

Mary O'Brien



# Plastic and Hand Surgery in Clinical Practice – Classifications and Definitions

 Springer

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*Mary O'Brien, MPhil, FRCS (Plast)*

*Consultant Plastic and Hand Surgeon,  
Pulvertaft Hand Centre, Derby, UK*



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Mary O'Brien, MPhil, FRCS (Plast)  
Consultant Plastic and Hand Surgeon  
Pulvertaft Hand Centre  
Derby  
UK

ISBN 978-1-84800-262-3 e-ISBN 978-1-84800-263-0  
DOI: 10.1007/978-1-84800-263-0

British Library Cataloguing in Publication Data

Library of Congress Control Number: 2008936262

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To my parents in whose footsteps I aspire to follow  
To my husband whose footsteps I walk alongside  
To my children whose footsteps I chase

# Preface

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## **THE PLASTIC SURGEON'S CREED**

Millard DR, Jr

“Know the ideal beautiful normal. Diagnose what is present; what is diseased, destroyed, displaced or distorted; and what is in excess. Then, guided by the normal in your mind's eye, use what you have to make what you want- and when possible go for even better than what would have been.”

## **THE PRINCIPLES OF PLASTIC SURGERY**

Gillies HD, Millard DR, Jr: The Principles and Art of Plastic Surgery. 1st Ed Boston. Little, Brown & Co 1957.

“Plastic surgery is a constant battle between blood supply and beauty.

Observation is the basis of surgical diagnosis.

Diagnose before you treat.

Make a plan and a pattern for this plan.

Make a record- sketches and photographs.

The lifeboat another flap or skin graft.

A good style will get you through- dexterity and gentleness.

Replace what is normal in normal position and retain it there.

Treat the primary defect first - borrow from Peter to pay Paul only when Peter can afford it.

Losses must be replaced in kind.

Do something positive- start with a landmark or two pieces that definitely fit.

Never throw anything away- a preserved piece may be used later.

Never let routine methods be your master.

Consult other specialists.

Speed in surgery consists of not doing the same thing twice.

The aftercare is as important as the planning.

Never do today what can honourably be put off till tomorrow- when in doubt, don't.

Time, although the plastic surgeon's most trenchant critic, is also his greatest ally."

# Acknowledgements

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I would like to express sincere thanks to Mr Keith Allison FRCS (Plast) and Mr Darren Chester FRCS (Plast) for their contributions in proof reading the manuscript.

I am particularly grateful to the many trainers both medical and those in professions allied to medicine for their teaching, encouragement, and support.

I also gratefully acknowledge the assistance and immense resources made available to me by the excellent library staff at University Hospitals Coventry & Warwickshire NHS Trust.

Without the helpful assistance of the team at Springer- Verlag, this book would not have been published.

Without the support of my family, this book would never have been written. Thank you.



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# Chapter I

## Fundamentals of Plastic Surgery

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*Plastic Surgery*

*Greek derivation—"Plastikos" = "To mould"*

### **1.1 A "SURGICAL SIEVE"**

A useful filter to obtain a pathological diagnosis

Congenital

or

Acquired – Trauma

– Tumour

– Infective

– Inflammatory

– Metabolic

– Endocrine

– Iatrogenic

### **1.2 THE "RECONSTRUCTIVE LADDER" (FIGURE 1.1)**

An evaluation of increasingly complex techniques to achieve wound closure:

Free tissue transfer (complex)

Regional flap

Local flap

Skin graft (split thickness or full thickness, meshed or unmeshed, skin substitutes)

Direct closure

Secondary intention healing (simple or vacuum therapy)

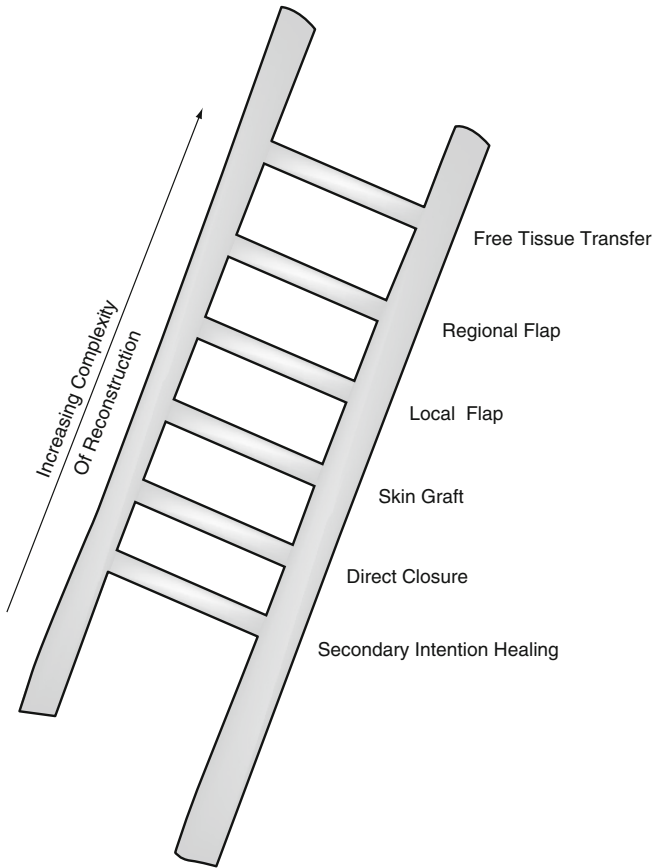


FIGURE 1.1. The reconstructive ladder.

### 1.3 FRAMEWORK FOR ANSWERING A QUESTION

- Incidence
- Aetiology/age
- Sex distribution
- Geographical
- Symptoms and signs
- Pathology
- Macroscopic and microscopic features
- Management
- Prognosis

**Mnemonic**

“In A Surgeon’s Gown, Some Physicians Might Make Progress”

**I.4 CLASSIFICATION OF SKIN GRAFTS**

Split thickness (contain varying amounts of dermis) – meshed or unmeshed  
 Full thickness (contains the entire dermis)

*Graft*

- Tissue separated from its donor bed and blood supply that relies on the ingrowth of new vessels for survival.

*Primary graft contraction*

- Physiological recoil of a newly harvested skin graft due to its inherent elastic properties. Full thickness skin grafts exhibit greater primary contraction than split thickness skin grafts.

*Secondary graft contraction*

- Contraction of a graft to the dimensions of the underlying wound over the period of graft maturation. Split thickness skin grafts exhibit greater secondary contraction than full thickness skin grafts. (Dermis appears to inhibit the differentiation of myofibroblasts).

*Composite graft*

- A combination of tissue types harvested in unity as a graft.

**I.5 CLASSIFICATION OF STAGES OF SPLIT SKIN GRAFT TAKE**

- (1) Adherence
- (2) Imbibition
- (3) Inosculation
- (4) Revascularization

*Adherence*

- Attachment of the graft to the host bed.

*Imbibition*

- Serum absorption by the graft

*Inosculation*

- Anastomoses between the graft and host vessels

*Revascularization*

- Re-establishment of a blood supply

**1.6 CLASSIFICATION OF FLAPS: “THE FIVE CS”**

Adapted from Adrian Richards. Key Notes on Plastic Surgery. Blackwell Science; 2002

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<i>Circulation</i> (“blood supply”)	– Random pattern – Axial (direct, fasciocutaneous, musculocutaneous, venous)
<i>Composition</i> (“component parts”)	– Cutaneous, fasciocutaneous, fascial, musculocutaneous, muscle, osseocutaneous, osseous
<i>Contiguity</i> (“relationship to defect”)	– Local, regional, distant, free
<i>Contouring</i> (“type of movement”) (Figs. 1.2–1.4)	– Advancement, rotation, transposition, interpolation
<i>Conditioning</i>	– Delay

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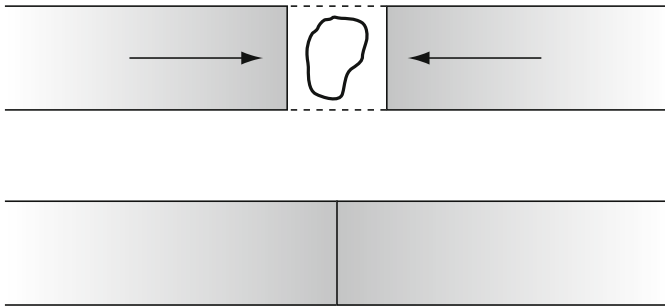


FIGURE 1.2. Bilateral advancement flaps.

*Flap*

– A composite block of tissue with its own blood supply.

*Pedicled flap*

– Tissue that remains attached to its blood supply and is transferred from one part of the body to another.

*Perforator flap*

– A flap based on a visible musculocutaneous or septocutaneous perforating vessel that is dissected free from surrounding muscle to obtain the desired pedicle length.

Flap Design

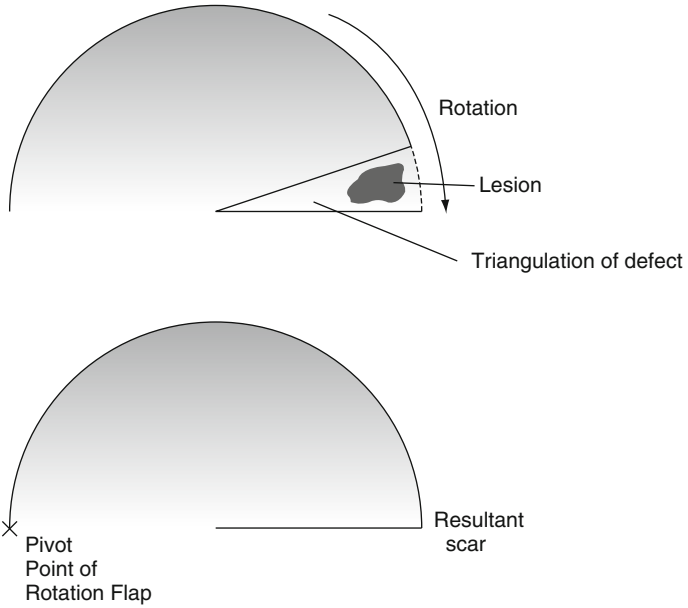


FIGURE 1.3. Rotation flap.

Flap design

Flap after transposition

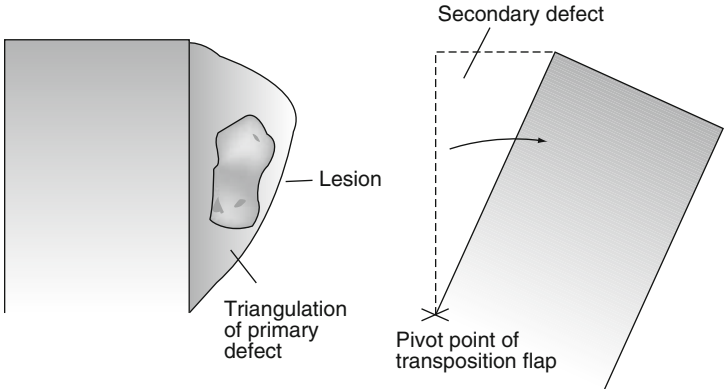


FIGURE 1.4. Transposition flap.

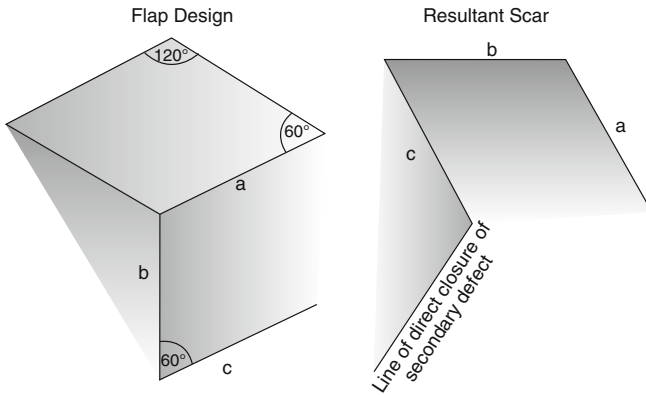


FIGURE 1.5. Rhomboid flap.

#### Free flap

- Tissue that is transferred from one part of the body to another and is revascularized by microvascular anastomoses to recipient vessels.

#### Chimeric flap

- A flap comprising of separate components ultimately supplied by the same source vessel.

#### Delay

- A planned initial manoeuvre to partially interrupt the blood supply of a flap before moving it to a new position at a later date. This facilitates the opening up of “choke” vessels, reorientation of existing flap vessels and the sprouting of new vessels within the flap which improves the flap’s ultimate blood supply.

#### Crane principle

- A technique to convert an ungraftable bed into a graftable bed. It involves transferring a flap into the defect, and after a period of time returning the superficial portion of the flap to its original position, minimizing the aesthetic defect and allowing the remaining now graftable bed to be skin grafted.

#### Z-plasty

- A technique involving the transposition of two triangular flaps, allowing elongation, realignment, and breaking up of a straight scar (Figs. 1.6–1.8)

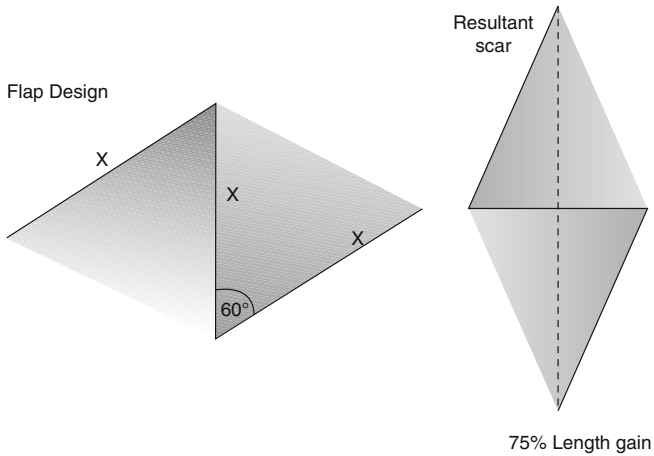


FIGURE 1.6. Classic Z-plasty.

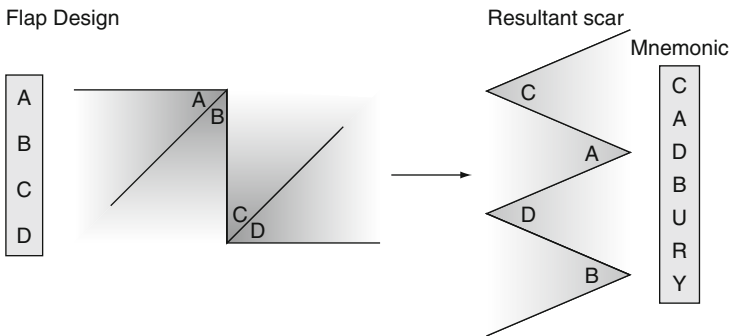


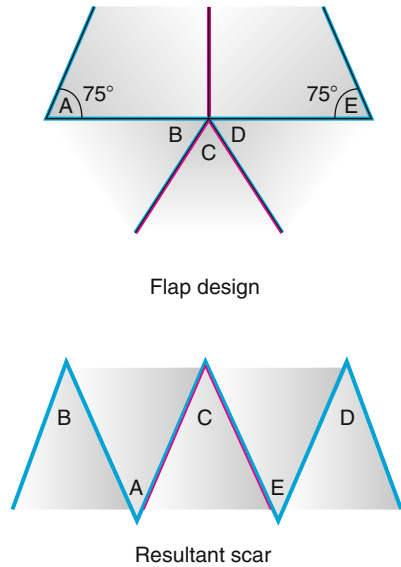
FIGURE 1.7. The 4 – Flap plasty.

### 1.7 CLASSIFICATION OF THEORETICAL LENGTH GAIN DEPENDING ON THE ANGLE OF DESIGN OF A Z-PLASTY

Z-plasty angle	Theoretical length gain (%)
30/30°	25
45/45°	50
60/60°	75
75/75°	100
90/90°	120



**FIGURE 1.8.** The 5 – Flap plasty or “Jumping Man” flap.



### 1.8 CLASSIFICATION OF FASCIOCUTANEOUS FLAPS: CORMACK AND LAMBERTY (FIGURE 1.9)

Cormack GC, Lamberty BG: *The Arterial Anatomy of Skin Flaps*. Edinburgh, Churchill Livingstone; 1986

Blood reaches the flap from fasciocutaneous vessels running from deep arteries of the body. Most flaps raised in a limb have a fasciocutaneous pattern of blood supply.

#### *Type A*

Multiple, unnamed fasciocutaneous vessels entering the base of the flap

E.g., Ponten lower leg flaps

#### *Type B*

Single fasciocutaneous vessel running along the axis of the flap

E.g., Scapular, parascapular flaps

#### *Type C*

Multiple perforating vessels from a deep artery in the septum between muscles

E.g., Radial forearm flap

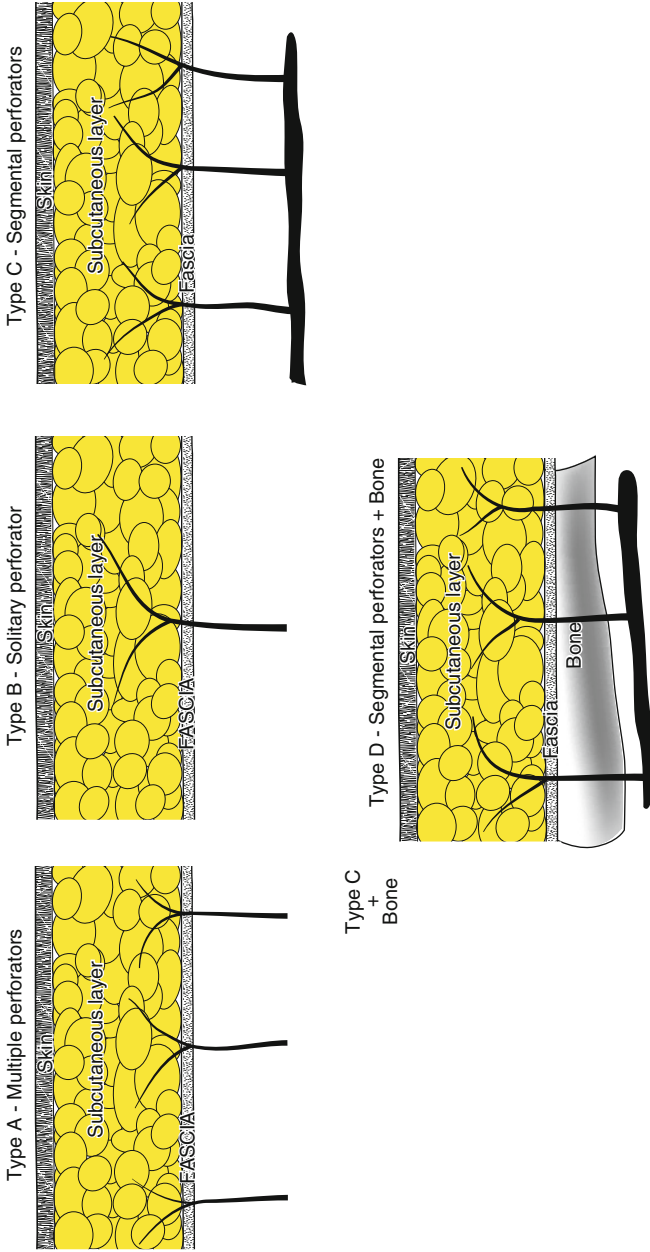


FIGURE 1.9. Classification of fasciocutaneous flaps – Cormack and Lamberty.

Type D

Type C+ Bone

E.g., Radial forearm flap with radius

Lateral arm flap with humeral lateral supracondylar ridge

### 1.9 CLASSIFICATION OF FASCIAL AND FASCIOCUTANEOUS FLAPS: MATHES AND NAHAI (FIGURE 1.10)

Mathes SJ, Nahai F. Reconstructive surgery: Principles, Anatomy, and Technique. New York, Churchill Livingstone; 1997

Type A	Direct cutaneous pedicle
Type B	Septocutaneous pedicle
Type C	Musculocutaneous pedicle

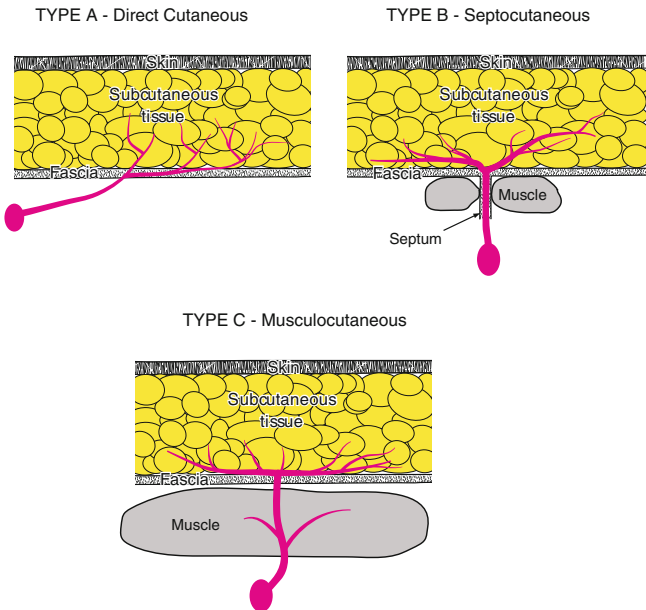


FIGURE 1.10. Classification of fascial and fasciocutaneous flaps – Mathes–Nahai.

### 1.10 CLASSIFICATION OF MUSCULOCUTANEOUS FLAPS: MATHES AND NAHAI (FIGURE 1.11)

Mathes SJ, Nahai F. Classification of the vascular anatomy of muscles: experimental and clinical correlation. *Plast Reconstr Surg* 1981;67:177

Based on perforators that reach skin through muscle

#### *Type I*

One vascular pedicle nourishes the whole flap (Gastrocnemius, Tensor fascia lata, Abductor digiti minimi)

#### *Type II*

Dominant vascular pedicle with additional minor vascular pedicles (Trapezius, Gracilis)

#### *Type III*

Two dominant vessels (Rectus abdominus, Gluteus Maximus, Serratus, Temporalis)

#### *Type IV*

Segmental supply (Sartorius, Tibialis anterior, Flexor hallucis longus)

#### *Type V*

Dominant pedicle but alternative minor pedicles which can support the flap (Latissimus Dorsi, Pectoralis Major)

### 1.11 CLASSIFICATION OF VENOUS FLAPS: THATTE AND THATTE (FIGURE 1.12)

Thatte MR, Thatte RL: Venous flaps. *Plast Reconstr Surg* 1992;91:747

A small artery may run with a vein

Flaps are based on a venous pedicle

E.g., Saphenous flap based on the short saphenous vein applied to knee defects

*Type I* – Single venous pedicle

*Type II* – Bipedicled venous flap

*Type III* – Arteriovenous venous flap

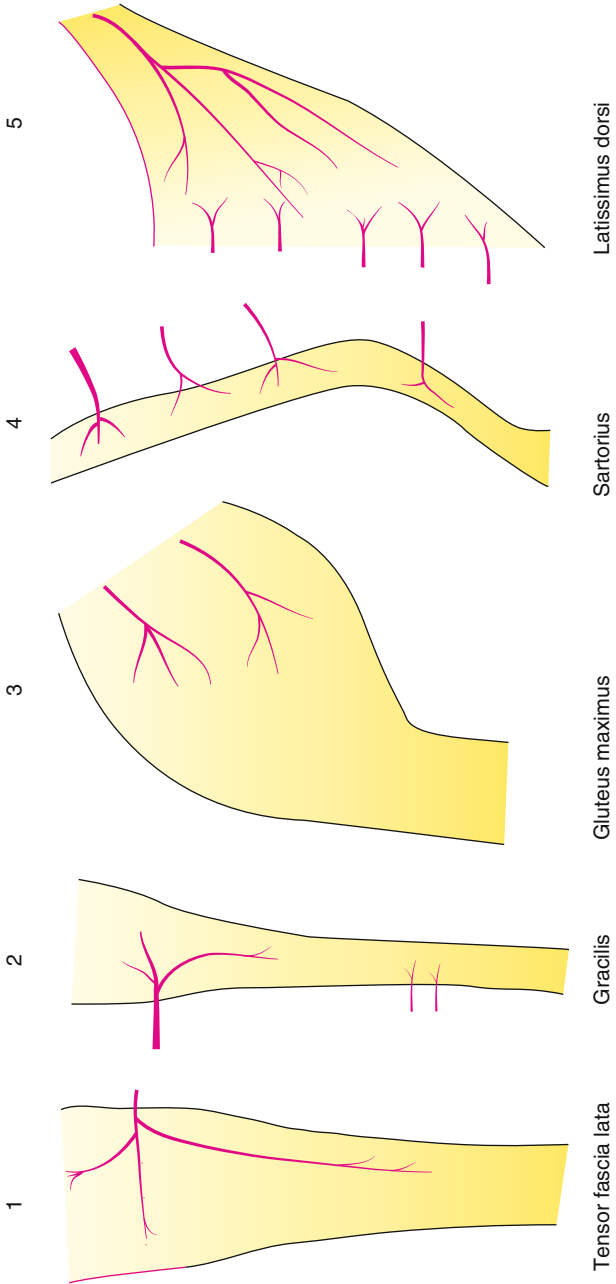


FIGURE 1.11. Classification of musculocutaneous flaps – Mathes-Nahai.

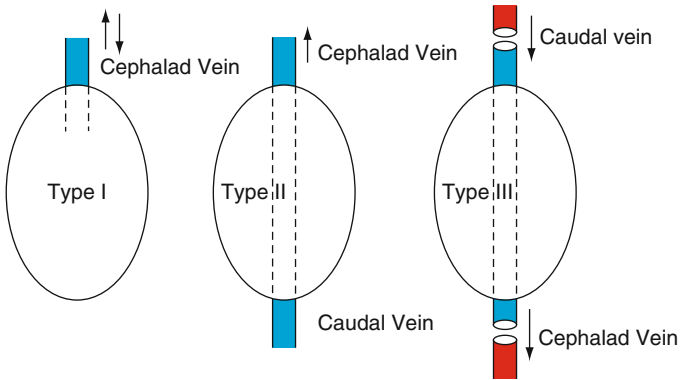


FIGURE 1.12. Classification of venous flaps – Thatte and Thatte.

### 1.12 CLASSIFICATION OF TYPES OF TRANSPLANT

Autograft  
 Allograft  
 Isograft  
 Xenograft

Heterotopic transplant  
 Orthotopic transplant

*Autograft*

– Tissue transplanted from one site to another within the same individual

*Allograft*

– Tissue transplanted between unrelated individuals of the same species

*Isograft*

– Tissue transplanted between genetically identical individuals

*Xenograft*

– Tissue transplanted between different species

*Heterotopic transplant*

– Transplantation of tissue into an anatomically different site

*Orthotopic transplant*

– Transplantation of tissue into an anatomically similar site

### 1.13 CLASSIFICATION OF TYPES OF WOUND HEALING

Primary intention  
Delayed primary closure  
Secondary intention

*Primary intention*

- *Skin edges directly apposed, normally heals well with minimal scar formation*

*Delayed primary closure*

- *Wound left open and closed as a secondary procedure*

*Secondary intention*

- *Open wound which heals by contraction and epithelialization*

### 1.14 CLASSIFICATION OF PHASES OF WOUND HEALING

Haemostasis  
Inflammation  
Proliferation  
Remodelling

*Wound contraction*

- *A process in which the surrounding skin is pulled towards an open wound and thought to be mediated by myofibroblast activity*

*Contracture*

- *A pathological manifestation of wound contraction resulting in tissue shortening that compromises joint mobility and function (and potentially growth in children)*

*Epithelialization*

- *Migration of keratinocytes across a partial thickness wound to restore epidermal continuity*

### 1.15 CLASSIFICATION OF FACTORS AFFECTING WOUND HEALING

*Local*

Blood supply  
Radiation  
Infection  
Trauma  
Nerve injury  
Foreign body  
Pressure  
Oedema

*Systemic*

Nutrition

Pharmacological – steroids, chemotherapy

Endocrine – diabetes

Medical – jaundice, uraemia, cancer

Age

Smoking

Toxins

*Congenital*

Ehlers Danlos, Progeria, Werners, Epidermolysis bullosa, Cutis laxa, Pseudoxanthoma elasticum

**1.16 CLASSIFICATION OF TYPES OF WOUND AND ASSOCIATED INFECTION RISK**

Cruse PJ, Foord R: The epidemiology of wound infection. A 10 year prospective study of 62,939 wounds. *Surg Clin North Am* 1980; 60(1):27–40

		Infection risk (%)
Clean	(Class I)	< 2
Clean contaminated	(Class II)	< 10
Contaminated	(Class III)	< 20
Dirty	(Class IV)	Approximately 40

**1.17 CLINICAL CLASSIFICATION OF SCARS**

Mustoe TA et al. International recommendations on scar management. *Plas Reconstr Surg* 2002;110:560–571

Mature scar

Immature scar

Linear hypertrophic

Widespread hypertrophic

Minor keloid

Major keloid

*Hypertrophic scar*

– Excessive cutaneous scar formation which is contained within the borders of the original wound.

*Keloid*

– Excessive cutaneous scar formation which extends outside the borders of the original wound.



## 1.18 CLASSIFICATION OF SCAR ASSESSMENT

### 1.18.1 Vancouver Burn Scar Assessment Scale (Summarized)

Sullivan T et al. Rating the burn scar. *J Burn Care Rehabil* 1990; 11:256–260

	Score
Pigmentation	0–2
Vascularity	0–3
Pliability	0–3
Height	0–3

### 1.18.2 Global Acne Scarring Classification

Goodman G, Baron J. The management of post acne scarring. *Dermatol Surg* 2007;33:1176

Grade 1	Macular	Erythematous, hyper, or hypopigmented flat marks
Grade 2	Mild	Mild rolling, small soft papular
Grade 3	Moderate	More significant rolling, shallow boxcar, mild to moderate hypertrophic or papular scars
Grade 4	Severe	Punched out atrophic (deep boxcar), ice pick, bridges and tunnels, marked atrophy, dystrophic significant hypertrophy, or keloid

## 1.19 CLASSIFICATION OF MUSCLE

Anatomical	(a) Striated (b) Smooth
Innervation	(a) Voluntary (b) Autonomic
Functional	Blood supply (see Mathes and Nahai classification)

## 1.20 CLASSIFICATION OF CARTILAGE

Hyaline  
Elastic  
Fibrocartilage

## 1.21 CLASSIFICATION OF SOURCES OF AUTOLOGOUS CARTILAGE GRAFTS

Costal cartilage  
Auricular cartilage  
Nasal septum

## 1.22 CLASSIFICATION OF BONE TYPE

Endochondral (e.g., Long bones)  
Membranous (e.g., Craniofacial skeleton)

## 1.23 CLASSIFICATION OF PHASES OF FRACTURE HEALING

Haemostasis  
Inflammation  
Proliferation – periosteal/endosteal  
Callus formation  
Remodelling

## 1.24 CLASSIFICATION OF TYPES OF BONE GRAFT

Autogenous  
Allogenic  
Xenogeneic  
Bone substitutes
 

- Calcium phosphates
- Calcium sulfate
- Methylmethacrylate

## 1.25 CLASSIFICATION OF NERVE INJURY

### 1.25.1 Seddon 1947

Seddon H. The use of autogenous grafts for the repair of large gaps in peripheral nerves. *Br J Surg* 1947; 35:151–167

Neuropraxia (equates to Sunderland 1)  
Axonotmesis (equates to Sunderland 2)  
Neurotmesis (equates to Sunderland 3–5)

#### *Neuropraxia*

– *A temporary conduction block in a nerve with axonal continuity*

#### *Axonotmesis*

– *Loss in axonal continuity. Surrounding connective tissue components intact*

### *Neurotmesis*

– Complete disruption of the axonal component as well as disruption of the surrounding sheath of connective tissue

#### **1.25.2 Sunderland 1951**

Sunderland S. A classification of peripheral nerve injuries producing loss of function. *Brain* 1951;74:491–516

- 1 Axonal continuity, conduction impaired, segment of demyelination (should recover in 12 weeks)
- 2 Axonal disruption, distal Wallerian degeneration
- 3 Axonal/endoneurium disruption – perineurium intact – some recovery
- 4 Epineurium only intact – neuroma in continuity
- 5 Complete nerve disruption
- 6 Mackinnon modification – Mixed/segmental injury

Scores 4–5 require surgical intervention; 6 variable recovery

#### **1.26 GRADING OF SENSORY RECOVERY (SUMMARY)**

Mackinnon S, Dellon A. *Surgery of the Peripheral Nerve*. New York, Thieme; 1988

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S0	No recovery
S1	Deep cutaneous sensation
S2	Superficial sensation
S2+	Hypersensitivity of superficial sensation
S3	Pain and Touch, 2 pd > 15 mm
S3+	Good localization, 2 pd 7–15 mm
S4	Complete recovery, 2 pd 2–6 mm

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#### **1.27 MRC GRADING OF MOTOR FUNCTION (SUMMARY)**

Barnes R. Traction injuries of the brachial plexus in adults. *J Bone Joint Surg Br* 1949;31:10–36

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M0	No contraction
M1	Palpable contraction
M2	Active movement of joint (gravity excluded)
M3	Active motion of joint against gravity
M4	Weaker than normal strength – full range of active motion
M5	Normal strength – full range of active motion

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*Nerve conduction studies*

- An electrical test which records measurements of conduction velocity along a nerve.

