfamylon®)
  - a. Continual surface contact
  - b. Good penetrating ability
  - c. Decrease bacterial counts of wounds
5. Biological dressings (allograft, xenograft, some synthetic dressings) debride wound, decrease pain.
6. Final closure
  - a. With a delayed flap, skin graft or flap
  - b. Convert the chronic contaminated wound bacteriologically to an acute clean wound by decreasing the bacterial count (debridement)

## VI. WOUND DRESSINGS

- A. Protect the wound from trauma
- B. Provide environment for healing
- C. Antibacterial medications
1. Bacitracin® and Neosporin®
    - a. Provide moist environment conducive to epithelialization
  2. Silver sulfadiazine (Silvadene®) and mafenide acetate (Sulfamylon®)
    - a. Useful for burns or other wounds with an eschar
    - b. Antibacterial activity penetrates eschar
- D. Splinting and casting
1. For immobilization to promote healing
  2. Do not splint too long — may promote joint stiffness
- E. Pressure Dressings
1. May be useful to prevent “dead space” (potential space in wound) or to prevent seroma/hematoma
  2. Do not compress flaps tightly
- F. Do not leave dressing on too long (<48 hours) before changing

ETHICON® Synthetic Absorbable Sutures				
SUTURE & COMPOSITION	COLOR & TYPE	BSR	ABSORPTION RATE	FREQUENT USES
Coated VICRYL RAPID* (polyglactin 910) suture	Undyed Braided	50% at 5 days 0% at 10 to 14 days	Essentially complete by 42 days	<b>Skin and Mucosa:</b> - Epistomony repair - Lacerations under casts - Mucosa in oral cavity - Skin repairs where rapid absorption may be beneficial, excluding joints and high stress areas
MONOCRYL* (polylactaprome 25) suture	Undyed/Dyed (violet) Monofilament	<b>Dyed:</b> 60 to 70% at 7 days 30 to 40% at 14 days <b>Undyed:</b> 50 to 60% at 7 days 20 to 30% at 14 days	Essentially complete between 91 and 119 days	<b>Soft Tissue Approximation:</b> - Ligation - Skin Repairs - Bowel - Peritoncum - Uterus - Vaginal Cuff
Coated VICRYL (polyglactin 910) suture	Undyed/Dyed (violet) Braided	75% at 14 days 50% at 21 days† 40% at 21 days‡	Essentially complete between 56 and 70 days	<b>Soft Tissue Approximation:</b> - Ligation - General Closure - Ophthalmic Surgery - Orthopaedic Surgery - Bowel
PDS® II (polydioxanone) suture	Undyed/Dyed (violet) Monofilament	70% at 14 days 50% at 28 days 25% at 42 days	Essentially complete within 6 months	<b>Soft Tissue Approximation:</b> - Fascia Closure - Orthopaedic Surgery - Blood Vessel Anatomoses - Pediatric Cardiovascular and Ophthalmic procedures - Patients with compromised wound healing conditions
				<b>MAIN BENEFIT</b> Patient comfort No suture removal  Unprecedented monofilament pliability Smooth tissue passage  Strength, preferred performance and handling Knot security  Longest lasting absorbable monofilament wound support Outstanding pliability

\*Trademark

† Sizes 6/0 and larger

‡ Sizes 7/0 and larger

## CHAPTER 1 — BIBLIOGRAPHY

### WOUNDS

1. Alster, T.S., and West, T.B. Treatment of scars: a review. *Ann Plast Surg.* 1997; 39:418-32.
2. Eppley, B.L. Alloplastic Implantation. *Plast Reconstr Surg.* 1999; 104:1761-83.
3. Hunt, T.K., et al. Physiology of wound healing. *Adv Skin Wound Care.* 2000; 13 (suppl 6-11).
4. Klein, A.W. Collagen substitutes: bovine collagen. *Clin Plast Surg.* 2001; 28:53-62.
5. Lawrence, W.T. Physiology of the acute wound. *Clin Plast Surg.* 1998; 25: 321-40.
6. Mast, B.A., Dieselmann, R.F., Krummel, T.M., and Cohen, I.K. Scarless wound healing in the mammalian fetus. *Surg. Gynecol. Obstet.* 1992; 174:441.
7. Nwomeh, B.C., Yager, D.R., Cohen, K. Physiology of the chronic wound. *Clin Plast Surg.* 1998; 25:3.
8. Saltz, R. and Zamora, S. Tissue adhesives and applications in plastic and reconstructive surgery. *Aesthetic Plast Surg.* 1998; 22:439-43.
9. Stadleman, W.K., Digenis, A.G., and Tobin, G.R. Physiology and healing dynamics if chronic cutaneous wounds. *Am J Surg.* 1998; 176:26S-38S.
10. Terino, E.O. Alloderm acellular dermal graft: applications in aesthetic soft tissue augmentation. *Clin Plast Surg.* 2001; 28:83-99.
11. Witte, M.B., and Barbul, A. General principles of wound healing. *Surg Clin North Am.* 1997; 77:509-28.

## CHAPTER 2

### GRAFTS AND FLAPS

Skin protects the body from outside invaders and prevents loss of fluids, electrolytes, proteins, etc. Skin may be replaced by spontaneous epithelialization and contraction or by a graft or flap.

#### I. SKIN GRAFT

A skin graft is skin separated completely from its bed (donor site) and transplanted to another area (recipient site) from which it must receive a new blood supply.

##### A. Classification

###### 1. By species

- a. Autograft — graft from one place to another on the same individual
- b. Allograft (homograft) — graft from one individual to another of the same species
- c. Xenograft (heterograft) — graft from one individual to another of a different species

###### 2. By thickness (Fig. 2-1)

###### a. Split thickness

- i. Includes epidermis and part of dermis
- ii. Some dermal skin appendages (sweat glands, hair follicles and sebaceous glands) remain, from which donor site heals by epithelialization
- iii. Thickness varies from thin to thick
  - (a) A higher percentage of "take" (survival) is more likely with a thinner graft
  - (b) Recipient site wound contraction is less with a thicker graft

###### iv. Uses

- (a) Large areas of skin loss
- (b) Granulating tissue beds
- (c) May be meshed to allow increased area of coverage

###### v. Harvesting methods (Fig. 2-2)

- (a) Free hand (razor blade or knife)
- (b) Dermatomes (drum or power driven "hair clipper" type machines)

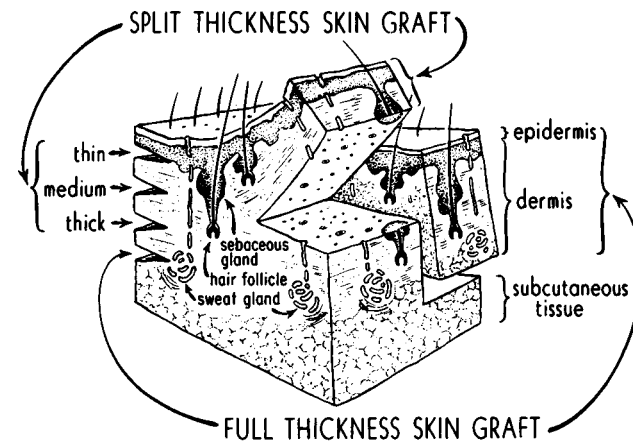


Fig. 2-1

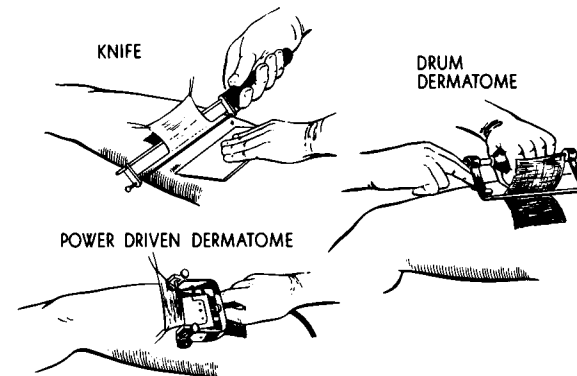


Fig. 2-2

###### vi. Donor site

- (a) Heals by epithelialization from wound edges and from skin appendages
- (b) A moist environment (e.g. bacitracin, impregnated gauze) hastens epithelialization

- (c) Requires care to prevent infection which can convert it to full thickness skin loss
  - b. Full Thickness
    - i. Includes epidermis and all dermis
    - ii. Provides better coverage but is less likely to “take” than a split thickness skin graft because of greater thickness and slower vascularization
    - iii. Donor site is full thickness skin loss and must be closed primarily or with a split thickness skin graft
    - iv. Uses
      - (a) Usually on the face for better color match
      - (b) On the finger to avoid contractures
      - (c) Anywhere that thick skin or less contraction of the recipient site is desired
    - v. Limited by size of defect to be closed
  - c. Skin Substitutes
    - i. Temporary skin coverage
    - ii. Homograft — cadaver skin
    - iii. Xenograft — pig skin
    - iv. Biobrane® — bilamellar synthetic skin
    - v. Alloderm® — human acellular dermis
    - vi. Integra® — bilamellar synthetic skin
- B. Donor site selection
  - 1. Determined by amount and thickness of tissue needed
  - 2. Best taken from inconspicuous areas (e.g. buttock or high lateral thigh for split thickness, groin for full thickness)
    - a. Be conscious of hair patterns when skin appendages included
  - 3. Color match is important especially when grafting the face
    - a. Best achieved by using the closest appropriate area above the clavicle (e.g. postauricular, upper eyelid, supraclavicular, scalp)

- C. Graft survival
  - 1. Both split and full thickness grafts “take” initially by diffusion of nutrition from the recipient site (plasmatic imbibition)
  - 2. Revascularization generally occurs between day 3-5 by either reconnection of blood vessels in the graft to recipient site vessels inosculation or by ingrowth of vessels from the recipient site into the graft
  - 3. All grafts must be placed on well-vascularized beds with low bacterial counts ( $<10^5$ ) to maximize chance of “take”
  - 4. The graft must be immobilized to minimize shearing of the graft from the bed and/or hematoma formation, which separates the graft from its bed and prevents diffusion of nutrients, ingrowth of new vessels, and subsequently less “take”
  - 5. Skin grafts generally will not “take” on poorly vascularized beds such as bare tendons, cortical bone without periosteum, heavily irradiated areas, infected wounds, etc.
  - 6. Inspection of graft to evacuate seroma/hematoma prior to day 4 may improve graft survival
  - 7. Graft loss most commonly the result of:
    - a. Hematoma/seroma under graft
    - b. Shearing forces between graft and recipient site
    - c. Poorly vascularized recipient site
    - d. Infection/colonization

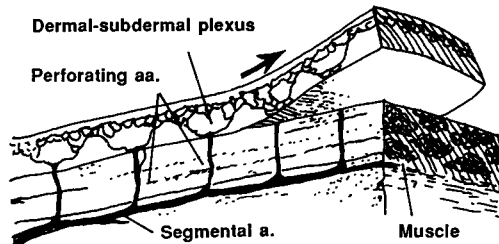
## II. FLAPS

A flap is tissue transferred from one site to another with its vascular supply intact. This may consist of skin, subcutaneous tissue, fascia, muscle, bone, or other tissues (e.g. omentum).

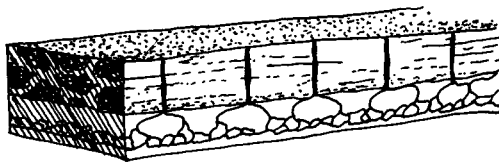
### A. Classification

- 1. Random pattern flaps (Fig. 2-3)
  - a. Blood supply is by dermal and subdermal plexus to skin flaps
  - b. Has limited length to width ratio (1.5-2:1)
  - c. Two types:
    - i. Those which rotate (rotation, transposition flaps)
    - ii. Those which advance (single pedicle advancement, V-Y advancement, bipedicle advancement)

**RANDOM/RANDOM CUTANEOUS PATTERN SKIN FLAPS**



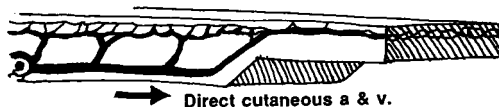
1. Random Cutaneous Flap



2. Myocutaneous Random Flap

*Fig. 2-3*

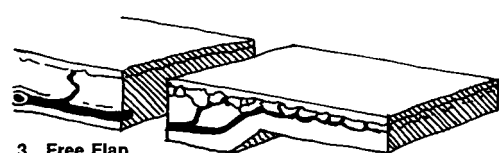
**AXIAL/ARTERIAL PATTERN SKIN FLAPS**



1. Peninsular Axial Pattern Flap



2. Island Axial Pattern Flap



3. Free Flap

*Fig. 2-4*

2. Axial pattern flaps (arterial flap) (Fig. 2-4)
  - a. Blood supply by direct artery and accompanying vein
  - b. Greater length possible than with random flap
  - c. Can be free flap, in which the vessels are divided, the flap moved to its new location and the vessels reanastomosed with microsurgical techniques to vessels at the recipient site
  - d. Peninsular — skin and vessel intact in pedicle
  - e. Island — vessels intact, but no skin in pedicle
3. Musculocutaneous flaps (myodermal flaps)
  - a. Compound flaps of skin, subcutaneous tissue, and muscle
  - b. Blood supply of skin and fat comes from blood vessels perforating the muscle (i.e. skin and fat lives off muscle)
  - c. Supplies well-vascularized tissue to defect (e.g. chronic irradiation wound)

**B. Uses**

1. Replaces tissue loss due to trauma or surgical excision
2. Provides skin coverage through which surgery can be carried out later
3. Provides padding over bony prominences
4. Brings in better blood supply to poorly vascularized bed
5. Improves sensation to an area (nerves to flap skin intact)
6. Brings in specialized tissue for reconstruction such as bone or functioning muscle

**III. OTHER GRAFTS**

The same basic principles which hold true for skin grafts apply to other grafts.

**A. Tendon**

1. Used to replace missing or non-functioning tendons
2. Preferred donor sites are palmaris longus and plantaris tendons

- B. Bone
  - 1. Used for repair of rigid defects such as facial bones, skull, and long bones
  - 2. Preferred donor sites are iliac bone, ribs and cranial bone
  - 3. May be taken as vascularized "graft"
- C. Cartilage
  - 1. Used to restore contour of ear and nose
  - 2. Preferred donor sites include costal cartilage, ear, and nasal septum
- D. Fascia
  - 1. Used in repair of dermal defects and in slings for facial nerve palsies
  - 2. Preferred donor sites are fascial lata of thigh and temporalis fascia
- E. Dermis
  - 1. Used for contour restoration such as a depressed scar
  - 2. Some fatty tissue can be included with the dermis to increase its bulk
  - 3. Preferred donor sites are thick skin areas such as the buttock
- F. Muscle
  - 1. Free grafts of skeletal muscle may be useful in selected circumstances but generally must be vascularized and neurotized
- G. Nerve
  - 1. Used to replace nerve gaps, most commonly in the median, ulnar, digital, and facial nerves
  - 2. Preferred donor sites are the sural nerve and forearm and arm cutaneous nerves
- H. Vessel
  - 1. Used to bridge vascular gaps
  - 2. The most common uses are in replantation and in the transfer of free flaps
  - 3. Preferred donor sites include forearm and foot veins for small vessels and the saphenous vein for larger vessels
- I. Fat
  - 1. Used to restore contour defects
  - 2. May be obtained by suction aspiration
  - 3. Variable long term results

- J. Allografts
  - 1. Irradiated cartilage
  - 2. Irradiated acellular dermis
  - 3. Cadaver irradiated bone

## CHAPTER 2 — BIBLIOGRAPHY

### GRAFTS AND FLAPS

- 1. Mathes, S.J. *Reconstructive Surgery: Principles, Anatomy and Techniques*. New York, Elsevier Science, 1997.
- 2. McCarthy, J.G. (ed). *Plastic Surgery, vol. 1*. New York: Elsevier Science, 1990.
- 3. Russell, R.C. and Zamboni, W.A. *Manual of Free Flaps* New York: Elsevier Science, 2001.
- 4. Serafin, D. *Atlas of Microsurgical Composite Tissue Transplantation*. New York: Elsevier Science, 1996.

## CHAPTER 3

### SKIN AND SUBCUTANEOUS LESIONS

The most common lesions of concern to plastic surgeons include tumors and scars.

#### I. TUMORS

Important to differentiate between benign and malignant. Biopsy (generally excisional biopsy) is done if lesion is suspicious or if patient is concerned.

##### A. Benign

1. Verruca (wart)
  - a. Usual viral etiology
  - b. May disappear spontaneously or respond to medical treatment
  - c. Do not excise as recurrence is likely; use cautery or liquid nitrogen
  - d. Do use pulsed dye laser for recalcitrant warts
2. Nevus (mole)
  - a. Classification
    - i. Intradermal (dermal)
      - (a) Most common, usually raised, brown, may have hair
      - (b) Essentially no potential for malignant change to melanoma
    - ii. Junctional
      - (a) Flat, smooth, hairless, various shades of brown
      - (b) Nevus cells most likely at basement membrane
      - (c) Low malignant potential
    - iii. Compound
      - (a) Often elevated, smooth or finely nodular, may have hairs
      - (b) Low malignant potential
    - iv. Large pigmented (bathing trunk nevus)
      - (a) Congenital lesion commonly occurring in dermatome distribution
      - (b) Potential for malignant transformations, therefore excision usually indicated

- v. Dysplastic nevus
    - (a) Irregular border
    - (b) Variegated in color
    - (c) Often familial
    - (d) Most likely nevus to become malignant melanoma
  - vi. Nevus sebaceous
    - (a) Most often seen on scalp and face
    - (b) 15-20% incidence of basal cell carcinoma
    - (c) Yellowish orange, greasy elevated plaque
- b. Treatment
- i. Excision and histological examination of all suspicious pigmented lesions based on:
    - (a) Clinical appearance
    - (b) History of recent change in:
      - [i] Surface area (enlarging)
      - [ii] Elevation (raised, palpable, nodular, thickened)
      - [iii] Color (especially brown to black)
      - [iv] Surface characteristics (scaly, serous discharge, bleeding and ulceration)
      - [v] Sensation (itching or tingling)
  - ii. Excision of unsightly or constantly irritated nevus (beltline, under bra or beard area)
  - iii. Careful follow-up of very large pigmented nevus, with excision of any area of change (nodularity) or staged excision of as much lesion as possible (tissue expanders and primary closure, or skin grafts when necessary)
3. Keratoses
- a. Seborrheic
    - i. Elevated, brown, greasy feeling, more frequent in older individuals, common on trunk, not premalignant, look "stuck on"
    - ii. Treat by curettage, superficial electrodesiccation or freezing with liquid nitrogen
    - iii. Excise if diagnosis uncertain



- b. Actinic or senile
  - i. Crusted, inflamed, history of exposed areas of face and scalp, chronic sun exposure or history of x-irradiation
  - ii. Premalignant, biopsy of suspicious lesions, especially when nodular (excision), liquid nitrogen, topical chemotherapy (5-fluorouracil)
- c. Keratoacanthoma
  - i. Rapidly growing, nodular, umbilicated lesion in sun-exposed areas
  - ii. Mistaken diagnosis of squamous carcinoma on incision biopsy often
  - iii. May in fact be malignant and excision required
- 4. Cyst
  - a. Epidermoid (often misnamed sebaceous)
    - i. Almost always attached to overlying skin, frequently acutely inflamed if not excised
    - ii. Excise with fusiform-shaped island of overlying skin attachment (including puncture) when not inflamed
    - iii. Acutely inflamed cyst may require incision and drainage with subsequent excision
  - b. Dermoid
    - i. Congenital lesion usually occurring in lines of embryonic fusion (lateral 1/3 of eyebrow, midline nose, under tongue, under chin)
    - ii. CT scan of midline dermoid to rule out intracranial extension
    - iii. Excision
- 5. Lipoma
  - a. Subcutaneous, feels fluctuant, but no inflammation, not adherent to overlying skin
  - b. Excise large lesions
- 6. Fibromata
  - a. Fibroma
    - i. Subcutaneous, solid, encapsulated, moveable without overlying skin involvement
    - ii. Can be associated with internal malignancy
    - iii. Excision for definitive diagnosis

- b. Neurofibroma
  - i. Intradermal, usually circumscribed, sometimes with overlying skin pigment changes, sometimes multiple, possibility of malignant transformation, familial, *café au lait* spots
  - ii. Excise when symptomatic, for appearance, to decrease bulk
- c. Dermatofibroma
  - i. Nodular intracutaneous lesion with slight pigment change
  - ii. Treatment is excision
- 7. Vascular Lesions — most common benign tumor of infancy
  - a. Hemangioma
    - i. Hemangioma (strawberry nevi)
      - (a) Most common benign vascular tumor, appears at or shortly after birth and increases in size for up to 6-7 months, then stops growth, whitens in areas and then begins to regress over several or more years
      - (b) Need for treatment very rare. Observe frequently at first and reassure parents
      - (c) In critical areas, laser therapy may be indicated early
      - (d) Involved areas of skin may require excision for appearance
      - (e) Radiation therapy is not indicated for hemangiomas
      - (f) Steroids may be indicated for rapidly enlarging hemangiomas
      - (g) Interferon may be indicated for uncontrolled hemangiomas
  - b. Malformations
    - i. Capillary malformations (port-wine stain)
      - (a) Pink-red-purple stain in skin, usually flat, but may be elevated above skin surface. Does not regress
      - (b) Laser therapy best, can be covered by cosmetics, excision not indicated

- ii. Venous
  - (a) Large blood-filled venous sinuses beneath skin and mucous membranes. Low flow. No bruit
  - (b) Angiography for larger and progressive lesions. Absolute alcohol or tissue glue injection. Excision may be indicated
- iii. Arterio-venous
  - (a) Progressive increase in size and extent, multiple arteriovenous fistulas, bruit
  - (b) A-V shunts or angiography
  - (c) Treatment is embolization under angiographic control by itself or prior to surgical excision
- iv. Lymphatic
  - (a) Subcutaneous cystic tumor (cystic hygroma) of dilated vessels which can be massive and disfiguring
  - (b) May cause respiratory obstruction, may become infected
  - (c) Spontaneous regression can occur, but surgical excision is often indicated
  - (d) Lymphatic malformation can occur with arteriovenous malformation
- v. Mixed
- 8. Miscellaneous
  - a. Pyogenic granuloma
    - i. Ulcerating, tumor-like growth of granulation tissue, the result of chronic infection, may resemble malignant tumor
    - ii. Treat by excision, curettage, laser
  - b. Xanthoma (xanthelasma)
    - i. Small deposits of lipid-laden histiocytes, most common in eyelids, sometimes associated with systemic disorders (hyperlipidemia, diabetes)
    - ii. Treat by excision
  - c. Rhinophyma
    - i. Severe acne rosacea of the nose, overgrowth of sebaceous glands causing bulbous nose
    - ii. Treat by surgical planing (shaving) with dermabrasion or laser

- B. Malignant
  - 1. Squamous cell carcinoma in situ (Bowen's Disease)
    - a. Scaly brown, tan or pink patch
    - b. Frequently associated with chronic arsenic medication
    - c. May be associated with internal malignancy
    - d. May develop into invasive squamous carcinoma
    - e. Treat by excision
  - 2. Basal cell carcinoma
    - a. Most common skin cancer
    - b. Types — all types may show ulceration, with rolled smooth pearly borders
      - i. Nodular — well-defined “rodent ulcer”
      - ii. Superficial
      - iii. Pigmented — resembles melanoma
      - iv. Morphea Type — sclerosing — poorly defined borders, high recurrence rates
    - c. Usually seen on face or other sun-exposed areas of body, caused by UVB ultraviolet radiation
    - d. Slow-growing (years), destroys by local invasion, particularly hazardous around eyes, ears, nose
    - e. Very rarely metastasizes
    - f. Surgical excision with adequate margins or with frozen section or with Mohs micrographic surgical excision followed by reconstruction
  - 3. Squamous cell carcinoma
    - a. Rapidly growing (months) nodular or ulcerated lesion with usually distinct borders
    - b. Occurs on exposed areas of body and x-irradiated areas and in chronic non-healing wounds (Marjolin's ulcer). Can metastasize to regional lymph nodes (10%)
    - c. Treatment is surgical excision with adequate margins or with histologic frozen section or with Moh's micrographic surgery followed by reconstruction
  - 4. Melanoma
    - a. Cause of great majority of skin cancer deaths
    - b. Early lymph node and systemic blood-borne metastases — frequently considered a systemic disease

- c. Usually appears as black, slightly raised, non-ulcerative lesion arising de novo or from a pre-existing nevus
- d. Early recognition of changes in color, size or consistency of a pigmented nevus is critical
- e. Classification
  - i. Pre-malignant: Lentigo maligna (Hutchinson's freckle)
    - (a) Flat, varied shades of brown pigmentation, larger than most nevi, irregular borders, smooth
    - (b) Usually slow-growing, most often on face, more frequently in elderly
    - (c) High incidence of development of invasive melanoma
    - (d) Treat by excision, with graft or flap reconstruction if necessary
  - ii. Invasive
    - (a) Lentigo maligna melanoma (10%)
      - (i) Develops in a Hutchinson's Freckle, usually as a thickened, elevated nodule
    - (b) Superficial spreading melanoma (70%)
      - (i) Flat to slightly elevated, may have a great variety of colors
      - (ii) Lesion initially spreads horizontally
    - (c) Nodular melanoma (15%)
      - (i) Characteristically blue/black in color
      - (ii) May be unpigmented (amelanotic)
      - (iii) Grows vertically, often with early surface ulceration
    - (d) Acral lentiginous melanoma (5%)
      - (i) On mucous membranes, palms, soles and subungual
      - (ii) May be amelanotic in African-Americans

- f. Histologic staging and correlation with metastases
  - i. Breslow's depth of invasion — more reliable indicator of prognosis than Clark's level (Fig. 3-1)
    - (a) Less than 0.76 mm — metastases virtually 0%
    - (b) 1.50-3.99 mm — metastases 50%
    - (c) Greater than 4 mm — metastases 66%
  - ii. Clark's levels of cutaneous invasion (Fig. 3-1)
    - (a) Level I (in situ) above the basement membrane — node metastases extremely rare
    - (b) Level II — in the papillary dermis — metastases in 2-5%
    - (c) Level III — to the junction of papillary and reticular dermis — metastases in up to 20%
    - (d) Level IV — into the reticular dermis — metastases in 40%
    - (e) Level V — into the subcutaneous tissue — metastases in 70%
  - iii. Staging
    - (a) Stage I: lesions less than 2 mm thick without ulceration
    - (b) Stage II: 1-2 mm thick with ulceration or greater than 2 mm thick with or without ulceration

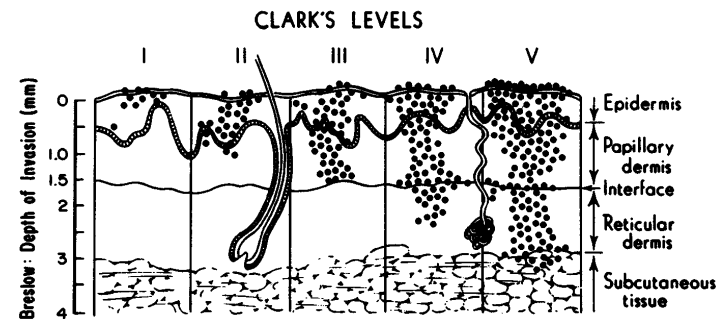


Fig. 3-1

(c) Stage III: regional node metastasis

(d) Stage IV: distant metastasis

g. Treatment

- i. Most important is the manner in which the primary lesion is removed
- ii. Complete excisional biopsy is necessary to determine level and thickness
- iii. Treated by “wide” excision with primary closure, split-thickness skin graft, or flap closure
  - (a) Thin lesions (less than 1 mm) = 1 cm margin
  - (b) Thick lesions (greater than 1 mm) = 2 cm margin
  - (c) Note that margin also depends on location and may be compromised in critical areas
- iv. Sentinel node biopsy is used to determine regional metastases.
- v. Regional node dissection indicated for positive sentinel nodes
- vi. Node dissection performed for palpable nodes
- vii. Extremity perfusion may be helpful for selected cases
- viii. Radiotherapy, chemotherapy, and immunotherapy have not been proven curative but may have some palliative effect

5. Dermatofibrosarcoma

- a. Requires wide excision to avoid recurrence

## II. SCARS

### A. Hypertrophic

1. Often confused with keloids but differ in that regression may occur spontaneously with time
2. Treatment
  - a. Primarily by prevention with elastic pressure support over long period of time
  - b. Intralesional steroid injections and occasionally excision may be indicated
  - c. Use of silicone sheeting

### B. Keloid

1. Abnormal over-abundance of collagen (scar fibrous connective tissue) beyond bounds of original lesion
2. Commonly seen on earlobes, deltoid, and pre-sternal areas
3. Higher incidence in dark-skinned races
4. Treatment
  - a. May be responsive to repeated intralesional injection of long-acting steroids and steroid-impregnated tape
  - b. Excision is reserved to reducing tumor bulk in the steroid responders — generally not used initially nor in steroid resistant cases
  - c. Pressure therapy may be helpful
  - d. Excision in combination with radiotherapy may be indicated in very stubborn cases
  - e. No single method of treatment is uniformly successful and recurrences are frequent

## III. MISCELLANEOUS

### A. Hidradenitis suppurativa

1. A chronic, recurrent inflammatory disease of apocrine sweat glands
2. Occurs in axilla, groin and perineum and breast
3. Treatment
  - a. In early stages, antibiotics and local care including incision and drainage of abscesses
  - b. Later stages require excision of all involved tissue and primary closure or closure by secondary intention or skin grafting

## IV. EXCISING SMALL SKIN LESIONS

The goal in excising a benign skin lesion is to leave a scar less apparent than the original lesion

### A. Factors under control of surgeon

1. Incision placement in relaxed skin tension lines so the scar will be as inconspicuous as possible (Fig. 3-2)
2. Appropriate operative technique
  - a. Fusiform (misnamed elliptical) excision of sufficient length to prevent excess or heaped-up skin at the ends of the wound called “dog-ears”

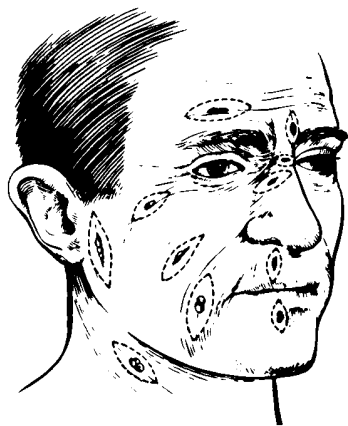


Fig. 3-2

- b. Layered closure including intradermal sutures to allow early skin suture removal and to prevent wound tension on skin sutures (Fig. 3-3)

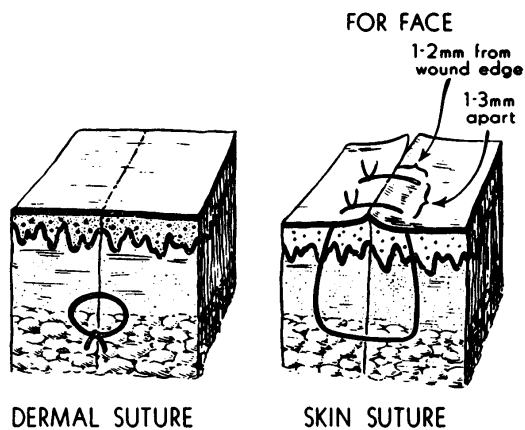


Fig. 3-3

## CHAPTER 3 — BIBLIOGRAPHY

### SKIN AND SUBCUTANEOUS LESIONS

1. Cruse, C.W. and D. Reintgen: Treatment of primary malignant melanoma: A Review. *Sem Surg Onc.*, 1993; 9:215-218.
2. Eshima, I. Role of plastic surgery in the treatment of malignant melanoma. *Surg Clin North Amer.* 1996; 26:1331-1342.
3. Goldberg, D.P. Assessment and surgical treatment of basal cell skin cancer. *Clin Plast Surg.* 1997; 24:673-86.
4. Graham, G.F. Cryosurgery. *Clin Plastic Surg.* 1993; 20: 131-146.
5. Kogan, L. et al. Metastatic spinal basal cell carcinoma: a case report and literature review. *Ann Plast Surg.* 2000; 44:86-8.
6. McCarthy, J. *Plastic Surgery.* (8 vols). St. Louis: Mosby, 1990.
7. Morganroth, G.S. and D.J. Leffell "Non-Excisional Treatment of Benign and Premalignant Cutaneous Lesions." *Clin Plast Surg.* 1993; 20:91-104.
8. Thompson, H.G. "Common Benign Pediatric Cutaneous Tumors: Timing and Treatment." *Clin Plast Surg.*, Jan 1990; 17:49-64.