*Electromyography*

- An electrical test which measures motor action potentials following stimulation of a motor nerve.

**1.28 CLASSIFICATION OF NERVE FIBRE TYPE**

			Conduction velocity (ms <sup>-1</sup> )	Diameter (µm)
Myelinated	Group A	Alpha	70–120	12–20
		Beta	60–80	10–15
		Gamma	15–40	3–8
		Delta	10–30	3–8
	(motor and sensory)			
	Group B		5–15	1–3
(preganglionic autonomic)				
Unmyelinated	Group C		0.5–2.5	0.2–1.5
(pain and temperature)				

*Double crush phenomenon*

- Entrapment at one level associated with symptoms of compression at another level along the same nerve

*Wallerian degeneration*

- Axon and myelin degeneration and phagocytosis by Schwann cells and macrophages distal to the site of nerve injury

*Neurotrophism*

- The ability of distal receptors to enhance the maturation of nerve fibres and direct nerve regrowth in a specific direction

*Neurotropism*

- The ability of regenerating fibres to demonstrate tissue and end organ specificity

**1.29 CLASSIFICATION OF SUTURES**

(a) Material	Natural	Synthetic
(b) Degradability	Absorbable	Non-absorbable
(c) Number of filaments	Braided	Monofilament

### 1.30 CLASSIFICATION OF IMPLANT MATERIALS

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Metals	Stainless steel, titanium, gold
Ceramics	Hydroxyapatite, hydroxyapatite cement
Biologic materials	Collagen, alloderm
Polymers	Silicone, polymethylmethacrylate, polyester, polyamide, polyethylene, polypropylene

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#### *Alloplastic*

– *Material of synthetic origin*

#### *Autologous*

– *Tissue derived from self*

### 1.31 CLASSIFICATION AND EXAMPLES OF DRESSINGS

Films (Opsite, Tegaderm)  
Hydrogel sheets  
Amorphous gels  
Hydrocolloids (Duoderm, Granuflex)  
Foams (Lyof foam)  
Alginates (Kaltostat, Sorbsan)  
Collagen  
Contact layers  
Low adherent (Paraffin gauze, Melolin)  
Vacuum dressing  
Biological dressing  
Enzymatic dressing  
Odour absorbent (Actisorb Silver)

### 1.32 ALPHABETICAL CLASSIFICATION OF IDEAL PROPERTIES OF DRESSINGS

#### “ABCDEFGHI”

O’Brien CM

**A**vailable, absorptive  
**B**arrier (protective)  
**C**ost effective, conformable, comfortable  
**D**ead or necrotic material removal  
**E**pithelialization encouraged  
**G**ranulation encouraged  
**H**ealing promoted, hydration  
**F**lexible  
non **I**rritant

**1.33 CLASSIFICATION OF TISSUE EXPANDER BIOLOGY ACCORDING TO SKIN COMPONENTS**

Austad ED, Paysk KA, Mc Clatchey KD, Cherry GW. Histomorphologic evaluation of guinea pig skin and soft tissue after controlled tissue expansion. *Plast Reconstr Surg* 1982;70:704-710

Epidermis – Thickens (this contrasts with other components of skin)

Dermis	Thins, collagen increases
Skin appendages	Separate, altered hair density and sensation
Subcutaneous tissue	Atrophy, fibrosis
Muscle	Atrophy, increased mitochondria
Bone	Resorption and deformity
Nerve	Altered conductivity
Mitotic rate of expanded skin	Increases
Vascularity	Increases, angiogenesis secondary to ischaemia

**1.34 CLASSIFICATION OF TYPES OF TISSUE EXPANDER**

Shape	Oval, round, square, rectangle, croissant
Size	Base, projection
Location of port	Integrated or remote
Envelope	Smooth, textured, with differential thickening

**1.35 TISSUE EXPANDER CAPSULE CLASSIFICATION – PAYSK**

Inner zone	Macrophages within a layer of fibrin
Central zone	Fibroblasts, Myofibroblasts
Transitional zone	Loose fibres of collagen
Outer zone	Blood vessels and collagen

*Creep*

– *Skin stretch in response to a sudden but constant load*

*Stress relaxation*

– *After time, a decrease occurs in the load required to maintain the same length*

**1.36 MICROSURGERY**

*Microsurgery*

– *Surgery with the aid of a microscope*

– *Greek derivation: – mikros = small*

– *skopein = to view*

*Triangulation*

*A technique of placing sutures 120° apart at the anastomosis site (helps to avoid inadvertent inclusion of the back wall).*

*Reperfusion injury*

*Release of accumulated free radicals into the circulation following Re-establishment of a blood supply*

*No-reflow phenomenon*

*– Lack of tissue perfusion despite adequate patent arterial and venous anastomoses. It is postulated to be due to endothelial swelling, interstitial oedema and platelet aggregation*

*Ischaemic time*

*– The time interval between interrupting and re-establishing a blood supply*

**1.37 CLASSIFICATION OF TYPES OF MICROVASCULAR ANASTOMOSIS**

End to end

End to side

Sleeve (one end inside the other)

**1.38 CLASSIFICATION OF FLAP MONITORING METHODS**

Clinical examination

Ultrasound Doppler

Laser Doppler

Thermocouple probes

Photoplethysmography

Transcutaneous oxygen monitoring

pH monitoring

Intravenous fluorescein

Near infrared spectroscopy

**1.39 CLASSIFICATION OF TECHNICAL REASONS FOR FLAP FAILURE**

(Any manoeuvre which produces intimal damage predisposes to thrombosis)

Suture technique – loose, tight, too many, tension, unequal spacing, partial thickness bites

Vessel – rough dissection, desiccation, diathermy, prolonged vasospasm

Clamp pressure > 30 g mm<sup>-2</sup>

Needle – calibre too large, repeated stabs

**1.40 VIRCHOW'S TRIAD**

Factors initially thought to contribute to venous thrombosis but now applied to the arterial circulation

Stasis

Endothelial damage

Hypercoagulability

**1.41 ACLAND'S CLASSIFICATION OF FACTORS INFLUENCING PATENCY OF AN ANASTOMOSIS**

Surgical precision

Vessel diameter

Blood flow

Tension

Anticoagulant/antithrombolytic agents

**1.42 OPTIONS FOR FLAP VIABILITY IMPROVEMENT: CLASSIFICATION OF INTERVENTION**

---

Preoperative	Planning, theatre set up, patient selection and optimization
Preanastomosis	Delay, flap hypothermia (reduce metabolic rate), short ischaemic time, anaesthetic input
Postanastomosis	Patient – Keep warm, well hydrated, pain free Leeches Drugs – Steroids, aspirin, dextran, heparin

---

**1.43 LOCAL ANAESTHETICS: CLASSIFICATION ACCORDING TO STRUCTURE**

*Amino amide (lidocaine, prilocaine, bupivacaine)*

– Metabolized in the liver, excreted by the kidney

*Amino ester (procaine, cocaine, benzocaine, amethocaine)*

– Hydrolysis in plasma by pseudocholinesterase, unstable in solution and may cause allergic reactions

**1.44 LOCAL ANAESTHETICS: CLASSIFICATION ACCORDING TO LENGTH OF ACTION**

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Doses	Plain	With adrenaline	Duration (min)
Lignocaine	3 mg kg <sup>-1</sup>	7 mg kg <sup>-1</sup>	60–120
Bupivacaine	2–3 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	240–480

---



1% solution = 10 mg ml<sup>-1</sup>

*EMLA*: Eutectic mixture of local anaesthetics – 2.5% prilocaine and 2.5% lignocaine

### 1.45 AMERICAN SOCIETY OF ANESTHESIOLOGISTS' PHYSICAL STATUS CLASSIFICATION (ASA GRADE)

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Class I	No systemic disease
Class II	Mild to moderate systemic disease – no functional limitation
Class III	Severe systemic disease with functional limitation
Class IV	Severe systemic disease that is life-threatening
Class V	Moribund patient
E	Emergency surgery

---

### 1.46 LASER

*LASER*

– *Light amplification by stimulated emission of radiation*

*Selective photothermolysis*

– *Selective damage of target tissue rather than surrounding normal tissue by the preferential absorption of light of a particular wavelength when delivered to the target during a pulse duration less than or equal to the thermal relaxation time of the target. (theory described by Anderson and Parrish 1983).*

*Thermal relaxation time*

– *Time taken for a given volume of tissue to cool to 50% of the initial temperature.*

*Energy*

– *Proportional to number of photons (J)*

*Power*

– *Rate of delivery of energy (W or J s<sup>-1</sup>)*

*Power density*

= *power/spot*

*Fluence*

= *power/spot/time (J cm<sup>-2</sup>)*

### 1.47 CLASSIFICATION OF CLASSES OF LASER

(British Standard on Laser Safety BS EN 60825-1: 1994 as amended)

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Class 1	Power output is below the level required to cause eye injury The irradiance does not exceed the maximum permissible exposure Lasers of a higher class may be incorporated into this group if the beam is protected from access by adequate engineering (laser printer)
Class 1M	Highly divergent or large diameter beam (fibre-optic communication)
Class 2	Blinking response prevents eye damage on exposure to beam Beam wavelength between 400 and 700 nm Maximum power output 1 mW (laser pointer, barcode scanner)
Class 2M	Highly divergent beam Beam wavelength between 400 and 700 nm Maximum power output 1 mW (civil engineering orientation or level instruments)
Class 3R	Potential to cause eye injury Maximum power output 5 mW
Class 3B	Potential to cause eye injury from direct beam and reflection Power output up to 500 mW (research lasers)
Class 4	Capable of causing injury to eye or skin Power output >500 mW Fire or flume hazard (laser surgery, laser displays, metal cutting lasers)

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## 1.48 CLASSIFICATION OF LASER APPLICATIONS IN PLASTIC SURGERY

Skin lesions – congenital and acquired  
Tattoo removal  
Skin resurfacing  
Hair removal

## 1.49 HAIR

### 1.49.1 Histological Classification of Parts of a Hair Follicle

Infundibulum  
Isthmus  
Stern  
Bulb

### 1.49.2 Classification of Hair Growth Phases

Anagen – Growth phase  
Catagen – Transition phase  
Telogen – Resting phase

### 1.49.3 Classification of Hair Removal Techniques

Plucking  
Shaving  
Waxing  
Depilatory creams  
Electrolysis  
LASER

### 1.49.4 Classification of Scalp Alopecia

McCauley RL, Oliphant JR, Robson MC. Ann Plast Surg 1990;25(2): 103–115

- Type I      Single alopecia segment  
              (a) < 25% – single expander  
              (b) 25–50% – single expander/over-inflation  
              (c) 50–75% – multiple expanders  
              (d) >75% – multiple expanders (uniform alopecia)
- Type II      Multiple areas of alopecia amenable to tissue expansion (segmental alopecia)
- Type III     Multiple areas of alopecia not amenable to tissue expansion (patchy alopecia)
- Type IV     Total alopecia

#### *Tumour*

- *An abnormal mass of tissue the growth of which exceeds and is uncoordinated with that of normal tissue and persists in the same injurious manner after cessation of the stimulus*

#### *Ulcer*

- *A breach in the epithelium with one or more factors preventing it from healing*

#### *Apoptosis*

- Programmed cell death

### 1.50 WHO CLASSIFICATION OF BODY MASS INDEX

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<18.5 kg m <sup>-2</sup>	Underweight, thin
18.5–24.9 kg m <sup>-2</sup>	Healthy weight, healthy
25.0–29.9 kg m <sup>-2</sup>	Grade I Obesity, overweight
30.0–39.9 kg m <sup>-2</sup>	Grade II Obesity, obesity
>40 kg m <sup>-2</sup>	Grade III Obesity, morbid obesity

---

*Body mass index*

*Weight (in kg)*

*Height (in m<sup>2</sup>)*

*Sensitivity*

*Proportion of reference test positive (diseased) subjects who test positive with the screening test (i.e., “True positives”)*

*Specificity*

*Proportion of reference test negative (healthy) subjects who test negative with the screening test (i.e., “True negatives”)*

# Chapter 2

## Hand Surgery

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### 2.1 CLASSIFICATION SYSTEMS OF CONGENITAL HAND DEFORMITY

Morphology based

Embryology based

Genetic based (gene localization)

### 2.2 CLASSIFICATION OF CONGENITAL LIMB MALFORMATIONS

Swanson A. A classification for congenital limb malformation. *J Hand Surg* 1976; 1:8

Accepted by the American Society for Surgery of the Hand (ASSH) and the International Federation of Societies for Surgery of the Hand (IFSSH).

This is the most commonly used system

#### 2.2.1 Overview

- I. Failure of formation of parts
- II. Failure of differentiation of parts
- III. Duplication
- IV. Overgrowth
- V. Undergrowth
- VI. Congenital constriction ring syndromes
- VII. Generalized skeletal abnormalities

## 2.2.2 Sub-classifications for Each Group

### Failure of Formation of Parts Sub-classifications

(A) Transverse

- (B) Longitudinal – Radial longitudinal deficiency (RLD), Central deficiency, Ulnar longitudinal deficiency  
– Intercalated (Phocomelia)

*Radial longitudinal deficiency (also known as “Radial Club Hand”)*

- *Hypoplasia or absence of the radius and or radial structures resulting in radial deviation. The wrist is unstable. It may be associated with other abnormalities. (associated syndromes include VATER, Holt Oram, TAR, Fanconi’s anaemia)*

*VATER syndrome*

- *Vertebral anomalies, Anal atresia, Tracheo-Eesophageal fistula, Renal abnormalities +RLD*

*Holt Oram syndrome*

- *Cardiac abnormalities + RLD*

*TAR*

- *Thrombocytopenia + Absent radius*

*Fanconi syndrome*

- *Progressive pancytopenia, predisposition to malignancy + RLD*

### Radial Longitudinal Deficiency Radiological Classification

- I. Deficient distal radial epiphysis
- II. Hypoplasia of radius
- III. Partial aplasia of radius
- IV. Total aplasia of radius

### Cleft Hand Classification

Typical

- V-shaped defect, Bilateral, Familial, Syndactyly, Cleft feet, Absence of central metacarpal shafts

Atypical (symbrachydactyly)

- U-shaped defect, Unilateral, Non-familial, No foot involvement

*Ulnar longitudinal deficiency (also known as “Ulnar club hand”)*

- A congenital deficiency on the ulnar side of the hand and forearm with varying degrees of elbow dysfunction. The wrist is stable.

### **Ulnar Longitudinal Deficiency: Bayne’s Classification**

Bayne, L. Ulnar Club Hand. In Green D, ed. *Operative Hand Surgery*. New York: Churchill Livingstone; 1982

- I Hypoplasia of ulnar
- II Partial aplasia of ulnar
- III Total aplasia of ulnar
- IV Radiohumeral synostosis

### **Phocomelia**

- A congenital intercalated deficiency usually characterized by reduced numbers and function of digital skeletal elements resulting in a significantly shortened limb.

### **Phocomelia Classification**

1. Complete (no arm or forearm, hand attached to trunk)
2. Proximal (no arm, forearm attaches to trunk)
3. Distal (no forearm, hand attaches to humerus)

### **2.2.3 Failure of Differentiation of Parts Sub-classifications**

Soft tissue	Bone
Syndactyly	Clinodactyly
Camptodactyly	Symphalangism
Trigger thumb	Radioulnar synostosis
Clasped thumb	Arthrogryposis
	Windblown hand

### **Syndactyly**

- Digits that are joined together as a result of failure of apoptosis (programmed cell death) in that region.

### **Syndactyly Classification**

Complete – Fusion of affected digits to level of distal phalanx

Incomplete – Fusion proximal to level of distal phalanx but distal to mid proximal phalanx

Simple – Soft tissue involvement only

Complex – Bone in addition to soft tissue involvement

Complicated (Acrosyndactyly) – Distal bony fusion associated with proximal fenestrations (Fig. 2.1)

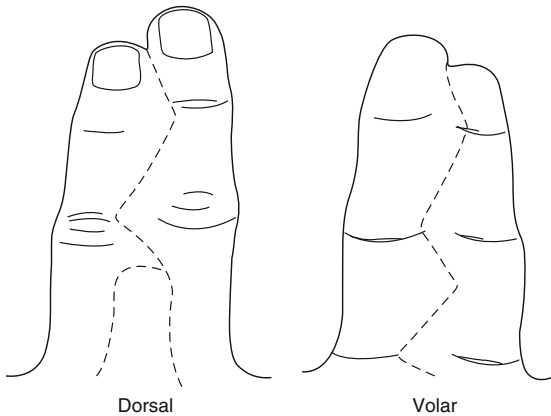


FIGURE 2.1. Complete, simple syndactyly release.

#### **Acrosyndactyly Classification: Walsh**

Walsh RJ. Acrosyndactyly: a study of 27 patients. *Clin Orthop* 1970;71:99–111

Moderate – Two phalanges and one interphalangeal joint per digit

Severe – One phalanx per digit

#### **Classification of Hand Deformities Associated with Apert's Syndrome**

Type I – Central digital mass, thumb and little finger free (spade hand)

Type II – Thumb only free (mitten/spoon hand)

Type III – Thumb and digital mass share a common nail (rosebud/hoof hand)

#### **Classification of Poland's Syndrome Deformities**

(A) Upper limb related

- Shortened digits (absent middle phalanx)
- Complete simple syndactyly
- Hand hypoplasia
- Absent sternocostal head of the ipsilateral pectoralis major
- Absent pectoralis minor

(B) Other associations

- Breast and nipple hypoplasia
- Absent anterior axillary fold
- Absent latissimus dorsi, deltoid, serratus anterior
- Bony abnormalities of chest wall
- Dextrocardia



*Camptodactyly*

– A congenital flexion deformity of the PIPJ that most commonly affects the little finger and is commonly bilateral.

**Camptodactyly Classification**

Infant type:

Camptodactyly evident in infancy and affects both sexes equally

Adolescent type:

Camptodactyly which presents in adolescence and more commonly affects females

**Camptodactyly Radiological Features Classification**

1. Proximal phalanx neck indentation (from anterior lip on the base of the flexed middle phalanx)
2. Middle phalanx – wide base (antero-posteriorly), articular surface indentation
3. Proximal phalanx – flattened head (dorsal 1/3)

*Trigger thumb*

– Inability to extend the thumb often associated with a nodule (Notta's node) on the flexor surface of the tendon at the level of the A1 pulley.

*Clasped thumb*

– A thumb characteristically held in adduction to the palm and extreme flexion of the MCPJ.

**Clasped Thumb Classification (Weckesser et al.)**

Weckesser E, Reed J, Heiple K. Congenital clasped thumb (congenital flexion adduction deformity of the thumb). *J Bone Joint Surg* 1968;37A:1417–1428

- Group I – Deficient extension but no contracture
- Group II – Deficient extension, flexion contracture
- Group III – Deficient extension, hypoplasia of thumb
- Group IV – Miscellaneous

**Clasped Thumb Classification (McCarroll)**

McCarroll HR Jr. Congenital flexion deformities of the thumb. *Hand Clin* 1985;1:567–575

- Supple – weak or absent thumb extensors
- Complex – above + joint, ligament, muscle and skin abnormalities

*Clinodactyly*

- A congenital radial or ulnar deviation of a digit most commonly seen as radial deviation of the little finger at the DIPJ due to a delta phalanx formed from a C shaped epiphysis (otherwise known as a longitudinal bracketed diaphysis).

**Clinodactyly Classification**

Type 1 – Angulation minor, Phalangeal length normal

Type 2 – Angulation minor, Phalangeal length short (Down's Syndrome)

Type 3 – Marked angulation, delta phalanx

**Clinodactyly Treatment Option Classification**

None

Closing wedge osteotomy – Type 1 deformity

Opening wedge osteotomy – Type 2 deformity

Exchange wedge osteotomy

Excision of additional delta phalanx, ligament preservation:

- Longer digit than normal
- Triphalangeal thumb

Physiolysis – for restoration of alignment, length, and orientation

*Kirner's deformity*

- Curvature of the distal phalanx of the little finger in a radial and palmar direction. Presents most commonly in females age 7–14 years

*Symphalangism*

- A failure of interphalangeal joint differentiation leading to stiff, short digits. Absent flexor and extensor tendons and absent skin creases.

**Symphalangism Classification**

Hereditary

Non-hereditary (associated with syndactyly, Apert's syndrome, Poland's syndrome)

*Synostosis*

- A complete or partial abnormal fusion of two bones

**Radioulnar Synostosis Classification**

Primary – absent radial head, extensive bony synostosis

Secondary – normally shaped radial head, often dislocated

*Arthrogryposis multiplex congenita*

- Greek derivation meaning “curved joint”
- Congenital contractures in more than two joints and multiple body areas. The primary abnormality is muscular resulting in secondary joint deformity.

**Classification of Arthrogryposis (Mennen)**

Loose type

Stiff type

**Classification of Arthrogryposis (Weeks)**

Weeks PM, Surgical correction of upper extremity deformities in arthrogrypotics. *Plastic Reconstr Surg* 1965;36:459–465

1. Single localized deformity
2. Full expression
3. Full expression + polydactyly, other systems involved in addition to neuro-musculoskeletal system

*Windblown hand*

- A rare congenital condition resulting in ulnar deviation of the fingers which is progressive and commonly bilateral. It may be associated with MCPJ flexion and a first web space contracture.

**2.2.4 Duplication Sub-classifications****Types of duplication**

Radial, central, ulnar, ulnar dimelia

**Thumb duplication classification – Wassell**

Wassell HD. The results of surgery for polydactyly of the thumb. *Clin Orthop* 1969;64:175–193

- Type 1. Bifid distal phalanx
- Type 2. Duplication starting at the DIPJ
- Type 3. Bifid proximal phalanx
- Type 4. Duplication starting at the MCPJ (commonest)
- Type 5. Bifid metacarpal
- Type 6. Duplication starting at the CMCJ
- Type 7. Thumb duplication with a triphalangeal thumb

*Bilhaut – Cloquet Procedure*

- A procedure undertaken to correct thumb duplication by sharing tissue from each thumb to create a single thumb

*Modified Bilhaut – Cloquet Procedure*

- A tissue sharing procedure to create a single thumb from a duplication using the entire nail from one thumb to avoid residual nail deformity

*Triphalangeal thumb*

- A thumb with an additional phalanx between the proximal and distal phalanges

**Classification of Types of Triphalangeal Thumb**

- (A) Delta phalanx
- (B) Short rectangular phalanx
- (C) Normal length rectangular phalanx

**Buck-Gramcko Classification of Triphalangeal Thumbs**

Buck-Gramcko D. Triphalangeal Thumb. In: *Congenital Malformations of the Hand and Forearm*. New York: Churchill Livingstone; 1998

- Type I – Rudimentary phalanx
- Type II – Short triangular middle phalanx
- Type III – Trapezoidal middle phalanx
- Type IV – Long rectangular middle phalanx
- Type V and VI – Hypoplastic triphalangeal thumb
- Type VI – Triphalangism associated with thumb polydactyly

**Stelling's Classification of Polydactyly**

- Type I – Extra “digit” with attachment by soft tissue only (no bone)
- Type II – Extra digit with all normal components articulating with a phalanx or metacarpal
- Type III – Extra digit articulating with an extra metacarpal

**2.2.5 Overgrowth***Macroductyly*

- A congenital localized hamartomatous enlargement of a digit

*True macroductyly*

- A localized enlargement of all structures within a digit

**Classification of Macroductyly**

- Static – enlarged digit grows in proportion with the body
- Progressive – enlarged digit grows progressively out of proportion with the body

### **Histological Classification of Macrodactyly**

Type 1 – Lipofibromatous hamartomas (fat)

Type 2 – Neurofibromatosis (nerve)

Type 3 – Hyperostosis (skeletal and soft tissue, no neural association)

### **2.2.6 Undergrowth**

#### **Classification of Thumb Hypoplasia (Blauth)**

Blauth W. Der hypoplastische daumen. *Arch Orthop Trauma Surg* 1967;62:225

This classification is based on skeletal appearance.

Grade I	Small thumb, all components present Bone – normal skeleton
Grade II	Small thumb Bone – normal skeleton Muscle – hypoplastic thenar muscles Ligament – lax UCL of MCPJ Adducted first web space
Grade III	Bone – skeletal hypoplasia Muscle – absent thenar muscles Tendon – abnormal extrinsics
Grade IV	Pouce flottant “floating thumb” attached by a skin bridge
Grade V	Absent thumb

#### **Paul Smith Modification of Blauth’s Classification of Thumb Hypoplasia**

Smith P. *Lister’s The Hand, Diagnosis and Indications*, 4th edn. London: Churchill Livingstone; 2002:505

Grade II A	Normal skeleton, MCPJ uniaxial instability
Grade II B	Thin skeleton, MCPJ multiaxial instability

#### **Manske Modification of Blauth’s Classification of Thumb Hypoplasia**

Manske PR. Classification and techniques in thumb hypoplasia. In: Safar P, Amadio PC, Foucher G, eds. *Current Practice in Hand Surgery*. London: Martin Dunitz; 1977:367–370

Grade III A	Metacarpal length – normal; CMCJ – normal
Grade III B	Metacarpal – absent proximally

### **2.2.7 Congenital Constriction Band Syndrome (Congenital Ring Constriction)**

*Congenital constriction band syndrome:*

- Tight bands arising in utero, which involve either partially or completely part of the limb.

**Patterson's Classification of Congenital Ring Constrictions**

Patterson TJS. Congenital ring constrictions. *Br J Plastic Surg* 1961;14:1–31

1. Simple soft tissue constriction (groove)
2. Constriction associated with distal deformity (+/- lymphoedema)
3. Constriction associated with acrosyndactyly (fusion of distal parts)
  - I Tips joined
  - II Tips joined  
Web creep
  - III Tips joined  
No web  
Complete syndactyly  
Proximal sinus
4. Constriction resulting in autoamputation

**2.2.8 Generalized Skeletal Abnormality****GENERAL HAND CLASSIFICATION SYSTEMS****2.3 ANATOMICAL CLASSIFICATION BY ZONE OF EXTENSOR TENDON INJURY (FIG. 2.2)**

Zones in the digit

- |        |                                       |
|--------|---------------------------------------|
| Zone I | Overlying DIPJ                        |
| II     | Between PIPJ and DIPJ                 |
| III    | Overlying PIPJ                        |
| IV     | Between MCPJ and PIPJ                 |
| V      | Overlying MCPJ                        |
| VI     | Between extensor retinaculum and MCPJ |
| VII    | Under extensor retinaculum            |
| VIII   | Proximal to extensor retinaculum      |

(In the finger even numbers are over bone, odd numbers over a joint)

Zones in the thumb

- |     |                            |
|-----|----------------------------|
| I   | Overlying IPJ              |
| II  | Overlying proximal phalanx |
| III | Overlying MCPJ             |
| IV  | Overlying metacarpal       |
| V   | Overlying carpus           |

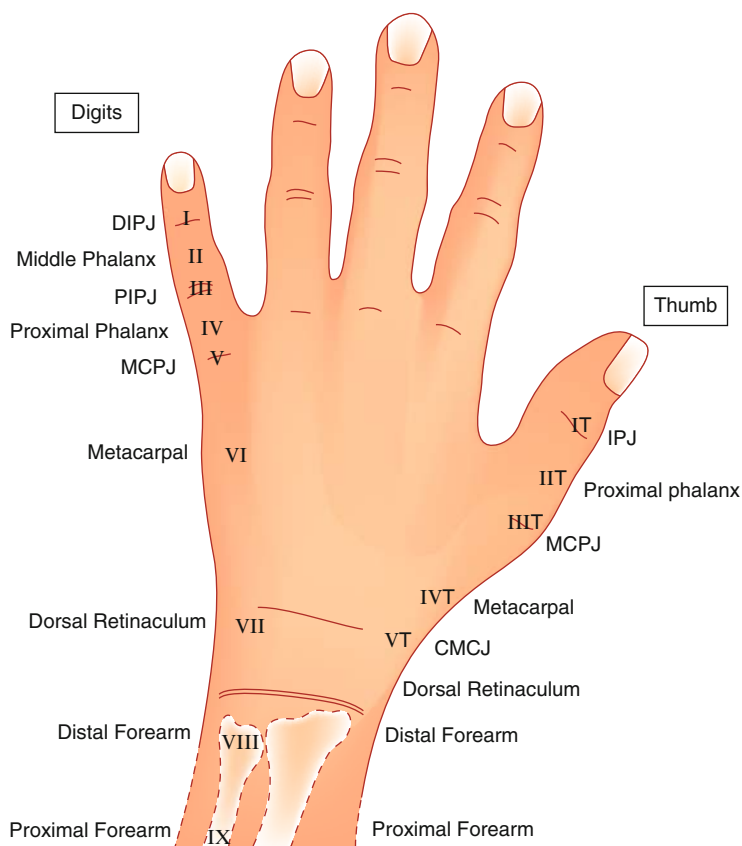


FIGURE 2.2. The extensor zones of the hand.