## CHAPTER 4

### HEAD AND NECK

Problems of the head and neck in the practice of plastic surgery include congenital, traumatic, infectious, neoplastic, and other conditions.

#### I. CONGENITAL

##### A. Cleft Lip and Cleft Palate

##### 1. Anatomy (Fig. 4-1)

- a. Clefts of the lip occur in the primary palate (anterior to the incisive foramen) and may also involve the alveolar process
- b. Clefts of the palate occur in the secondary palate, the roof of the mouth posterior to the incisive foramen and may involve both hard and soft palate

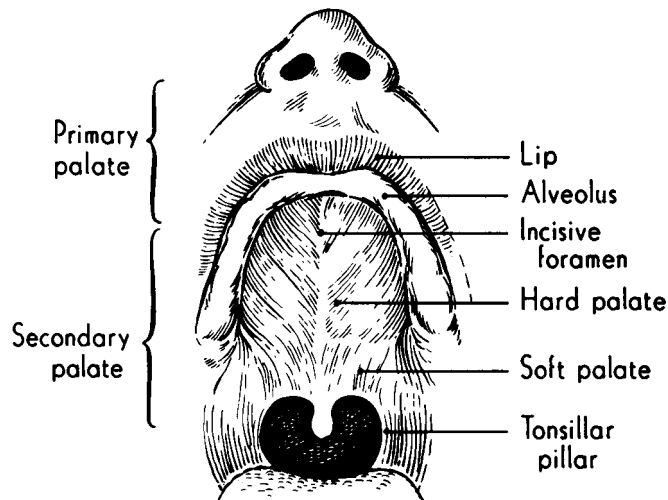


Fig. 4-1

##### 2. Classification

##### a. Lip (Fig. 4-2)

- i. Unilateral
  - (a) Complete
  - (b) Incomplete
- ii. Bilateral
  - (a) Complete
  - (a) Incomplete
- iii. Median
  - (a) Complete
  - (a) Incomplete

##### b. Palate (Fig. 4-3)

##### 3. Prevalence

- a. Cleft of lip with or without cleft palate (CL±CP) 1:700 in Caucasians, less in African-Americans, greater in Asians
- b. Cleft of palate alone (CP) 1:2500

##### 4. Occurrence risk in offspring (Table 4-1)

##### 5. Etiology

- a. Multifactorial combination of heredity with or without environmental factors
- b. Teratogenic agents — e.g. pheyntoin, alcohol
- c. Nutritional factors may contribute — folate deficiency

#### Affected Relatives

CL±CP

One sibling

One Parent

Sibling and a Parent

CP

One Sibling

One Parent

Sibling and a Parent

#### Predicted Outcomes\*

≈ 4%

≈ 4%

≈ 16%

≈ 2-4%

≈ 2-4 %

≈ 15%

*Note — If congenital lip pits, inherited as autosomal dominant gene with variable penetrance (Van der Woude's Syndrome) — 50% incidence*

*\*General predictions; individual cases may vary*

Table 4-1

### CLASSIFICATION OF LIP CLEFTS

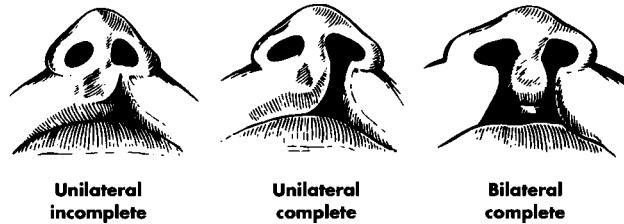


Fig. 4-2

### CLASSIFICATION OF PALATE CLEFTS

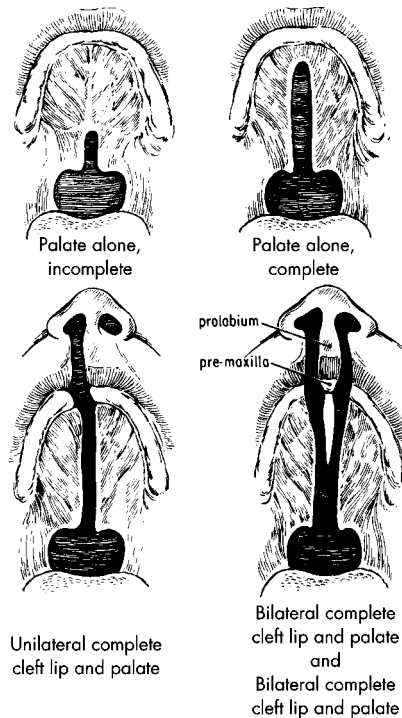


Fig. 4-3

6. Embryology
  - a. Cleft lip with palate forms at 4-6 weeks due to lack of mesenchymal penetration (merging) and fusion
  - b. Isolated cleft palate forms later, at 7-12 weeks, from lack of fusion
7. Pathophysiology
  - a. Cleft lip
    - i. Inability to form fluid and air seal in eating or speech
    - ii. Malocclusion as a result of failure of lip seal and intrinsic deformities of alveolar process and teeth
    - iii. Lack of continuity of skin, muscle and mucous membrane of lip with associated nasal deformity and nasal obstruction
    - iv. Deformity
  - b. Cleft palate
    - i. Inability to separate nasal from oral cavity so that air and sound escape through nose in attempted speech
    - ii. Feeding impaired by loss of sucking due to inability to create intra-oral negative pressure
    - iii. Loss of liquids and soft foods through nose due to common nasal-oral chamber
    - iv. Middle ear disease in 100% of patients due to Eustachian tube dysfunction, abnormal mucus
    - v. If Pierre-Robin sequence (cleft palate, micrognathia, glossoptosis), airway obstruction and failure to thrive requires various positioning in intensive care setting, possible surgery to position tongue forward or rarely, tracheostomy
8. Team concept
 

Because of multiple problems with speech, dentition, hearing, etc., management of the patient with a cleft should be by an interdisciplinary team, preferably in a cleft palate or craniofacial center

9. Timing of Primary Repair
  - a. Cleft lip — most common 10 weeks of age (range 1 wk to 6 mos)
  - b. Cleft palate — before purposeful sounds made (9-12 mos), depending upon health of infant, extent of cleft, but certainly before 18 months of age, if possible
10. Principles of Primary Repair
  - a. Cleft lip
    - i. Repair of skin, muscle and mucous membrane to restore complete continuity of lip, symmetrical length and function
    - ii. Simultaneous repair of both sides of a bilateral cleft lip
    - iii. Preference for primary nasal reconstruction at time of lip repair
  - b. Cleft palate
    - i. One stage repair of both hard and soft palate
11. Secondary Repair
  - a. Cleft lip
    - i. Revision of lip repair if needed
    - ii. Revision of nose as required
    - iii. Repair of alveolar cleft (if present) with bone graft around 9 years of age (time of eruption of canine teeth)
  - b. Cleft palate
    - i. Correction of velopharyngeal inadequacy (nasal escape of sound and air due to remaining structural defect of palate)
    - ii. Repair of any palate fistula
- B. Other Congenital Anomalies
  1. The most common anomalies are:
    - a. Branchial cyst, sinus, or fistula
      - i. An epithelial-lined tract frequently in the lateral neck presenting along the anterior border of the sternocleidomastoid muscle. May present as a cyst or as a sinus connected with either the skin or oropharynx, or as a fistula between both skin and oropharynx openings
      - ii. Treatment — excision

- b. Thyroglossal duct cyst or sinus
  - i. Cyst in the mid-anterior neck over or just below the hyoid bone, with or without a sinus tract to the base of the tongue
  - ii. Treatment — excision
- c. Ear deformities
  - i. Types
    - (a) Complete absence (anotia) — very rare
    - (b) Vestigial remnants or absence of part of ear (microtia)
    - (c) Absence of part or all of external ear with mandibular deformity (hemifacial microsomia)
    - (d) Abnormalities of position (prominent ears)
  - ii. Treatment
    - (a) Anotia or microtia—construction from autogenous cartilage graft or synthetic implant, vascularized fascial flap, skin graft — usually requires more than one operation. (Traumatic loss of part or all of ear is treated similarly). Use of a prosthetic ear may be indicated in some patients
    - (b) Prominent ears — creation of an anthelical fold and/or re-positioning/reduction of concha
2. Less common anomalies
  - a. First and second branchial arch syndrome
  - b. Treacher-Collins Syndrome: mandibulofacial dysostosis
  - c. Crouzon's and Apert's syndrome: craniosynostosis with skull and facial deformities including midface retrusion
  - d. Many others — see reference in bibliography
    - i. Treatment — most patients can be significantly improved by surgical operations (craniofacial surgery)



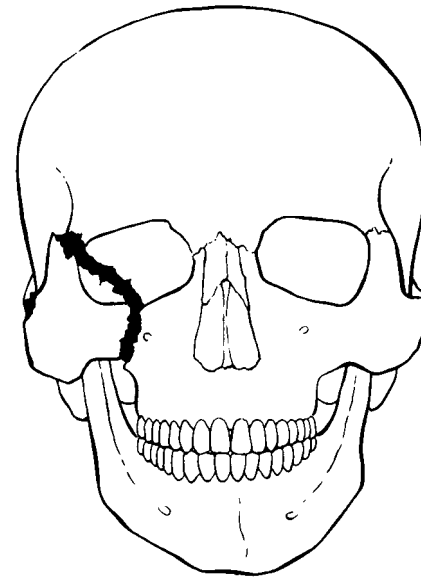
## II. TRAUMATIC

### A. Facial soft tissue injuries

1. Evaluation of all systems by trauma team
2. Establishment of airway (may be obstructed by blood clots or damaged parts) by:
  - a. Finger
  - b. Suction
  - c. Endotracheal intubation
  - d. Cricothyroidotomy or tracheotomy
3. Control of active bleeding by pressure until control by hemostats and ligatures or cautery in operating room
4. Treatment of shock
5. Very conservative debridement of detached or nonviable tissue
6. Careful wound irrigation with physiologic solution
7. Remove all foreign materials
8. Palpate or explore all wounds for underlying bone injury; rule out injury to facial nerve, parotid duct, etc.
9. Radiologic evaluation
10. Repair as soon as patient's general condition allows with meticulous reapproximation of anatomy
  - a. Preferably less than 8 hours post-injury
  - b. Primary closure may be delayed up to 24 hours (dressing should be applied and antibiotics given while waiting)
11. Tetanus prophylaxis
12. Antibiotics if indicated

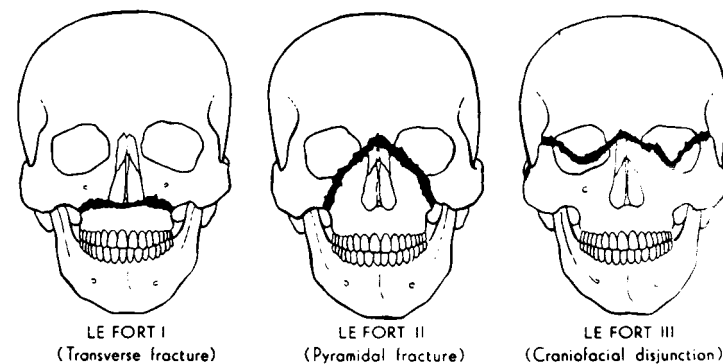
### B. Facial bone fractures

1. Classification
  - a. Mandible only — often bilateral
  - b. Zygomatic complex (Fig. 4-4)
  - c. Maxillary — Le Fort I, II, III (Fig. 4-5)
  - d. Naso-orbital-ethmoidal (NOE)
  - e. Frontal sinus
  - f. Other isolated fractures — e.g. nasal
  - g. Combination of above
  - h. Closed or open



FRACTURE OF ZYGOMATIC COMPLEX

*Fig. 4-4*



*Fig. 4-5*

2. Diagnoses
  - a. Consider patient history
  - b. Physical examination for asymmetry, bone mobility, diplopia, extraocular muscle entrapment, sensory loss, malocclusion, local pain
  - c. X-rays
    - i. Skull and cervical spine
    - ii. CT scan — axial and coronal
    - iii. Specialized views
      - (a) Waters view for facial bones (Fig. 4-6)
      - (b) Mandibular views and Panorex if mandibular fracture present since CT scan does not visualize mandible fractures well
3. Treatment
  - a. Consultant (dentist or ophthalmologist) when indicated
  - b. Re-establishment of normal occlusion is of primary importance

### WATERS VIEW

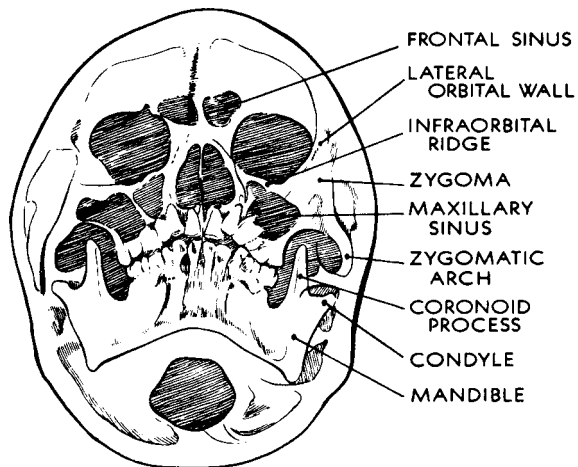


Fig. 4-6

- i. Use of interdental wiring, plating, or other devices in patient with teeth
- ii. Use of patient's dentures or fabricated temporary dentures in edentulous patient
- c. Reduction and immobilization of other fractures
  - i. Maintain by plating with or without wiring
  - ii. In orbital floor or wall fractures, reconstitute floor and walls to prevent enophthalmos

### III. INFECTIONS

- A. The head and neck are relatively resistant to infection due to their robust vascularity
- B. Routes of spread
  1. Upper aerodigestive infections may track into the mediastinum
  2. Scalp and orbital infections may spread intracranially via the dural sinuses and ophthalmic veins
- C. Facial cellulitis — mostly due to staph or strep — may use a cephalosporin
- D. Oral cavity infections — mostly due to anaerobic strep and bacteroides. Use extended spectrum penicillin or other anaerobic coverage
- E. Acute Sialadenitis — fever, pain, swelling over the involved parotid gland. Seen with dehydration, debilitation, diabetics, poor oral hygiene. Treat with antibiotics, fluids
- F. Atypical mycobacteria — seen in enlarged lymph nodes; drainage rarely required. Special cultures may be necessary

### IV. NEOPLASTIC (exclusive of skin — see Chapter 3)

- A. Salivary gland tumors or disorders
  1. Classification of tumors by location
    - a. Parotid — most common (80%), most are benign (80%)
    - b. Submandibular — 55% incidence of malignancy
    - c. Minor salivary glands — least common, with highest incidence of malignancy (about 75%)
  2. Diagnosis
    - a. Primarily by physical examination
      - i. Any mass in the pre-auricular region or at the angle of the jaw is a parotid tumor until proven otherwise

- b. Bimanual palpation — simultaneous intraoral and external palpation
  - c. X-rays occasionally helpful for diagnosis of stone; sialography (injection of contrast material into duct) is rarely if ever indicated
  - d. Signs more commonly seen with malignancy
    - i. Fixed or hard mass
    - ii. Pain
    - iii. Loss or disturbance of facial nerve function
    - iv. Cervical lymph node metastases
3. Treatment
- a. For stone near duct orifice
    - i. Simple removal
  - b. For benign tumors ( or stones in duct adjacent to gland)
    - i. Surgical removal of gland with sparing of adjacent nerves, e.g. facial nerve with parotid; lingual and hypoglossal nerves with submandibular
  - c. For malignant tumors
    - i. Surgical removal of entire gland with sparing of nerve branches that are clearly not involved
      - (a) Radiation therapy if tumor not completely removed
      - (b) Cervical lymph node dissection with tumors prone to metastasize to nodes
4. Pathology
- a. Benign
    - i. Pleomorphic adenoma — (benign mixed) high recurrence rate with local excision
    - ii. Papillary cystadenoma lymphomatosum (Warthin's tumor) — may be bilateral — (10%) male, age 40-70
  - b. Malignant
    - i. Mucoepidermoid
    - ii. Malignant mixed
    - iii. Adenocarcinoma