### 2.3.1 Extensor Compartments

1. APL/EPB (a longus and a brevis)
2. ECRL/ECRB (a longus and a brevis)
3. EPL
4. EIP/EDC
5. EDM
6. ECU

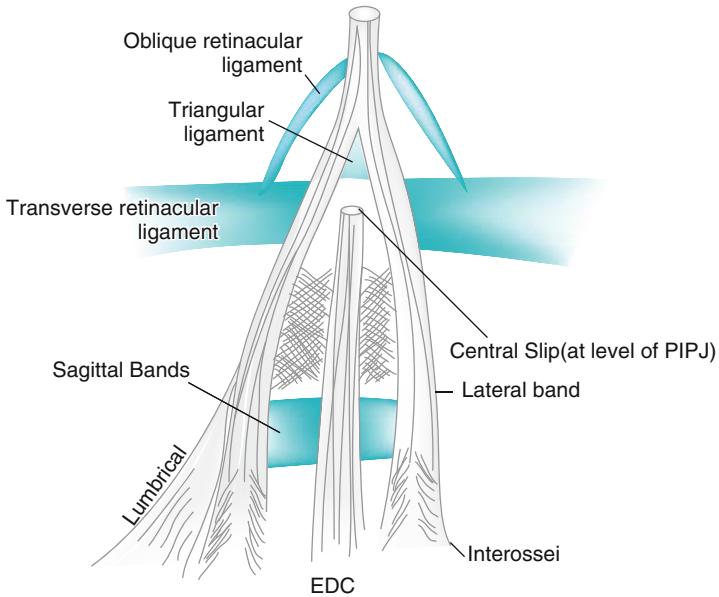


FIGURE 2.3. Diagram of an extensor tendon.

## 2.4 FLEXOR TENDON INJURY ZONES: VERDAN

Verdan C. Half a century of flexor tendon surgery. *J Bone Joint Surg* 1972;54A:472 (Fig. 2.4)

Zone

1. Distal to FDS insertion (therefore includes FDP alone)
2. Proximal A1 pulley to FDS insertion (“No man’s land” – Bunnell)
3. Distal margin of carpal tunnel to just proximal to A1 pulley
4. Within the carpal tunnel “Enemy territory”
5. Distal forearm musculotendinous junctions to proximal carpal tunnel

Thumb Zones

1. Distal to IPJ
2. Overlying proximal phalanx, i.e., A1 pulley to IPJ
3. Thenar eminence
4. and 5. As above

## 2.5 TENDON HEALING CLASSIFICATIONS

- Classification according to mechanism of tendon healing
  - Extrinsic healing
  - Intrinsic healing



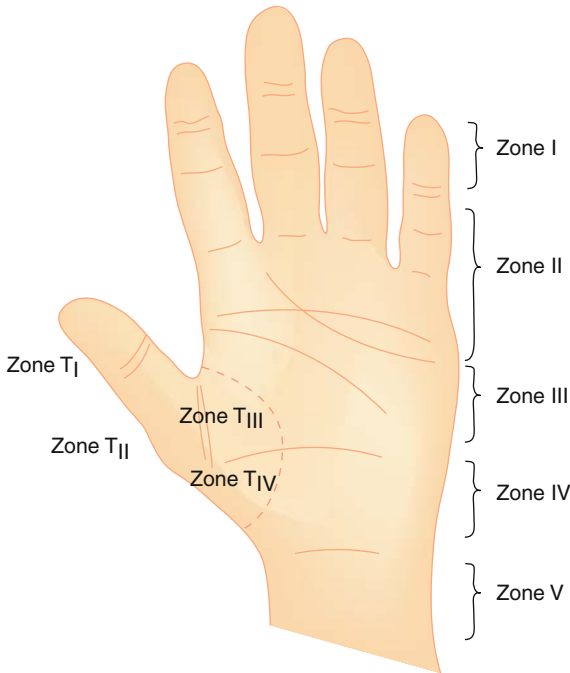


FIGURE 2.4. Flexor tendon zones of the hand.

- Classification according to phases of tendon healing
  - Inflammation
  - Proliferation
  - Remodelling

## 2.6 CLOSED AVULSION OF FDP: LEDDY AND PACKER

Leddy JP, Packer JW. Avulsion of the profundus tendon in athletes. *J Hand Surg* 1977;2-A:66–69

1. Tendon retracts into palm, both vinculae also ruptured
2. Distal tendon held by long vinculum at level of PIPJ
3. Fracture fragment large trapped at level of A4 pulley  
Tendon unable to retract further

*Rugby finger*

Lunn PG, Lamb DW. Rugby finger – avulsion of profundus of ring finger. *J Hand Surg (Br)* 1984;9(1):69–71

- Avulsion of the profundus tendon of the ring finger

*Stener Lesion*

*Stener B. Displacement of the ruptured ulnar collateral ligament of the MCPJ of the thumb. J Bone Joint Surg 1962;44B:869–879*

- *A traumatic disruption of the UCL of the thumb at the MCPJ resulting in the torn ligament lying superficial to the adductor expansion thus preventing healing*

*Mallet finger*

- *An extension lag at the DIPJ associated with loss of active DIPJ extension*

**2.7 DOYLE'S CLASSIFICATION OF MALLETT FINGER INJURY**

Doyle JR. Extensor tendons – acute injuries. In: Green DP, ed. *Operative Hand Surgery*, vol. 2, 3 edn. New York: Churchill-Livingstone; 1993:1925–1954

- Type 1 Closed injury +/- avulsion fracture (most common type)
- Type 2 Open injury, laceration at or proximal to DIPJ, loss of tendon continuity
- Type 3 Open injury + soft tissue and tendon loss
- Type 4 A Transepiphyseal plate fracture
  - B Fracture 20–50% articular surface (hyperflexion injury)
  - C Fracture > 50% articular surface, volar subluxation (hyperextension injury)

**2.8 CLASSIFICATION OF AETIOLOGY OF A FLEXION CONTRACTURE (LIMITATION OF EXTENSION)**

Smith P, ed. *Lister's The Hand, Diagnosis and Indications*. London: Churchill Livingstone; 2002:179

Extensor laceration

Bony block

Collateral adhesions

Palmar plate shortening

Flexor tendon shortened, adhesions

Sheath involved in Dupuytren's contracture

Skin scar contracture

**2.8.1 Classification of Aetiology of an Extension Contracture (Limitation of Flexion)**

Smith P, ed. *Lister's The Hand, Diagnosis and Indications*. London: Churchill Livingstone; 2002:181

Skin scar contracture, skin loss

Extensor long, intrinsic contracture

Capsule adhesions

Collateral adhesions  
 Bony block  
 Chondral fractures  
 Palmar plate  
 Flexor tendon adherence within sheath  
 Oedema

## 2.9 NERVE INJURY CLASSIFICATION SYSTEMS

See Chapter 1 – Fundamentals of Plastic Surgery Classifications and Definitions

### 2.9.1 Classification of Types of Nerve Injury

It may be classified according to mechanism of injury:

- Laceration
- Avulsion
- Compression
- Traction
- Abnormal excursion
- Tethering
- Ischaemia
- Vibration

### 2.9.2 Brachial Plexus Injury: Millesi

Millesi H. Surgical management of brachial plexus injuries. *J Hand Surg* 1977;2:367–379

- I Supraganglionic
- II Infraganglionic
- III Trunk
- IV Cord

## 2.10 ROLLING BELT INJURY

Ada et al. Rolling belt injuries in children. *J Hand Surg* 1994;19B:601–603

- I Skin lesion
- II A Skin, tendon, artery and nerve uninjured, Circulation present
- II B Skin, tendon, artery and nerve uninjured, Circulation absent
- III A Skin, tendon, artery and nerve injured, Circulation present
- III B Skin, tendon, artery and nerve injured, Circulation absent
- IV Total finger amputation

## 2.11 CLASSIFICATION OF VESSEL INJURY

### (A) Complete division

Less blood loss due to contraction of muscle in the arterial wall which closes the lumen at each end of the divided vessel

### (B) Partial division

Contraction of muscle maintains an opening in the vessel wall in a partial division

## 2.12 RING AVULSION INJURY: URBANIAK'S CLASSIFICATION

Urbaniak JR, Evans JP, Bright DS. Microvascular management of ring avulsion injuries. *J Hand Surg (Am)* 1981;6:25–30

Class I Circulation adequate

Class II Circulation inadequate: vessel repair preserves viability

Class III Complete degloving or amputation

### 2.12.1 Ring Avulsion Injury: Kay's Classification

Kay S, Werntz J, Wolff TW. Ring avulsion injuries: classification and prognosis. *J Hand Surg* 1989;14A:204–213

Class I Circulation adequate + /- skeletal injury

Class II Circulation inadequate (arterial and venous), no skeletal injury  
(a) Arterial circulation inadequate only  
(b) Venous circulation inadequate only

Class III Circulation inadequate (arterial and venous) fracture or joint injury present

Class IV Complete amputation

## 2.13 CLASSIFICATION OF REPLANTATION

### *Macroreplant*

– Amputate has high muscle bulk. Speed important to prevent reperfusion injury

### *Microreplant*

– Amputate is usually a digit. Longer ischaemic time

## 2.14 CLASSIFICATION OF THUMB AMPUTATION AND RECONSTRUCTIVE OPTIONS

Kleinman and Strickland. Thumb reconstruction. In: *Green's Operative Hand Surgery*. New York: Churchill Livingstone; 1999: 2096 (Fig. 2.5)

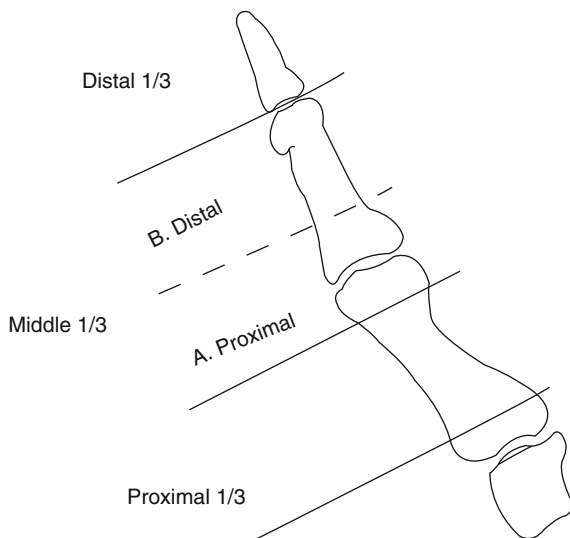


FIGURE 2.5. Levels of thumb amputation.

Proximal third		-Pollicization
Middle third	A. Proximal	-Toe to thumb -Osteoplastic reconstruction -Dorsal rotation flap
	B. Distal	-Web deepening -Metacarpal lengthening -Toe to thumb
Distal third		-Primary closure -Toe to thumb -Local flaps

### 2.14.1 Levels of Thumb Amputation

Morrison W, O'Brien BM, Macleod AM. Experience with thumb reconstruction. *Br J Hand Surg* 1984;9:224

Total	Level of MCPJ
Proximal subtotal	Midshaft proximal phalanx
Distal subtotal	Base of distal phalanx
Soft tissue or segmental	

## 2.15 EPIPHYSEAL FRACTURES: SALTER AND HARRIS CLASSIFICATION

Salter RB, Harris WR. Injuries involving the epiphyseal plate. *J Bone Joint Surg* 1963;45A:587–622 (Fig. 2.6)

- Type I Shearing of epiphysis from metaphysis
- Type II Epiphysis separated taking a small fragment of metaphysis
- Type III Epiphysis intra-articular fracture. No interference with epiphyseal plate
- Type IV Vertical displaced fracture through epiphysis, growth plate, and metaphysis
- Type V Compression fracture. No evident injury of epiphysis or metaphysis

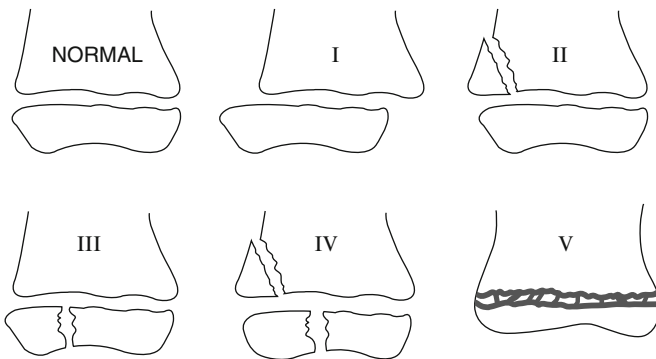


FIGURE 2.6. Salter and Harris classification of epiphyseal fractures.

## 2.16 CLASSIFICATION OF LONG BONE FRACTURE PATTERNS

- Head            Condylar, T shape
- Diaphysis      Spiral
- Longitudinal
- Oblique
- Transverse
- Comminuted
- Base            Palmar
- Dorsal
- Lateral
- Physis         See above Salter–Harris classification

## 2.17 SCAPHOID FRACTURE CLASSIFICATION—HERBERT CLASSIFICATION

A	Acute, stable	A <sub>1</sub> Tubercle A <sub>2</sub> Nondisplaced crack in waist
B	Acute, unstable	B <sub>1</sub> Oblique, distal third B <sub>2</sub> Displaced or Mobile Waist B <sub>3</sub> Proximal Pole B <sub>4</sub> Fracture dislocation B <sub>5</sub> Comminuted
C	Delayed Union	
D	Established non union	D <sub>1</sub> Fibrous D <sub>2</sub> Sclerotic

### 2.17.1 Scaphoid Fracture Classification—Russe Classification

Russe O. Fracture of the carpal navicular. Diagnosis, non-operative treatment, and operative treatment. *J. Bone Joint Surg* 1960;42A: 759–768

Horizontal oblique: Stable

Transverse: Stable

Vertical oblique: Unstable

Stability also depends on comminution and other factors

### 2.17.2 Classification of Scaphoid Nonunion

Alnot JY. Fractures et pseudarthroses du scaphoïde carpien. *Rev Chir Orthop* 1988;74:714

I Linear pseudarthrosis

IIA Slight resorption of bone, no displacement

IIB Unstable pseudarthrosis, anterior flexion and bone loss, DISI (adaptive)

IIIA Radioscaphoid arthritis

IIIB Radiocarpal arthritis

*Preiser's Disease:*

– *Avascular necrosis of the scaphoid without prior injury*

*Kienbock's Disease (lunatomalacia):*

– *Avascular necrosis of the lunate leading to collapse*

## 2.18 STAGE OF KIENBOCK'S DISEASE (LICHTMAN)

- Stage I X-ray normal, bone scan increased uptake, tender lunate
- Stage II Sclerosis, no collapse
- Stage III Collapse and fragmentation of lunate
  - A. Scaphoid normal alignment
  - B. Scaphoid-rotatory malalignment (ring sign)
- Stage IV Perilunate arthritis, secondary degenerative changes of carpus

## 2.19 SCAPHOLUNATE ADVANCED COLLAPSE (SLAC) WRIST

Krakauer et al. *JHS* 1994;19A:751

- I Degenerative change involving radial styloid alone
- II Scaphoid fossa involvement
- III Capitulate joint involvement

*Terry Thomas Sign:*

- Increased space between the scaphoid and lunate on a postero-anterior radiograph and indicates scapholunate instability (name derived from an English actor renowned for the gap between his front teeth)

## 2.20 CLASSIFICATION OF TYPES OF ARTHRITIS

- Inflammatory – Rheumatoid, Psoriatic, Gout
- Degenerative – Osteoarthritis
- Infective – Septic arthritis

*Rheumatoid Arthritis*

- A systemic chronic inflammatory disease involving synovium of joints and tendons, characterized by inflammation and synovial proliferation
- It is a multi-organ disease with extra-articular manifestations

### 2.20.1 Diagnostic Criteria for Rheumatoid Arthritis

Arnett FC, Edworthy SM, Bloch DA et al. The American Rheumatism Association 1987 revised criteria for the classification of rheumatoid arthritis. *Arthritis Rheum* 1988;31(3):315–324

1. Morning stiffness: lasting 1 h, located around joints
2. Three or more joint areas
3. Hand
4. Symmetric
5. Rheumatoid nodules
6. Rheumatoid factor



### 7. X-ray changes

Criteria 1–4 must be present for 6 weeks

4 out of 7 criteria needed for diagnosis

#### 2.20.2 Classification of Typical Radiological Changes of Rheumatoid Arthritis

Narrow joint space

Marginal erosions

Osteoporosis

Cyst formation

Swelling of soft tissue

#### 2.20.3 Radiological Classification of Rheumatoid Arthritis: Larsen's Grading System

Larsen. *Acta Radiol Diagn* 1977;18:481–491

0. Normal

1. Osteoporosis, swelling of soft tissue

2. Erosions, normal architecture

3. Erosions, abnormal architecture

4. Severe destruction of joint, joint line visible

5. Mutilans, joint line not visible

#### 2.20.4 Classification of Rheumatoid Arthritis by Pathology

Proliferation

Destruction

Reparation

#### 2.20.5 Classification of Rheumatoid Arthritis by Clinical Course

Monocyclic (one episode)

Polycyclic (multiple episodes)

Progressive (chronic deterioration)

#### 2.20.6 Classification of Rheumatoid Arthritis by Number of Joints Involved

Monoarthropathy (single joint involvement)

Pauciarthropathy (2–4 joints involved)

Polyarthropathy (> 4 joints involved)

#### 2.20.7 Classification Rheumatoid Arthritis by Grade of Function

Grade 1 No functional incapacity

Grade 2 Performs all tasks except the heaviest

Grade 3 Performs light tasks only

Grade 4 Chair/Bed bound

### 2.20.8 Classification of Neural Deficit in Atlanto-Axial Subluxation

Hospital for Special Surgery in New York; Ranawat CS, O'Leary P, Pellicci P et al. Cervical spine fusion in rheumatoid arthritis. *J Bone Joint Surg* 1979;61A:1003–1010

- I Nil
- II Subjective weakness, hyperreflexia, dysaesthesia
- IIIa Objective long tract signs
- IIIb Quadriparesis

*Swan neck deformity: A deformity characterized by PIPJ hyperextension and DIPJ flexion*

### 2.20.9 Classification of Types of Swan Neck Deformity: Nalebuff

Nalebuff EA. The rheumatoid swan neck deformity. *Hand Clin* 1989;5:203–214

- Type I Full PIPJ flexion
- Type II Intrinsic tightness but full passive correction
- Type III PIPJ fixed in hyperextension
- Type IV PIPJ fixed in hyperextension, Joint destruction

### 2.20.10 Classification of Types of Swan Neck Deformity: Welsh and Hastings

Welsh RP, Hastings DE. Swan neck deformity in rheumatoid arthritis. *Hand* 1977;9:109–116

- Type I Secondary to primary PIPJ disease (a) Mobile (b) Snapping (c) Fixed
- Type II Secondary to MCPJ disease (a) Mobile (b) Snapping (c) Fixed

*Boutonniere deformity:*

*A deformity characterized by PIPJ flexion and DIPJ extension*

### 2.20.11 Classification of the Stages of Boutonniere Deformity: Nalebuff and Millender

Nalebuff EA, Millender LH. Surgical treatment of the boutonniere deformity in rheumatoid arthritis. *Orthop Clin North Am* 1975;6:753–763

- Stage I Extensor lag at PIPJ, Passively correctable
- Stage II 40° flexion deformity at PIPJ, Passively correctable
- Stage III Fixed flexion deformity at PIPJ, Possible intraarticular damage

### 2.20.12 Classification of Severity of Boutonniere Deformity

- Grade 1 Mild (10–15° lag)
- Grade 2 Moderate (30–40° lag)
- Grade 3 Severe, extension deficit

### 2.20.13 Classification of the Rheumatoid Thumb Deformity

Nalebuff EA. Diagnosis, classification and management of rheumatoid thumb deformities. *Bull Hosp Joint Dis* 1968;29:119–137 (Initially 4 types but now updated to 6)

Terrono A, Nalebuff EA, Phillips C. The rheumatoid thumb. In: Hunter JM, Mackin ES, Callahan AD, eds. *Rehabilitation of the Hand: Surgery and Therapy*. St Louis, MO: CV Mosby;1995:1329–1343

- I Boutonniere (MCPJ flexion)
- II Adducted boutonniere
- III Adducted Swan Neck (Z thumb)
- IV Gamekeeper's thumb (Subluxed CMCJ + Attenuation/rupture UCL)
- V Isolated Swan Neck
- VI Arthritis Mutilans

### 2.20.14 Harrison's Classification of MCPJ Involvement in Rheumatoid Arthritis

Harrison DH, Harrison SH, Smith P. Re-alignment procedure for ulnar drift of the metacarpophalangeal joint in rheumatoid arthritis. *Hand* 1979;11(2):163–168

- Grade 1 Extensor tendon dislocated, No medial shift
- Grade 2 Ulnar drift, Medial shift
- Grade 3 Ulnar drift, Medial shift, MCPJ subluxation
- Grade 4 Ulnar drift, Medial shift, MCPJ subluxation, Limited passive extension

### 2.20.15 Rheumatoid Arthritis:Wrightington Wrist Classification

Hodgson et al. *JHS* 1989;14B:451

- Grade 1 Wrist architecture preserved  
Scaphoid: mild rotatory instability  
Periarticular osteoporosis, erosions, cysts
- Grade 2 Radio-scaphoid, Intercarpal joint preservation  
Ulnar translocation  
Volar intercalated segment instability  
Scaphoid: flexed  
Degenerate radio-lunate joint
- Grade 3 Radius pseudocysts otherwise preserved

- Degenerate intercarpal joints
- Radio-scaphoid joint erosion
- Carpus subluxed in volar direction on radius
- Grade 4 Radius: – loss of bone stock
  - medial erosion

*Psoriatic arthritis:*

- A seronegative arthropathy in which the inflammatory process involves joint synovitis, fibrosis and osteolysis. A typical skin rash and nail changes are associated. Rheumatoid factor and nodules are absent. The DIPJ may be involved which is another distinguishing feature from rheumatoid arthritis.

## **2.21 PSORIATIC ARTHRITIS CLINICAL CLASSIFICATION: WRIGHT AND MOLL**

Wright V. Psoriatic arthritis. In: Kelly WN et al. *Textbook of Rheumatology*, vol. II. Philadelphia: WB Saunders; 1981

- Different types:
- DIPJ involvement
  - Ankylosis (widespread)
  - Rheumatoid arthritis picture but rheumatoid factor negative
  - Monoarticular
  - Ankylosing spondilitis

### **2.21.1 Classification of Psoriatic Arthritis: Kapasi et al**

Kapasi OA, Ruby LK, Calney K. The psoriatic hand. *J Hand Surgery (Am)* 1982;7:492–497

1. Joint involvement EARLY, Skin involvement LATE, Arthritis – MILD
2. Joint involvement LATE, Skin involvement EARLY, Arthritis – SEVERE
3. Simultaneous onset Arthritis – UNPREDICTABLE

### **2.21.2 Classification of Psoriatic Arthritis: Nalebuff**

Nalebuff EA. Surgery of psoriatic arthritis of the hand. *Hand Clin* 1996;12:603–614

- Type I Spontaneous ankylosis mainly affecting DIP and PIP joints
- Type II Bone loss
- Type III Rheumatoid arthritis like + stiffness

**Gout:**

- A metabolic disorder giving rise to hyperuricaemia which clinically presents as an acute monoarticular episode of inflammation. The joint is painful, hot and swollen. The MTPJ of the big toe is most commonly affected. In addition to raised uric acid blood levels, urate crystals may be isolated from synovial fluid or tophi.

**Pseudogout:**

- Chondrocalcinosis most commonly affecting large joints giving rise to an acute and recurrent arthritis. Calcium pyrophosphate crystals may be isolated from joint fluid.

**Osteoarthritis:**

- A chronic degenerative joint disease characterized by cartilage degeneration and bone hypertrophy at the articular surface. Clinically pain, tenderness, reduced range of movement and joint deformity are evident.

**Heberden's nodes:**

- Osteophytes around the DIPJ

**Bouchard's nodes:**

- Osteophytes around the PIPJ

**2.22 CLASSIC X-RAY CHANGES OF OSTEOARTHRITIS**

Narrowed joint space (due to loss of articular surface)

Subchondral sclerosis

Cyst formation

Osteophytes

Marginal bone hypertrophy

**2.22.1 Classification of Osteoarthritis**

Swanson et al. *JHS* 1985;10A:1013–1024

- I Joint narrowing
- II I+subchondral sclerosis, hypertrophic nodes
- III II+erosions
- IV III+cysts, deviation
- V IV+ subluxation or dislocation

**2.22.2 Classifications of Thumb Base Osteoarthritis**

Eaton RG, Glickel SZ. Trapeziometacarpal osteoarthritis. Staging as a rationale for treatment. *Hand Clin* 1987;3:455–471

Eaton and Littler. *JBJS* 1973;55A:1655

- Stage I Widened joint space, <1/3 subluxation  
II 1/3 subluxation, <2 mm diameter fragments  
III >1/3 subluxation, >2 mm diameter fragments, joint narrowing (minor)  
IV Advanced. Major subluxation, osteophytes, sclerosis, joint narrowing

### 2.23 CLASSIFICATION OF TRIGGER FINGER

Quinnell. *Practitioner* 1980;224:187

- I Pain and nodularity  
II Triggering – self correctable  
III Triggering – manually correctable  
IV Irreducible

*De Quervain's Disease:*

- *A stenosing tenovaginitis at the radial styloid. Synovial inflammation of the first dorsal compartment through which run abductor pollicis longus and extensor pollicis brevis.*

*Finkelstein test:*

- *With the thumb positioned in the palm and the wrist deviated ulnarwards, pain is produced on the radial border of the wrist in de Quervain's disease.*

*Tennis Elbow:*

- *Lateral epicondylitis (common extensor origin)*

*Golfer's Elbow:*

- *Medial epicondylitis (common flexor origin)*

### 2.24 GENERAL CLASSIFICATION OF TUMOURS

Benign

Malignant – Primary or Secondary

#### 2.24.1 Classification of Tumours of the Hand: Anatomical

Primary (Benign or Malignant):

*Skin* – SCC, BCC, MM, AK, inclusion cyst, keratoacanthoma (see classification of skin tumours)

*Adnexal structures of skin* – Sweat gland tumour

*Fibrous tissue* – Dupuytren's, dermatofibroma, DFSP, fibromatoses

*Subcutaneous tissue* – Lipoma, liposarcoma, lymphoma

*Nerve* – Neuroma, neurofibroma, Merkel cell

*Vessel* – Glomus tumour, haemangioma, vascular malformation, aneurysm, angiosarcoma

*Muscle* – Leiomyoma, leiomyosarcoma, rhabdomyosarcoma

*Synovium/Tendon* – Ganglion, giant cell (PVNS), nodules, synovitis

*Cartilage* – Enchondroma, chondrosarcoma

*Bone* – Osteoid osteoma, osteochondroma, osteosarcoma, simple bone cyst, aneurysmal bone cyst

Secondary (Metastases)

### 2.24.2 Musculoskeletal Tumour: Enneking's Staging

Enneking WF. *Musculoskeletal Surgery*. Edinburgh: Churchill Livingstone; 1983

Grade	Location	Metastases
Benign (G0)	Intracompartmental (T1)	None (M1)
Low grade (G1)	Extracompartmental (T2)	Present (M2)
High grade (G2)		

### 2.25 DIABETIC STIFF HAND

Rosenbloom. *J Diabet Comp* 1989; 3:77

	Limitation	Clinical findings
0	None	Equivocal/unilateral
I	Mild	One or two IPJs involved or MCPJ only bilaterally
II	Moderate	Three or more IPJ or 1 digit + 1 large joint bilaterally
III	Severe	Obvious hand deformity at rest

### 2.26 CLASSIFICATION OF BURN CONTRACTURES OF THE HAND (SEE CHAPTER 11)

*Dupuytren's disease:*

– A fibromatosis which affects the palmar or digital fascia and may progress to contracture of the digit.

### 2.27 CLASSIFICATION OF DUPUYTREN'S CONTRACTURE

Mikkleson. *Hand* 8:265, 176

I Contracture 0, Nodule/Band present

II Contracture 1–45° (i.e., Total contracture of all joints)

- III Contracture 46–90°
- IV Contracture 91–135°
- V Contracture > 135°

## 2.28 CLASSIFICATION OF FIBROMATOSES

Allen 1977/Enziger and Weiss; 1983

Infantile

- Adult
1. Superficial (fascial) (Dupuytren's Disease)
    - Palmar fibromatosis
    - Garrod's pads
    - Plantar fibromatosis (Lederhosen's disease)
    - Penile fibromatosis (Peyronie's disease)
  2. Deep
    - Extra-abdominal
    - Abdominal
    - Intra-abdominal: pelvic, mesenteric (Gardner's syndrome)

*Volkman's contracture:*

- *The clinical sequelae of a compartment syndrome of the anterior forearm resulting in flexion deformities of the fingers and wrist (originally described as a complication of a supracondylar fracture of the humerus in a child)*

## 2.29 VOLKMAN ISCHAEMIC CONTRACTURE

Tsuge K. Treatment of established Volkman's contracture. *JBJS Am* 1975;57:925

- Mild – Usually affects FDP (middle and ring most commonly)
- Moderate – FDP, FPL, hand intrinsics, wrist flexors
- Severe – Involves remaining forearm flexors and extensors, median or ulnar nerve necrosis + /– Skin involvement

## 2.30 CLASSIFICATION OF SPASTICITY IN CEREBRAL PALSY

Braun et al. Phenol nerve block in the treatment of acquired spastic hemiplegia in the upper limb. *J Bone Joint Surg* 55A:580–585

*Classified by response to stretch:*

- Severe – strong reflex halting initial motion
- Moderate – visible response
- Minimum – palpable response

### 2.30.1 Classification of Thumb Contractures in Cerebral Palsy

- Grade 1 Contracture of basal joint (first dorsal interosseous and adductor)
- Grade 2 + MCPJ (and FPB)
- Grade 3 + IPJ (and FPL)



### 2.30.2 Classification of the Spastic Hand

Surgery of the spastic hand in cerebral palsy: report of the Committee on Spastic Hand Evaluation (International Federation of Societies for Surgery of the Hand).

Zancolli et al. *J Hand Surg (Am)* 1983;8(5 Pt 2):766–772.

- Group 1 Full finger extension with wrist in neutral
- Group 2 Full finger extension with wrist flexed
  - (a) wrist extension with fingers flexed
  - (b) no wrist extension with fingers flexed
- Group 3 Finger extension nil with wrist flexed

### 2.30.3 Classification of the Pronation Deformity in Cerebral Palsy

Gschwind, Tonkin. *JHS* 1992;17B:391–395

- I Active supination beyond neutral
- II Active supination to less than or equal to neutral
- III No active supination, free passive supination
- IV No active supination, tight passive supination

*Upper limb nerve compression:*

- A nerve may be compressed at any site (including more than one, i.e., the double crush phenomenon) from its entry into the upper limb, along its course until it reaches its final destination.