- B. Tumors of oral cavity
1. Classification
- a. Anatomical — malignancies behave differently according to anatomic site and prognosis worsens from anterior to posterior
    - i. Lip
    - ii. Anterior two-thirds tongue
    - iii. Floor of mouth
    - iv. Buccal
    - v. Alveolar ridge
    - vi. Posterior tongue
    - vii. Tonsillar fossa and posterior pharynx
    - viii. Hypopharynx
  - b. Histopathologic
    - i. Benign — according to site — fibroma, osteoma, lipoma, cyst, etc.
    - ii. Malignant
      - (a) Most are squamous cell carcinoma or variants
      - (b) Palate carcinomas are often of minor salivary gland origin
      - (c) Sarcomas in mandible, tongue, other sites are rare
      - (d) TNM staging is helpful for treatment planning and prognosis (i.e. tumor size, lymph node metastases, systemic metastases)
2. Diagnosis
- a. Examination — including indirect laryngoscopy and nasopharyngeal endoscopy when indicated
  - b. Biopsy of any lesion unhealed in 2-4 weeks
  - c. X-rays and scans as indicated
    - i. Conventional views, panorex, etc.
    - ii. Tomography
    - iii. Computerized axial tomography
    - iv. Bone scan
    - v. Magnetic resonance imaging
3. Treatment
- a. Surgical
    - i. Benign
      - (a) Simple excision

- ii. Malignant
  - (a) Wide local excision with tumor-free margins
  - (b) Regional lymph node dissection when indicated
  - (c) Palliative resection may be indicated for comfort and hygiene
  - (d) Immediate reconstruction with vascularized flaps when indicated by size and location of defect
- b. Radiation therapy
  - i. Preoperative
    - (a) To increase chance for cure, especially with large lesions
    - (b) May make an inoperable lesion operable
  - ii. Postoperative
    - (a) If tumor-free margin is questionable
    - (b) For recurrence
    - (c) Prophylactic — controversial
- c. Chemotherapy — usually for advanced disease

**V. MISCELLANEOUS**

- A. Disorders of the jaw
  - 1. Deformities of the mandible
    - a. Classification
      - i. Retrognathia — retrusion with respect to maxilla
      - ii. Prognathia — protrusion with respect to maxilla
      - iii. Micrognathia — underdeveloped, retruded mandible
      - iv. Open bite — teeth cannot be brought into opposition
      - v. Crossbite — lower teeth lateral to upper teeth
      - vi. Micro — and macrogenia — under- or over-development of chin

- b. Diagnosis
  - i. Physical examination
  - ii. X-rays, including a cephalogram (lateral x-ray at a fixed distance) to measure relationships of skull, maxilla and mandible
- c. Treatment
  - i. Establishment of normal or near normal occlusion of primary importance
  - ii. Use of osteostomies with repositioning of bone segments, bone grafts as needed, with or without orthodontic corrective measures as needed
- 2. Deformities of the maxilla
  - a. Most commonly, retrusions or under-development, “dish-face”
  - b. Diagnosis — as for lower jaw
  - c. Treatment — as for lower jaw
- 3. Temporomandibular joint disorder
  - a. Etiology
    - i. Previous trauma
    - ii. Arthritis
    - iii. Bone overgrowth
    - iv. Bruxism
    - v. Tumors
  - b. Symptoms:
    - i. Pain
    - ii. Erepitus
    - iii. Joint Noises
    - iv. Limited opening
    - v. Occlusion change
  - c. Diagnosis
    - i. Consider patient history
    - ii. Examination
      - (a) Auscultation
      - (b) Opening
      - (c) Occlusion
    - iii. X-rays
      - (a) Tomograms
      - (b) Arthrogram/arthroscopy
      - (c) MRI

- d. Treatment
  - i. Conservative: joint rest, analgesias, bite plate, etc.
  - ii. Surgery — seldom indicated
- B. Facial paralysis
 

Loss of facial nerve results in very significant asymmetry and deformity of the face, drooling, exposure of the cornea on the affected side. Deformity is accentuated by muscle activity of normal side (if unilateral)

  - 1. Etiology
    - a. Idiopathic (Bell's palsy)
    - b. Congenital
    - c. Traumatic
    - d. Infectious
    - e. Tumor
    - f. Vascular (intracranial)
  - 2. Diagnosis
    - a. Demonstrated by asking patient to raise eyebrow, smile, etc.
  - 3. Treatment includes:
    - a. Supportive — for most Bell's palsies
    - b. Protect cornea by taping lids, lid adhesions
    - c. Re-establishment of nerve function by repair or nerve graft
    - d. Other measures, such as muscle transfers, static suspension, skin resections, free tissue transfers of muscle, etc.

## CHAPTER 4 — BIBLIOGRAPHY

### HEAD AND NECK

1. Evans, G.R. and Manson, P.N. Review and current perspectives of cutaneous malignant melanoma. *J Am Coll Surg.* 1994; 178:523-40.
2. Gruss, J.S. Advances in craniofacial fracture repair. *Scand J Plast Reconstr Surg Hand Surg Suppl.* 1995; 27:67-81.
3. Luce, E.A. Reconstruction of the lower lip. *Clin Plast Surg.* 1995; 22:109-21.
4. Manson, P.N. et al. Subunit principles in midline fractures: the importance of sagittal buttresses, soft-tissue reductions, and sequencing treatment of segmental fractures. *Plast Reconstr Surg.* 1998; 102:1821-34.
5. Wells, M.D. et al. Intraoral reconstructive techniques. *Clin Plast Surg.* 1995; 22:91-108.
6. Williams, J.K. et al. State-of-the-art in craniofacial surgery: nonsyndromic craniosynostosis. *Cleft Palate Craniofac J.* 1999; 36:471-85.

## CHAPTER 5

### TRUNK AND EXTERNAL GENITALIA

Reconstructive problems of the trunk consist of restoring chest wall and abdominal wall structural integrity after major trauma or tumor removal.

#### I. CHEST WALL RECONSTRUCTION

- A. Soft tissue loss only
  1. Large areas of full thickness skin loss +/- loss of subcutaneous/muscle tissue can be closed with a skin graft if a well vascularized bed is present and there is no exposed bone
  2. Flap coverage may be needed if nerve, blood vessels, or bone is exposed or if the tissue is irradiated
- B. Chest wall defect including bone
  1. Small defects result in some paradoxical movement of the chest wall but are functionally insignificant
    - a. Soft tissue coverage only is required for restoring chest wall integrity
  2. Large defects (>10 cm diameter; loss of more than three adjacent ribs) may result in a large flail segment and be functionally detrimental if not corrected
    - a. Rigid reconstruction with either split rib grafts or alloplastic material such as polypropylene mesh may be needed in addition to skin flap coverage
    - b. Previously irradiated areas often do not need skeletal reconstruction due to the rigidity of the tissue
- C. Sternal Infection/Dehiscence
  1. Occurs in approximately 2% of median sternotomy wounds
    - a. Managed successfully in a majority of cases with removal of sternal wires, generous debridement, appropriate antimicrobial therapy, and flap closure
  2. Flaps used for closure of sternal wounds include pectoralis major, rectus abdominis, omentum, and latissimus dorsi
  3. Some movement of the sternum usually occurs after successful closure. This is usually accepted by the patients

#### II. BREAST RECONSTRUCTION

The breast is important as a symbol of femininity and sexual intimacy. Significant abnormalities may include absence of the breast or gross enlargement. Many women will have significant improvement in body image with reconstruction of a breast of proportionate size.

- A. Reconstruction after mastectomy for cancer
  1. The mastectomy defect varies in complexity
    - a. All mastectomy defect wounds lack a breast mound and nipple/areolar complex
    - b. More complex wound problems may include:
      - i. Insufficient skin
      - ii. Irradiated bed
  2. Treatment goal, as defined by the patient, will vary from looking acceptable in modest clothing to precise symmetry and attractiveness when unclothed. Individual needs are very different and require extensive preoperative counseling. The woman must know that there will be scars, where they will be, and that perfect replication of the premastectomy breast is not possible.
    - a. Treatment options — immediate or delayed
      - i. Local flaps +/- implant
      - ii. Implant only (subpectoral)
      - iii. Tissue expansion with subsequent implant
      - iv. Latissimus dorsi myocutaneous flap and implant
      - v. TRAM (Transverse Rectus Abdominis Myocutaneous Flap) — provides both skin coverage and breast volume
      - vi. Free flaps e.g. gluteal
  3. Management of the opposite breast depends on the patient's concerns for symmetry and the risk of developing cancer. Management options: No procedure; mastopexy; reduction mammoplasty; simple mastectomy with immediate or delayed reconstruction; augmentation mammoplasty
  4. Nipple-areola reconstruction is generally performed secondarily with a combination of local flaps and skin grafts or tattoos

- B. Subcutaneous mastectomy with reconstruction
  - 1. Involves removal of a majority of breast tissue (approximately 95%) with coring out of nipple to remove ductal tissue
  - 2. Immediate reconstruction usually with a subpectoral implant
  - 3. This is theoretically a prophylactic procedure. There is no clear evidence at this point that it is beneficial. Some women, in consultation with their physician, are opting for this treatment in certain high risk groups such as:
    - a. Severe multifocal dysplasia/precancerous mastopathy
    - b. Strong family history of breast cancer, e.g. mother and sister had breast cancer
    - c. Fibrocystic disease or mastodynia is usually **not** an indication for this procedure
  - 4. Simple mastectomy is a better way to remove the maximum amount of breast tissue
- C. Breast reduction
  - 1. Large breasts cause functional problems as well as aberrations in body image
    - a. Shoulder, back, and neck pain
    - b. Bra straps cutting into shoulders
    - c. Symptoms of brachial plexus compression in more severe cases
    - d. Submammary intertrigo
    - e. Personal embarrassment and psychosocial problems, especially in young women
    - f. Inability to fit clothes properly
  - 2. There are a variety of procedures to significantly reduce the breast size. It is not uncommon to remove greater than one kilogram from each breast. All procedures involve:
    - a. Moving the nipple areola to a more superior position on the chest wall
    - b. Most techniques maintain a vascular connection to the nipple areola complex, but this may need to be relocated as a full thickness graft in very large breasts
    - c. Scars on the inferior portion of the breast and around the areola

- 3. Studies document the significant relief of pain and intertrigo after surgery

### III. ABDOMINAL WALL RECONSTRUCTION

The abdominal wall is a complex juxtaposition of muscle and fascia. Small defects can be closed primarily. Most significant defects are either from traumatic close-range blast injuries, synergistic gangrenous infections or tumor excision.

- A. Skin and muscle loss
  - 1. Bowel serosa or muscularis will take a skin graft very well
    - a. Appropriate as an intermediate procedure when more life threatening problems are pressing
  - 2. Permanent restoration of the integrity of the abdominal wall requires fascial and skin restoration
    - a. Tensor fascia lata grafts or flaps, rectus femori flaps and lateral abdominal component flaps can be used for autogenous reconstruction
    - b. Alloplastic material such as Marlex or Goretex may be used if needed

### IV. PRESSURE SORES

Decubitus ulcer is a term of Latin derivation which refers to sores obtained in the lying position. Many pressure sores are acquired in the sitting position.

- A. Etiology
  - 1. Pressure transmitted to the tissue, especially over bony prominences, exceeds the arteriolar or capillary pressure (35 mmHg). Ischemia of tissue results. Initiation of pressure ulceration may occur after as little as two hours of continuous pressure
  - 2. This may be complicated by inoculation of the ischemic tissue with resident flora which expands the area of injury and increases tissue necrosis
  - 3. Most patients are either paralyzed from spinal cord injury or compromised with severe illness, stroke or coma. They cannot recognize or respond to the painful stimulus of pressure

4. Pressure is greater over the bony prominences and muscle and fat are more susceptible to ischemia. Therefore, the deeper tissues have much more damage than the skin. A small wound on the surface often means substantial tissue necrosis below
  5. The most common sites are over the greater trochanter, the ischial tuberosity, the sacrum, and the heel
  6. Paraplegics have many other health problems that should be addressed:
    - a. Nephrocalcinosis and urinary tract calculi
    - b. Amyloidosis
    - c. Recurrent urinary tract infections
    - d. Contractures
    - e. Soft tissue calcification
    - f. Depression and social problems
    - g. Problems of sexual function
    - h. A patient can be septic from a pressure sore although the most likely source is the urinary tract
- B. Classification**
1. Grade I — Erythema of skin
  2. Grade II — Skin ulceration and necrosis into subcutaneous tissue
  3. Grade III — Grade II plus muscle necrosis
  4. Grade IV — Grade III plus exposed bone/joint involvement
- C. Treatment**
1. Prevention — best treatment
    - a. Keep skin clean and dry
    - b. Frequent turning of patient (at least every two hours)
    - c. Pressure in special areas may be partially relieved with foam cushions or flotation mattresses
    - d. Avoid shearing forces, i.e. sheepskin
  2. Preoperative
    - a. Debride necrotic tissue
    - b. Whirlpool and appropriate dressings, i.e. debriding/antimicrobial
    - c. Systemic antibiotics if indicated
    - d. X-rays, bone scan and/or bone biopsy to determine bony involvement

3. Operative
  - a. Adequate ulcer excision
  - b. Excise involved bone and smooth out bony prominence
  - c. Wound closure with adequate soft tissue pad (frequently myocutaneous flap)
  - d. Potential benefits of myocutaneous flaps
    - i. Reduces dead space
    - ii. Increases padding
    - iii. Improves blood supply to exposed bone
    - iv. More dependable vascularity of skin component of flap

## **V. EXTERNAL GENITALIA**

The problems most commonly encountered by the plastic surgeon are due to trauma, congenital defects, neoplastic defects, and infections.

### **A. Traumatic**

1. Avulsion of penis skin and scrotum
  - a. Penis: temporary coverage by burying shaft under scrotum or suprapubic skin or split thickness skin graft
  - b. Testes: cover with split-thickness skin grafts or bury in medial thighs
2. Penile amputation
  - a. Reattachment with microvascular techniques when possible provides a superior result, or
  - b. Reconstruction by a variety of alternative methods

### **B. Congenital**

1. Ambiguous genitalia
  - a. Gender assignment by 18 months of age — usually female
  - b. Caused by adrenal hyperplasia, maternal drug ingestion, hermaphroditism
2. Hypospadias
  - a. Small meatus proximal to glans
  - b. Surgery at 1 to 2 years of age
3. Vaginal agenesis
  - a. Often undiagnosed until amenorrhea noted
  - b. Reconstruction in puberty by progressive dilation, grafts, or flaps



4. General
  - a. One-third of patients with a genitourinary anomaly have more than one urinary tract abnormality
  - b. Never circumcise a male child with an abnormal appearing penis; the tissue may be needed for future
- C. Neoplastic defects
  1. Vaginal defect 2° to bladder, bowel, or gyn tumor excision
    - a. Lining made by skin graft, cutaneous flaps, or bowel
    - b. Tube formed by omentum, gracilis or rectus abdominus flaps
  2. Phallic reconstruction
    - a. Need urethra reconstruction as well as penile reconstruction
    - b. Radial forearm free flap, gracilis or rectus muscle flaps, or groin flaps are commonly used
- D. Infectious
  1. Hidradenitis suppurativa
    - a. Chronic infection of apocrine sweat glands in groin, perineum, axilla
    - b. Treat with local I&D or more radical excision if severe; antibiotics helpful
  2. Fournier's gangrene
    - a. Caused by mixed aerobic and anaerobic organisms
    - b. Treat with debridement, antibiotics, and grafts or flaps

## CHAPTER 5 — BIBLIOGRAPHY

### TRUNK AND EXTERNAL GENITALIA

1. Arnold, P.G. and Johnson, C.H. Chest Wall Reconstruction. *Surg Oncol Clin N Am.* 1997; 6:91-114.
2. Collins, E.D., Kerrigan, C.L., Striplin, D.T. et al. The effectiveness of surgical and nonsurgical interventions in relieving the symptoms of macromastia. *Plast Recon. Surg.* In press. 2002.
3. Eidh, J. et al. Long-term follow up after sex reassignment surgery. *Scand J Plast Reconstr Surg Hand Surg.* 1997; 31:39-45
4. Epply, B.L. Pediatric plastic surgery revisited. *Clin Plast Surg.* 2001; 28:731-44.
5. Georgiade, G.S. (ed). *Georgiade Plastic, Maxillofacial and Reconstructive Surgery.* Baltimore: Lippincott, Williams and Wilkins, 1996.
6. Karanas, Y.L. et al. Hypospadias repair: collaboration between the urologist and plastic surgeon. *Ann Plast Surg.* 2000; 45:338-9.
7. Kerrigan, C.L., Collins, E.D., Striplin, D.T. et al. The health burden of breast hypertrophy. *Plast Recon Surg.* 2001; 108:1591-9.
8. Parks, R.W. and Parks, T.G. Pathogenesis, clinical features and management of hidranitis suppurativa. *Ann R Coll Surg.* 1997; 79:83-9.
9. Sadove, A.M. and Eppley, B.L. Pediatric plastic surgery. *Clin Plast Surg.* 1996; 23:139-55.
10. Thomas, D.R. Prevention and treatment of pressure sores. What works? What doesn't? *Cleve Clin J Med.* 2001; 68:704-7, 710-14; 717-22.
11. Walker, P. Management of pressure sores. *Oncology.* 2001; 15:1499-1511.