## 2.31 CLASSIFICATION OF MECHANISMS OF NERVE COMPRESSION (FIG. 2.7)

Congenital anomalous structures

Anatomical

Postural

Traumatic

Inflammatory

Metabolic

Iatrogenic/postsurgery

Swellings/tumours

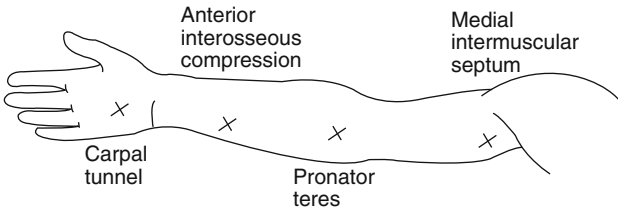
### 2.31.1 Classification for Carpal Tunnel Syndrome

Chang B and Dellon AL. Surgical management of recurrent carpal tunnel syndrome. *J Hand Surg (Br)* 1993;18(4):467–470

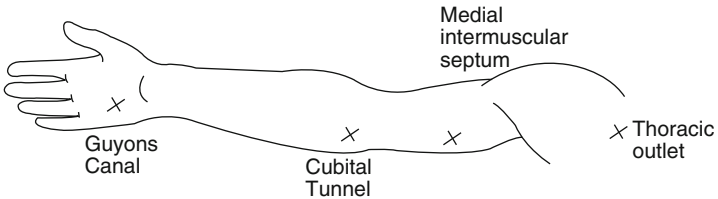
- 0 No impairment
- I Parasthesiae intermittent
- II Threshold – mild (SWM = 2.83–3.84)
- III Weak abduction
- IV Threshold severe (SWM > 3.84)
- V Parasthesiae persistent
- VI Sensory 2 PD mild (7–10 mm)

- VII Atrophy-mild
- VIII Sensory 2PD severe (>10 mm)
- IX Anaesthesia
- X Atrophy

a) Median nerve



b) Ulnar nerve



c) Radial nerve

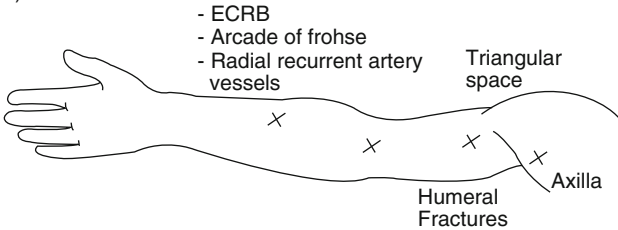


FIGURE 2.7. Common sites of compression of major nerves of the upper limb. (a) Median nerve. (b) Ulnar nerve. (c) Radial nerve.

2.31.2 Anatomical Classification of the Zones of Guyon's Canal

Zone 1

Area proximal to bifurcation of the ulnar nerve  
 Damage at this level causes motor and sensory loss in ulnar nerve distribution

Zone 2

Encompasses motor branch of ulnar nerve after bifurcation

Damage at this level causes pure motor loss to ulnar innervated muscles

### Zone 3

Encompasses superficial or sensory branch of ulnar nerve after bifurcation

Damage at this level causes sensory loss to the hypothenar eminence, little and ulnar half of ring finger

### 2.31.3 Posterior Interosseous Nerve Palsy Classification

Hirachi et al. *JHS* 1998;23B:413

- I Complete palsy
- II Loss of extension: little, ring, middle finger (recurrent branch)
- III Loss of extension and abduction thumb and index extension (descending branch)

*Martin-Gruber anastomosis:*

- An anomalous neural connection in which fibres usually carried in the ulnar nerve throughout its course join it from the median nerve or anterior interosseous in the forearm. In this situation, if a high median nerve injury occurs there is total motor loss in the hand, if a high ulnar nerve injury occurs there is no motor loss.

*Riche-Cannieu anastomosis:*

- An anomalous neural connection between the median and ulnar nerves in the palm.

### 2.31.4 Classification of Abnormal Neural Connections: Martin-Gruber

Leibovic SJ, Hastings H. Martin-Gruber revisited. *JHS (Am)* 1992;17(1):47–53

- Type I Motor branches from median to ulnar nerve to innervate “median” muscles (60%)
- Type II Motor branches from median to ulnar nerve to innervate “ulnar” muscles (35%)
- Type III Motor fibers from ulnar to median nerve to innervate “median” muscles (3%)
- Type IV Motor fibers from ulnar to median nerve to innervate “ulnar” muscles (1%)

## 2.32 CLASSIFICATION OF HAND INFECTIONS

O'Brien CM

(A) *Local infections of the hand:*

Digital Infection	Palmar Infection	Dorsal Infection
Herpetic whitlow	Thenar space	Dorsal subcutaneous space
Felon	Mid-palmar space	Sub extensor retinaculum
Paronychia	Hypothenar space	
(a) Acute	Horseshoe abscess	
(b) Chronic	Collar-stud abscess (web space)	
Tendon sheath		
Septic arthritis		
Osteomyelitis	Osteomyelitis	Osteomyelitis

(B) *General infections which may involve the hand:*

Cellulitis

Necrotizing fasciitis

Meningococcal septicaemia (purpura fulminans)

Others

*Collar stud abscess:*

– *An accumulation of pus at two or more sites between natural tissue planes which communicate with each other.*

### 2.32.1 Classification of Signs of a Flexor Sheath Infection

Kanavel AB. *Infections of the Hand*. Philadelphia: Lea and Febiger; 1912

1. Semiflexed finger posture
2. Localized tenderness over flexor sheath
3. Pain on passive extension
4. Fusiform swelling of whole finger

### 2.32.2 Microbiological Classification of Hand Infections

Bacterial

Viral

Fungal

Protozoal

Metazoal

Zoonosis

**2.32.3 Anatomical Classification of Abscess Formation in the Hand**

Subcuticular  
 Intracutaneous  
 Subcutaneous  
 Subfascial

**2.32.4 Necrotizing Fasciitis Syndromes**

Type I Polymicrobial  
 Type II Group A streptococcal  
 Type III Gas gangrene clostridial myonecrosis

*Complex regional pain syndrome:*

– A variety of painful conditions following injury whereby the severity and duration are disproportionate to the expected clinical course of the inciting event. Clinically a combination of pain, swelling, stiffness and vasomotor changes may be observed.

**2.33 COMPLEX REGIONAL PAIN SYNDROME CLASSIFICATION**

Type 1 (Primary) – No predisposing nerve injury (otherwise referred to as RSD, algodystrophy)  
 Phases: acute, dystrophic, atrophic  
 Type 2 (Secondary) – Initial identifiable nerve injury (otherwise referred to as causalgia)

**2.34 CLASSIFICATION OF SPLINTS**

Static  
 Serial static  
 Dynamic

# Chapter 3

## Skin and Vascular

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### 3.1 FITZPATRICK SKIN TYPE CLASSIFICATION

Fitzpatrick TB. The validity and practicality of sun reactive skin type I through VI. *Arch Dermatol* 1988;124:869–871

Skin type	Tanning response	Skin colour
I	Always burns, never tans	White, freckled
II	Burns easily, tans with difficulty	White
III	Mild burn, average tan	White to olive
IV	Rarely burns, tans easily	Brown
V	Very rarely burns, tans very easily	Dark brown
VI	Never burns, tans easily	Black

### 3.2 WORLD CLASSIFICATION OF SKIN TYPE

Goldman MP. Simplified facial rejuvenation. In Shiffman, Mirrafati, Lam, eds. Springer, Berlin; 2007

- European/Caucasian – white
- Arabian/Mediterranean/Hispanic – light brown
- Asian – yellow
- Indian – brown
- African – black

### 3.3 CLASSIFICATION OF SKIN FUNCTIONS

- Temperature regulation
- Ultraviolet light protection
- Protects against microbial invasion
- Protects against water loss
- Sensibility
- Physical barrier to trauma
- Immunological function

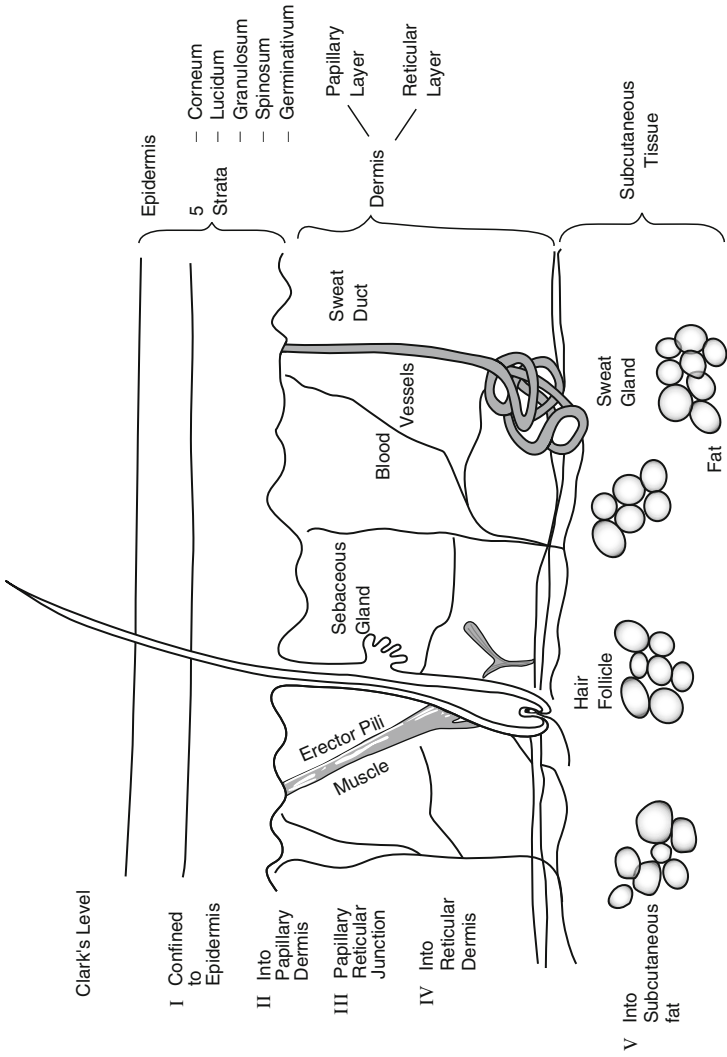


FIGURE 3.1. Structure of skin including Clark's levels.

### 3.4 CLASSIFICATION OF SKIN BLOOD SUPPLY

Regional deep vessels:

Arise from the aorta and form the main supply to head, neck, trunk, and limbs

Interconnecting vessels:

- Fasciocutaneous/septocutaneous (limbs)
- Musculocutaneous (trunk)

Vascular plexuses (Fig. 3.2):

- Muscle
- Subfascial
- Prefascial
- Subcutaneous: level of superficial fascia
- Subdermal
- Dermal
- Subepidermal

*Angiosome*

- *A composite block of tissue supplied by a named source artery*

*Greek derivation*

- *angeion = vessel*
- *somite = segment of body*
- *soma = body*

*Choke vessels*

- *Reduced calibre vessels which pass between anatomical territories*



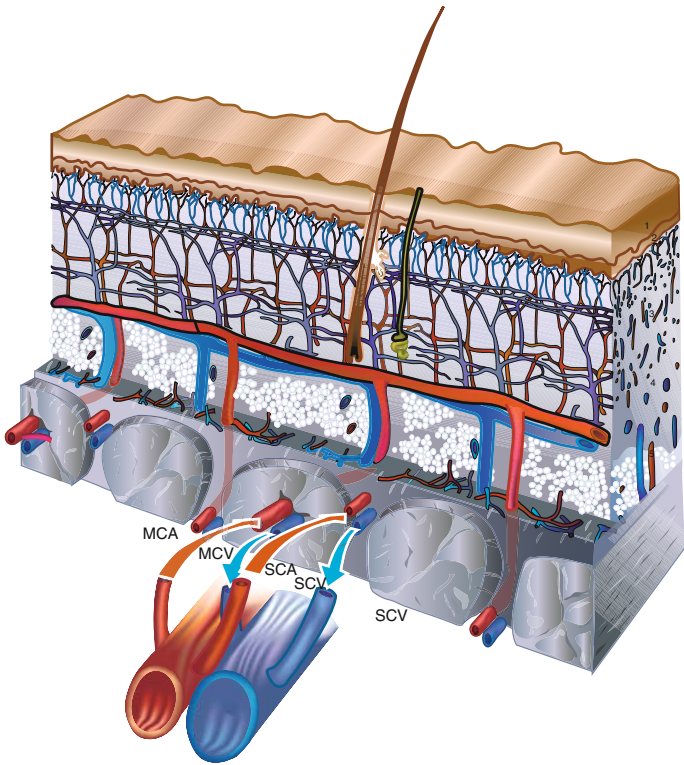


FIGURE 3.2. The cutaneous microcirculation.  
(from Delaere. Laryngotracheal reconstruction. Springer, Berlin; 2004)

### 3.5 CLASSIFICATION OF ARTERIAL TERRITORIES

*Anatomical:*

- Area in which vessel branches ramify before anastomosing with adjacent vessels

*Dynamic:*

- Area in which staining extends after IV fluorescein administration

*Potential:*

- Area which can be included in a flap if it is delayed

### 3.6 CLASSIFICATION OF SKIN LESIONS

	Non-pigmented	Pigmented
Benign	Epidermal, dermal, cyst derived	Benign melanocytic naevi
Malignant – primary	BCC, SCC, Merkel, sebaceous	Malignant melanoma
Malignant – secondary	Any source (direct or indirect spread)	

### 3.7 GENERAL CLASSIFICATION OF BENIGN NON-PIGMENTED SKIN LESIONS ACCORDING TO TISSUE OF ORIGIN

Epidermal origin:

Seborrhoeic keratosis (Basal cell papilloma), Actinic keratosis, Bowen's Disease, Squamous papilloma, Keratotic horn, Keratoacanthoma, Viral wart

Dermal origin:

Derivation from	
(a)	Sebaceous glands: sebaceous naevi, sebaceous adenoma, sebaceous hyperplasia
(b)	Eccrine glands: cylindroma, eccrine poroma, syringoma
(c)	Hair follicles: calcifying epithelioma of Malherbe (pilomatrixoma), tricholemmoma, trichoepithelioma, trichofolliculoma
(d)	Neural tissue: neurofibroma

Cyst origin:

Epidermoid, pilar, milia, xanthelasma

### 3.8 CLASSIFICATION OF TYPES OF BENIGN PIGMENTED LESION

Melanocytic naevi – Epidermal (Ephelis, Lentigo, Becker's nevus, Café au lait spot) – Dermal (Blue nevus, Mongolian blue spot, Naevi of Ota or Ito)
Naevus cell naevi Congenital (Small, Intermediate, Large, Giant > 20 cm/5% sa) Acquired (Junctional, Compound, Intra-dermal) Special (Spitz, Dysplastic, Halo)

*Congenital melanocytic naevus (CMN):*

– A naevus which presents at birth or is evident within the first 12 months of life

### 3.9 CLASSIFICATION OF BASAL CELL CARCINOMA (BCC)

Localized	Superficial	Infiltrative
Nodular	Superficial spreading	Morphoeic
Nodulocystic	Multifocal	
Micronodular		
Pigmented		
Ulcerative		

### 3.10 CLASSIFICATION OF DIAGNOSTIC CRITERIA FOR GORLIN'S SYNDROME

Adapted from Mathes. Plastic Surgery, vol. 5. Saunders, Elsevier; 2006: 399

Two major or one major + two minor required for diagnosis

#### Major criteria:

- >2 BCCs in a person under 20 years
- Jaw odontogenic keratocysts
- ≥3 palmar/plantar pits
- Falx cerebri calcification
- Bifid or fused ribs
- First degree relative affected

#### Minor criteria:

- Macrocephaly
- Craniofacial abnormality: cleft lip/palate, hypertelorism, frontal bossing
- Skeletal abnormality: pectus excavatum, syndactyly, Sprengel deformity
- X-ray findings: vertebral anomalies, lucency hands or feet, bridging sella turcica
- Ovarian fibroma
- Medulloblastoma

### 3.11 CLASSIFICATION OF TREATMENT OPTIONS FOR NON-MELANOMA SKIN CANCER

(The appropriate treatment is patient and tumour dependent)

- Surgical excision
- Curettage and cautery
- Mohs micrographic surgery
- Cryotherapy
- Radiotherapy

### 3.12 MALIGNANT MELANOMA CLASSIFICATIONS

- Morphological
- Histological: Clark's level, Breslow thickness
- Clinical findings: Stage (AJCC)

*Breslow thickness:*

- *The thickness of the melanoma in millimetres. Measurements are taken between the overlying granular layer and the deepest tumour cell identified by means of an ocular micrometre on the microscope. It is a good indicator of prognosis in Stage I melanoma.*

*Clark's level (Fig. 3.1):*

- *A measurement of the depth of penetration of a melanoma into the skin according to anatomic layer*

Level I	Melanoma confined to epidermis
Level II	Melanoma extends into papillary dermis
Level III	Melanoma extends to the junction of the papillary and reticular dermis
Level IV	Melanoma extends to the reticular dermis
Level V	Melanoma extends into subcutaneous fat

### 3.13 CLASSIFICATION OF MALIGNANT MELANOMA ACCORDING TO MORPHOLOGY

Superficial spreading	(60%)
Nodular	(30%)
Lentigo Maligna Melanoma	(7%)
Acral Lentiginous	(< 2%)
Amelanotic	(< 1%)
Desmoplastic	(< 1%)

### 3.14 TNM STAGING OF MELANOMA

Summarized from American Joint Committee on Cancer staging system for cutaneous melanoma (AJCC). Balch et al. J Clin Oncol 2001;19:3635

T classification:

Tis	In situ		
T1	Breslow thickness <1.0 mm	(a) No ulceration	(b) Ulceration
T2	Breslow thickness 1.01–2.0 mm	(a) No ulceration	(b) Ulceration
T3	Breslow thickness 2.01–4.0 mm	(a) No ulceration	(b) Ulceration
T4	Breslow thickness >4 mm	(a) No ulceration	(b) Ulceration

N classification:

N1	1 node	(a) Micrometastasis (pathologically detected)	(b) Macrometastasis (detected clinically)
N2	2–3 nodes	(a) Micrometastasis	(b) Macrometastasis
N3	In transit metastases/satellites or matted nodes		

M classification:

M0	No metastases	
M1	Metastases	(a) Distant skin, subcutaneous, nodal (b) Lung (c) Other visceral/distant

Pathological Staging-Summarized from American Joint Committee on Cancer staging system for cutaneous melanoma (AJCC). Balch et al. J Clin Oncol 2001;19:3635

0	Tis	N0	M0	
IA	T1a	N0	M0	Relates to tumour size
IB	T1b/2a	N0	M0	
IIA	T2b/3a	N0	M0	
IIB	T3b/4a	N0	M0	
IIC	T4b			
IIIA	Any T,	N1a/2a	M0	Relates to nodal involvement
IIIB	Any T,	N2abc/N1ab	M0	
IIIC	Any T,	N1b/2b/3	M0	
IV	Any T or N,		M1	Relates to metastases

### 3.15 CLASSIFICATION OF SUNBLOCKS

Chemical (absorptive):  
Para-amino-benzoic acid (PABA)  
PABA ester  
Benzophenones

Physical (reflective):  
– Zinc oxide  
– Titanium oxide

### 3.16 WHO CLASSIFICATION OF SOFT TISSUE TUMOURS 2002

(Summary)

Benign  
Intermediate (locally aggressive)  
Intermediate (rarely metastasing)  
Malignant

### 3.17 SARCOMA CLASSIFICATION SYSTEMS

(Now based on line of differentiation of tissue rather than type of tissue of origin)

Line of differentiation of tissue (tissue of origin)

Enneking

Stage

TNMG

### 3.18 ENNEKING CLASSIFICATION OF SARCOMA

1	Low grade	(A) Intracompartmental spread	(B) Extracompartmental spread
2	High grade	(A) Intracompartmental spread	(B) Extracompartmental spread
3	Regional or distant metastasis		

### 3.19 SARCOMA CLASSIFICATION BY TISSUE OF ORIGIN

Skin	– Dermatofibrosarcoma protuberans (DFSP), – Malignant fibrous histiocytoma (MFH), – Atypical fibroxanthoma (AFX)
Fat	– Liposarcoma
Fibrous tissue	– Fibrosarcoma
Muscle: – Smooth	– Leiomyosarcoma
– Striated	– Rhabdomyosarcoma
Blood vessel	– Angiosarcoma, Kaposi sarcoma
Lymph vessel	– Lymphangiosarcoma
Bone	– Osteosarcoma
Cartilage	– Chondrosarcoma

### 3.20 SARCOMA CLASSIFICATION BY “TNMG” (TUMOUR, NODE, METASTASIS, GRADE)

T1	< 5 cm diameter
T2	> 5 cm diameter
T3	Invades bone, vessel, nerve
N0	No nodes
N1	Positive nodes
M0	No metastases
M1	Distant metastases
G1	Low grade
G2	Intermediate grade
G3	High grade

### 3.21 STAGING OF SARCOMA

1. T1 or T2, G1
2. T1 or T2, G2
3. T1 or T2, G3, N1
4. T3, M1

### 3.22 GRADE OF SOFT TISSUE TUMOUR: TROJANI SCORES FROM 2 TO 8

Trojani et al. 1984

FNCLCC system of classification for soft tissue tumours also based on Trojani (French Federation Nationale des Centres de Lutte Contre Le Cancer)

Mitotic figures (per 10 HPF) (HPF high power fields 0.1734 mm <sup>2</sup> ): 1. 0–9 2. 10–19 3. >20
Tumour differentiation: 1. Sarcoma resembles normal adult mesenchyme 2. Sarcoma histological type uncertain 3. Embryonal undifferentiated sarcoma, doubtful type, synovial, osteosarcoma, PNET tumour
Tumour necrosis: 0. No necrosis: 1. <50% 2. ≥50%
Grade 1: score 2, 3 Grade 2: score 4, 5 Grade 3: score 6, 7, 8

(HPF High power fields 0.1734 mm<sup>2</sup>) Not all tumours are appropriate to grade (e.g., Well differentiated liposarcoma or Ewings)

### 3.23 CLASSIFICATION OF FEATURES OF A SOFT TISSUE LUMP SUGGESTIVE OF MALIGNANCY

Cardinal symptoms and signs suggesting malignancy:

- Lump >5 cm
- Lump increasing in size
- Lump deep to deep fascia
- Lump painful

### 3.24 CLASSIFICATION OF VASCULAR ANOMALIES

Mulliken JB, Glowacki J. Haemangiomas and vascular malformations in infants and children: A classification based on endothelial characteristics. *Plast Reconstr Surg* 1982;69:412

Haemangioma	Vascular malformation
	– Slow flow: capillary, lymphatic, venous – Fast flow: arterial, arteriovenous fistula, arteriovenous

### 3.25 INTERNATIONAL SOCIETY FOR THE STUDY OF VASCULAR ANOMALIES (ISSAV): CLASSIFICATION OF VASCULAR ANOMALIES

Tumours	Malformations
Haemangioma	Slow Flow – Capillary – Lymphatic – Venous
Haemangioendothelioma	
Angiosarcoma	
Miscellaneous	
	Fast Flow – Arterial – Combined

#### *Vascular malformation:*

- An error of embryonic development giving rise to dysplastic vessels lined by quiescent endothelium. They are by definition present at birth and usually clinically obvious. They do not regress but often expand. They may be associated with an overgrowth of bone and soft tissue. They can be further classified as slow flow or fast flow.

#### *Haemangioma:*

- A vascular lesion that is not usually present at birth but occurs shortly afterward. It undergoes a rapid proliferative phase followed by involution.

### 3.26 CLASSIFICATION OF CONGENITAL HAEMANGIOMA

RICH: Rapidly involuting congenital haemangioma

NICH: Non-rapidly involuting congenital haemangioma

#### *Pyogenic granuloma:*

- A rapidly growing proliferation of vascular tissue

#### *Kasabach–Merritt phenomenon:*

- An invasive vascular tumour associated with platelet trapping, profound thrombocytopenia giving rise to an increased risk of intracranial, pleural-pulmonic, intraperitoneal, and gastrointestinal haemorrhage. It is associated with Kaposiform haemangioendothelioma



**3.27 CLASSIFICATION OF LYMPHATIC MALFORMATIONS**

- Microcystic (e.g., Lymphangioma)
- Macrocystic (e.g., Cystic hygroma)
- Mixed

*Lymphangioma circumscriptum:*

- Small intradermal vesicles which overlie a deeper lymphatic malformation

**3.28 CLASSIFICATION OF HAEMANGIOMA RESOLUTION**

(This classification is a rough guide only)

- 60% Resolution at age 6 years
- 70% Resolution at age 7 years
- 80% Resolution at age 8 years
- 90% Resolution at age 9 years

**3.29 SCHOBINGER ARTERIOVENOUS MALFORMATION STAGING CLASSIFICATION**

- I Blush or stain. Warm. Arteriovenous shunting by continuous doppler
- II Stage I + Enlargement. Tortuous tense veins. Pulsation. Thrill. Bruit
- III Stage I + Dystrophic changes. Ulceration. Persistent pain. Bleeding. Destruction
- IV Stage II + Cardiac failure

**3.30 WANER GRADING FOR CAPILLARY MALFORMATION**

- Grade I Sparse, pale, non-confluent discoloration
- II Denser pink, non-confluent discoloration
- III Discrete ectatic vessels
- IV Confluent
- V Nodular

**33.31 CLASSIFICATION OF VASCULAR MALFORMATIONS ASSOCIATED WITH OVERGROWTH SYNDROMES**

Slow flow	Fast flow
Klippel–Trenaunay	Parkes–Weber
Proteus	
Maffucci	

*Maffucci Syndrome:*

- A syndrome of enchondromas associated with multiple venous vascular anomalies

*Proteus Syndrome:*

- A rare condition characterized by multiple cutaneous and subcutaneous hamartomas as well as vascular malformations, naevi, lipomas, and hyperpigmentation. Partial gigantism of a limb or digit is pathognomonic.  
(The “Elephant Man” is thought to have had proteus syndrome).

*Klippel–Trenaunay Syndrome:*

- A combined slow-flow vascular anomaly associated with limb hypertrophy

*Parkes–Weber Syndrome:*

- Multiple arteriovenous fistulae and usually involves a limb

*Sturge–Weber Syndrome*

- A capillary vascular malformation (port-wine stain) that lies within the distribution of the ophthalmic and maxillary branches of the trigeminal nerve. It is associated with epilepsy, glaucoma, and meningeal vascular malformations

*Osler–Weber–Rendu Syndrome (hereditary haemorrhagic telangiectasia)*

- A condition characterized by multisystem vascular dysplasia (bright red lesions) and recurrent haemorrhage. Epistaxis is the most common presentation

# Chapter 4

## Craniofacial, Cleft Lip and Palate

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### *Congenital malformation*

- *A structural defect at birth due to abnormal development in utero*

### *Deformation*

- *A change in size or shape due to the effect of mechanical forces*

### *Disruption*

- *An event that interrupts the normal sequence of development*

### *Dysplasia*

- *Abnormal development or growth of tissues, organs or cells*

### *Moss's functional matrix*

- *The morphology of the bony skeleton is a result of processes in the soft tissues*

### *Frankfort horizontal plane*

- *A craniometric plane passing from the upper part of the external auditory meatus through the lowest point of the left orbital margin*

## **4.1 CRANIOFACIAL ABNORMALITY CLASSIFICATION**

### **American society of cleft lip and palate**

#### Cleft

Synostosis (syndromal or non-syndromal)

Hypoplastic conditions

Hyperplastic and neoplastic conditions

## 4.2 FACIAL CLEFTS

### 4.2.1 Tessier's Classification of Facial Clefts (Fig. 4.1)

Tessier P. Anatomical classification of facial, cranio-facial and latero-facial clefts. *J Maxillofac Surg* 1969;4:69–92

Key landmarks – orbit, nose, mouth

- 0–7 Represent facial clefts (lower hemisphere) – extend down from orbit
- 8 Represents the equator
- 9–14 Represent cranial clefts (upper hemisphere) – extend up from orbit

If a malformation traverses both hemispheres a craniofacial cleft is produced that tends to follow a “time zone.” The combination adds up to 14

- Cleft 0 – Craniofacial dysraphia – midline upper lip and nose affected
- Cleft 1 – Paramedian craniofacial dysraphia – cleft lip
- Cleft 2 – Paranasal
- Cleft 3 – Oro-naso-ocular involvement
- Cleft 4 – Oro-ocular cleft and passes medial to infraorbital foramen
- Cleft 5 – Oro-ocular cleft passes lateral to infraorbital foramen
- Cleft 6 – Cleft separating zygoma from maxilla as it enters lateral 1/3 of orbit
- Cleft 7 – Cleft passes between zygoma and temporal bone (macrostomia, hemifacial microsomia)
- Cleft 8 – Cleft passes from lateral canthus to temporal region
- Cleft 9 – Lateral supraorbital clefts
- Cleft 10 – Middle 1/3 supraorbital cleft
- Cleft 11 – Medial supraorbital cleft
- Cleft 12 – Cleft passes through frontal process of maxilla. Hypertelorbitism
- Cleft 13 – Cleft passes medial to eyebrow. Hypertelorbitism. Widened cribriform plate
- Cleft 14 – Midline cranial defect may give rise to encephalocoeles or frontonasal dysplasia
- Cleft 30 – Midline lower lip and mandible

#### *Special clefts*

- 6 – Absent eye lashes
- 7 – Microtia, conductive hearing loss
- 8 – Absent lateral orbital rim

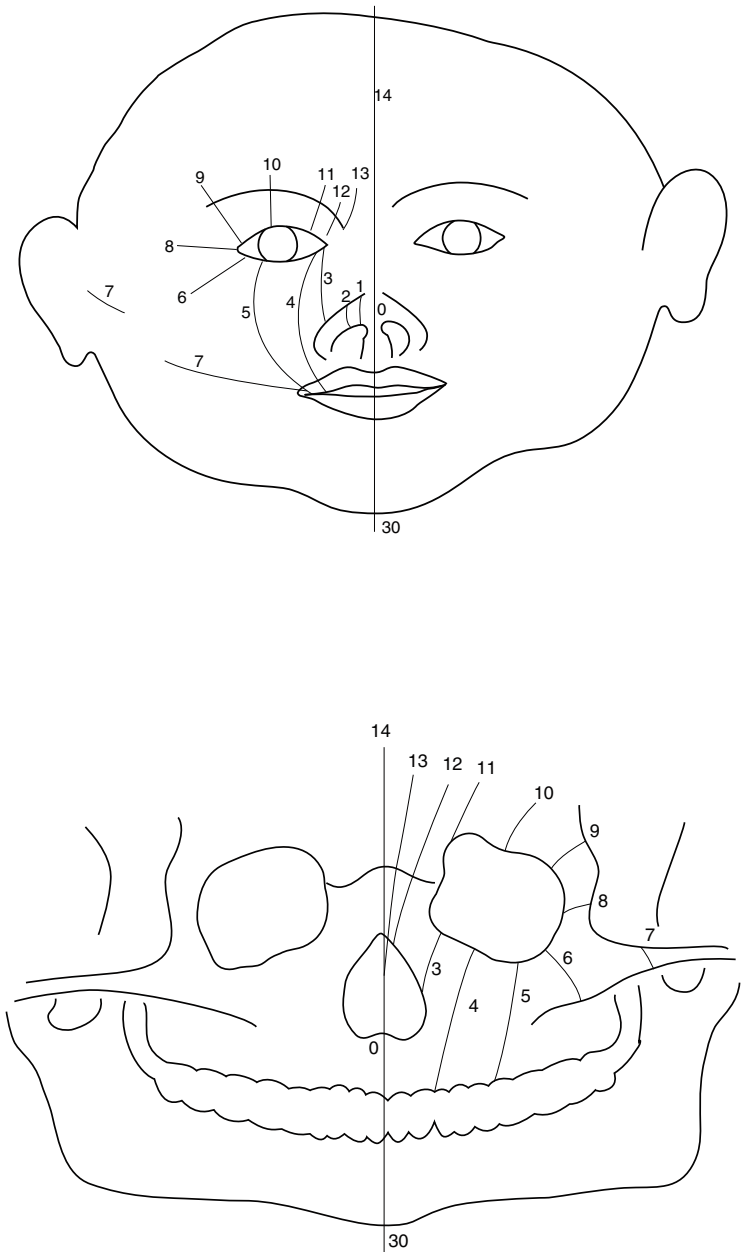


FIGURE 4.1. (a, b) Tessier's classification of facial clefts.