## CHAPTER 6

### UPPER EXTREMITY

The surgical treatment of hand problems is a specialized area of interest in plastic surgery. The hand is a unique organ which transmits sensations from the external environment to us as well as allowing us to modify and interact with the external environment. The hand is made up of many finely balanced structures. It must function with precision, as in writing, as well as with strength, as in hammering. Since the hand is a major tool of interaction with others, it is essential that it look as normal as possible, as well as function well.

#### I. HAND ANATOMY

- A. Surface Anatomy — Knowledge of proper terminology is essential to communicate the location of injuries to others
- B. Nerves
  1. Sensory — median, ulnar, radial (Fig. 6-1)
  2. Motor — intrinsic muscles of hand
    - a. Median nerve — thenar muscles, radial lumbricals
    - b. Ulnar nerve — interossei, ulnar lumbricals, hypothenar muscles

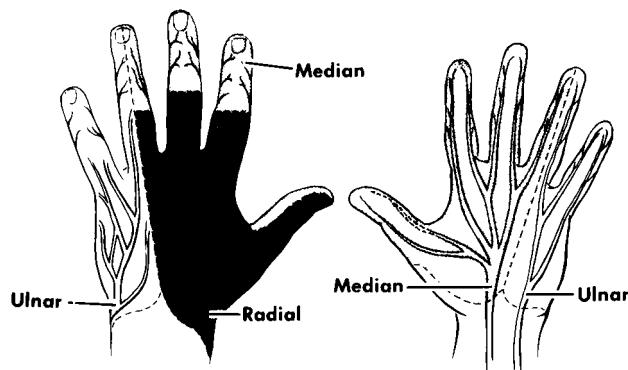


Fig. 6-1

#### C. Muscles and tendons

1. Flexor system (Fig. 6-2)
  - a. Long flexors — Flexor digitorum profundus attaches to distal phalanx and bends the DIP (distal interphalangeal) joint. Flexor digitorum superficialis attaches to middle phalanx and bends PIP (proximal interphalangeal) joint.
  - b. Intrinsic flexors — Lumbricals bend the MCP (metacarpal-phalangeal) joints

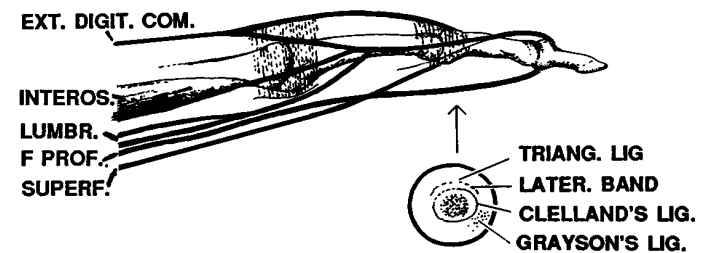


Fig. 6-2

2. Extensor system (Fig. 6-3)
  - a. Long extensors insert on base of middle phalanx
  - b. Intrinsic (interossei and lumbricals) pass volar to the axis of the MCP joint (where they act as flexors) and move dorsal to the axis of the PIP joint to insert on the dorsal distal phalanx. They act as extensors to the PIP and DIP joints

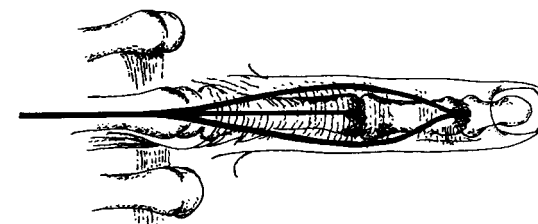


Fig. 6-3

D. Skeleton (Fig. 6-4 — see bibliography page 66)

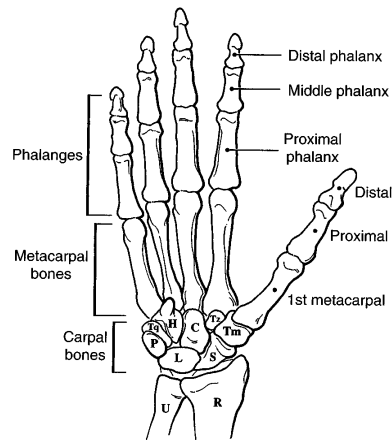


Fig. 6-4\*

E. Wrist — a large number of tendons, nerves and vessels pass through a very small space, and are vulnerable to injury (Fig. 6-5)

**Anatomy at the Wrist**

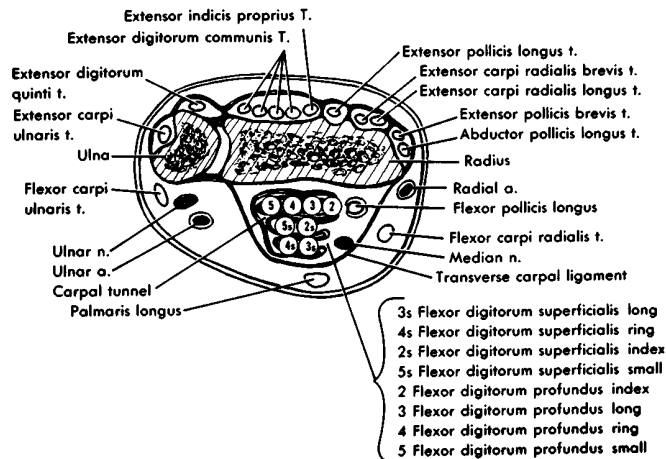


Fig. 6-5

**II. INITIAL EVALUATION OF THE INJURED HAND**

A. History

1. Time and place of accident
2. Agent and mechanism of injury
3. First aid given
4. Right or left hand dominance
5. Occupation
6. Age

B. Examination

1. Observation
  - a. Position of fingers — normally slightly flexed. An abnormally straight finger might indicate a flexor tendon injury (the unopposed extensors hold the finger straight)
  - b. Sweating patterns (indicate innervation)
  - c. Anatomic structures beneath the injury
2. Sensory — must test prior to administering anesthesia
  - a. Pin to measure sharp/dull sensitivity, paper clip to measure two point discrimination
  - b. Test all sensory territories (median, ulnar, radial)
  - c. Test both sides of each finger
3. Motor
  - a. Profundus — stabilize PIP joint in extension, ask patient to flex fingertip (Fig. 6-6)
  - b. Superficialis — stabilize other fingers in extension. This neutralizes profundus action. Ask patient to flex finger (Fig. 6-7)
  - c. Motor branch of median nerve; test palmar abduction of thumb against resistance
  - d. Motor branch of ulnar nerve; ask patient to fully extend fingers, then spread fingers apart
  - e. Extensor tendons
    - i. Ask patient to extend fingers at MCP joints (tests long extensors)
    - ii. Ask patient to extend PIP, DIP joints with MPs flexed (tests intrinsic extensors)

TESTING PROFUNDUS

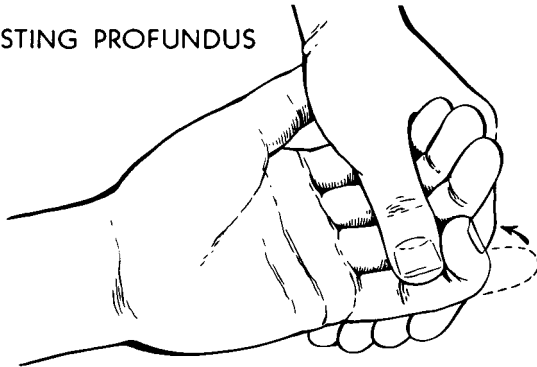


Fig. 6-6

TESTING SUPERFICIALIS

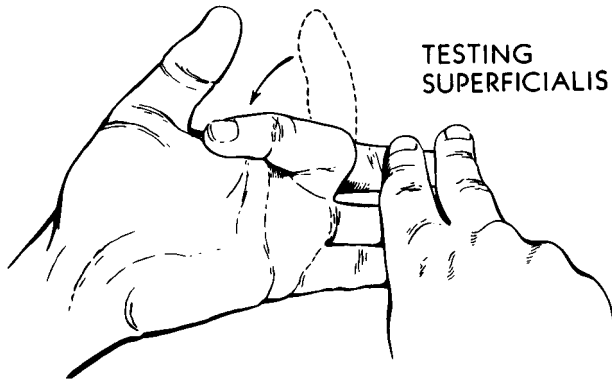


Fig. 6-7

4. Vascular
  - a. Color — nailbed should be pink, blanch with pressure, and show capillary refill within one second
  - b. Temperature — finger or hand should be similar in temperature to uninjured parts
  - c. Turgor — pulp space should be full without wrinkles

C. Early care

1. Use pneumatic tourniquet or BP cuff inflated to 250mmHg to control bleeding for examination and treatment. An awake patient will tolerate a tourniquet for 15-30 min
2. If bleeding is a problem, apply direct pressure and elevate until definitive care available
  - a. Do not clamp vessels
  - b. Tourniquet may be used as last resort, but must be released intermittently
3. Splint in safe position if possible (Fig. 6-8)
  - a. Position where collateral ligaments are at maximum stretch, so motion can be regained with least effort
  - b. Positioning — wrist extended ( $45^\circ$ ), MCP joints flexed ( $60^\circ$ ), IP joints straight, thumb abducted and rotated in opposing position
  - c. Proper splinting prevents further injury, prevents vessel obstruction, prevents further tendon retraction
4. All flexor tendon, nerve and vascular injuries, open fractures, and complex injuries are managed in the operating room
5. Tetanus prophylaxis and antibiotic coverage as indicated

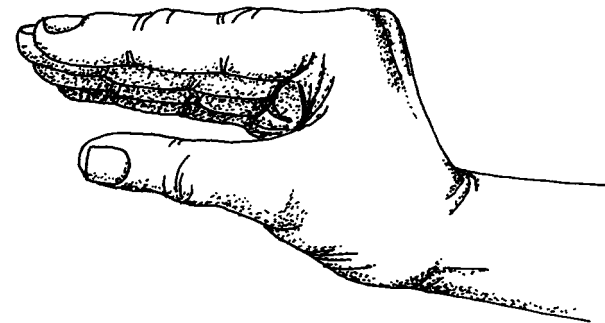


Fig. 6-8

D. Definitive treatment

1. Thorough cleaning of entire hand and forearm, with wound protected
2. Apply sterile drapes
3. Inspect wound — use tourniquet or BP cuff for hemostasis
4. Wound irrigation with normal saline
5. May need to extend wound to inspect all vital structures
6. Assure hemostasis with fine clamps and cautery
7. Nerve injuries should be repaired with magnification
8. Tendons are repaired primarily, except in special instances (e.g. human bite)
  - a. Flexor tendon injuries in Zone II, “no man’s land” (Fig. 6-9) should be repaired by a trained hand surgeon
  - b. If a hand surgeon is not available, clean and suture the skin wound, splint the hand, and refer as soon as possible for delayed primary repair. Repair needs to be done within 10 days
9. Reduce fractures and dislocations, apply internal or external fixation if needed
10. Postoperative dressings
  - a. Splinting should be in safe position when possible, but alternative positioning may be required to protect tendon or nerve repairs
  - b. Dressings should not be tight

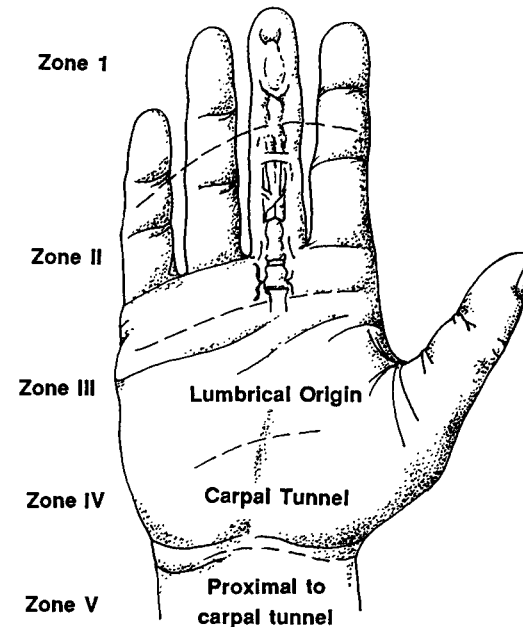
III. SPECIAL INJURIES

A. Fingertip — most common injury

1. Tip amputations
  - a. Basic principles — maintain length, bulk and sensibility
  - b. Treatment options include secondary healing, skin graft, flap
2. Nailbed injury
  - a. Nailbed should be repaired with fine chromic gut suture
  - b. Nail can be cleaned and replaced as a splint, or silastic sheet used as splint to prevent adhesion of the eponychial fold to the nailbed

B. Amputation

1. Indications for replantation — thumb, multiple fingers. Single finger replantations often not indicated. Must discuss with replant team.
2. Care of amputated part
  - a. Remove gross contamination and irrigate with saline
  - b. Wrap part in gauze moistened in saline, place in clean plastic bag or specimen cup, seal
  - c. Lay container on ice, or float on ice cubes in water. Don’t immerse part directly in ice water or pack directly in ice — it may freeze



Flexor zones of hand.

Fig. 6-9

3. Care of patient
  - a. Do not clamp vessels — use direct pressure to control bleeding
  - b. Supportive care
  - c. X-ray stump and amputated part
- C. Burned hand
  1. Initial treatment
    - a. Cleanse wound, debride broken blisters
    - b. Evaluate blood supply — circumferential full thickness burns may require escharotomy
    - c. Apply occlusive dressings to reduce pain
    - d. Immobilize in safe position
    - e. Refer to plastic surgeon if burn is extensive or may require grafting
  2. Hand therapy may be needed to maintain motion

#### IV. INFECTIONS

- A. General principles
  1. Infection can be localized by finding:
    - a. The point of maximum tenderness
    - b. Signs of local heat
    - c. Overlying skin edema
    - d. Pain on movement
  2. A fever usually denotes lymphatic involvement
  3. Pressure from edema and pus in a closed space can produce necrosis of tendons, nerves and joints in a few hours. Extreme cases can lead to amputation and even death
- B. Treatment principles
  1. Surgical drainage, cultures
  2. Immobilization in safe position, elevation
  3. Antibiotics
- C. Specific infections
  1. Paronychia — infection of the lateral nail fold  
Treatment: if early, elevation of skin over nail to drain. If late, with pus under nail, must remove lateral portion of nail
  2. Felon
    - a. Pus in pulp space of fingertip — closed space without ability to expand — very painful
    - b. Pressure of abscess may impair blood supply
    - c. Treatment is drainage over point of maximal tenderness — lateral if possible

3. Subcutaneous abscess — incise and drain with care not to injure digital nerve. Be alert to possibility of foreign body
4. Tenosynovitis — infection of tendon sheath
  - a. Diagnostic signs (Kanavel's signs)
    - i. Fusiform swelling of finger
    - ii. Finger held in slight flexion
    - iii. Pain with passive extension
    - iv. Tenderness over flexor tendon sheath
  - b. Treatment is to open and irrigate tendon sheath. Untreated infection can destroy the tendon within hours
5. Human bite
  - a. Have high index of suspicion — patients are often unwilling to admit being in a fight. Most common site over a knuckle
  - b. Debride, cleanse thoroughly, culture
  - c. Must rule out penetration of joint space — may need to explore in OR
  - d. Broad spectrum antibiotics — often I.V.
  - e. Do not suture wound

#### V. FRACTURES

- A. General principles
  1. Inspect, palpate, x-ray in multiple planes — AP, true lateral, oblique
  2. Reduce accurately
  3. Immobilize for healing
  4. Hand therapy to maintain motion
- B. Specific fractures
  1. Metacarpal fractures
    - a. Boxer's fracture — fracture of 4th or 5th metacarpal neck. Can accept up to 30 degrees of angulation. Treatment can range from gentle protective motion if minimally displaced to closed reduction and cast to open reduction and internal fixation
    - b. Metacarpal shaft fractures — must check for rotatory deformity. Flex all fingers. If involved finger overlaps another, there is rotation at the fracture site which must be reduced. Unstable fractures must be fixed with pins or plates and screws

2. Phalangeal fractures
  - a. Unstable fractures require internal or percutaneous fixation
  - b. Joint surfaces should be anatomically reduced
3. Tuft fractures (distal phalanx)
  - a. If crushed, mold to shape
  - b. Repair associated nailbed injury if needed
  - c. Splint for comfort (DIP only) for 1-2 wks

## VI. JOINT INJURIES

- A. Dislocation
  1. If already reduced, test for instability in range of motion and with lateral stress
  2. Most can be treated with closed reduction; open reduction can be necessary if supporting structures entrap the bone (e.g. metacarpal head through extensor mechanism)
- B. Ligamentous injury — usually lateral force
  1. Gamekeeper's thumb — rupture of ulnar collateral ligament of MP joint
  2. Wrist injury — multiple ligaments can be involved. Diagnosis may require arthrogram, arthroscopy, or MRI. Clinical diagnosis by pattern of pain, x-rays, palpation for abnormal movement
- C. Treatment
  1. Try to maintain controlled protected motion
  2. Unstable joint — immobilize for 3 wks. (some, e.g. thumb ulnar collateral ligament, might need operative repair)

## VII. CONGENITAL DEFECTS

- A. Classification system (Table 6-1)
- B. Common defects
  1. Polydactyly — most common. Duplication of fingers, usually border digits. Duplication of 5th finger is common autosomal dominant trait in African-Americans. Thumb duplication often requires reconstructive surgery
  2. Syndactyly — 2nd most common — May be simple, involving skin only, or complex, involving bone
- C. Treatment — goal to decrease deformity and improve function

- I. Failure of formation of parts
  - A. Transverse
  - B. Longitudinal
- II. Failure of separation of parts
- III. Duplication of parts
- IV. Overgrowth of parts
- V. Undergrowth of parts
- VI. Congenital constriction bands
- VII. Generalized skeletal abnormalities

Adapted from Swanson, A.B.: *J Hand Surg* 1:8, 1976.