### 4.2.2 Karfik Facial Cleft Classification

Karfik V. Proposed classification of rare congenital cleft malformations in the face. *Acta Chir Plast* 1966;8:163–168 (summarized classification)

- Group A – Rhinencephalic disorders
- Group B – Branchiogenic disorders
- Group C – Ophthalamo-orbital disorders
- Group D – Cranioccephalic disorders
- Group E – Atypical facial disorders

### 4.2.3 Van der Meulen Classification of Craniofacial Malformations

From van der Meulen JC, Mazzola B, Stricker M, et al. Classification of craniofacial malformations. In Stricker M, van der Meulen JC, Raphael B, et al, eds. *Craniofacial Malformations*. Edinburgh, Churchill Livingstone, 1990:149–309.

van der Meulen JC, et al. A morphogenetic classification of craniofacial malformations. *Plast Reconstr Surg* 1983;71:560

Summarized:

- Cerebrocranial dysplasia
- Cerebrofacial dysplasia
- Craniofacial dysplasia:
  - with clefting
  - with dysostosis
  - with synostosis
- Craniofaciosynostosis
  - Faciosynostosis:
    - with dyostosis and synostosis
    - with dyschondrosis
- Craniofacial dysplasias with other origin:
  - Osseous
  - Cutaneous
  - Neurocutaneous
  - Neuromuscular
  - Muscular
  - Vascular

### *Encephalocele*

*A congenital midline defect affecting the central nervous system*

#### 4.2.4 Encephalocele Classifications

- Content of mass (Ballantyne 1904)
- Location of external mass (Davies 1959)
- Location of cranial defect (Suwanela and Suwanela 1972)

### 4.3 CRANIOSYNOSTOSIS

#### *Craniosynostosis*

- *The premature and abnormal fusion of one or more sutures of the skull that can appear as part of a syndrome or in isolation.*

#### *Virchow's Law*

- *Skull growth proceeds in a direction that is parallel to the affected suture.*

#### 4.3.1 Classification of Craniosynostosis

Non-syndromic (most common)

Syndromic

#### 4.3.2 Classification of Craniosynostosis According to Suture Affected and Resultant Head Shape

Suture affected	Head shape
Sagittal 50–58%	Scaphocephaly-keel shape
Coronal 20–29%	Plagiocephaly One fused – twisted Two fused – brachycephaly (short front to back) – compensatory turricephaly
Metopic 4–10%	Trigonocephaly – triangular
Lambdoid 2–4%	One fused – twisted Two fused – short – brachycephaly
Multiple	Clover leaf – Kleeblattschadel

#### *Positional plagiocephaly:*

- *A distortion of skull shape due to external pressure. (There is no premature fusion of the sutures and viewed from above the skull appears as a parallelogram).*

#### *True plagiocephaly:*

- *A distortion of skull shape due to premature unilateral fusion of the coronal or lambdoid sutures.*

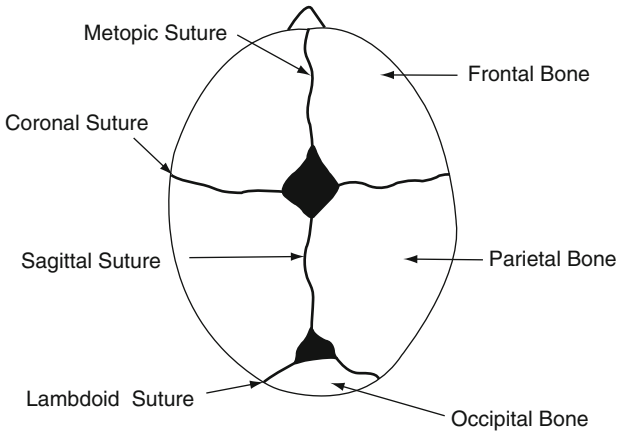


FIGURE 4.2. The bones and sutures of the skull.

### 4.3.3 Classification of Features Differentiating Deformational from Synostotic Frontal Plagiocephaly

Anatomic feature	Deformational	True synostosis
Skull shape from above	Rhomboid/parallelogram	Trapezoid
Ipsilateral palpebral fissure	Narrow	Wide
Ipsilateral ear	Postero-inferior	Antero-superior
Ipsilateral cheek	Backward	Forward
Nasal root	Midline	Ipsilateral
Chin deviation	Ipsilateral side	Contralateral side

#### *Harlequin deformity:*

- An abnormally shaped orbit visible on radiograph resulting from superior displacement of the lesser wing of the sphenoid due to coronal synostosis

#### *Torticollis:*

- A tilt of the head toward the affected side

### 4.3.4 Classification of Torticollis

Congenital

Acquired

#### *Coloboma*

- Clefts of the eyelid presenting as a notch



### 4.3.5 “TIPPS” Classification of Signs of Raised Intracranial Pressure in an Infant

O'Brien CM

- T Tense anterior and posterior fontanelles
- I Irritability
- P Papilloedema
- P Psychomotor impairment
- S Seizure, skull radiograph appearance  
(copper beaten, thumb printing)

### 4.3.6 Classification of Syndromal Craniosynostoses (Acrocephalosyndactyly)

- Apert's syndrome: bicoronal synostosis, midface hypoplasia associated with a complex syndactyly (see Chap. 2 for classification of hand deformities)
- Crouzon's syndrome: bicoronal synostosis, midface hypoplasia, no hand abnormality
- Carpenter's syndrome: craniosynostosis, foot polydactyly, incomplete syndactyly of hands
- Saethre-Chotzen: bicoronal synostosis, low set hairline, eyelid ptosis, incomplete syndactyly mainly second web space
- Pfeiffer syndrome: craniosynostosis, broad thumbs and great toes, incomplete syndactyly of second web space

### 4.3.7 Classification of Surgical Procedures for Craniosynostosis

*Strip craniectomy:*

- Excision of a strip of bone over the prematurely fused suture to allow normal brain growth and expansion

*Fronto-orbital advancement:*

- Advancement of the frontal bone allowing decompression and reshaping of the cranial vault. In addition, advancement of the supraorbital bar to promote better globe protection and improved facial appearance

*Le Fort III osteotomy:*

- A midface advancement procedure by performing osteotomies to separate the cranial vault from the facial skeleton (see facial fractures)

*Skeletal distraction:*

- A midface advancement procedure involving application of a distraction device after performing osteotomies

*Monobloc advancement:*

- Simultaneous advancement of the forehead, orbits and midface

### 4.3.8 Classification of General Management Plan According to Age in Craniofacial Abnormalities (Multidisciplinary Team)

<p>Infancy</p> <p>– Assess for:</p> <p><i>Airway obstruction, feeding, hearing, parental support</i></p> <p>Soft tissue correction (skin tags, macrostomia, VII graft to prevent muscle atrophy)</p> <p>Bony surgery: if severe (e.g., fronto-orbital advancement in craniosynostosis)</p>
<p>Mixed dentition:</p> <p>Monitor growth and development</p> <p>Orthodontic treatment, hearing and speech, cranial nerve function, promote maxillary and mandibular growth</p>
<p>Adult:</p> <p>Bony: orthognathic surgery, correct dystopia, bone graft facial skeleton</p> <p>Soft tissue augment: definitive auricle, rhinoplasty</p> <p>Genetic counselling</p>

#### *Beckwith-Wiedemann syndrome:*

- *Metopic synostosis associated with a large body size and visceromegaly. May have prognathism and macroglossia. Complicated by Wilm's Tumour (or other malignancies), hypoglycaemia, seizures, and aspiration pneumonia*

## 4.4 HYPOPLASTIC CONDITIONS

### 4.4.1 Hemifacial Microsomia

Vento AR, La Brie RA, Mulliken JB. The O.M.E.N.S. classification of hemifacial microsomia. *Cleft Palate Craniofac J* 1991;28:68

Grade 1–3 for each

The acronym denotes each of the five areas of involvement:

Orbit  
Mandible  
Ear  
Nerve-VII  
Soft tissue

Orbit            O0 Normal orbit size and position  
                  O1 Abnormal size  
                  O2 Abnormal position  
                  O3 Abnormal size and position

Mandible	M0 Normal mandible M1 Small mandible and glenoid fossa M2 Short abnormally shaped mandibular ramus M2a Acceptably positioned glenoid M2b Medially displaced TMJ M3 Absent ramus, glenoid fossa, TMJ
Ear	E0 Normal E1 Mild hypoplasia and cupping E2 Absent external auditory canal E3 Malpositioned lobule, absent auricle
Nerve	N0 No VII involvement N1 Upper VII involvement N2 Lower VII involvement N3 All branches affected
Soft tissue	S0 No soft tissue deformity S1 Mild tissue deformity S2 Moderate tissue deformity S3 Severe subcutaneous and muscular deficiency

Associated with – Ear tags (40%), Macrostomia (60%)

#### 4.4.2 Classification and Treatment of Hemifacial Microsomia

Munro IR, Lauritzen CG. In: Caronni EP, ed. *Craniofacial Surgery*. Boston: Little, Brown; 1985:391–400

- IA Craniofacial skeleton: Mildly hypoplastic; Occlusal plane: horizontal
- IB Craniofacial skeleton: Mildly hypoplastic; Occlusal plane: canted
- II Absent condyle and part of affected ramus
- III Absent condyle and part of affected ramus, zygomatic arch and glenoid fossa
- IV Zygoma: Hypoplastic; Lateral orbital wall: medial and posterior displacement
- V Orbit: inferior displacement and decreased volume

#### 4.4.3 Classification of Unilateral Craniofacial Microsomia

Harvold, Vargervik, Chierici

- IA Unilateral facial underdevelopment  
No microphthalmos or dermoids  
+/- Vertebral, Heart, Kidney abnormalities
- IB Above + microphthalmos
- IC Bilateral asymmetric (one side worse than the other)
- ID Complex
- II Limb deficiency type (unilateral or bilateral +/- ocular deformity)

- III Frontonasal type
- IV Goldenhar type associated with upper dermoids +/- upper lid coloboma
  - A – Unilateral B – Bilateral

#### 4.4.4 Pruzansky's Classification of Mandibular Deformity 1969

Modified by Mulliken and Kaban in 1987

- Type I Condyle/ramus small, morphology maintained
- Type II A Condyle/ramus morphology abnormal. Glenoid fossa position maintained
- Type II B Ramus/condyle: hypoplastic, malformed, displaced
- Type III Ramus absent. No TMJ

*Treacher Collin's Syndrome (Franceschetti: Klein, Mandibulofacial dysostosis, Confluent 6,7,8 cleft):*

- A bilateral, symmetrical craniofacial disorder with an autosomal dominant pattern of inheritance. Characteristic facies include a vertically deficient lower lid, a lower eyelid coloboma, downslanting palpebral fissures and hypoplastic malar eminences

*Romberg's Disease:*

- A progressive hemifacial atrophy which affects soft tissues (usually skin and subcutaneous tissue) but also potentially bone. It is unilateral in 95% of cases. A coup de sabre (a vertical depression extending from hairline to eyebrow) is a clinical sign of the disease

*Binder's Syndrome:*

- Maxillonasal dysostosis characteristic features include mid-face hypoplasia, a short flat nose, wide shallow philtrum and convex upper lip. May be associated with vertebral abnormalities (50%)

## 4.5 HYPERPLASTIC CONDITIONS

*Fibrous dysplasia:*

- A developmental derangement of bone that results from abnormal proliferation of mesenchyme. Although a benign disorder of bone that affects the axial skeleton as well as the craniofacial skeleton it may behave aggressively in the latter

### 4.5.1 Classification of Fibrous Dysplasia

- (A) Monostotic (B) Polyostotic

*Albright Syndrome:*

- A combination of polyostotic fibrous dysplasia, café au lait spots, endocrine and extraskelatal abnormalities

*Cherubism (Described by Jones 1933):*

- A hereditary form of fibrous dysplasia affecting the maxilla and mandible

**4.6 OTHER CRANIOFACIAL SYNDROMES***Moebius Syndrome:**“Classic” definition*

- A paralysis of the sixth and seventh cranial nerves resulting in a mask like face with an inability to laterally deviate the eyes (A broader definition includes malfunction of additional cranial nerves most commonly III, IX, X, XII)

*Goldenhar’s Syndrome:*

- A congenital abnormality consisting of hemifacial microsomia, epibulbar dermoids and vertebral anomalies

**4.6.1 Neurofibromatosis (NF): Classification of Diagnostic Criteria**

1987 National Institutes of Health Consensus Conference

Type I (two or more of the following)	Type II
Café- au-lait spots	Bilateral VIII nerve tumours
Two neurofibromata or one plexiform neurofibroma	Affected first degree relative (NF II)+
Axillary/Inguinal freckling	1. Unilateral VIII nerve tumour
Optic glioma	2. Two or more
Two or more Lisch nodules (Iris hamartoma)	Neurofibroma
Distinct osseous lesion	Meningioma
Affected first degree relative (with NF I)	Glioma
	Schwannoma
	Lenticular opacity

*Congenital dermoid cyst:*

- Benign cysts that are formed due to retention of dermal and epidermal cells into embryonic fusion lines of development. Often present in the upper lateral orbit or nasal midline. They may extend intracranially

## 4.7 CLEFTS OF THE LIP AND PALATE

### 4.7.1 Anatomical Classification of Clefts of the Lip and Palate

Clefts may be of the Primary or Secondary palate

*Primary palate (cleft lip, prepalatal):*

- Structures of the primary palate are those anterior to the incisive foramen. They include the lip and alveolus. The nasal tip cartilages and floor of the nose may also be involved

*Secondary palate (cleft palate, palatal):*

- Structures of the secondary palate are those behind the incisive foramen. They include the hard palate, soft palate, and uvula

*The incisive foramen:*

- This occurs where the lateral maxillary bones meet the premaxilla in the midline and is just behind the upper front incisors

### 4.7.2 Striped Y Classification

Kernahan DA. The striped Y: a symbolic classification for cleft lip and palate. *Plast Reconstr Surg* 1971;47:469–470

This has been modified by Millard and Jackson and Noordhoff (Fig. 4.3)

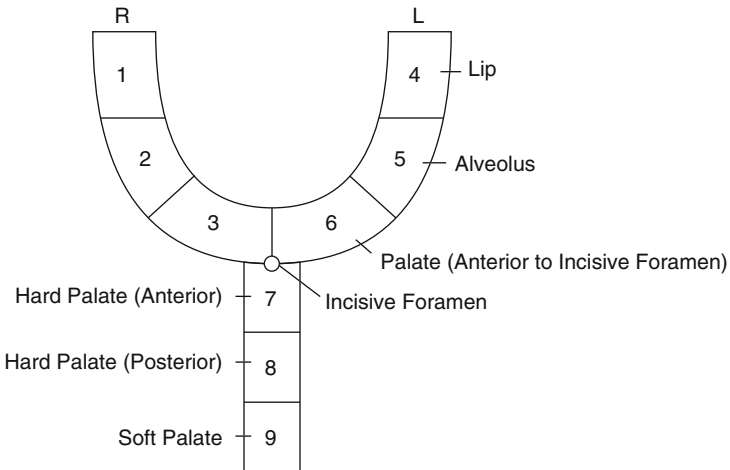


FIGURE 4.3. “Kernahan’s Y”.

This system diagrammatically attempts to describe a cleft of the lip and or palate. A “Y” shape is used to represent different parts of the lip and palate which is divided into numbered regions

Stippled box = Cleft in that area

Cross hatched box = Submucous cleft

### 4.7.3 Cleft Lip Descriptive Classification

Complete, Incomplete, Microform

Unilateral, Bilateral

Left, Right

*Microform cleft (forme fruste):*

- A microform cleft is characterized by a vertical furrow or scar across the upper lip. It may be accompanied by a notch in the vermillion, an abnormal white roll and a mild degree of shortening of the lip

*Simonart’s Band:*

- A band of lip tissue bridging a cleft of the primary palate

### 4.7.4 Maxillary Segment Position (Fig. 4.4)

Unilateral complete clefts may be classified according to the position of the maxillary segment:

- Narrow/no collapse
- Narrow/collapse
- Wide/no collapse
- Wide/collapse

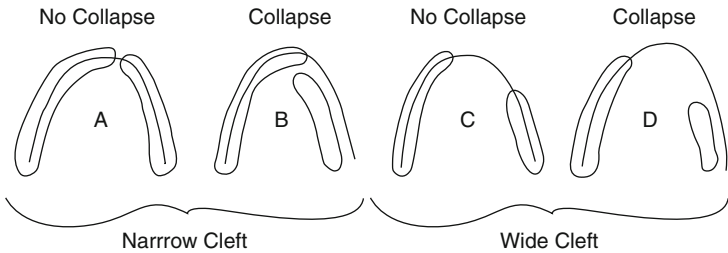


FIGURE 4.4. Classification of maxillary segment position.

### 4.7.5 “LAHSAL” Classification

Used by the National database on clefts

L = Complete cleft of Lip

A = Complete cleft of Alveolus

H = Complete cleft of Hard palate

S = Complete cleft of Soft palate

l = Incomplete cleft of Lip

a = Incomplete cleft of alveolus

h = Incomplete cleft of hard palate

s = Incomplete cleft of soft palate

Anatomically describes right to left

Capital letter = complete cleft, lower case letter = incomplete cleft

#### 4.7.6 Classification of Treatment Principles in Cleft Lip Repair

1. Lengthening of the lip
2. Detachment of abnormal muscle insertions
3. Reconstruction of lip musculature
4. Accurate apposition of skin and vermillion

#### 4.7.7 Classification of Types of Cleft Lip Repair

1. Straight line repair (e.g., Rose-Thompson)
2. Upper lip Z-Plasty (e.g., Millard) (Fig. 4.5)
3. Lower lip Z-Plasty (e.g., Le Mesurier)
4. Combination of upper and lower lip Z-plasties (e.g., Trauner, Skoog)

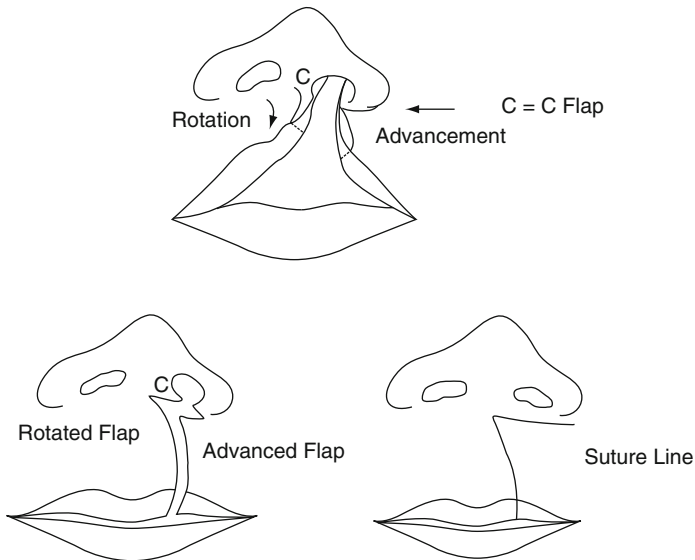


FIGURE 4.5. Millard's rotation advancement technique of cleft lip repair.

#### 4.7.8 Classification of Timings of Cleft Lip Repair

- Traditional "10s": 10 lbs, 10 weeks, 10 g dl<sup>-1</sup> haemoglobin
- Neonatal < 48 h
- Conventional: 3/12-lip and anterior palate, 6/12 remaining hard and soft palate
- Other regimes: Delaire – 6–9/12 – lip and soft palate, 12–18/12 remaining hard palate



- Schweckendick:
- 1 year lip and soft palate
- 8 years remaining hard palate

#### 4.7.9 Cleft Palate Classification

Complete or Incomplete  
 Unilateral or Bilateral  
 Submucous

*Cleft palate:*

- *Failure of lateral palatal shelves to fuse with each other*

*Submucous cleft palate:*

- *A deformity characterized by a bifid uvula, palpable notch of the posterior hard palate and a zona pellucida*

*Zona pellucida:*

- *A thin, blue coloured central area at the site of velar muscle diastasis*

*Pierre Robin sequence:*

- *A sequence of events initiated by a congenitally small jaw that gives rise to limited tongue descent, prevention of upward palatal shelf rotation and fusion therefore resulting in a wide “U” shaped cleft of the palate*

*Syndrome:*

- *A collection of congenital abnormalities giving rise to a particular phenotype*

#### 4.7.10 Classification of Syndromes Associated with Cleft Palate

Aperts  
 Crouzons  
 Downs  
 Sticklers  
 Treacher Collins  
 Velocardiofacial

#### 4.7.11 Veau Classification of Clefts

Veau V. Division Palatine. Paris: Masson; 1931

- Group 1 Cleft of soft palate only
- Group 2 Cleft of soft palate and hard palate
- Group 3 Unilateral cleft of lip and palate
- Group 4 Bilateral cleft lip and palate

#### 4.7.12 Classification of Bone Graft Timing for Cleft Palate

Primary: at the time of primary repair

Delayed

Secondary: 8–10 years, timing just prior to eruption of permanent canine tooth

Late secondary

#### 4.7.13 Classification of Cleft Nose Deformity

a) Unilateral

Mild – Alar base wide, Dome projection normal

Moderate – Alar base wide, Dome depressed (minimal alar hypoplasia)

Severe – Alar base wide, Dome retroposed (alar hypoplasia)

b) Bilateral – Short columella, broad depressed nasal tip

*Velopharyngeal incompetence (VPI):*

– Failure of closure of the velopharyngeal sphincter resulting in abnormal coupling of the nasal and oral cavities. It may result in hypernasality, nasal emission, lack of voice projection and articulation

#### 4.7.14 Classification of Techniques to Correct VPI

Pharyngoplasty:

– Posterior wall procedures: augmentation, superiorly based flap, inferiorly based flap

– Lateral wall procedures: Hynes, Orticochoea, Jackson's modification of Orticochoea

Palate lengthening:

– Push-back procedures (Veau–Wardill–Kilner)

Furlow's palatoplasty:

– Double opposing Z plasty palatoplasty

*Intravelar veloplasty*

– A technique to improve palatal movement

*Traffic light system for speech:*

– An evaluation system of speech represented by a visual color scheme of red, yellow, and green

*GOSLON yardstick* (“Great Ormond Street, London and Oslo”):

– A tool to assess dental arch relationships, quality of facial growth and allow comparison

# Chapter 5

## Head and Neck

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### 5.1 CLASSIFICATION OF NECK DISSECTION

Robbins KT, Medina JE, Wolf GT et al: Standardising neck dissection terminology. *Arch Otolaryngol Head Neck Surg* 1991;117:601–605

#### 5.1.1 Comprehensive Neck Dissection

– *Removes the contents of all five levels of the neck*

(a) Radical neck dissection: – Removes the contents of all five neck levels  
+  
Internal jugular vein (IJV)  
Sternocleidomastoid muscle (SCM)  
Accessory nerve (AN)

(b) Modified radical neck dissection (MRND):  
– Removes the contents of all five levels but preserves one or more of the three structures above

*Medina-Classification of MRND:*

Type 1: Accessory nerve preserved

Type 2: Accessory nerve and SCM preserved

Type 3: Accessory nerve, SCM, IJV preserved

(To avoid confusion it is now preferable to state which structures are spared or sacrificed as different classifications systems are not consistent with regard to structure and category type)

(c) Extended radical: Removes all five levels of the neck but may also include paratracheal nodes, mediastinal nodes and the parotid gland

#### 5.1.2 Selective Neck Dissection

– *Clears the nodes from some but not all levels of the neck due to a predilection of certain tumours for certain levels hence avoiding morbidity:*

- (a) Supraomohyoid (Levels 1–3)
- (b) Anterolateral (Levels 2–4)
- (c) Anterior (Levels 2–4 + tracheo-oesophageal nodes)
- (d) Posterior (Levels 2–5)

**5.1.3 Classification of Neck Dissection Incisions (Fig. 5.1)**

(A balance between exposure and flap blood supply)

Y-shape (Crile, Conley) (“S”-shape lower limb to avoid contracture)

Double Y (Hayes Martin)

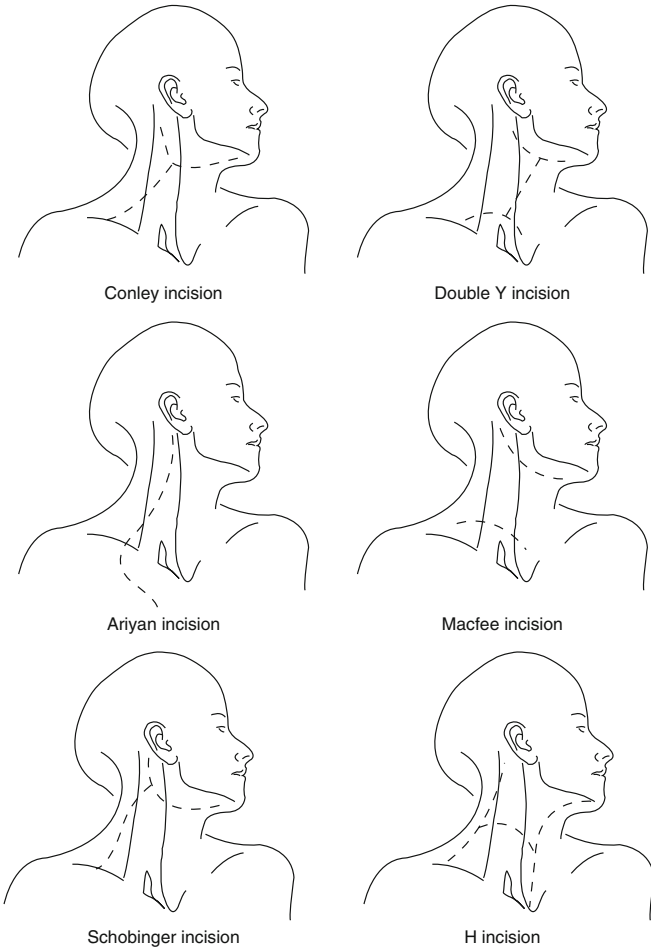


FIGURE 5.1. Neck dissection incisions.

J or hockey stick (Ariyan)

Bipedicled (MacFee) (good blood supply, consider if post DXT)

Schobinger

H

Apron

#### 5.1.4 Classification of Defects of the Head and Neck

*Hanna:*

A. Mandatory

B. Functional

C. Cosmetic

#### 5.1.5 Classification of Levels of the Neck (Fig. 5.2)

##### *I. Submandibular triangle*

– Inferior border of mandible and above both bellies of digastric (submandibular gland is included in the Level I dissection specimen)

Contents: Submental and submandibular lymph nodes

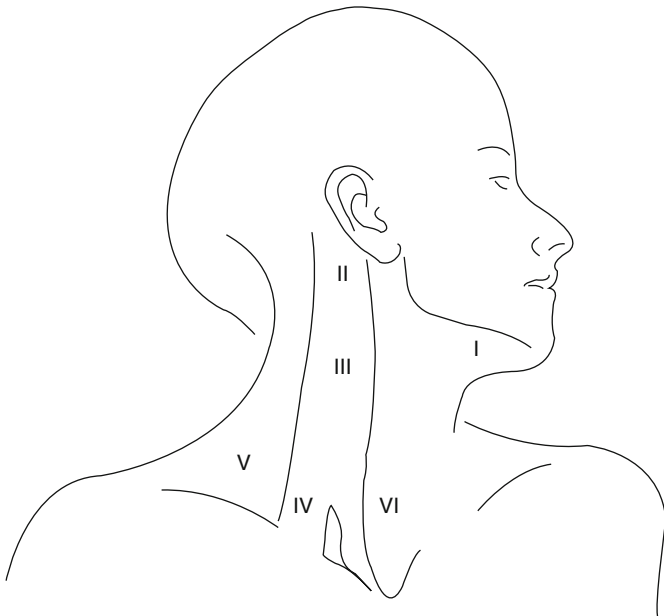


FIGURE 5.2. Levels of the neck.

### *II. Upper jugular*

- Horizontal border: Lateral sternohyoid border to posterior SCM border
  - Vertical border: Skull base to carotid bifurcation
  - Clinical landmark (lower border) is the hyoid
- Contents: Upper jugular and jugulodigastric lymph nodes

### *III. Middle jugular*

- Horizontal border: Lateral sternohyoid border to posterior SCM border
  - Vertical border: Bifurcation of carotid to omohyoid
  - Clinical landmark (lower border) is the cricothyroid membrane
- Contents: Middle jugular lymph nodes

### *IV. Lower jugular*

- Horizontal border: Lateral sternohyoid border to posterior SCM border
  - Vertical border: Omohyoid to clavicle
- Contents: Lower jugular lymph nodes and thoracic duct on left

### *V. Posterior triangle*

- Posterior SCM border, anterior border of trapezius, clavicle
- Contents: Cervical plexus branches, transverse cervical artery

### *VI. Anterior compartment*

- Vertical border is from hyoid to suprasternal notch
  - Lateral boundary is medial border of carotid sheath
- Contents: Lymph nodes around midline visceral structures (paratracheal, perithyroid, lymph nodes along recurrent laryngeal nerves)

## **5.2 GENERAL SCHEME FOR CLASSIFICATION OF TUMOURS OF THE HEAD AND NECK IN ADULTS**

### **5.2.1 Histological Classification**

Benign  
Malignant  
Primary  
Secondary

### **5.2.2 Anatomical Classification**

Scalp  
Ear  
Orbit  
Nasal cavity and paranasal sinuses  
Lip/oral cavity/oropharynx  
Mandible, maxilla  
Soft tissue head and neck sarcomas

### 5.3 CLASSIFICATION OF HEAD AND NECK TUMOURS IN CHILDREN

#### *Benign*

Inflammatory mass:

- Lymph node, abscess, pyogenic granuloma, sialadenitis

#### *Tumour:*

- Vascular anomaly, cystic hygroma, dermoid cyst, branchial cleft anomalies, neurofibroma, thyroglossal duct remnant, lipomatosis, fibromatoses, adnexal tumour, odontogenic tumour, osteogenic tumour, teratoma

#### *Malignant*

##### (a) Primary:

- Neuroblastoma, sarcomas of soft tissue, bone tumour, retinoblastoma, salivary gland tumour, nasopharyngeal carcinoma, thyroid cancer

##### (b) Secondary

### 5.4 TUMOUR, NODE, METASTASIS (TNM) CLASSIFICATION OF HEAD AND NECK CANCER

#### *Tumour*

(T varies according to tumour site)

Oral/oropharyngeal cancer

T1 < 2cm, T2 2–4 cm, T3 > 4 cm, T4 into local tissue

Nasopharyngeal cancer

T1 one subsite, T2 > one subsite, T3 beyond nasal cavity, T4 skull

Hypopharyngeal cancer

T1 one subsite, T2 > one subsite unfixed, T3 larynx, T4 neck

Maxillary sinus cancer

T1 antral mucosa, T2 Below Ohngren's line, T3 Above Ohngren's line, T4 adjacent structures involved

#### *Node*

Nx - Unable to assess

N0 - None

N1 - Single, ipsilateral, < 3 cm

N2a - Single, ipsilateral 3–6 cm

N2b - Multiple, ipsilateral < 6 cm

N2c - Bilateral, contralateral 3–6 cm

N3 > 6 cm

*Metastasis*

- Mx – Unable to assess
- M0 – None
- M1 – Distant metastases

*Ohngren’s line*

– An imaginary line between the medial canthus of the eye and angle of the mandible classifying localized tumours of the maxillary sinus into a posterosuperior and anteroinferior plane. It is of prognostic significance since tumours above the line tend to invade adjacent structures earlier and therefore have a poorer prognosis.