**Table 6-1**

1. Some problems are treated in infancy — e.g. splinting for club hand, thumb reconstruction
2. Some treated in early childhood — e.g. separation of syndactyly
3. Some require multi-staged procedures — e.g. club hand

## VIII. HAND TUMORS

- A. Benign
  1. Ganglion cysts — most common
    - a. Synovial cyst of joint or tendon sheath
    - b. Treatment is excision
  2. Giant cell tumor
  3. Glomus tumors — of thermoregulatory neuromyoarterial apparatus. Presents with pain and temperature sensitivity
  4. Bone tumors — enchondroma, osteoid, osteoma
- B. Malignant
  1. Skin cancers (e.g. basal cell, squamous cell, melanoma)
  2. Malignant bone tumors are uncommon in hand

## IX. MISCELLANEOUS

- A. Rheumatoid arthritis — synovial hypertrophy can lead to nerve compressions (carpal tunnel syndrome), joint destruction. Hand surgeons get involved with synovectomy, joint replacement, carpal tunnel release

- B. Dupuytren's contracture
  - 1. Fibrous contraction of palmar fascia causes flexion contractures of fingers
  - 2. Treatment is surgical excision of involved fascia
- C. Nerve compressions — compression of nerve by overlying muscle, ligament or fascia
  - 1. Example: carpal tunnel — compression by transverse carpal ligament
  - 2. Diagnosis by symptoms and EMG
  - 3. Treatment options include splinting, steroid injections, surgery

## **CHAPTER 6 — BIBLIOGRAPHY**

### **UPPER EXTREMITY**

1. Achauer, B.H. *Plastic Surgery: Indications, Operations, Outcomes*. St. Louis: Mosby, 2000.
2. Aston, S.J. et al. (eds.) *Grabb and Smith's Plastic Surgery*. 5th Ed. Baltimore: Lippincott, Williams and Wilkins, 1997.
3. Green, D.P. *Operative Hand Surgery*. New York: Churchill Livingstone, 1996.
4. McCarthy, J. *Plastic Surgery*. (8 vols). St. Louis: Mosby, 1990.

\*Fig. 6-4 reprinted with permission from Marks, M.W., Marks, C. *Fundamentals of Plastic Surgery*: Philadelphia: W.B. Saunders Co., 1997.



## CHAPTER 7

### LOWER EXTREMITY

The plastic and reconstructive surgeon is often called upon to treat many wound problems of the lower extremity. These include leg ulcers of various etiologies, trauma with extensive soft tissue loss or exposed bone, vascular or neural structures, and lymphedema.

#### I. ULCERATIONS

An ulcer is an erosion in an epithelial surface. It is usually due to an underlying pathophysiological process. The proper treatment depends upon the etiology

##### A. Etiology

1. Venous Stasis Ulcer
  - a. Due to venous hypertension; related to venous valvular incompetence — usually found over the medial malleolus
  - b. Increased edema
  - c. Increased hemosiderin deposition (dark discoloration)
  - d. Not painful
2. Ischemic Ulcer
  - a. Due to proximal arterial occlusion
  - b. Usually more distal on the foot than venous stasis ulcers
  - c. Most often found on the lateral aspects of the great and fifth toes, and the dorsum of the foot
  - d. No edema
  - e. No change in surrounding pigmentation
  - f. Painful
  - g. Doppler ankle/brachial indices 0.1-0.3
  - h. Indicates advanced atherosclerotic disease
  - i. Dirty, shaggy appearance
3. Diabetic Ulcer
  - a. Due to decreased sensation (neurotrophic) or occasionally decreased blood flow
  - b. Usually located on plantar surface of foot over metatarsal heads or heel
  - c. Edema ±
  - d. No change in surrounding pigmentation

4. Traumatic Ulcer
  - a. Failure to heal is usually due to compromised blood supply and an unstable scar
  - b. Usually occurs over bony prominence
  - c. Edema ±
  - d. Pigmentation change ±
  - e. Pain ±
5. Pyoderma Gangrenosum
  - a. Frequently associated with arthritis and/or inflammatory bowel disease or an underlying carcinoma
  - b. Clinical diagnosis — microscopic appearance non-specific
  - c. Zone of erythema at advancing border of the lesion

B. Treatment

Each ulcer type requires accurate diagnosis, specific treatment of the underlying etiology, and care of the wound. Not all ulcers of the lower extremity will require surgical intervention when appropriate management is pursued. The key to healing these ulcers is wound hygiene, correction of the underlying problem, and specific surgical intervention when appropriate. The plastic surgeon is an integral member of the treatment team from the onset of the problem. Remember that two different predisposing conditions may occur in the same patient. If so, the treatment must address both conditions.

1. Venous Stasis Ulcers
  - a. Most will heal if venous hypertension is controlled
  - b. Decrease edema with constant bed rest with foot elevation
  - c. Clean wound 2-3 times a day with soap and water
  - d. Topical antimicrobials may be required
  - e. Systemic antibiotics are required if cellulitis is present or bacteremia occurs
  - f. "Unna boots" may heal ulcers in patients who are noncompliant with bed rest or must continue to work. These are changed on a weekly or bi-weekly basis

- g. Surgical treatment requires excision of the entire area of the ulcer, scar tissue, and surrounding area of increased pigmentation (hemosiderin deposition). Subfascial ligation of venous perforators is also performed
  - i. Skin grafting of large areas is usually not a problem. Intact periosteum or paratenon will take a graft well
  - ii. Free flaps can be effective for recalcitrant ulcers
- h. Pressure gradient stocking (such as Jobst™ garments) and a commitment to avoiding standing for long periods of time are necessary for long term success

2. Ischemic Ulcers

- a. Most require revascularization based upon angiographic findings
- b. Control associated medical problems such as congestive heart failure, hypertension, diabetes, etc.
- c. Bed rest without elevation of the foot of the bed
- d. Topical and/or systemic antibiotics are usually required
- e. If possible, it is best to perform bypass surgery first, and then healing of the ulcer by any means will be easier
- f. Usually a skin graft will close the wound; flap closure may be required. A more proximal amputation may be required if revascularization is not possible

3. Diabetic Ulcer

- a. Debride necrotic tissue and use topical and systemic antibiotics to control the infection
- b. Be conservative in care; early amputation is detrimental since many patients will have life-threatening infections in the other leg within a few years
- c. After control of bacterial contamination, small ulcers may be excised and closed primarily; larger ulcers may require flap coverage
- d. Treatment should also include resection of underlying bony prominence

- e. Rule out proximal arterial occlusion and improve arterial inflow when needed
- f. Postoperative diabetic foot care at home is paramount to proper management. Patient education in caring for and examining their feet is extremely important
- 4. Traumatic Ulcer
  - a. Nonhealing is usually secondary to local pathology
  - b. Resection of the ulcer, thin skin, and unstable scar is required
  - c. Reconstruction with a local or distant flap is required
- 5. Pyoderma Gangrenosum
  - a. Very difficult
  - b. May include anti-inflammatory drugs or immunosuppressives, as well as local wound care agents
  - c. Success in treatment has been reported with hyperbaric oxygen in conjunction with local wound care

## II. TRAUMA

Lower extremity trauma is frequently very complex, and often requires a team approach involving the orthopedic, vascular and plastic surgeons. Limb salvage with bipedal ambulation and normal weight bearing is the goal of all surgical intervention

### A. Initial Management

- 1. All patients with lower extremity trauma should be evaluated for associated injuries, and treated according to ATLS criteria
- 2. All life threatening injuries (intracranial, intrathoracic, and intra-abdominal) should be addressed initially in the operating room
- 3. Surgical debridement of the wound in the operating room and irrigation with pulsatile jet lavage of a physiologic solution is the proper initial management. Specific management depends upon the level of injury, presence or absence of bony and neurological injury

- 4. Limb threatening injuries of vascular interruption or open fracture are best assessed in the OR with radiologic backup
- 5. Fasciotomy is often required to maintain tissue perfusion in severe high energy or crush injuries
- 6. Intra-operative evaluation for viability utilizing visual and surgical techniques may be supplemented by intravenous fluorescein to assess the viability of degloved tissue
- B. Level of Injury
  - 1. Thigh
    - Usually managed with delayed primary closure or skin graft. An abundance of soft tissue in the thigh makes coverage of bone or vessels rarely a problem
    - a. Open joint wounds are usually managed by the orthopedic service with profuse lavage and wound closure
    - b. Extensive soft tissue loss will often require flap rotation — the tensor fascia lata, gracilis, rectus femoris, vastus lateralis, and biceps femoris are primarily utilized
    - c. The medial and lateral heads of the gastrocnemius muscle are most often utilized to cover an open knee joint
  - 2. Lower Leg
    - a. Paucity of tissue in the pre-tibial area results in many open fractures which cannot be closed primarily
    - b. General principles of wound closure and achieving bacterial balance prevail
    - c. Delayed primary closure, healing by secondary intention, or skin grafts are good alternatives in the management of wounds where bone or fractures are not exposed
    - d. Rigid fixation with vascularized tissue coverage is necessary for bone healing
    - e. Fractures of the lower leg are usually classified by the Gustilo system (Table 7-1)
      - i. Type I and II fractures usually have a good outcome with varied treatment
      - ii. Gustilo Type III injuries have a worse prognosis

### **Gustilo Classification of Open Fractures of the Lower Leg**

Type I	Open tibial fracture with a wound less than one centimeter
Type II	Open tibial fracture with a wound greater than one centimeter, without extensive soft tissue damage
Type IIIA	Open tibial fracture with adequate soft-tissue coverage despite extensive laceration or flaps, or high-energy injury accompanied by any size wound
Type IIIB	Open tibial fracture, extensive soft-tissue loss with periosteal stripping and bone exposure
Type IIIC	Open tibial fracture with arterial injury requiring repair

**Table 7-1**

- f. Depending on the level of injury, different muscle flaps can be used to close the wounds
    - i. Proximal 1/3 of tibia
      - Medial head of the gastrocnemius muscle
      - Lateral head of the gastrocnemius muscle
      - Proximally based soleus
    - ii. Middle 1/3 of tibia
      - Proximally based soleus
      - Flexor digitorum longus muscle
      - Extensor hallucis longus muscle
    - iii. Lower 1/3 of tibia
      - Microvascular free tissue transfer
  - g. Fasciocutaneous flaps are another alternative for closure of difficult wounds in the lower leg
3. Foot
    - a. Split thickness skin grafts should be used if bone not exposed
    - b. The heel may be covered by medial or lateral plantar artery flaps
    - c. Forefoot — toe fillet and plantar digital flaps

4. The technical feasibility of lower extremity reconstruction must be weighed against the option of amputation with early prosthesis fitting and ambulation. Extensive injuries may lead to rehabilitation and non-weight bearing of up to two years, and late complications may still require amputation

### **III. LYMPHEDEMA**

Lymphedema may be a congenital or acquired problem, and results in accumulation of protein and fluid in the subcutaneous tissue. It may be a very debilitating and disfiguring disease, and at this time has no good surgical answer

- A. Primary (idiopathic)
  1. Female: Male = 2:1
  2. Classification — depends on age of onset
    - a. Congenital — present at birth
      - i. Milroy's disease — familial autosomal dominant incidence
      - ii. 10% of all primary lymphedema
    - b. Lymphedema praecox
      - i. Usually a disease of females
      - ii. 80% of all primary lymphedema
      - iii. Appears at puberty or early adulthood
      - iv. Localized swelling on dorsum of foot that gets worse with activity
      - v. Meige's disease presents with significant symptoms of acute inflammation
    - c. Lymphedema tarda
      - i. Appears in middle or later life
  3. Diagnosis
    - a. By history — sometimes hard to discern a component of venous stasis from the lymphedema
    - b. Lymphangiogram — 70% have hypoplasia, 15% aplasia and 15% hyperplasia
- B. Secondary: Acquired — Usually secondary to pathology in the regional lymph nodes
  1. *Wucheria bancrofti* — number one cause of lymphedema worldwide
  2. Post traumatic or post surgical

3. Secondary to regional node metastases
4. Treatment
  - a. Nonoperative
    - i. Preferable in most circumstances and many patients are managed quite well
    - ii. Elevation and elastic support are the mainstays of therapy — intermittent compression machines may be of benefit
    - iii. Use of steroids controversial
    - iv. Benzopyrones may be of benefit in high protein lymphedema
    - v. Antiparasitic medications are indicated when appropriate
    - vi. Systemic antibiotics and topical antifungal medications are often required
  - b. Surgical management
    - i. Ablative procedures — usually involve excision of tissue and closure with a flap or skin graft
    - ii. Attempted re-establishment of lymphatic drainage by microvascular techniques has shown early improvement, but is prone to high late failure rate. May offer hope for patients with secondary lymphedema in the future

## **CHAPTER 7 — BIBLIOGRAPHY**

### **LOWER EXTREMITY**

1. Heller, L. and Levin, S.L. Lower extremity microsurgical reconstruction. *Plast Reconstr Surg.* 2001; 108:1029-41.

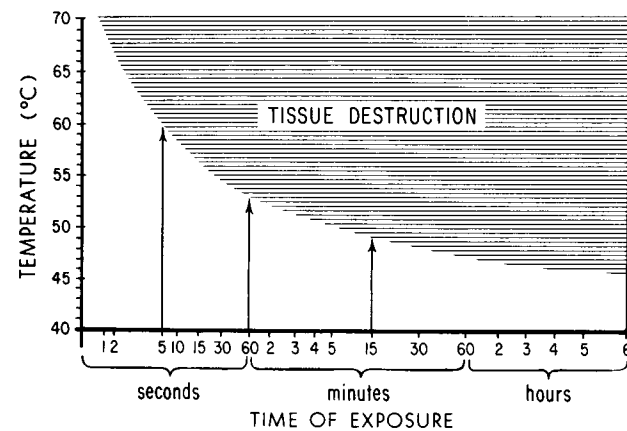
## CHAPTER 8

### THERMAL INJURIES

Thermal destruction of the skin results in severe local and systemic alterations. This destruction can occur from thermal energy, chemical reactions, electricity, or the response to cold. The management of the patient with a major thermal injury requires understanding of the pathophysiology, diagnosis, and treatment not only of the local skin injury but also of the derangements that occur in hemodynamic, metabolic, nutritional, immunologic, and psychologic homeostatic mechanisms.

#### I. BURNS

- A. Pathophysiology: Amount of tissue destruction is based on temperature ( $>40^{\circ}\text{C}$ ) and time of exposure (Fig. 8-1)
- B. Diagnosis and prognosis
  - 1. Burn size: % of total body surface area (TBSA) burned
    - a. Rough estimate is based on rule of 9s (Fig. 8-2)
    - b. Different charts are required for adults and children because of head-chest size discrepancy and limb differentials for ages birth to seven years (Fig. 8-3 and 8-4)



*Fig. 8-1*

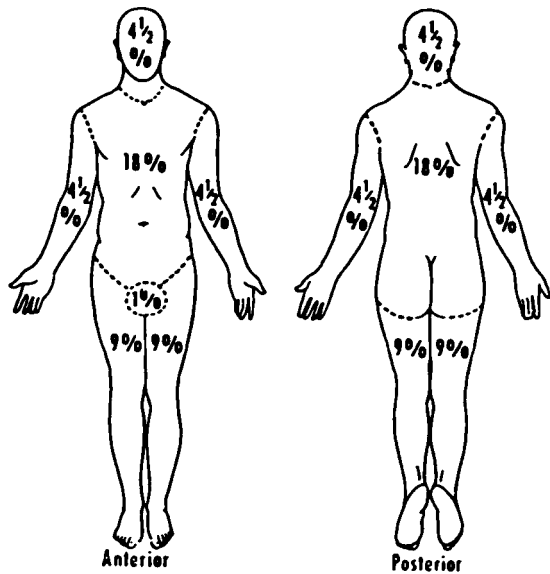
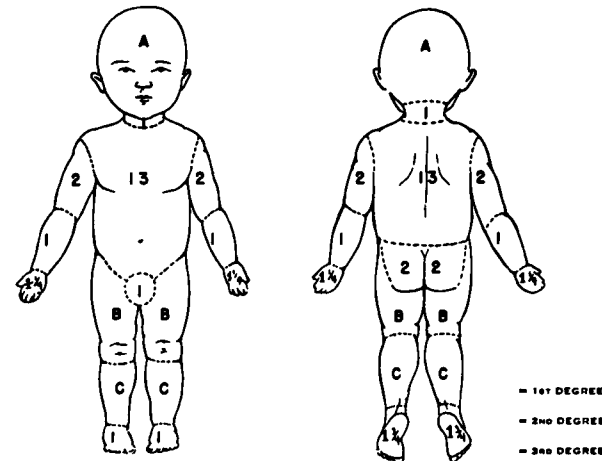


Fig. 8-2

### BURN SHEET

NAME \_\_\_\_\_ AGE \_\_\_\_\_ NUMBER \_\_\_\_\_  
 BURN RECORD. AGES - BIRTH - 7 1/2 DATE OF OBSERVATION \_\_\_\_\_



#### RELATIVE PERCENTAGES OF AREAS AFFECTED BY GROWTH

AREA	AGE 0	1	5
A 1/2 OF HEAD	9 1/2	8 1/2	6 1/2
B 1/2 OF ONE THIGH	2 1/2	3 1/2	4
C 1/2 OF ONE LEG	2 1/2	2 1/2	2 1/2

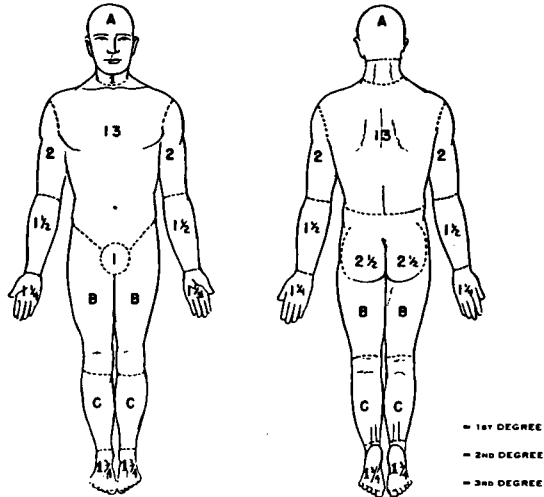
#### % BURN BY AREAS

PROBABLE	HEAD	NECK	BODY	UP ARM	FOREARM	HANDS
3rd° BURN	GENITALS	BUTTOCKS	THIGHS	LEGS	FEET	
TOTAL BURN	HEAD	NECK	BODY	UP ARM	FOREARM	HANDS
	GENITALS	BUTTOCKS	THIGHS	LEGS	FEET	
SUM OF ALL AREAS	PROBABLY 3rd°		TOTAL BURN			

Fig. 8-3

**BURN SHEET**

NAME \_\_\_\_\_ AGE \_\_\_\_\_ NUMBER \_\_\_\_\_  
 BURN RECORD. AGES 7 TO ADULT. DATE OF OBSERVATION \_\_\_\_\_



RELATIVE PERCENTAGES OF AREAS AFFECTED BY GROWTH

AREA	AGE 10	15	ADULT
A 1/2 OF HEAD	5 1/2	4 1/2	3 1/2
B 1/2 OF ONE THIGH	4 1/4	4 1/2	4 3/4
C 1/2 OF ONE LEG	3	3 1/4	3 1/2

		% BURN BY AREAS						
PROBABLE 3RD° BURN	{	HEAD	NECK	BODY	UP. ARM	FOREARM	HANDS	
		GENITALS	BUTTOCKS	THIGHS	LEGS	FEET		
TOTAL BURN	{	HEAD	NECK	BODY	UP. ARM	FOREARM	HANDS	
		GENITALS	BUTTOCKS	THIGHS	LEGS	FEET		

Fig. 8-4

2. Age: burns at the extremes of age carry a greater morbidity and mortality
3. Depth: difficult to assess initially
  - a. History of etiologic agent and time of exposure helpful
  - b. Classification (Fig. 8-5)
    - i. First degree: erythema but no skin breaks
    - ii. Second degree: blisters, red and painful
      - (a) Superficial partial-thickness, involves epidermis and upper dermis
      - (b) Deep partial-thickness, involves deeper dermis
    - iii. Third degree: full-thickness-insensate, charred or leathery
    - iv. Fourth degree: muscle, bone
4. Location: face and neck, hands, feet, and perineum may cause special problems and warrant careful attention; often necessitate hospitalization/burn center
5. Inhalation injury: beware of closed quarters burn, burned nasal hair, carbon particles in pharynx, hoarseness, conjunctivitis
6. Associated injuries, e.g. fractures

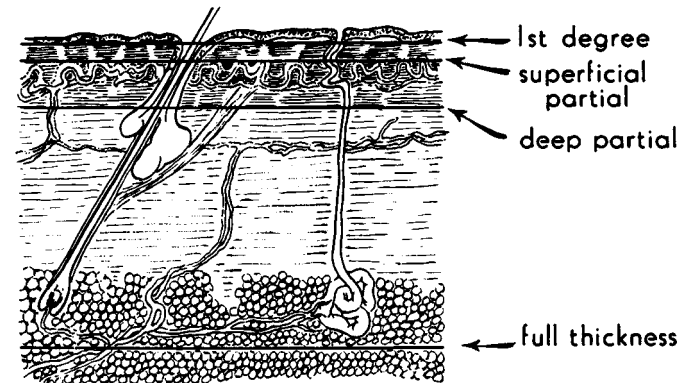


Fig. 8-5



7. Co-morbid factors, e.g. pre-existing cardiovascular, respiratory, renal and metabolic diseases; seizure disorders, alcoholism, drug abuse
  8. Prognosis: best determined by burn size (TBSA) and age of patient, inhalation injury
  9. Circumferential burns: can restrict blood flow to extremity, respiratory excursion of chest and may require escharotomy
- C. Categorization of burns is used to make treatment decisions and to decide if treatment in a burn center is necessary (Table 8-1, Table 8-2)
- D. Treatment plan
1. History and physical exam
  2. Relieve respiratory distress — escharotomy and/or intubation
  3. Prevent and/or treat burn shock — IV — large bore needle
  4. Monitor resuscitation — Foley catheter and hourly urine output
  5. Treat ileus and nausea — N.G. tube if > 20% burn
  6. Tetanus prophylaxis
  7. Baseline laboratory studies i.e. Hct., UA, glucose, BUN, chest x-ray, electrolytes, EKG, cross-match, arterial blood gases, and carboxyhemoglobin
  8. Cleanse, debride, and treat the burn wound
- E. Respiratory distress
1. Three major causes of respiratory distress in the burned patient:
    - a. Unyielding burn eschar encircling chest
      - i. Distress may be apparent immediately
      - ii. Requires escharotomy (cutting into the eschar to relieve constriction)
    - b. Carbon monoxide poisoning
      - i. May be present immediately or later
      - ii. Diagnosed by carboxyhemoglobin levels measured in arterial blood gas
      - iii. Initial Rx is displacement of CO by 100% O<sub>2</sub> by facemask
      - iv. Hyperbaric oxygen treatment may be of value

#### Categorization of burns (American Burn Association):

	Major Burn	Moderate Burn	Minor Burn
Size-Partial thickness	> 25% adults > 20% children	15-25% adults 10-20% children	< 15% adults < 10% children
Size-Full thickness	>10%	2-10%	< 2%
Primary areas	major burn if involved	not involved	not involved
Inhalation injury	major burn if present or suspected	not suspected	not suspected
Associated injury	major burn if present	not present	not present
Co-morbid factors	poor risk patients make burn major	patient relatively good risk	not present
Miscellaneous	electrical injuries		
Treatment environment	usually specialized burn care facility	general hospital with designated team	often managed as out-patient

*Table 8-1*

#### Burns That Dictate Patient Admission to a Hospital or Burn Center

- 2° and 3° burns greater than 10% of BSA in patients under 10 or over 50 years of age
- 2° and 3° burns greater than 20% BSA in any age group
- 2° and 3° burns posing a serious threat of functional or cosmetic impairment, e.g. the face, hands, feet, genitalia, perineum, and about major joints)
- 3° burns greater than 5% BSA in any age
- Electrical burns including lightning
- Chemical burns posing a serious threat of functional or cosmetic impairment
- Inhalation injury
- Burns associated with major trauma

*Table 8-2*

- c. Smoke inhalation leading to pulmonary injury
  - i. Insidious in onset (18-36) hours
  - ii. Due to incomplete products of combustion, not heat
  - iii. Causes chemical injury to alveolar basement membrane and pulmonary edema
  - iv. Initial Rx is humidified O<sub>2</sub> but intubation and respiratory support may be required
  - v. Secondary bacterial infection of the initial chemical injury leads to progressive pulmonary insufficiency
  - vi. Severe inhalation injury alone or in combination with thermal injury carries a grave prognosis
  - vii. Three stages of presentation have been described:
    - (a) Acute pulmonary insufficiency (immediately post burn to 48 hours)
    - (b) Pulmonary edema (48-72 hours)
    - (c) Bronchopneumonia (25 days)

F. Burn shock

- 1. Massive amounts of fluid, electrolytes, and protein are lost from circulation almost immediately after burning (Table 8-3)

**Burn or Associated Condition Dictating Extra Fluid Administration**

- Underestimation of the %TBSA burn
- Burn greater than 80% TBSA
- Associated traumatic injury
- Electrical burn
- Associated inhalation injury
- Delayed start of resuscitation
- 4<sup>o</sup> burn
- Administration of osmotic diuretics
- Pediatric burns

*Table 8-3*

- 2. Resuscitation requires replacement of sodium ions and water to restore plasma volume and cardiac output
  - a. Many formulas have been reported to achieve resuscitation
    - i. This can be given by prescribing 4cc Ringer's lactate/Kg/%TBSA burn over the first 24 hours (Baxter or Parkland Hospital formula)
    - ii. 1/2 of the first 24 hour fluid requirement should be given in the first eight hours postburn and the remaining 1/2 over the next 16 hours
  - b. A plasma volume gap may remain Restored between 24-30 hours postburn by administering .35-.50cc plasma/Kg/% TBSA burn
  - c. After 30 hours D5W can be given at a rate to maintain a normal serum sodium

G. Monitoring resuscitation

- 1. Urine output 30-55cc/hr in adults and 1.2cc/Kg/hr in children < age 12
- 2. A clear sensorium, pulse <120/min, HCO<sub>3</sub> > 18 meq/L, cardiac output >3.1 L/M<sup>2</sup>
- 3. CVP in acute major burns is unreliable

H. Treatment of the burn wound (Table 8-4)

- 1. Wound closure by the patient's own skin is the ultimate goal of treatment
  - a. By spontaneous healing
  - b. Autograft
  - c. Allograft
  - d. Xenograft
  - e. Artificial skin
  - f. Cultured epithelial cells
- 2. Specific treatment of the burn wound differs from one burn center to another
  - a. The most commonly employed topical antibacterials are silver sulfadiazine (Silvadene®) and mafenide acetate (Sulfamylon®)
  - b. Status of burn wound bacterial colonization and effectiveness of topical antibacterial treatment can be monitored by biopsies of wound for quantitative and qualitative bacteriology

### Sample Orders

**For a 70 Kg 40 year old patient with a 40% flame burn:**

1. Admit to ICU portion of burn center
2. Strict bedrest with head elevated 45°
3. Maintain elevation of burned extremities
4. Vital signs: pulse, BP respiration q 15 min, temperature q 2 h
5. Check circulation of extremities (capillary refill or Doppler) q 30 min
6. 100% O<sub>2</sub> face mask
7. Infuse Ringer's lactate at 700cc for first hour, then reassess
8. Measure urinary output by Foley catheter to closed drainage
9. Notify physician of first hour's urine output (must be 30-50cc: 1.2-1.5cc in pediatric patient)
10. N.P.O.
11. N.G. tube to intermittent low suction
12. Measure pH of gastric content q 2 h — stress ulcer prophylaxis (e.g. Zantac)
13. Morphine sulfate 4 mg intravenously q 2-3 hr prn pain - no intramuscular narcotics (unreliable absorption)
14. Tetanus toxoid 0.5cc IM (if patient previously immunized)
15. Send blood for Hct., glucose, BUN, cross match 2 units, electrolytes
16. Urine for U.A. and culture
17. Chest x-ray
18. EKG
19. Arterial blood gases q 6 h and prn
20. Cleanse wounds with Betadine solution, debride all blisters, map injury on Lund-Browder chart, and photograph wounds
21. Apply silver sulfadiazine to all wounds with sterile gloved hand (use reverse isolation technique when burn wounds are exposed)
22. Dress wounds with burn gauze and surgifix
23. Splint extremities as per physical therapist
24. Change all dressings, cleanse wounds, and reapply topical antibacterial q 8 h or q 12 h
25. Bronchoscopy — If inhalation injury suspected

**Table 8-4**

3. Necrotic tissues may be removed by any of several techniques:
    - a. Formal excision
    - b. Tangential (layered) debridement
    - c. Enzymatic debridement
    - d. Hydrotherapy — a useful adjunct
  4. Autografts should be applied to priority areas first, such as the hands, face and important joints
  5. Once healed, pressure is usually necessary with elastic supports to minimize hypertrophic scarring
  6. Physical therapy — important adjunct in burn care
- I. Complications: can occur in every physiologic system secondary to burn injury (Table 8-5)
1. Renal failure
    - a. From hypovolemia
    - b. Beware of nephrotoxic antibiotics in the burn patient

### Risk Factors in Burn Wound Infection

- I. PATIENT FACTORS
  - A. Extent of burn > 30% of body surface
  - B. Depth of burn: full-thickness vs. partial-thickness
  - C. Age of patient (very young or very old at higher risk)
  - D. Pre-existing disease
  - E. Wound dryness
  - F. Wound temperature
  - G. Secondary impairment of blood flow to wound
  - H. Acidosis
- II. MICROBIAL FACTORS
  - A. Density >10<sup>5</sup> organisms per gram of tissue
  - B. Motility
  - C. Metabolic products
    1. Endotoxin
    2. Exotoxins
    3. Permeability factors
    4. Other factors
  - D. Antimicrobial resistance

**Table 8-5**

2. Gastrointestinal bleeding
  - a. More likely in burns over 40%
  - b. Usually remains subclinical
  - c. Antacids and H<sub>2</sub> blockers
  - d. Increased risk with burn wound sepsis
3. Burn wound sepsis
  - a. Monitored by tissue biopsy — qualitative and quantitative
  - b. Must keep bacterial count < 10<sup>5</sup> bacteria/gm of tissue
  - c. Clinically suspect sepsis with
    - i. Sudden onset of hyper or hypothermia
    - ii. Unexpected congestive heart failure or pulmonary edema
    - iii. Development of the acute respiratory distress syndrome
    - iv. Ileus occurring after 48 hours postburn
    - v. Mental status change
    - vi. Azotemia
    - vii. Thrombocytopenia
    - viii. Hypofibrinogenemia
    - ix. Hyper or hypoglycemia is especially suspect if burn > 40% TBSA
    - x. Blood cultures may be positive but in many cases are not
4. Progressive pulmonary insufficiency
  - a. Can occur after:
    - i. Smoke inhalation
    - ii. Pneumonia
    - iii. Cardiac decompensation
    - iv. Sepsis from any cause
  - b. Produces:
    - i. Hypoxemia
    - ii. Hypocarbica
    - iii. Pulmonary shunting
    - iv. Acidosis