**5.5 STAGING OF HEAD AND NECK CANCER**

- Stage 1 T1, N0, M0
- Stage 2 T2, N0, M0
- Stage 3 T3, N0, M0 or N1 with tumour T0–3
- Stage 4 T4, N0/1, M0 or Any T, N2/3, M0 or Any T/N, M1

**5.6 “S” CLASSIFICATION ORAL CANCER AETIOLOGY**

- Smoking } Synergistic effect
- Spirits (alcohol) }
- Spices (betel nuts)
- Sharp tooth (repetitive trauma, ill fitting dentures)
- Sun
- Syphilis

Some premalignant conditions: leukoplakia, erythroplakia (90% of primary oral tumours are Squamous cell)

**5.7 CLASSIFICATION OF ORAL CAVITY TUMOUR APPROACHES**

- Transoral
- Mandible sparing
- Mandibulotomy
- Composite resection

**5.8 CLASSIFICATION OF RELATIVE INCIDENCE OF SALIVARY GLAND TUMOURS**

	Major salivary gland		Minor salivary gland	
	Parotid	Submandibular	Sublingual	
Benign	80%	60%	40%	20%
Malignant (Primary)	20%	40%	60%	80%

Secondary

- Kidney, breast, lung, colon



## 5.9 HISTOLOGICAL CLASSIFICATION OF SALIVARY GLAND TUMOURS

### *Benign*

- (a) Epithelial
  - Pleomorphic adenoma, monomorphic adenoma, Warthin's tumour, oncocytoma
- (b) Nonepithelial
  - Haemangioma

### *Malignant*

- (a) Epithelial
  - Mucoepidermoid carcinoma, adenoid cystic, acinic cell, mixed tumour, squamous cell, adenocarcinoma, oncocytic carcinoma
- (b) Nonepithelial
  - Lymphoma

Secondary tumours

- Kidney, breast, lung, colon

## 5.10 FACIAL PALSY

### 5.10.1 Classification of the Aetiology of Facial Palsy

Congenital, e.g. Mobius, Goldenhar

Acquired (pathology at any point along the course of the facial nerve, apply surgical sieve)

### 5.10.2 Classification of Aetiology of Facial Nerve Palsy According to Site of Lesion

Extratemporal – e.g., Trauma, tumour (parotid), iatrogenic injury

Intratemporal – e.g., Acoustic neuroma, otitis media, trauma, cholesteatoma, varicella zoster (Ramsay Hunt)

Central – e.g., Tumour, multiple sclerosis, polio

Other – Bell's palsy

### *Bells Palsy*

- *A temporary, unilateral, idiopathic facial paralysis diagnosed by the exclusion of other known causes of facial nerve damage. It may be virally mediated*

### *Ramsay Hunt Syndrome*

- *Facial palsy associated with a varicella zoster viral infection*

### 5.1.1 GRADING OF SEVERITY OF FACIAL PALSY

House JW, Brackmann DE. Facial nerve grading system. *Otolaryngol Head Neck Surg* 1985;93(2):146–147

This system assesses gross facial function in addition to motion of the forehead, eye and mouth associated with the level of effort required

I. Normal facial function all areas

II. Mild dysfunction

- Gross      – Slight weakness noticeable on gross inspection  
               – Slight synkinesis  
               – At rest normal symmetry and tone
- Motion     – Forehead: moderate to good  
               – Eye: complete with effort  
               – Mouth: slight asymmetry

III. Moderate dysfunction

- Gross      – Obvious but not disfiguring difference between the two sides  
               – Noticeable synkinesis but not severe  
               – At rest: normal symmetry and tone
- Motion     – Forehead: slight/moderate movement  
               – Eye: complete closure with effort  
               – Mouth: slightly weak with maximum effort

IV. Moderately severe dysfunction

- Gross      – Obvious weakness +/- disfiguring asymmetry  
               – At rest, normal symmetry and tone
- Motion     – Forehead: none  
               – Eye: incomplete closure  
               – Mouth: Asymmetric with maximum effort

V. Severe dysfunction, no movement

- Gross      – Barely perceptible motion  
               – Asymmetry at rest
- Motion     – Forehead: none  
               – Eye: incomplete closure  
               – Mouth: slight movement

VI. Total paralysis, no movement

#### 5.1.1.1 Classification of Treatment Options for Facial Palsy

Conservative: Eye lubricant, taping, glasses

Medical: (BOTOX injections to normal side to promote facial symmetry, limited use targeted at specific muscles, e.g., depressor anguli oris)

**Surgical:**

- (a) Static      Tarsorrhaphy  
                   Skin excision  
                   Ectropion correction  
                   Brow/face lift  
                   Gold weights  
                   Slings (fascia lata)
- (b) Dynamic
- Nerve           – Repair  
                   – Graft  
                   – Transfer  
                   – Cross-facial nerve graft
- Muscle           – Local flaps (masseter/temporalis)  
                   – Free flaps (gracilis/pectoralis minor/latissimus  
                           dorsi)  
                   + cross facial nerve graft

**5.12 EAR ABNORMALITIES****5.12.1 Ear Defect Classification**

- Congenital  
 Acquired

**5.12.2 Congenital Auricular Deformity Classification: Tanzer**

Tanzer RC. Reconstructive Plastic surgery. 2nd edn. Philadelphia, PA: WB Saunders; 1977

- Type:   1    Anotia  
           2A   Microtia PLUS External auditory meatus (EAM) atresia  
           2B   Microtia MINUS External auditory meatus atresia  
           3    Middle 1/3 of ear Hypoplasia  
           4A   Constricted Ear  
           4B   Cryptotia  
           4C   Upper 1/3 of ear Hypoplasia  
           5    Prominent ear

**5.12.3 Meurman Classification of Auricular Anomalies**

- Grade I    – Small malformed ear, most components present  
 Grade II   – Vertical remnant of skin and cartilage, external auditory  
                   meatus atresia  
 Grade III  – Almost entirely absent auricle, diminutive skin  
                   and cartilage remnants, misplaced lobule

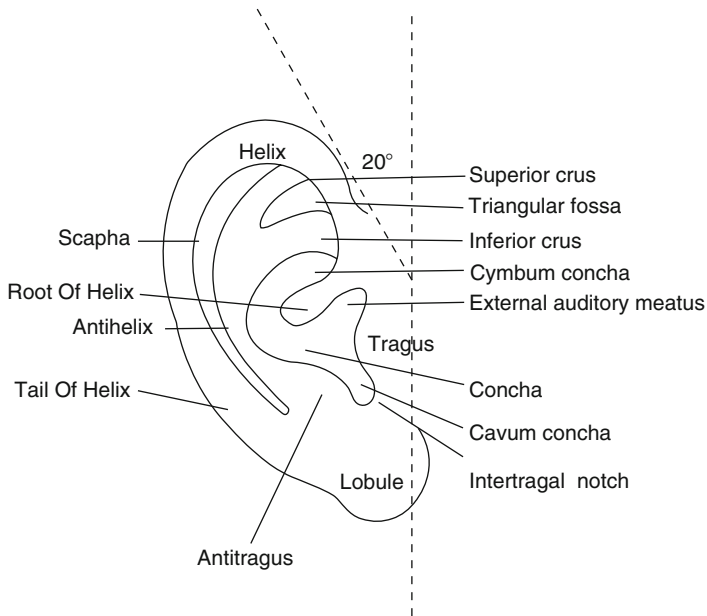


FIGURE 5.3. A normal ear showing the vertical relationship to the skull.

*Anotia:*

- A complete absence of the ear. It may be associated with a syndrome such as *Hemifacial microsomia* (more commonly unilateral) or *Treacher Collins syndrome* (more commonly bilateral)

*Microtia:*

- A malformation of the external and middle ear of varying severity. The ear may range from being small to having disorganized cartilage attached to a variable amount of lobule

*Cryptotia:*

- An absence of the retroauricular sulcus causing part of the ear to appear buried

*Lop/cup ear*

- A deformity of the ear consisting of an overhang of the helix which is short, a flattened antihelix, a wide concha and compressed conchal and scaphoid fossae

*Constricted ear:*

- *An ear with a deficiency of the circumference*

*Prominent ear:*

- *An abnormally protruding ear with an absent antihelix, widened scaphoconchal angle, and deep concha. There is an increased distance between the helical rim and scalp.*

*Stahl ear deformity:*

- *Presence of an extra (third) crus with a flattened antihelix and malformed scaphoid fossa*

*Gibson principle:*

- *Cartilage tends to bend away from the surface on which it is scored*

### 5.13 OCULOPLASTICS (FIG. 5.4)

*Eyelid ptosis:*

- *An abnormal low lying upper eyelid margin with the eye in primary gaze. (The normal lid covers 1–2 mm of the upper limbus, the normal distance between mid pupil and lid margin is 5 mm)*

*Pseudoptosis:*

- *The appearance of ptosis without a true upper lid margin droop*

#### 5.13.1 Classification of Ptosis

Congenital

Acquired:

- Neurogenic
- Myogenic
- Aponeurotic
- Mechanical
- Traumatic
- Pseudoptosis

#### 5.13.2 Classification of Factors Influencing Choice of Surgical Technique of Ptosis Correction

1. Levator function
2. Degree of ptosis
3. Level of opposite lid

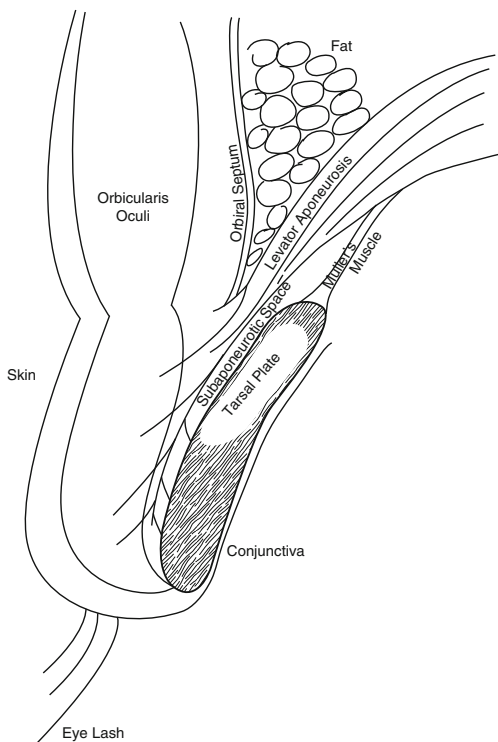


FIGURE 5.4. Upper eyelid in cross section.

### 5.13.3 Classification Degree of Ptosis

Mild	1–2 mm
Moderate	3 mm
Severe	4+ mm

### 5.13.4 Classification of Levator Function

Excellent	12–15 mm
Good	8–12 mm
Fair	5–7 mm
Poor	2–4 mm

*Blepharochalasis:*

- Excess eyelid skin particularly evident in older individuals

*Blepharochalasis Syndrome:*

- Excess skin associated with laxity of the canthi and eyelids associated with recurrent bouts of eyelid oedema and usually presents in young to middle aged females

*Blepharophimosis:*

- Congenitally small palpebral fissures resulting from ptosis, epicanthal folds and telecanthus

*Ocular dystopia:*

- An abnormal position of the globe

*Orbital dystopia:*

- An abnormal position of the bony orbits

**5.13.5 Classification of Orbital Dystopia**

## Vertical:

- The bony orbital cavity is displaced up or down (not on the same horizontal plane)

## Horizontal:

- The bony orbital displacement is medial (hypotelorism) or lateral (hypertelorism)

*Enophthalmos:*

- Posterior displacement of the globe in the bony orbit, associated with a deepened supratarsal fold, pseudoptosis and malpositioned lateral canthus

**5.13.6 Classification of Mechanisms Giving Rise to Enophthalmos**

1. Increase in orbital volume due to a blow out fracture (Orbito-zygomatic complex fracture most commonly)
2. Decrease in orbital content volume due to herniation through a fracture
3. Posterior tethering of orbital contents in the fracture line
4. Late atrophy of intraorbital fat

**5.13.7 Classification of Principles of Reconstruction of Enophthalmos**

Skeletal reconstruction

Soft tissue rearrangement

(Ortiz-Monasterio: Increase volume with rib;

Kawamoto: Craniofacial approach/bone graft)

*Superior orbital fissure syndrome (Rochon-Duvigneaud's Syndrome):*

- Ptosis, proptosis, paralysis of III, IV, VI, anaesthesia VI

*Orbital apex syndrome:*

- Blindness + Superior fissure syndrome

*Annulus of Zinn:*

- Recti origin, fibrous thickening of perisotum, common tendinous ring

*Marcus Gunn Pupil:*

- An afferent pupillary defect whereby light shone into the affected eye causes pupillary dilatation of the affected pupil; light shone into the unaffected eye provokes a normal pupillary consensual response (both pupils constrict)
- Associations: orbital fractures, globe rupture, lens dislocation, vitreous haemorrhage

### 5.13.8 Classification of Anophthalmia

---

Primary

- Complete absence of ocular tissue within the orbit

Secondary

- Arrest of development at various stages of growth of the optic vesicle

Importance

- Development of the orbit depends on presence of a normal sized eye:
  - Problems
    1. Absent seeing eye
    2. Disfigurement: Orbit, lid (asymmetry and hemifacial hypoplasia)
- 

*Microphthalmia:*

- A very small rudimentary globe within the orbital soft tissue

*Epicanthic fold:*

- A fold of skin overhanging the medial canthus

*Dacrocystitis:*

- Infection of the lacrimal sac which may be congenital, acute or chronic



*Exophthalmos:*

- *Excess orbital contents within a normal bony orbit*

*Exorbitism:*

- *Normal orbital contents within a reduced orbital volume*

*Malignant exorbitism:*

- *Intraorbital swelling, conjunctivitis, inability to close the eyelids*

### 5.13.9 Classification of the Aetiology of Exorbitism

Congenital:

- Skeletal (fibrous dysplasia, craniofacial abnormalities – e.g., Crouzons)

Acquired:

- Trauma (bony fragment), Tumour (osteoma, meningioma, mucocoele)

### 5.13.10 Classification of Eyelid Malposition

Jelks GW, Smith BC. Reconstruction of the eyelids and associated structures. In McCarthy JG, ed. Plastic Surgery. Philadelphia WB Saunders; 1990:1671

Entropion: cicatricial, involutinal

Ectropion: cicatricial, involutinal

### 5.13.11 Classification of Lower Lid Eversion

In Plastic Surgery. Ed. Mathes, Philadelphia WB Saunders, Elsevier; 2006:842

- 
- |     |  |
|-----|--|
| I   | Minimal lid margin eversion                |
| II  | Moderate lid margin eversion, scleral show |
| III | Lid margin eversion, lash rotation         |
| IV  | Lid margin eversion, ectropion             |
- 

*Ectropion:*

- *Eversion of lower eyelid margin away from the globe leading to scleral show and exposure keratitis*

### 5.13.12 Classification Aetiology of Ectropion

Congenital: Rare vertical deficiency of the anterior lamella  
Paralytic-associated with Downs, Blepharophimosis, Microphthalmia, Ichthyosis

Acquired:

Cicatricial: Deficiency of the anterior lamella

Post trauma, burn, blepharoplasty, post surgery for orbital fracture, T cell lymphoma

Involucional: Laxity of lid (tarsus, canthal structures, lid retractors)

Mechanical

Paralytic

### 5.13.13 Classification of Ectropion Treatment Techniques

Medial laxity + Medial canthal stability = Medial Wedge

Medial laxity + Medial canthal Instability = Medial canthopexy

Lateral laxity + Lateral canthal stability = Kuhnt-Szymanowski

Lateral laxity + Lateral canthal Instability = Lateral canthal sling

*Kuhnt-Szymanowski procedure:*

- An operation to correct ectropion involving a lateral wedge resection of the posterior lamella of the lower lid

*Canthal Sling/Canthopexy:*

- A procedure to tighten the lateral part of the lower lid by tightening the lower limb of the lateral canthal tendon and securing to the lateral orbital rim at a level equal to the upper edge of the pupil

*Lateral cantholysis:*

- Division of the lower limb of the lateral canthal tendon which enables mobilization and direct closure of defect 1/4 to 1/3 the horizontal width of the eyelid

*Entropion:*

- Inversion of eyelid which may give corneal irritation from in turned lashes

### 5.13.14 Classification of Aetiology of Entropion

Congenital

Involucional

Cicatricial

Acute spastic (ocular irritation resulting in orbicularis oculi overwhelming lid retractors)

Post ptosis correction: removal of too much tarsal plate

*Evisceration:*

- Removal of contents of globe leaving the sclera intact

*Enucleation:*

- Removal of the globe

*Exenteration:*

- Removal of contents of orbit and eyelids

*Schirmer's Test:*

- A test evaluating tear secretion and therefore assessing the integrity of the greater petrosal nerve  
(A strip of filter paper (5 × 35 mm) is placed in the lower conjunctiva for 5 min < 10 mm wetting is abnormal).

*Schirmer's Test 2:*

- Involves local anaesthetic administration to block reflex tear secretion in addition to above

*Hypertelorism:*

- An increase in the distance between the bony orbits

**5.13.15 Tessier's Classification of Hypertelorism**

Type 1 30–34 mm interorbital distance

Type 2 35–39 mm

Type 3 > 40 mm

*Hypotelorism:*

- A shorter than normal distance between the bony orbits

*Telecanthus:*

- A widened distance between the canthi

*Pseudotelecanthus:*

- An apparently widened intercanthal distance between the canthi caused by epicanthal folds or a wide nasal bridge

**5.13.16 Approach to Reconstruction of Specific Facial Defects**

Classification of eyelid defects

Upper lid

Lower lid

Anterior lamella: skin, orbicularis oculi  
 Posterior lamella: tarsal plate, conjunctiva

Partial thickness  
 Full thickness

### 5.13.17 Classification of Eyelid Reconstructive Options

Full thickness defects	Lower lid
<1/4	Direct closure of wedge or pentagonal excision
1/4 to 1/3	Wedge/pentagon + lateral cantholysis
>1/3	<u>Anterior lamella:</u> Skin graft Flap – cheek advancement (McGregor includes Z plasty) or (Mustarde), Tripier, superiorly based cheek flap, lateral nose flap, glabella flap  <u>Posterior lamella:</u> Septomucosal graft via lateral rhinotomy incision Other options: Hughes tarsoconjunctival flap

(Lower lid may be used to reconstruct the upper lid but not usually the other way around)

Full thickness defects	Upper lid
<1/4	Direct closure of wedge or pentagonal excision
<1/3	Wedge/pentagon + lateral cantholysis
>1/3	Central cutler-beard flap Mustarde lower lid switch + reconstruction of lower lid

See Fig. 5.5

### 5.13.18 Classification of Approach to Eyebrow Reconstruction

Hair bearing FTSG  
 Pinch grafts  
 Pedicled flap on superficial temporal vessels

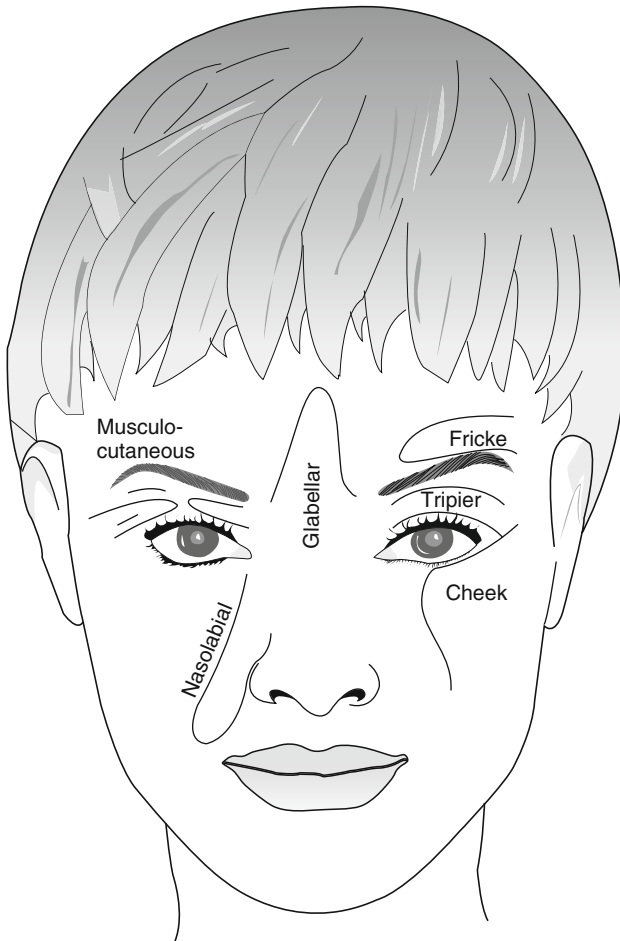


FIGURE 5.5. Local flap options for skin cover of eyelid defects.

## 5.14 NASAL RECONSTRUCTION

### 5.14.1 Classification of Type of Nasal Defect

Total: Involves part or all of the nasal bones

Subtotal: Loss of cartilaginous portion of the nose

### 5.14.2 Classification of Principles of Nasal Reconstruction

1. Lining: Barton's five procedures:

- Turn in nasal flap

- Infolded extra-nasal flap
  - Pre-laminated (SSG) forehead flap
  - Composite nasal septal flap
  - Lining advancement
2. Support:
    - Midline: L strut, hinged septal flap, septal pivot flap, cantilever bone graft
    - Lateral
  3. Cover: Skin graft
    - Local flap: Banner flap, bilobed flap, Sliding dorsal flap
    - Regional flaps: Naso-labial, cheek advancement, forehead flap
    - Free: Radial forearm, auricular

(Historically tube pedicles)

Composite graft:

Provides lining, support and cover for alar defects (defect size limited to 1.5 cm)

## 5.15 LIP RECONSTRUCTION (FIGS. 5.6 AND 5.7)

### 5.15.1 Classification of Principles of Lip Reconstruction

- Align the vermilion
- Approximate the muscle to maintain oral competence

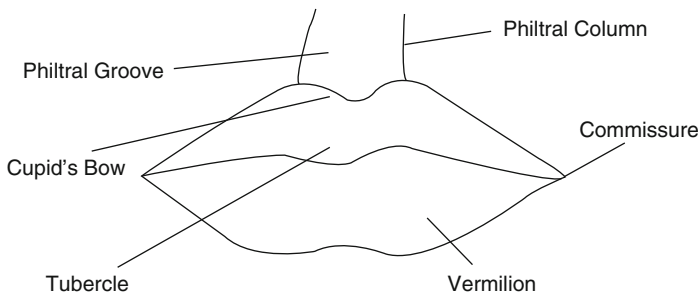
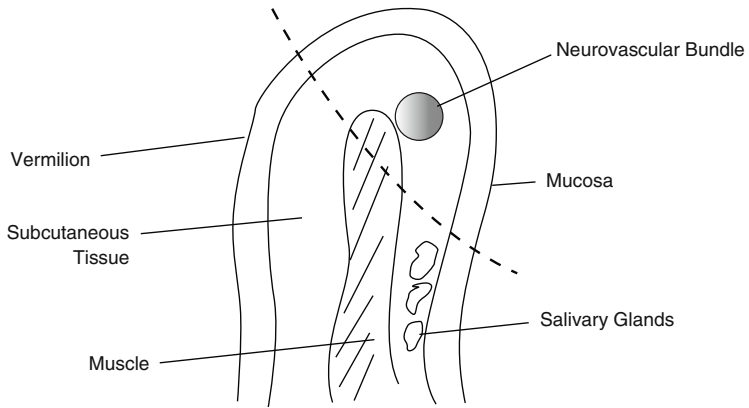


FIGURE 5.6. Anatomy of the lip.



**FIGURE 5.7.** The lower lip in cross section illustrating the position of the neurovascular bundle.

### 5.15.2 Classification of Reconstructive Options for Full Thickness Lip Defects According to Size of Tissue Loss

<30%

Direct closure

(Upper lip 25% unless elderly patient with tissue laxity)

30–50%

Abbe flap (Fig. 5.8)

Estlander flap (used for commissure defects)

Johansen step advancement

Karapandzic flap

> 50%

Webster modification of Bernard flap

Gillies fan flap

McGregor flap

Mucosal defect

V–Y mucosal advancement

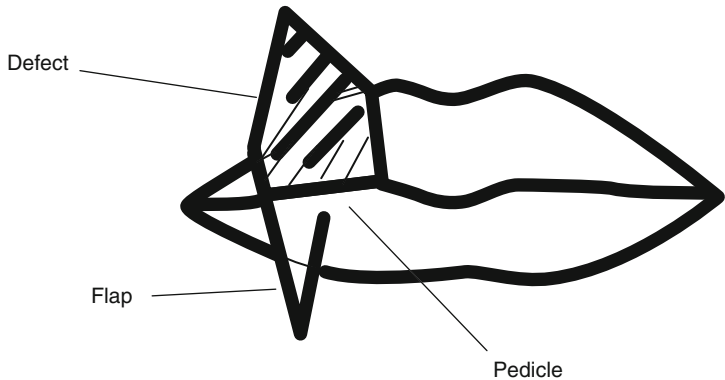


FIGURE 5.8. The Abbe flap.

## 5.16 CHEEK RECONSTRUCTION

### 5.16.1 Classification of the Cheek Aesthetic Unit and Overlapping Zones

- Zone 1: Suborbital – subdivisions A, B, C
- Zone 2: Preauricular
- Zone 3: Buccomandibular

### 5.16.2 Classification of Reconstructive Options for Cheek Defects

Direct closure

SSG

FTSG

Local flaps: Rhomboid, transposition

- Regional flaps: – Cervicofacial inferomedially or inferolaterally based
- Neck flap
  - Deltopectoral
  - Trapezius myocutaneous
  - Pectoralis major

Tissue expansion

Free flap – Radial forearm, TFL, Parascapular flaps

### 5.16.3 Classification of Layers of the Scalp

Skin

Connective tissue (fat and fibrous tissue)

Aponeurosis (Galea: a tough fibrous layer which runs from frontalis to occipitalis)

Loose areolar tissue

Pericranium



### 5.16.4 Classification of Scalp Reconstructive Options

Direct closure

Skin graft (onto vascularized soft tissue or after removal of outer table of bone)

Local flap (+/- scoring of galea)

Pericranial flap + skin graft

Tissue expansion

Free flap

### 5.17 MANDIBULAR DEFECT CLASSIFICATION

Bone loss is described in terms of the following:

C – Central segment, lies between the two canine teeth

L – Lateral segments (condyle not included)

H – Hemimandible segments (includes condyle)

*Andy Gump deformity:*

- *The deformity resulting from resection of the anterior mandible giving rise to loss of height, width and projection of the lower third of the face (Fig. 5.9)*



**FIGURE 5.9.** The Andy Gump deformity (from *Laryngotracheal reconstruction*, p. 279. fig. 8.16 Delaere, Springer 2004).

### 5.17.1 Classification of Mandibular Reconstructive Options

Non-vascularized bone graft:

Prosthetic: Metal plates, Dacron trays packed with cancellous bone

Pedicled flaps: Trapezius, Pectoralis – osteomyocutaneous flaps

Free flaps: Fibula, Ilium, Scapula, Radius

### 5.17.2 Classification of Chin Deformities

Macrogenia

Microgenia

Combined

Assymetry

Pseudomacrogenia

Pseudomicrogenia

Witch's chin deformity

*Witch's chin deformity:*

– *Characteristic appearance of the chin resulting from soft tissue ptosis*

# Chapter 6

## Facial Fractures

---

### 6.1 CLASSIFICATION OF FACIAL FRACTURES

Open or closed

#### 6.1.1 Anatomical Classification of Facial Fractures

Upper face – Frontal bone, Frontal sinus, Supraorbital  
Orbit – Rim: Supraorbital, Zygomatic, Nasoethmoidal  
– Internal

Maxilla

Nose

Mandible

### 6.2 LE FORT CLASSIFICATION OF MAXILLARY FRACTURES (FIG. 6.1)

Le Fort R. Experimental study of fractures of the upper jaw: Part I and II. Rev Chir Paris 1901;23:208

Translated by P Tessier and reprinted in Plast Reconstr Surg 1972;50:497

Le Fort R. Experimental study of fractures of the upper jaw: Part III. Rev Chir Paris 1901;23:479

Translated by P Tessier and reprinted in Plast Reconstr Surg 1972;50:600

*Le Fort I (Geurin fracture):*

- *A transverse fracture line through the maxilla separating the upper mid face from the maxillary alveolus. The lower segment may be referred to as a “floating palate” and comprises of the alveolus, palate and pterygoid plates*

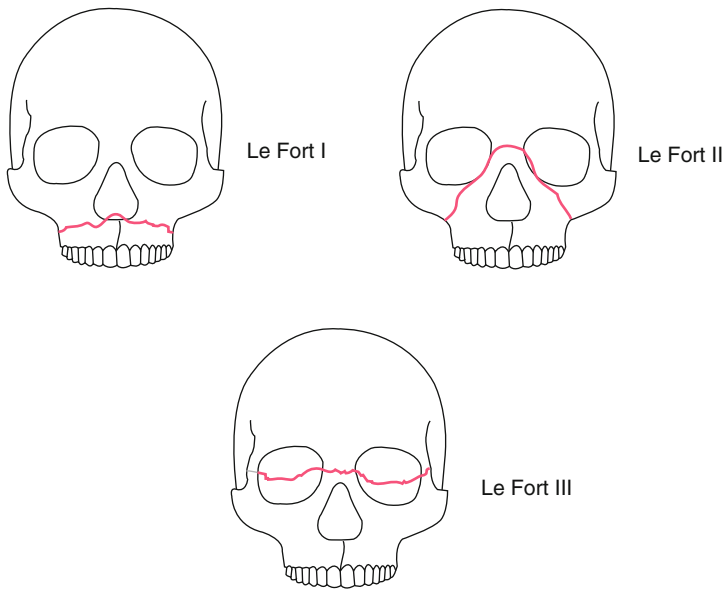


FIGURE 6.1. Le fort fracture lines.