5. Wound contracture and hypertrophic scarring
  - a. Largely preventable
  - b. Since a burn wound will contract until it meets an opposing force, splinting is necessary from the outset
    - i. Splints are used to prevent joint contractures, e.g. elbow and knee are kept in extension, and MCP joints of fingers in flexion
  - c. Timely wound closure with adequate amounts of skin should largely eliminate these problems
  - d. Continued postoperative splinting and elastic pressure supports are of value in the remodeling of collagen with prevention of hypertrophic scars

## II. CHEMICAL BURNS

- A. Pathophysiology
  1. Tissue damage secondary to a chemical depends on:
    - a. Nature of agent
    - b. Concentration of the agent
    - c. Quantity of the agent
    - d. Length of time the agent is in contact with tissue
    - e. Degree of tissue penetration
    - f. Mechanism of action
- B. Diagnosis
  1. Chemical burns are deeper than initially appear and may progress with time
    - a. Fluid resuscitation needs often underestimated
    - b. Watch for renal/liver/pulmonary damage
- C. Treatment
  1. Initial treatment is dilution of the chemical with water
  2. Special attention to eyes — after copious irrigation with saline, consult ophthalmologist
  3. After 12 hours initial dilution, local care of the wound with debridement, topical antibacterials, and eventual wound closure is same as for thermal burn

D. Of particular note are:

1. Gasoline
  - a. Excretion by lung
  - b. May cause large skin burn, if immersed
  - c. Watch for atelectasis, pulmonary infiltrates; surfactant is inhibited
2. Phenol
  - a. Dull, gray color to skin, may turn black
  - b. Urine may appear smoky in color
  - c. **Spray** water on burn surface
  - d. Wipe with polyethylene glycol
  - e. Direct renal toxicity
3. Hydrofluoric acid
  - a. Irrigate copiously with water
  - b. Subcutaneous injections of 10% of calcium gluconate
  - c. Monitor EKG patients — may become hypocalcemic
  - d. Pulmonary edema may occur if subjected to fumes
4. White phosphorous
  - a. Do not allow to desiccate — may ignite
  - b. Each particle must be removed mechanically
  - c. Copper sulfate (2%) may counteract to make phosphorous more visible (turns black in color)
  - d. Watch for EKG changes (Q - T interval and S - T and T wave changes)
  - e. May cause hemoglobinuria and renal failure

### III. ELECTRICAL INJURIES

A. Pathophysiology

1. Effects of passage of electric current through the body depend on:
  - a. Type of circuit
  - b. Voltage of circuit
  - c. Resistance offered by body
  - d. Amperage of current flowing through tissue
  - e. Pathway of current through the body
  - f. Duration of contact
2. Tissue resistance to electrical current increases from nerve (least resistant) to vessel to muscle to skin to tendon to fat to bone

B. Diagnosis

1. Types of injury

- a. Arc injury: localized injury caused by intense heat
- b. Injury due to current
  - i. Due to heat generated as current flows through tissue
    - (a) Injury more severe in tissue with high resistance (i.e. bone)
    - (b) Vessels thrombose as current passes rapidly along them
  - ii. Effects of current may not be immediately seen

C. Special effects of electrical injury

1. Cardiopulmonary

- a. Anoxia and ventricular fibrillation may cause immediate death
- b. Early and delayed rhythm abnormalities can occur
- c. EKG changes may occur some time after the burn

2. Renal

- a. High risk of renal failure due to hemoglobin and myoglobin deposits in renal tubules
  - i. Requires higher urine flow (75cc/hr in adults)
  - ii. Must alkalinize urine to keep hemoglobin and myoglobin in more soluble state
  - iii. Mannitol may be useful to clear heavy protein load

3. Fractures:

- a. Tetanic muscle contractions may be strong enough to fracture bones, especially spine

4. Spinal cord damage

- a. Can occur secondary to fracture or demyelinating effect of current

5. Abdominal effects

- a. Intraperitoneal damage can occur to G.I. tract secondary to current

- 6. Vascular effects
  - a. Vessel thrombosis progresses with time
  - b. Delayed rupture of major vessels can occur
- 7. Cataract formation — late complication
- 8. Seizures
- D. Treatment
  - 1. CPR if necessary
  - 2. Fluids — usually large amounts
    - a. No formula is accurate because injury is more extensive than can be predicted by skin damage
    - b. Alkalinize with  $\text{NaHCO}_3$ , if myoglobinuria or hemoglobinuria present
  - 3. Monitoring
    - a. CVP or pulmonary wedge pressure helpful since total capillary leak does not occur as it does in a thermal burn
    - b. Maintain urine output at 75-100cc/hr until all myoglobin and/or hemoglobin disappears from urine
  - 4. Wound Management
    - a. Topical agent with good penetrating ability is needed [i.e. silver sulfadiazine (Silvadene®) or mafenide acetate (Sulfamylon®)]
    - b. Debride non-viable tissue early and repeat as necessary (every 48 hrs) to prevent sepsis
    - c. Major amputations frequently required
    - d. Technicium-99 stannous pyrophosphate scintigraphy may be useful to evaluate muscle damage
  - 5. Treat associated injuries (e.g. fractures)

#### IV. COLD INJURIES

The two conditions of thermal injury due to cold are local injury (frostbite) and systemic injury (hypothermia)

- A. Frostbite
  - 1. Pathophysiology
    - a. Formation of ice crystals in tissue fluid
      - i. Usually in areas which lose heat rapidly (e.g. extremities)
    - b. Anything which increases heat loss from the body such as wind velocity, or decreases tissue perfusion, such as tight clothing, predisposes patient to frostbite

- c. Ability of various tissue to withstand cold injury is inversely proportional to their water content
- 2. Treatment
  - a. The key to successful treatment is rapid rewarming in a  $40^\circ\text{C}$  waterbath
    - i. Admission to hospital usually required
      - (a) Tetanus prophylaxis
      - (b) Wound management
      - (c) Physical therapy
        - (i) Maintenance of range of motion important
        - (ii) Daily whirlpool and exercise
      - (d) Sympathectomy, anti-coagulants, and early amputation of questionable value in controlled studies
    - ii. Usually wait until complete demarcation before proceeding with amputations. Non-viable portions of extremities will often autoamputate with good cosmetic and functional results.

#### B. Hypothermia

- 1. Diagnosis
  - a. Core temperature  $< 34^\circ\text{C}$
  - b. Symptoms and signs mimic many other diseases
  - c. High level of suspicion necessary during cold injury season
- 2. Treatment
  - a. Must be rapid to prevent death
  - b. Monitor EKG, CVP, and arterial blood gases and pH during warming and resuscitation, maintain urine output of 50cc/hr
  - c. Begin Ringer's Lactate with 1 ampule  $\text{NaHCO}_3$
  - d. Oral airway or endotracheal tube if necessary
  - e. Rapidly rewarm in  $40^\circ$  hydrotherapy tank (requires 1-2 hours to maintain body temperature at  $37^\circ\text{C}$ )
  - f. Treat arrhythmias with IV Lidocaine drip if necessary
  - g. Evaluate and treat any accompanying disease states

## V. LIGHTNING INJURIES

- A. Cutaneous effects — lightning strikes may cause cutaneous burn wounds
  - 1. Contact burns from clothing on fire or contact with hot metal (i.e. zippers)
  - 2. Entry and exit burns are usually small, may be partial or full thickness
  - 3. Lightning burns are not the same as electrical burns — don't get deep tissue injury
- B. May have temporary ischemic effects on extremity — pallor or neurologic deficits. Spontaneous recovery after a few hours is the rule — probably due to local vasoconstriction
- C. Systemic effects can occur such as arrhythmias, cataracts, CNS symptoms

## CHAPTER 8 — BIBLIOGRAPHY

### THERMAL INJURIES

- 1. Gibran, N.S. and Heimbach, D.M. Current status of burn wound pathophysiology. *Clin Plast Surg.* 2000; 27:11-22.
- 2. Matthews, M.S. and Fahey, A.L. Plastic surgical considerations in lightning injuries. *Ann Plast Surg.* 1997; 39:561-5.
- 3. van Zuijlen, P.P. et al. Dermal substitution in acute burns and reconstructive surgery: a subjective and objective long-term follow-up. *Plast Reconstr Surg.* 2001; 108: 1938-46.

## **CHAPTER 9**

### **AESTHETIC SURGERY**

Aesthetic surgery includes those procedures that provide an enhancement of one's appearance to improve one's self-esteem. The goals of patients should be realistic and their motivation should be appropriate. Unrealistic expectations and/or personality disorders should alert the surgeon to the possibility of refusing to accept the patient or to refer the patient for psychiatric evaluation.

There are many valid reasons for seeking aesthetic surgery. A teenager may desire a more pleasing nose, a young woman may want her breasts enlarged so she is able to wear certain clothing or swimming attire, a balding man may want his hair restored, a public relations person may want to have a more youthful appearance with a facelift, etc. The common denominator of these examples is the reasonable desire to improve one's outward appearance for oneself rather than for another person or reason.

If patients are selected carefully and their expectations are realistic, then well-executed surgical procedures generally will result in a happy patient and a gratified surgeon. The patient's self-image is improved and self-confidence is increased. If patients, on the other hand, are poorly selected, even if the procedure is performed flawlessly, the outcome may be tragic for both the patient and the surgeon. If the deformity is minimal and the concern of the patient is great, the chances for a successful outcome are small and the chance for an untoward result is great. Do not operate on these patients.

Commonly performed aesthetic surgical procedures can be classified in many ways. One way is by anatomic location.

#### **I. FACE**

##### **A. Facelift for facial and neck aging**

1. Incisions usually begin above the hairline at the temples, follow the natural line in front of the ear, the curve behind the earlobe into the crease behind the ear, and into or along, the lower scalp
2. Facial and neck tissue and muscle may be separated; fat may be trimmed or suctioned and underlying muscle may be tightened



3. After deep tissues are tightened, the excess skin is pulled up and back, trimmed and sutured into place. Most of the scars will be hidden within the hair and in the normal creases of the skin
- B. Blepharoplasty and browlift for excessive eyelid tissues and/or periorbital aging
1. Before surgery, the surgeon marks the incision sites, following the natural lines and creases of the upper and lower eyelids. Underlying fat along with excess skin and muscle, can be removed or rearranged during the operation
  2. Incisions for browlift are made behind the hairline. Forehead tissues are mobilized and elevated. Glabellar muscles are removed. Endoscopy may be used
  3. The surgeon closes the incisions with fine sutures, which leave nearly invisible scars
- C. Rhinoplasty for nasal deformity
1. The surgeon removes a hump using a chisel or a rasp, then brings the nasal bones together to form a narrower bridge
  2. Cartilage is trimmed to reshape the tip of the nose.
  3. Trimming the septum improves the angle between the nose and the upper tip
  4. If the nostrils are too wide, the surgeon can remove small wedges of skin from their base, bringing them closer together
  5. To improve the nasal airway, the shape or the position of the septum may be altered, or the deviated portion of the septum may be partially removed
  6. A splint of tape with an overlay of plastic, metal or plaster is applied to help the bone and cartilage of the nose maintain a new shape
  7. After surgery, the patient has a straighter bridge, a well-defined nasal tip, and an improved angle between the nose and upper lip
- D. Otoplasty for prominent ears
1. Ears that appear to stick out or are overly large or malformed can be helped by ear surgery

2. An incision is made in the back of ear so cartilage can be sculpted or folded. Stitches are used to maintain the new shape and close the skin incision
  3. Creating a fold in the cartilage makes the ear lie flatter against the head and appear more normal.
- E. Skin rejuvenation for wrinkles or blemishes
1. Chemical peels for facial wrinkles
    - a. Alphahydroxy acids — lightest peels
    - b. Trichloroacetic acid — intermediate in strength
    - c. Phenol/croton oil — most efficacious
    - d. Chemical peel is especially useful for the fine wrinkles on the cheeks, forehead and around the eyes, and the vertical wrinkles around the mouth
    - e. The chemical solution can be applied to the entire face or to a specific area — for example around the mouth — sometimes in conjunction with a facelift
    - f. At the end of the peel, various dressings or ointments may be applied to the treated area
    - g. A protective crust may be allowed to form over the new skin. When it's removed, the skin underneath will be bright pink
    - h. After healing, the skin is lighter in color, tighter, smoother, younger looking
  2. Laser Resurfacing
    - a. Laser surfacing is also used to improve facial wrinkles and irregular skin surfaces
    - b. In many cases, facial wrinkles form in localized areas, such as near the eyes or around the mouth. The depth of laser of treatment can be tightly controlled so that specific areas are targeted as desired
    - c. When healing is complete, the skin has a more youthful appearance
  3. Dermabrasion to improve raised scars or irregular skin surface
    - a. In dermabrasion, the surgeon removes the top layers of the skin using an electrically operated instrument with a rough wire brush or diamond impregnated bur

## II. BREAST

- A. Augmentation mammoplasty to increase size of breasts
  - 1. Incisions are made to keep scars as inconspicuous as possible, and may be located in the breast crease, around the nipple or in the axilla. Breast tissue and skin is lifted to create a pocket for each implant
  - 2. The breast implant may be inserted under breast tissue or beneath the chest wall muscle
  - 3. After surgery, breasts appear fuller and more natural in contour. Scars will fade in time
- B. Mastopexy to reposition ptotic breasts
  - 1. Incisions outline the area of skin to be removed and the new position for the nipple
  - 2. Skin formerly located above the nipple is brought down and together to reshape the breast
  - 3. Sutures close the incision, giving the breast its new contour and moving the nipple to its new location
  - 4. After surgery, the breasts are higher and firmer, with sutures located around the areola, below it, and sometimes in the crease under the breast

## III. TRUNK AND EXTREMITIES

- A. Arm or thigh lift to remove excess skin
  - 1. Incisions can be made in the groin crease and laterally across the thigh or over the buttock, depending on the areas to be lifted. Deeper fascial tissues, rather than skin alone, are used to support the repair. Excess skin and underlying fat are discarded
- B. Abdominal skin or muscles
  - 1. An incision just above the pubic area is used to remove excess skin and fat from the middle and lower abdomen
  - 2. Skin is separated from the abdominal wall up to the ribs
  - 3. The surgeon plicates underlying muscle and tissue together, thereby narrowing the waistline and tightening the abdominal wall
  - 4. Abdominal skin and fat are drawn down and the excess is removed. With complete abdominoplasty, a new opening is cut for the navel
  - 5. Some liposuction may be done to augment the result

- C. Liposuction to remove unwanted fatty tissues in localized regions
  - 1. Traditional liposuction
    - a. The best candidates for liposuction are of normal weight with localized areas of excess fat — for example, in the buttocks, hips and thighs
    - b. The surgeon inserts a cannula through small incisions in the skin. At the other end of the tube is a vacuum-pressure unit that suctions the fat
    - c. As the healing progresses, a more proportional look will emerge
  - 2. Ultrasonic Liposuction
    - a. Ultrasonic waves emulsify the fat
    - b. Traditional liposuction is then done to remove the liquified fat

## CHAPTER 9 — BIBLIOGRAPHY

### AESTHETIC SURGERY

- 1. American Society of Plastic Surgeons. Statement on Liposuction. June 2000.
- 2. Clinics in Plastic Surgery. Selected issues. Facial aesthetic surgery. 24:2, 1997. Aesthetic laser surgery. 27:2, 2000. New directions in plastic surgery, part I. 28:4, 2001. New directions in plastic surgery, part II. 29:1, 2002.
- 3. LaTrenta, G. Atlas of Aesthetic Breast Surgery. New York: Elsevier Science, 2003.
- 4. Peck, G.C. and G.C, Jr. Techniques in Aesthetic Rhinoplasty. New York: Elsevier Science, 2002.
- 5. Plastic Surgery Educational Foundation. Patient Education Brochures, by topic. Arlington Heights, IL. 1-800-766-4955.
- 6. Rees, T.D. and LaTrenta, G.S. Aesthetic Plastic Surgery, 2 vol. New York: Elsevier Science, 1994.
- 7. Spinelli, H. Atlas of Aesthetic Eyelid Surgery. New York: Elsevier Science, 2003.

**NOTES**