*Le Fort II (Pyramidal fracture):*

- A pyramidal shaped fracture separating the maxillary segment with accompanying dentition from the orbits and upper craniofacial skeleton

*Le Fort III (Craniofacial dysjunction):*

- Separation of the maxilla at the level of the upper part of the zygoma, orbital floor and nasoethmoid region from the remainder of the craniofacial skeleton (separation of the facial from the cranial bones)

### 6.2.1 Classification of Maxillary Buttresses

Vertical buttresses:

- Nasomaxillary
- Zygomaticomaxillary
- Pterygopalatine

Horizontal buttresses:

- Frontal bar
- Infra-orbital rims
- Zygomatic arch
- Mandibular body

### 6.3 STRANC CLASSIFICATION OF NASAL FRACTURES

Stranc MF, Robertson GA. A classification of injuries of the nasal skeleton. *Annals Plast Surg.* 1978;2:468

- Type I Frontal impact, anterior part of the nasal pyramid and septum involved
- Type II More comminution of the nasal pyramid and septum
- Type III Frontal processes of maxilla involved (effectively naso-orbito-ethmoid)

#### 6.3.1 Knight and North Classification of Zygomatic Fractures

Knight JS, North JF. The classification of malar fractures: an analysis of displacement as a guide to treatment. *Br J Plast Surg* 1961;13:325

- Group 1 No significant displacement
- 2 Isolated zygomatic arch fracture
- 3 Unrotated body fracture
- 4 Medially rotated body fracture
- 5 Laterally rotated body fracture
- 6 Complex fracture

### 6.4 ORBITAL FRACTURES (ALSO SEE OCULOPLASTICS SECTION IN CHAPTER 5)

Blow – out

Blow – in

*Blow-out orbital fracture:*

- *As a result of force to the rim or globe, pressure causes fracture of the medial wall and floor of the orbit and is often accompanied by herniation of contents (inferior rectus, inferior oblique, and fat) through a trapdoor. It may give rise to enophthalmos and diplopia*

*Forced duction test:*

- *A test for entrapment of orbital contents. The inferior rectus is grasped and the globe rotated in all four directions noting any restriction*

#### 6.4.1 Classification of Surgical Approaches to the Orbital Floor

Lower lid:

- Subciliary
- Mid-lid

Transconjunctival

Bicoronal

Intraoral

Medial canthal

### 6.4.2 Classification of Frontal Sinus Fractures

- Anterior wall fracture:
  - undisplaced
  - displaced, no nasofrontal duct involvement
  - displaced, with nasofrontal duct involvement
- Anterior wall fracture displaced+posterior wall fracture minimal displacement (<thickness of the bone). Dural damage.
- Displaced fracture of anterior and posterior walls. Dural damage.+/- nasofrontal duct involvement

## 6.5 MANDIBULAR FRACTURES

Open (penetration of skin, tooth socket, mucosa)	Closed
Displaced	Non displaced
Complete	Incomplete
Comminuted	Non comminuted

### 6.5.1 Classification of Mandibular Fractures According to Dentition

Dentulous  
Partially dentulous  
Edentulous

### 6.5.2 Classification of Mandibular Fractures According to Mandibular Anatomy

Condyle/Condylar neck	36%
Ramus	3%
Coronoid	2%
Angle	20%
Body	21%
Symphysis	14%
Alveolus	3%
Midline	<1%

### 6.5.3 Classification of Mandibular Fracture According to Fracture Pattern

Oblique  
Transverse  
Comminuted  
Greenstick

### 6.5.4 Classification of Mandibular Fractures According to Stability (Fig. 6.2)

Stable  
Unstable

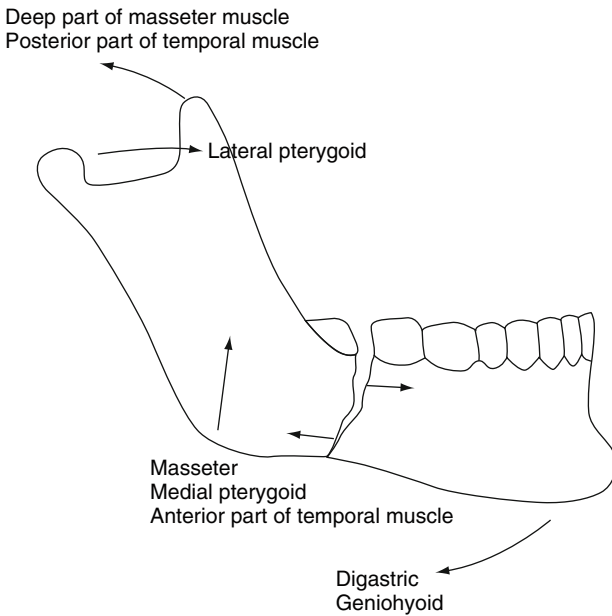


FIGURE 6.2. Forces acting on the fractured mandible.

### 6.5.5 Kazanjian and Converse Classification of Mandibular Fractures

- Class I – Teeth on both bony fragments adjacent to fracture
- Class II – Teeth on one bony fragment adjacent to fracture
- Class III – Teeth on neither bony fragment adjacent to fracture

### 6.6 CLASSIFICATION OF PALATAL FRACTURES

Hendrickson M, Clark N, Manson PN et al. Palatal fractures: classification, patterns and treatment with rigid internal fixation. *Plast Reconstr Surg* 1998;101:319

- I Anterior and posterolateral alveolar
- II Sagittal
- III Para-sagittal
- IV Para-alveolar
- V Complex
- VI Transverse

*Occlusion:*

- *The relationship of the upper and lower teeth*

## 6.7 ANGLES CLASSIFICATION OF MALOCCLUSION

### Edward Angle

Three classes of malocclusion based on the mesiodistal relationship of the permanent molars on eruption and locking

Class 1: Normal molar occlusion

Class 2: Retro occlusion or mandibular deficiency – upper molars are not in mesiobuccal groove but are anterior to it (over bite)

Class 3: Prognathic occlusion or maxillary deficiency – the lower front teeth are more prominent than the upper front teeth (under bite)

## 6.8 THE “P SYSTEM” FOR EXAMINATION OF THE HEAD AND NECK

A systematic and comprehensive method of examination of the traumatised head and neck as illustrated in the figure below is depicted by the letter “P”

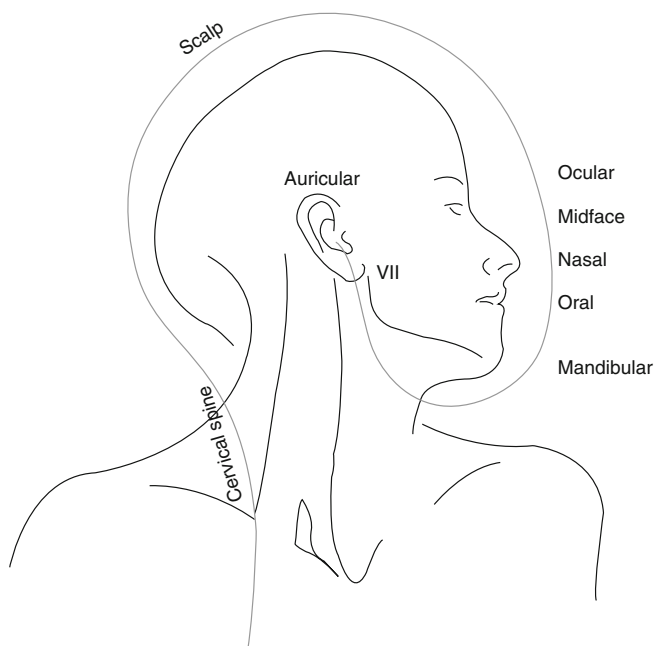


FIGURE 6.3. The “P System” for examination of the head and neck.



## 6.9 GLASGOW COMA SCALE

Teasdale G, Jennett B. Assessment of coma and impaired consciousness. *Lancet* 1974;81–84

*Eye opening:*

- 4 Spontaneous
- 3 To voice
- 2 To pain
- 1 None

*Best verbal response:*

- 5 Oriented
- 4 Confused
- 3 Incoherent words
- 2 Incomprehensible sounds
- 1 None

*Best motor response:*

- 6 Obeys commands
- 5 Localizes to pain
- 4 Withdraws to pain
- 3 Decorticate posture (flexes to pain)
- 2 Decerebrate posture (extends to pain)
- 1 None

### 6.9.1 Classification of Brain Injury According to Glasgow Coma Score

It is the components and not just the total score that are important when assessing brain injury

Normal	15
Mild	13 or more
Moderate	9–12
Severe	8 or less

# Chapter 7

## Breast

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### **7.1 CLASSIFICATION OF CAPSULAR CONTRACTURE FOLLOWING BREAST AUGMENTATION**

Baker. Aesthetic Breast Symposium. Scottsdale, Arizona; 1975

Baker DE, Schultz. The theory of natural capsular contracture around breast implants and how to prevent it. *Aesthetic Plast Surg* 1980;4:357

- I Natural breast appearance (Soft)
- II Minimal contracture (Palpable implant)
- III Moderate contracture (Palpable and visible implant)
- IV Severe contracture (Palpable, visible, painful implant)

### **7.2 MODIFIED BAKER CLASSIFICATION IN POST BREAST RECONSTRUCTION PATIENTS**

Spear SL, Baker JL Jr. Classification of capsular contracture after prosthetic breast reconstruction. *Plast Reconstr Surg* 1995;96:1119

- IA Soft
- IB Soft but implant visible
- II Implant with mild firmness
- III Implant with moderate firmness
- IV Excessively firm and symptomatic breast

### **7.3 CLASSIFICATION OF APPROACH TO TREATMENT OF CAPSULAR CONTRACTURE**

Capsulotomy – (closed: historically but not current practice)  
– open

Capsulectomy

Implant removal, +/- exchange

### 7.3.1 Classification of Breast Implants

Implant shape	– Round, anatomically shaped
Implant shell	– Smooth, textured
Implant content	– Liquid silicone gel, cohesive silicone gel, saline, hydrogel, triglyceride hyaluronic acid
Incision	– Inframammary, axillary, periareolar, umbilical
Position	– Subglandular, subpectoral, submuscular, dual plane

### 7.3.2 Tebbets “High Five” Classification

Tebbetts JB, Adams WP. Five critical decisions in breast augmentation using five measurements in 5 minutes: the high five decision support process. *PRS* 2005;116(7):2005–2016

1. Coverage (determines pocket location)
2. Implant volume
3. Implant dimensions, Type, Manufacturer
4. Inframammary fold location
5. Incision location

### 7.3.3 Scales Criteria for a Successful Implant

Scales JT. Discussion on metals and synthetic materials in relation to tissue; tissue reactions to synthetic materials. *Proc R Soc Med* 1953;46:647

Impervious to tissue fluid  
 Chemically inert  
 Non-irritant  
 Non-carcinogenic  
 Non-allergenic  
 Resistant to mechanical strain  
 Capable of being fabricated to the desired form

*Linguini sign:*

- A sign on MRI of a linear focus of decreased intensity within a breast implant indicating a collapsed outer shell as a result of rupture

## 7.4 CLASSIFICATION OF BREAST PTOSIS

Regnault P. Breast ptosis. Definition and treatment. *Clin Plast Surg* 1976;3:193

First degree	– Nipple is at the level of the inframammary fold
Second degree	– Nipple lies below the inframammary fold
Third degree	– Nipple is positioned at the most dependent part of the breast below the inframammary fold

See [Fig. 7.1](#)

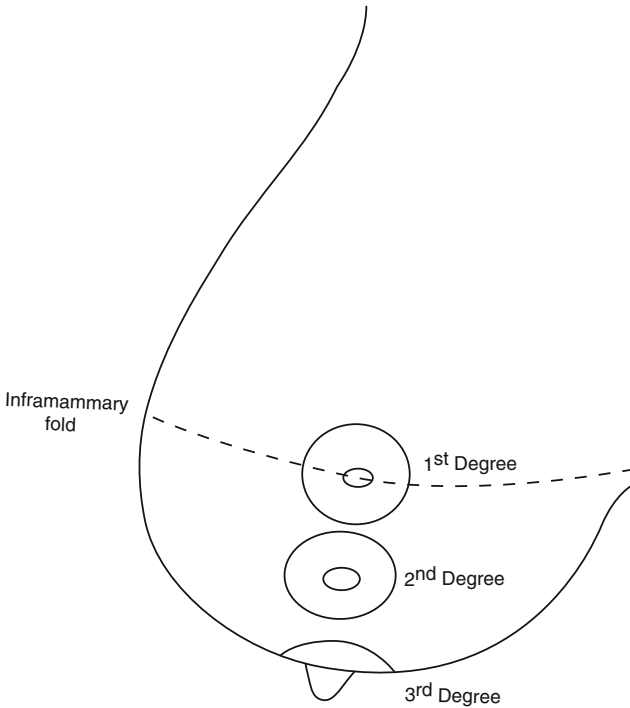


FIGURE 7.1. Regnault's classification of breast ptosis.

*Pseudoptosis:*

- Majority of breast mound lies below the inframammary fold although the nipple areola complex lies at the level of or above it

**7.4.1 Brink's Classification of Breast Ptosis**

Brink RR. Management of true ptosis of the breast. *Plast Reconstr Surg* 1993;91:657

Glandular ptosis

True ptosis

Pseudoptosis

Parenchymal maldistribution

*Mastopexy:*

- A surgical procedure to lift the breast by excising skin and tightening tissues to reshape and support the new breast contour

*Breast reduction:*

- A surgical procedure to reduce breast volume and symptoms of hypertrophy whilst attaining a smaller aesthetically shaped breast mound

## 7.5 CLASSIFICATION OF BREAST REDUCTION TECHNIQUES

*Skin pattern:*

(Wise)	Keyhole
(Regnault)	B shape
(Lassus, Lejour)	Vertical scar
(Marchac)	Short lateral scars
(Benelli)	Periareolar

*Pedicle:*

(Courtiss, Ribiero)	Inferior
(Pitanguy, Weiner)	Superior
(Biesenberger, Hester)	Central mound
(Orlando)	Supero-medial
(Skoog)	Supero-lateral
(Strombeck)	Horizontal bipedicle
(McKissock)	Vertical bipedicle
(Breast amputation and free nipple graft)	

*Closure:*

### 7.5.1 Classification of Size of Reduction

Small to moderate	150–500 g per breast
Major	500–1,500 g per breast
Massive	>1,500 g per breast

*Gynaecomastia:*

- Over development of the male breast as a result of an increase in oestrogen or decrease in testosterone or receptors

## 7.6 SIMON'S CLASSIFICATION OF GYNAECOMASTIA BASED ON SURGICAL REQUIREMENT

Grade 1	– Small enlargement (subareolar button), no excess skin
Grade 2a	– Moderate enlargement, no excess skin
Grade 2b	– Moderate enlargement, excess skin
Grade 3	– Marked enlargement, excess skin

## 7.7 WEBSTER'S CLASSIFICATION OF GYNAECOMASTIA

Glandular  
Fatty glandular  
Fatty

## 7.8 HISTOLOGICAL CLASSIFICATION OF GYNAECOMASTIA

Florid

Fibrous

Combination

## 7.9 LETTERMAN SCHUSTER CLASSIFICATION OF GYNAECOMASTIA

Based on the type of surgical correction

1. Intra-areolar incision, no excess skin
2. Intra-areolar incision, mild skin redundancy, corrected with skin excision through superior periareolar scar
3. Excision of chest skin and shifting nipple

## 7.10 ROHRICH CLASSIFICATION OF GYNAECOMASTIA

- I Minimal hypertrophy (<250 g breast tissue) without ptosis
- II Moderate hypertrophy (250–500 g breast tissue) without ptosis
- III Severe hypertrophy (>500 g breast tissue) with Grade I ptosis
- IV Severe hypertrophy with Grade II or III ptosis

## 7.11 CLASSIFICATION OF AETIOLOGY OF GYNAECOMASTIA: 3 “PS”

*Physiological*: neonate, puberty, old age (increased oestrogens or decreased androgens and or receptors)

*Pharmaceutical*: digoxin, spironolactone, cimetidine, diazepam, oestrogens, reserpine, theophylline, marijuana, heroin

*Pathological*: tumour (testicular, pituitary, lung, adrenal), hypogonadism, thyroid disease, liver disease (cirrhosis), malnutrition, Klinefelters syndrome (20–60× increase in breast cancer)

## 7.12 TUBEROUS BREAST DEFORMITY (ALSO KNOWN AS TUBULAR/CONSTRICTED BREAST DEFORMITY)

- A developmental disorder of the breast in which the fundamental anatomical feature is a herniation of breast tissue through a constricting fascial ring beneath the areola

## FEATURES OF A TUBEROUS BREAST

“ABCDEF” Classification

O’Brien CM

Areolar	– Stretched
Base	– Deficient
Complex (Nipple areola complex)	– Herniated, constrictions in breast parenchyma
Difficult deformity to correct	
Elongated and thin breast	
Fold (Inframammary fold)	– Tight and elevated

### 7.12.1 Grolleau Classification of Tuberous Breast Deformity 1996

- I Hypoplasia of lower medial quadrant
- II Hypoplasia of both lower quadrants
- III Hypoplasia of all four quadrants

### 7.12.2 Von Heimberg Classification of Tuberous Breast Deformity 2000

Heimberg et al. The tuberous breast deformity: classification and treatment BJPS 1996;49:339–345

Heimberg et al. Refined version of the tuberous breast classification. PRS 2000;105:2269–2270

- Type 1 Hypoplasia of inferior medial quadrant
- Type 2 Hypoplasia of both inferior quadrants, sufficient subareolar skin
- Type 3 Hypoplasia of both lower quadrants and subareolar skin shortage
- Type 4 Severely constricted breast base

*Northwood index:*

- *An index used to define a tuberous breast deformity*  
 $\text{Ratio} = \text{nipple herniation} / \text{areola diameter}$

## 7.13 BREAST CARCINOMA: WORLD HEALTH ORGANIZATION (WHO) CLASSIFICATION

Non-invasive:

- Ductal carcinoma in situ (DCIS)
- Lobular carcinoma in situ (LCIS)

Invasive:

- Invasive ductal carcinoma (75% of invasive tumours)
- Invasive lobular carcinoma (10% of invasive tumours)
- Medullary carcinoma
- Tubular carcinoma
- Papillary carcinoma
- Mucinous carcinoma
- Adenoid cystic carcinoma

## 7.14 VAN NUYS PROGNOSTIC INDEX FOR DCIS

Score	1	2	3
Size	<15 mm	15–40 mm	>40 mm
Margins	>10 mm	1–9 mm	<1 mm
Pathology	Non high grade – Necrosis	Non high grade + Necrosis	High grade + Necrosis

## 7.15 CLASSIFICATION OF RELATIVE RISK FACTORS FOR BREAST CANCER IN WOMEN

Hulka BS, Stark AT. Breast cancer cause and prevention. *Lancet* 1995;197:33

Relative risk >4	Inherited mutations (BRCA 1, BRCA 2) Past medical history of breast cancer Age Family history: two or more first degree relatives with early onset breast cancer
Relative risk 2.1–4	One first degree relative with breast cancer High dose irradiation of the chest Benign breast disease: Atypical hyperplasia, nodular densities (>75% breast volume) Oophorectomy <40 years
Relative risk 1.1–2.0	Reproductive history: early menarche, late menopause, first child after age 30 years Postmenopausal obesity Has never breast fed a child Cancer of the endometrium, ovary, colon High socio-economic status

## 7.16 AMERICAN JOINT COMMITTEE ON CANCER (AJCC) STAGING SYSTEM INCORPORATES CLINICAL AND PATHOLOGICAL FACTORS INTO TUMOUR CLASSIFICATION

Simplified to a summary of TNM

Primary tumour (T):

Tx	Unable to assess
T0	No primary tumour evident
Tis	In situ or Pagets disease of nipple
T1	<2 cm
T2	2–5 cm
T3	>5 cm
T4	Any size, involves chest wall or skin



Regional lymph nodes (N):

*Clinical classification:*

- Nx Unable to assess regional nodes
- N0 No regional nodes involved
- N1 Ipsilateral nodes involved
- N2 Ipsilateral nodes fixed to each other or another structure
- N3 Ipsilateral internal mammary nodes involved

*Pathological classification* (beyond scope of this text)

Metastasis (M)

- Mx Unable to assess
- M0 No distant metastases
- M1 Distant metastases

## 7.17 AMERICAN COLLEGE OF RADIOLOGY BREAST IMAGING REPORTING AND DATA SYSTEM

### 7.17.1 “BI-RADS” Classification

- 0 Incomplete assessment, needs additional imaging evaluation
- 1 Negative, routine mammogram in 12 months
- 2 Benign, routine mammogram in 12 months
- 3 Probably benign, short interval follow-up (6 months)
- 4 Suspicious abnormality, consider biopsy
- 5 Highly suggestive of malignancy, take appropriate action

*Eklund manoeuvre:*

- *Displacement of a patient’s implant to allow optimum mammographic screening*

## 7.18 STAGING OF BREAST CANCER

- I, II – Early breast cancer
- III – Locally advanced breast cancer
- IV – Metastatic disease

### 7.18.1 5-Year Relative Survival Rate in Breast Cancer (Classified by Stage)

- 0 100%
- I 98%
- IIA 88%
- IIB 76%
- IIIA 56%
- IIIB 49%
- IV 16%

## 7.19 CLASSIFICATION OF TYPES OF BREAST SURGERY FOR BREAST CANCER

### *Lumpectomy:*

- Removal of the breast tumour with a margin of surrounding tissue

### *Quadrantectomy:*

- Removal of the breast tumour in conjunction with the entire surrounding breast quadrant

### *Total (simple) mastectomy:*

- Excision of the breast including an ellipse of skin that contains the nipple–areola complex. The resultant defect may be closed primarily

### *Subcutaneous mastectomy:*

- Resection of the breast through an inframammary or axillary incision leaving the skin and nipple–areola complex intact

### *Skin sparing mastectomy:*

- Removal of the breast including the nipple–areola complex whilst retaining the skin

### *Prophylactic mastectomy:*

- Removal of the breast prior to the development of breast cancer
- Three types:
  - Total (simple) mastectomy
  - Subcutaneous mastectomy
  - Skin-sparing mastectomy

### *Modified radical mastectomy:*

- Removal of the breast, nipple–areola complex and ipsilateral axillary lymph nodes

### *Radical mastectomy (Halsted procedure):*

- Removal of the breast, nipple areola complex, ipsilateral lymph nodes, pectoralis major and minor (now obsolete)

### 7.19.1 Classification of Levels of Axillary Dissection (Fig. 7.2)

The levels are classified according to the relationship of the lymphatic tissue below the axillary vein to the pectoralis minor muscle

- |           |  |
|-----------|--|
| Level I   | Lymphatic tissue below and lateral to Pectoralis Minor |
| Level II  | Lymphatic tissue behind Pectoralis Minor               |
| Level III | Lymphatic tissue above and medial to Pectoralis Minor  |

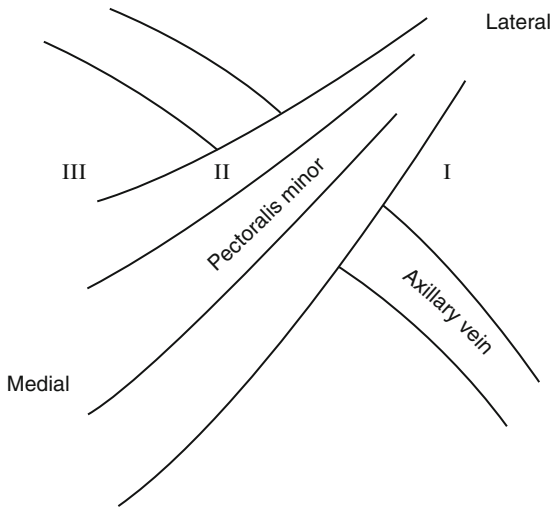


FIGURE 7.2. Levels of axillary dissection.

## 7.20 CLASSIFICATION OF RECONSTRUCTIVE OPTIONS FOLLOWING MASTECTOMY

Immediate

Delayed

Prosthesis

Autologous tissue: Oncoplastic or Flap (pedicled or free)

Implant/Expander

Combination

### 7.20.1 Classification of Factors Affecting Choice of Breast Reconstruction

Type of mastectomy

Co-morbidity

Body habitus

Smoking

Contralateral breast

Radiotherapy/Chemotherapy

Patient choice

### 7.20.2 Classification of Breast Deformities After Reconstruction: Mathes

In Plastic Surgery, Ed. Mathes Chapter 150, p. 1090. Saunders Elsevier; 2006

Envelope  
Mound  
Position  
Scar  
Symmetry

## 7.21 CLASSIFICATION OF RESPONSE TO NEOADJUVANT CHEMOTHERAPY

Singletary SE. Neoadjuvant chemotherapy in the treatment of stage II and III breast cancer. *Am J Surg* 2001;182:341–346

Response of tumour is compared to pre-treatment size

Complete	No measurable tumour
Partial	Greater or equal to 50% reduction
Minor	Greater or equal to 25% reduction but less than 50% reduction
No change	Less than 25% decrease or increase in tumour size
Progression	Greater than 25% increase in tumour size

*Oncoplastic breast surgery:*

– *A combination of breast conserving therapy in conjunction with plastic surgery techniques to immediately remodel the breast following lumpectomy*

## 7.22 CLASSIFICATION OF TYPE OF DEFORMITY FOLLOWING ONCOPLASTIC TREATMENT FOR BREAST CANCER

Clough, Thomas, Fitoussi et al. Cosmetic sequelae of conservative treatment of breast cancer. *Ann Plast Surg* 1998;41:471

Type I:

Overall shape of treated breast maintained

Assymetry in shape and volume when compared to contralateral side

Type II:

Obvious breast deformity

Asymmetry in volume

Correctable without resorting to mastectomy using local tissue and symmetrization of the contralateral breast

Type III:

Major breast deformity

Mastectomy and reconstruction only reasonable option to restore breast shape and contour

### 7.23 CLASSIFICATION OF GOALS OF NIPPLE RECONSTRUCTION

Mathes SJ, Ueno CM. Reconstruction of the nipple-areola Complex. In Plastic Surgery Ed. Mathes. Chap. 139, p. 792. Elsevier Saunders; 2006

Position

Symmetry

Colour

Size

Projection

Sensitivity

### 7.24 CLASSIFICATION OF TECHNIQUES OF NIPPLE-AREOLAR COMPLEX RECONSTRUCTION

Mound	Areola
Nipple sharing	Tattoo
Local flap	Full thickness skin graft

Alternatively: Prosthesis

# Chapter 8

## Trunk

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### 8.1 CLASSIFICATION OF CONDITIONS THAT MAY PRESENT FOR CHEST WALL RECONSTRUCTION

Congenital: Poland's syndrome, pectus excavatum, pectus carinatum, sternal cleft, myelomeningoceles (posteriorly)

Acquired: Sternal dehiscence, trauma, tumour, infection (osteomyelitis), radiation ulcers

#### 8.1.1 Willital's Classification of Congenital Chest Wall Deformities

Willital GH. Indication and operative technique in chest deformities. *Z Kinderchir* 1981;33(3):244–252

Pectus excavatum (Funnel chest) (four types) (see below)

Pectus carinatum (Pigeon chest) (four types)

Combination of pectus excavatum and carinatum (funnel and pigeon chest)

Chest wall aplasia

Cleft sternum

#### 8.1.2 Classification of Poland Syndrome Deformities

Poland A. Deficiency of the pectoral muscles. *Guys Hosp Rep* 1841;6:191–193

Clarkson later attributed the syndrome to Poland.

A. Upper limb related

- Shortened digits (absent middle phalanx)
- Complete simple syndactyly
- Hand hypoplasia
- Absent sternocostal head of the ipsilateral pectoralis major
- Absent pectoralis minor

## B. Other associations

- Breast and nipple hypoplasia
- Absent anterior axillary fold
- Absent latissimus dorsi, deltoid, serratus anterior
- Bony abnormalities of chest wall
- Dextrocardia

*Pectus excavatum:*

- A congenital abnormality of the chest wall resulting in a funnel shaped chest.  
(10× more common than *pectus carinatum*)

**8.1.3 Classification of Pectus Excavatum**

(Sub-classification from Willital's classification of congenital chest wall deformities)

- I Symmetrical depression
- II Asymmetrical depression
- III Symmetrical depression with platythorax
- IV Asymmetrical depression with platythorax

*Pectus Carinatum:*

- A congenital abnormality of the chest wall resulting in a pigeon shaped chest

**8.1.4 Classification of Sternal Clefts**

Complete

Incomplete

**8.1.5 Classification of Congenital Sternal Defects (Modified Ravitch)**

Hersh JH et al. Sternal malformation/vascular dysplasia association. *Am J Med Genet* 1985;21:177

- I Cleft sternum without associated anomalies
  - A Partial to complete
  - B Variable median abdominal raphe
- II Cleft sternum with vascular dysplasia
- III True ectopia cordis
  - A Cardiac lesions
  - B Other associated midline malformations
- IV Cantrell's pentalogy

*Cantrell's Pentalogy:*

- A rare congenital abnormality characterized by defects of the lower sternum, diaphragm, pericardium, thoracoabdominal wall (omphalocele), and heart

*Sternal dehiscence:*

- Breakdown of a median sternotomy wound (in approximately 1% of cases) and is predisposed to by devascularization of sternum if one or both internal mammary arteries are harvested

**8.1.6 Classification of Infected Median Sternotomy Wounds**

From Pairolero PC, Arnold PG. Chest wall tumours. Experience with 100 consecutive patients. J Thorac Cardiovasc Surg 1985;90: 367–372

- Type I – Serosanguinous discharge, no cellulitis within days
- Type II – Purulent mediastinitis+costochondritis and osteomyelitis within weeks
- Type III – Chronic wound infection+costochondritis and osteomyelitis occurs months to years later

**8.1.7 The “O” Classification of Principles of Chest Wall Reconstruction**

O’Brien CM

Optimize the patient

Optimize the wound (microbiology swabs and treatment, excise necrotic/nonviable tissue, vacuum therapy where appropriate)

Outline of the defect: size, location, and components

Over four contiguous rib segments involved, provide skeletal stabilization

Autogenous tissue (e.g., rib grafts free or vascularized, fascia, muscle flap)

Synthetic (e.g., Teflon, Prolene mesh, Gore-tex)

Composite mesh (e.g., marlex methylmethacrylate sandwich)

Obliterate the dead space and provide cover with well vascularized tissue

**8.1.8 Classification of Flap Options for Anterior Chest Wall Reconstruction**

Skin flaps: Deltpectoral

Muscle or musculocutaneous flaps (preferred choice)

Narrow defect: Advancement

Wider defect: Pectoralis major

Rectus abdominus

Latissimus dorsi

Serratus anterior

Omentum (Carberry, Jurkiewicz) – for anterior chest wall or sternal dehiscence



Microvascular free flap (if regional options are unavailable or have failed) Latissimus dorsi, Tensor fascia lata

### 8.1.9 Classification of Flap Options for Sternal Dehiscence

Pectoralis major:

- Unilateral or bilateral muscles
- Based on thoracoacromial pedicle
- Based on internal mammary artery perforators as a turnover flap

Rectus abdominus:

- Based on the superior epigastric pedicle

## 8.2 Classification of Posterior Chest Wall Muscle Flap Reconstructive Options

(Defects may be congenital or acquired complications of neurosurgical or orthopaedic surgery)

Latissimus Dorsi: Advancement or turnover (based on secondary paraspinal perforators)

Trapezius: Advancement or turnover (based on secondary paraspinal perforators)

### 8.2.1 Congenital Abnormalities of the Abdominal Wall

*Gastroschisis:*

- *A congenital condition whereby the intestine and possibly other viscera herniate outside the foetal abdomen through an opening in the abdominal wall usually to the right of the umbilicus*

*Omphalocele:*

- *A congenital condition whereby the intestine and possibly other viscera herniate through the umbilical ring into the umbilical cord and develop outside the foetal abdomen. The intestine and viscera are surrounded by a membranous sac of amnion and parietal peritoneum rather than being in direct continuity with the amniotic cavity*

*Bladder extrophy:*

*See Chapter 10*

### 8.2.2 Principles of Abdominal Wall Reconstruction

Protection of intra-abdominal viscera

Repair abdominal wall support mechanism

Prevention of further herniation

Provide an acceptable contour

### 8.2.3 Classification of Abdominal Wall Reconstructive Options

Direct closure

Mesh

Skin graft

Local tissue techniques:

- Components separation
- Tissue expansion
- Fascial release

Pedicled flaps:

- Tensor fascia lata
- Rectus femoris
- Vastus lateralis
- Gracilis

Free tissue transfer

*Component separation:*

- Mobilization and advancement of separate layers of the abdominal wall to achieve midline closure (*Fig. 8.1*)

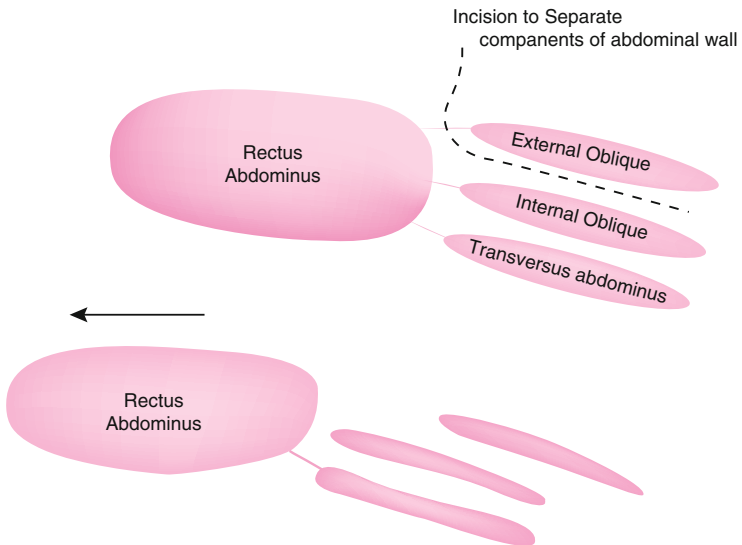


FIGURE 8.1. Components separation method of abdominal wall closure.

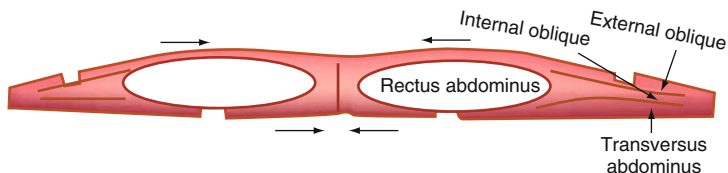


FIGURE 8.2. Fascial partition release.

*Fascial partition release:*

- The use of vertical parasagittal relaxing incisions in the external oblique and transversus abdominus muscles to allow medial advancement and anterior abdominal wall defect closure (Fig. 8.2)

#### 8.2.4 Abdominal Reconstructive Flap Options: Classification by Location of Defect

Adapted from Plastic Surgery. Ed Mathes. Vol. 1 447 Saunders Elsevier; 2006

Zone 1 (superior half)	Rectus abdominus superiorly based or advancement
Zone 1 (inferior half)	Rectus abdominus inferiorly based or advancement, TFL, Rectus femoris
Zone 2	LD, Rectus abdominus superiorly based, TFL
Zone 3	Rectus abdominus inferiorly based, external oblique advancement, TFL, Rectus femoris

#### 8.2.5 Abdominal Reconstructive Flap Options: Classification by Type of Flap

Adapted from Plastic Surgery. Ed Mathes. Vol. 1, 447. Saunders Elsevier; 2006

Regional	Rectus abdominus, external oblique
Distant	TFL, LD, Rectus femoris
Free tissue transfer	TFL, LD, Rectus femoris, Anterolateral thigh flap, Groin flap

### 8.2.6 Classification of Abdominal Visceral Flaps

Adapted from Plastic Surgery. Ed Mathes. Vol 1, 379. Elsevier Saunders; 2006

Based on the muscle classification system:

Type I	Colon, Jejunum	One vascular arcade with a single dominant vessel
Type III	Omentum	Two dominant arcades or pedicles

### 8.2.7 Classification of Visceral Blood Supply

Coeliac axis	– Foregut
Superior mesenteric axis	– Midgut
Inferior mesenteric axis	– Hindgut

## 8.3 PRESSURE SORES

*Pressure sore:*

- A wound acquired from pressure over a bony prominence resulting from extrinsic factors propagated by intrinsic factors. The visible pressure sore represents the “tip of the iceberg” of a cone distribution of tissue destruction

*Decubitus ulcer derivation:*

- *Decumbere (Latin) = “to lie down”*

### 8.3.1 Classification of Pressure Sore Pathogenesis

(a) Extrinsic factors: Pressure (>32mmHg), shear, friction

(b) Intrinsic factors:

- General: Age (old), incontinence, malnutrition (Mnemonic “AIM”)
- Wound: Neuropathy (sensory/autonomic), ischaemia, fibrosis, infection

*Shear:*

- A mechanical stress perpendicular to surface of skin resulting in kinked vessels and reduced perfusion

*Friction:*

- Two surfaces which move across each other causing loss of the superficial layer of epidermis

### 8.3.2 Classification of Pressure Sore Risk Factors

From Waterlow J. A risk assessment card. *Nurs Times* 1985;81(48): 49–55

Waterlow Score summarized into “ABC’S”:

- 10 at risk
- 15 high risk
- 20 very high risk

Risk scale which scores:

A – Appetite, age/sex, ambulation(mobility), anaemia

B – Build and weight

C – Continence

S – Skin type

    Steroids/NSAIDS

    Smoking

    Surgery: previous orthopaedic or fracture below waist

    Sensory disturbance: diabetes, paraplegia, CVA

### 8.3.3 Pressure Sore Staging Systems

#### 8.3.4 Shea’s Classification

Shea JD. Pressure sores: classification and management. *Clin Orthop* 1975;112:89

- |           |  |
|-----------|--|
| Grade I   | Ulcer confined to epidermis and superficial dermis   |
| Grade II  | Ulcer extends through the skin into subcutaneous fat |
| Grade III | Ulcer extends into underlying muscle                 |
| Grade IV  | Ulcer invades bone or joint                          |

#### 8.3.5 Barczak’s Classification

Barczak et al. *Adv Wound Care* 1997;10(4):18–26

- 1 Nonblanchable erythema for >1h after relief of pressure
- 2 Breach in the dermis
- 3 Subcutaneous destruction to muscle
- 4 Bone/joint involvement

#### 8.3.6 National Pressure Ulcer Advisory Panel’s Classification 1989

National Pressure Ulcer Advisory Panel 1989

1. Non blanchable erythema of intact skin
2. Partial thickness loss: breach of epidermis/dermis-blistering and ulceration

3. Full thickness loss: subcutaneous involvement not breaching fascia
4. Breach in fascia: extends to bone, muscle, tendon, joint capsule, extensive destruction

### 8.3.7 Classification of Pressure Sores by Anatomical Frequency in Paraplegic Patients

Dansereau et al. Closure of decubiti in paraplegics. *Plast Reconstr Surg* 1964;33:474

Ischial	28%
Trochanteric	19%
Sacral	17%
Heel	9%
Malleolar	5%
Pretibial	5%
Patellar	4%
Other	13%

### 8.3.8 Classification of Pressure Sore Treatment Principles

- (a) Prevention – Awareness
  - Pressure relief
  - Low air loss mattress
  - Seated patients: 10s lift every 10min
  - Bed bound: 2h repositioning
  - Skin care: clean, dry, remove particulate matter, treat infection
  - Urinary/faecal diversion
  - Nutrition
- (b) Multidisciplinary care – Nursing, Occupational therapy, Dietician, Orthotics, Surgical
- (c) Surgical care – Debridement: scar, bursa, bony spurs, soft tissue calcification
  - Dead space obliteration
  - Durable resurfacing
  - Judicious choice of flaps to avoid wastage
  - Careful positioning of suture lines away from pressure areas
  - Adequate drainage under flap
  - Optimize patient pre and postoperatively (Figs. 8.3, 8.4)

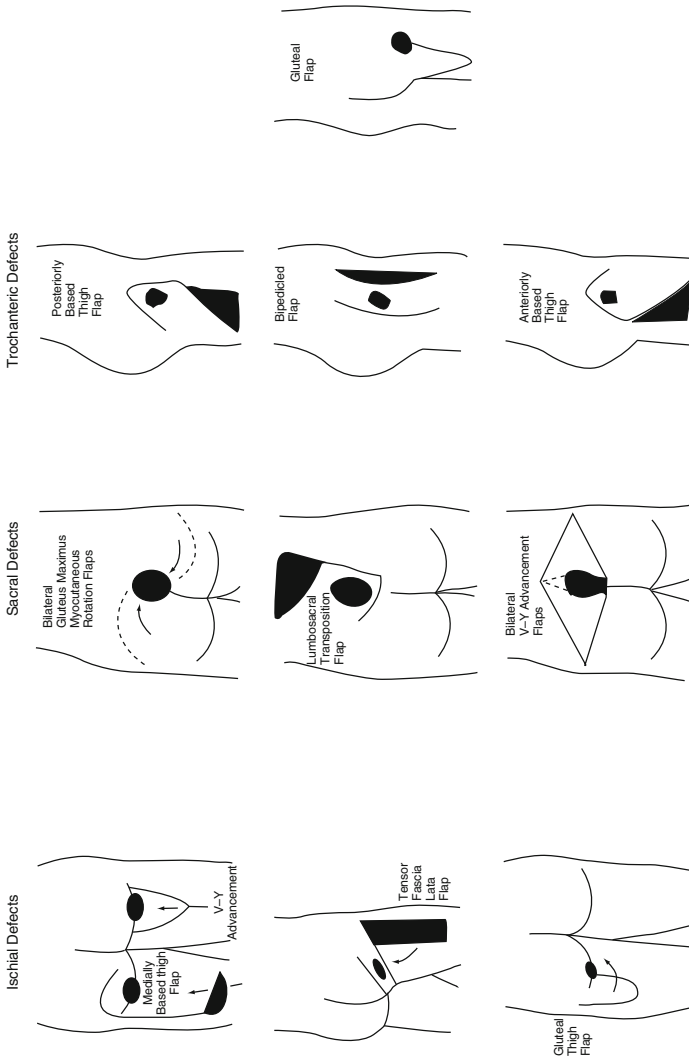
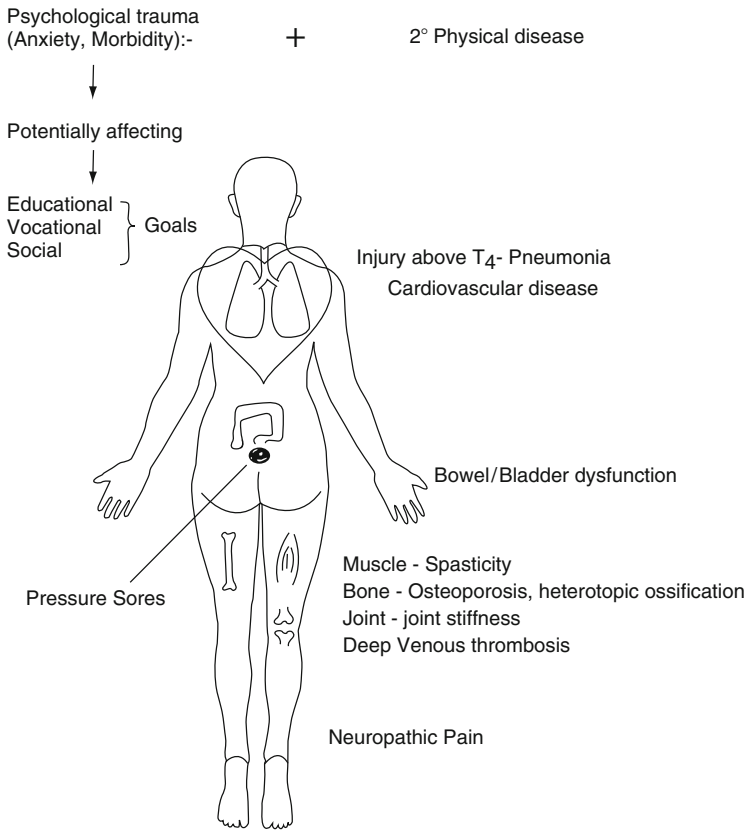


FIGURE 8.3. Pressure sore reconstructive options.



**FIGURE 8.4.** “Top to toe” diagrammatic classification of the problems of paraplegia (O’Brien CM).



# Chapter 9

## Lower Limb

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### 9.1 CLASSIFICATION OF OPEN TIBIAL FRACTURES (GUSTILLO ET AL.)

Gustillo et al. The management of open fractures. JBJS Am 1990;72:299–304

- I Bone: Simple non-comminuted fracture/Soft tissues <1 cm clean puncture
- II Bone: Moderately comminuted fracture/Soft tissues >1 cm laceration
- III High energy:  
Bone: Comminuted/segmental/bone loss/amputation  
Soft tissues: Extensive damage >10 cm long wound  
Subtype (1984):
  - (a) Adequate soft tissue cover
  - (b) Periosteal stripping, bone loss and exposure, major contamination
  - (c) Soft tissue injury + Arterial injury requiring repair

### 9.2 CLASSIFICATION OF OPEN TIBIAL FRACTURES (BYRD AND SPICER)

Byrd HS, Spicer TE, Cierny G. Management of open tibial fractures. PRS 1989;76:159

*Type I:*

Low energy, <2 cm laceration, relatively clean wound. Fracture pattern: spiral or oblique

*Type II:*

Moderate energy >2 cm laceration, Moderate muscle and skin contusion. Fracture pattern: comminuted or displaced

*Type III:*

High energy, Extensive skin loss, devitalized muscle. Fracture pattern: displaced, severely comminuted, segmental

*Type IV:*

Extreme energy (e.g., gunshot) + crush or degloving, vascular injury requiring repair. Fracture pattern as in Type III

**9.3 MANGLED EXTREMITY SEVERITY SCORE – “MESS”**

Johansen K, Daines M, Howey T et al. Objective criteria accurately predict amputation following lower extremity trauma. *J Trauma* 1990;30:568

Score of 6 or less: Salvageable limb

Score of 7 or more: Unlikely salvage

## (A) Bone/soft tissue injury:

Low energy	1
Medium energy	2
High energy	3
Very high energy	4

## (B) Limb ischaemia (double if greater than 6 h)

Pulse reduced, perfusion normal	1
Pulseless, parasthetic with decreased capillary refill	2
Cool, parasthetic, insensate, numb	3

## (C) Shock

Systolic >90	0
Transient hypotension	1
Persistent hypotension	2

## (D) Age

<30	0
30–50	1
>50	2

**9.4 HIDALGO AND SHAW CLASSIFICATION OF FOOT TRAUMA**

Hidalgo DA, Shaw WW. Reconstruction of foot injuries. *Clin Plast Surg* 1986;13(4):663–80

- Type I – Small soft tissue loss <3 cm<sup>2</sup>  
 Type II – Large tissue loss >3 cm<sup>2</sup> without bone involvement  
 Type III – Large tissue loss with bone involvement

## 9.5 ORTHOPAEDIC TRAUMA ASSOCIATION CLASSIFICATION OF LONG BONE FRACTURES

Linear (transverse, oblique, spiral)

Comminuted (<50%, >50%, butterfly <50%, butterfly >50%)

Segmental (two level, three level, longitudinal split, comminuted)

Bone loss (<50%, >50%, complete)

## 9.6 SOFT TISSUE INJURY CLASSIFICATION OVER CLOSED FRACTURES

Tscherne H, Gotzen L. Fractures with soft tissue injuries. New York: Springer; 1984

- Grade 0 – Minimal damage
  - Simple fracture patterns
- Grade 1 – Superficial abrasion or contusion caused by pressure from within
  - Mild-moderate fracture pattern
- Grade 2 – Deep abrasion with localized muscle contusion
  - Possible compartment syndrome
- Grade 3 – Extensive contusion or crush, degloving, vascular injury

## 9.7 CLASSIFICATION OF OPTIONS FOR MANAGING BONY DEFECTS ACCORDING TO SIZE

<6 cm bone defect: Bone graft, Ilizarov technique

>6 cm bone defect: – Pedicled bone flaps  
– Free vascularized bone flap transfer

*The Ilizarov Technique:*

- *A method of distraction histiogenesis (leg lengthening) comprising of the following sequence*
  - (1) *Application of a stable external fixation device*
  - (2) *Bony corticotomy causing minimal disruption to blood supply*
  - (3) *Latent period*
  - (4) *Gradual rhythmic distraction*

*Congenital pseudoarthrosis:*

- *Maldevelopment of a major bony articulation*

### 9.8 BOYD CLASSIFICATION OF CONGENITAL PSEUDOARTHROSIS

- I Anterior bowing, present at birth
- II Hourglass constriction present at birth
- III Congenital cyst
- IV Sclerotic segment with medullary obliteration
- V Dysplastic fibula
- VI Interosseous neurofibroma or schwannoma

*Acquired pseudoarthrosis:*

- *A chronically unstable bone union at a fracture site*

*Ulcer:*

- *A breach in the epithelium with one or more factors preventing it from healing*

### 9.9 CLASSIFICATION OF LEG ULCER AETIOLOGY

Venous disease

Arterial disease

Trauma: direct, deliberate self-harm, bites, frostbite, radiation

Tumour: BCC, SCC (Marjolin's ulcer), lymphoma, Kaposi

Infection: bacterial, fungal, TB, Syphilis

Metabolic: pyoderma, necrobiosis lipoidica diabetorum, gout

Autoimmune: rheumatoid, polyarteritis, lupus

Neuropathic: diabetes

*Marjolin's ulcer:*

- *The formation of carcinoma within a burn scar (as originally described) but now has a wider definition which includes malignant transformation within a chronic wound*

### 9.10 CLASSIFICATION OF THE MECHANISMS INVOLVED IN VENOUS ULCER PRODUCTION

Venous hypertension

Valvular incompetence (secondary to thrombophlebitis)

Protein exudate accumulation in soft tissues

Lipodermatosclerosis

*Osteomyelitis:*

*An infection of bone potentially resulting in necrosis within a compromised skin envelope*

## 9.11 OSTEOMYELITIS CLASSIFICATION

Acute: Haematogenous or Direct spread

Subacute

Chronic

### 9.11.1 Classification of Osteomyelitis: Cierny and Mader

Cierny G III, Mader JT. Approach to adult osteomyelitis. Orthop Rev 1987

*Anatomic criteria:*

Type I Medullary/endosteal lesion

Type II Superficial

Type III Localized

Type IV Diffuse

*Physiologic criteria:*

Class A Normal host response

Class B Compromised wound healing

Class C Potentially worsening

*Compartment syndrome:*

– A clinical condition arising from an increase in intracompartmental tissue pressure which potentially compromises the circulation causing ischaemia and destroying function

*Pressures suggestive of a compartment syndrome:*

– Compartment Pressure >30 mmHg in a normotensive patient

– Compartment Pressure <30 mmHg below diastolic blood pressure

*Described thresholds are guidelines only, the diagnosis is a clinical one*

## 9.12 “P” CLASSIFICATION OF COMPARTMENT SYNDROME DIAGNOSTIC FEATURES

Pain out of proportion to injury

Pain on passive extension

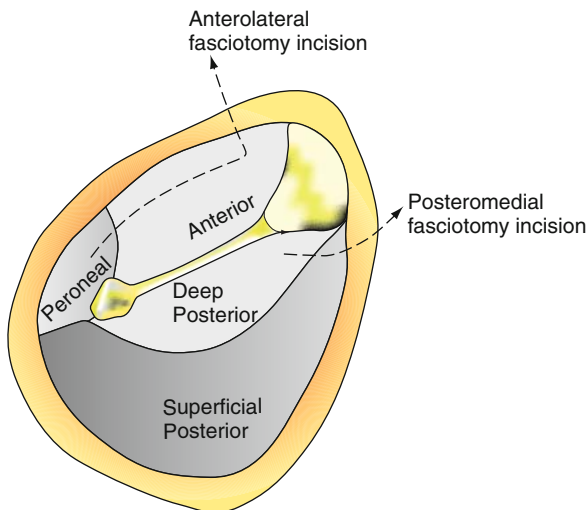
Pain on palpation of the compartment

Parasthesiae

Pulselessness: occurs late, presence of a pulse does not exclude a compartment syndrome

Pressures (intracompartmental) >30 mmHg

<30 mmHg below diastolic



**FIGURE 9.1.** Decompression of the four anatomical compartments of the lower leg.

### 9.13 CLASSIFICATION OF TYPES OF LYMPHOEDEMA

(a) Primary (classified by age):

*Lymphoedema congenita* (20%) – Early childhood

*Lymphoedema praecox* (70%) – Puberty

*Lymphoedema tarda* (10%) – >35 years

(b) Secondary:

Trauma

Tumour (primary/secondary)

Infection (e.g., *Wucheria bancrofti* – filariasis-most common cause worldwide)

Inflammation

Irradiation

Iatrogenic (e.g., Block dissection/Varicose vein stripping)

*Lipoedema:*

– An abnormal collection of subcutaneous fat between the hip and the ankle, sparing the feet

*Stemmer sign:*

– Inability to tent the skin over the toes

– Positive in lymphoedema

– Negative in lipoedema

*Lymphoedema:*

– *An abnormal collection of interstitial fluid*

### 9.13.1 Wolf and Kinmonth Classification of Primary Lymphoedema

Classified according to lymphangiography appearance

Anaplastic		Associated with lymphoedema congenita
Hypoplastic	(a) Obstructive (b) Non obstructive	Associated with lymphoedema praecox
Hyperplastic		Associated with lymphoedema tarda

### 9.14 COMPRESSION BANDAGES

Thomas S. Bandages and bandaging. Nurs Stand 1990;4(39 Suppl.):4–6

Light compression 14–17 mmHg at ankle

Moderate compression 18–24 mmHg at ankle

High compression 25–35 mmHg at ankle

Extra high compression 60 mmHg at ankle

### 9.15 BRITISH STANDARDS INSTITUTE: THREE CLASSES OF COMPRESSION STOCKINGS

Class I 14–18 mmHg

Class II 18–24 mmHg

Class III 25–35 mmHg

#### *Ankle/Brachial index:*

– *A value calculated by dividing pressure measured at the ankle by brachial systolic pressure to indicate the relative degree of lower limb ischaemia*

*Normal index = 1.0*

*Index acceptable for most reconstructive techniques = 0.7*

*Index correlating with rest pain, nonhealing wounds = 0.3*

### 9.16 SANTANELLI DESCRIPTIVE CLASSIFICATION OF FOOT DEFECTS

Extension

Depth

Localization

Aetiology

### 9.16.1 Classification of Reconstructive Options for Heel Pressure Sores

Conservative: Dressings, Vacuum therapy

Skin graft

Local flaps: – Sural artery  
– Lateral calcaneal artery  
– Medial plantar

Free tissue – Radial forearm, serratus

### 9.17 DIABETIC FOOT ULCER:WAGNER SCALE 1981

Wagner, The dysvascular foot; a system for diagnosis and treatment. FW Foot Ankle 1981;2:64

Grade 0 At risk foot

Grade 1 Superficial ulcer, not clinically infected

Grade 2 Deeper ulcer, often infected, no osteomyelitis

Grade 3 Deeper ulcer, abscess formation, osteomyelitis

Grade 4 Localized gangrene (toe, forefoot, heel)

Grade 5 Gangrene whole foot

### 9.17.1 Classification of Local Reconstructive Flap Options for the Foot

*Ankle and Dorsum:*

- Abductor hallucis, Abductor digiti minimi, extensor digitorum brevis, sural neurocutaneous, lateral supramalleolar

*Plantar Forefoot:*

- Toe fillet, neurovascular island, V-Y plantar, suprafascial

*Midfoot:*

- Neurovascular island, V-Y advancement, suprafascial

*Hindfoot:*

- Abductor hallucis, flexor digitorum brevis, abductor digiti minimi, medial plantar artery flap, sural artery flap



# Chapter 10

## Urogenital Tract

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### *Hypospadias:*

- *A congenital abnormality characterized by a triad of features which include an abnormally proximal urethral meatus positioned on the ventral aspect of the penis, a hooded prepuce and chordee. Associated conditions include inguinal hernia, undescended testes, paraurethral sinuses, urethral valves and a flattened glans penis, and other genito-urinary tract abnormalities*

### *Chordee:*

- *Ventral curvature of the penis due to the presence of a fibrous band between the meatus and glans*

### *Horton test:*

- *An artificial erection test used to assess the degree of chordee. It involves the injection of normal saline into one of the corpora cavernosa of the penis after application of a tourniquet around the base of the penis*

### **10.1 CLASSIFICATION OF HYPOSPADIAS ACCORDING TO POSITION OF THE MEATUS (AFTER CORRECTION OF THE ASSOCIATED CHORDEE)**

Distal:

Glanular	} 75%
Coronal	
Subcoronal	
Distal shaft	

Proximal:

Midshaft	15%
Proximal shaft	} 10%
Penoscrotal	
Scrotal	
Perineal	

### 10.1.1 Classification of Corrective Techniques for Hypospadias

Urethral advancement

On lay procedures

In lay procedures

One stage

Two stage

*Epispadias and Bladder extrophy:*

- A congenital abnormality of the external genitalia and bladder resulting in failure of normal development of the dorsal surface of the penis, abdomen and anterior bladder wall

*Micropenis:*

- A penis that is more than two standard deviations smaller than the norm expected for that age

*Buried penis:*

- A normal sized penis for age but hidden from view due to excessive peri-perineal fat and subcutaneous tissue

*Peyronie's disease:*

- A disease characterized by fibrous nodules within the tunica albuginea of the corpora cavernosa giving rise to a dorsal curvature of the penis. It is associated with veno-occlusive dysfunction

*Fournier's gangrene:*

- Necrotising fasciitis of the perineum and genitalia caused by a mixture of gram-positive and gram-negative organisms and anaerobes (*Clostridium perfringens*). Predisposing conditions include diabetes mellitus, alcoholism, smoking, leukaemia, and immunosuppression

*Balanitis xerotica obliterans:*

- A genital form of lichen sclerosis et atrophicus which may be caused by the spirochete *Borrelia burgdorferi*. White patches develop on the glans and can spread in a retrograde fashion along

*the urethra giving rise to stenosis of the meatus and urethral strictures. It may predispose to malignant change*

## 10.2 CLASSIFICATION OF SYNDROMES CAUSING AMBIGUOUS GENITALIA AND ASSOCIATED CHROMOSOMAL ABNORMALITY

Syndrome	Genetics	Abnormality
Congenital adrenal hyperplasia (Female pseudohermaphroditism) (Adrenogenital syndrome)	46XX	21 hydroxylase deficiency Over exposure to androgens
Male pseudohermaphroditism	46XY	5 alpha reductase deficiency Incomplete masculinization
Mixed gonadal dysgenesis	46XY or 46XO	1 Testis/1 streak gonad (Malignant potential)
True hermaphroditism	46XX	1 Ovary/1 Testis Well differentiated male and female tissue in same individual

*Vaginal agenesis (Mayer-Rokitansky-Kuster-Hausler Syndrome):*

– A congenital abnormality resulting from paramesonephric duct development failure and may be associated with urinary tract abnormality. Clinical presentation includes either amenorrhea or haematocolpos depending on the spectrum of disease

## 10.3 CLASSIFICATION OF VAGINAL RECONSTRUCTIVE OPTIONS FOR CONGENITAL DEFECTS

Dilatation	– Frank
Split skin graft over a mould	– Abbe–McIndoe procedure
Full thickness skin grafts over stent	
Local flap	– e.g., Labial, fasciocutaneous vulvoperineal, or pudendal thigh
Regional flap	– e.g., Gracilis, vertical, or transverse rectus abdominus myocutaneous flap
Distant flap	– e.g., Pedicled colon

## 10.4 ANATOMICAL CLASSIFICATION OF ACQUIRED VAGINAL DEFECTS

In Plastic Surgery VI, Ed. Mathes. Trunk and Lower Extremity. Saunders Elsevier; 2006:1296

Type I: Partial

- (A) Anterior or lateral wall involvement
- (B) Posterior wall involvement

Type II: Circumferential

- (A) Upper 2/3 of vagina
- (B) Total vaginal resection

# Chapter 11

## Burns

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*Epidermal burn:*

- A burn that affects only the epidermis (e.g., Sunburn)

*Superficial burn:*

- A painful partial thickness burn affecting the epidermis and upper dermis, commonly accompanied by blistering

*Deep dermal burn:*

- A partial thickness burn extending deep into the dermis with fixed staining becoming evident 48 h post injury. Potential regeneration due to some skin adnexal structure sparing

*Full thickness burn:*

- A burn extending through the full thickness of the skin and potentially deeper, associated with destruction of all skin adnexae

### 11.1 CLASSIFICATION OF BURN DEPTH

	Partial thickness				Full thickness
	Superficial	Superficial dermal	Mid dermal	Deep dermal	Dermal
Colour	Red	Pale pink	Dark pink	Red fixed staining	White
Refill	+	+	Slow	-	-
Sensation	+	+	+	-	-
Blisters	-	Small	Large	-	-
Healing	+	+	Usually	-/+	-

## 11.2 CLASSIFICATION OF BURN TYPE

Thermal  
Chemical  
Electrical  
Inhalational  
Non-accidental  
Friction

### 11.2.1 Classification of Thermal Burns

Scald  
Flame  
Flash  
Contact

### 11.2.2 Classification of Chemical Burns

Alkalis (cause a liquefactive necrosis)  
Acids (cause a coagulative necrosis)  
Organic compounds  
Phosphorus

### 11.2.3 Classification of Electrical Burns

Low voltage <1,000 V  
High voltage >1,000 V  
Extremely high voltage  
Lightning:  
    (a) Direct (fatal)  
    (b) Sideflash (hits a tree and then discharges current through the air or ground to an individual)

## 11.3 CLASSIFICATION OF INHALATIONAL INJURY

Supraglottic  
Subglottic  
Systemic

---

*Minor burn – <10% TBSA child, <20% adult*

*Critical site – Face, Hands, Genitalia*

*Major burn – A burn covering 20% or more of the total body surface area (TBSA)*

*Extensive burn – >60%*

*Formal fluid resuscitation burn – 15% adult, 10% child*

## 11.4 PARKLAND FORMULA FOR BURNS RESUSCITATION

4 ml kg<sup>-1</sup> per percent Total burn surface area  
1/2 given in the first 8 h post injury  
Remainder given over the subsequent 16 h

PLUS maintenance fluids in children

4 ml kg<sup>-1</sup> for first 10 kg

+

2 ml kg<sup>-1</sup> for second 10 kg

+

1 ml kg<sup>-1</sup> > 20 kg

### 11.5 URINE OUTPUT INDICATING ADEQUATE FLUID RESUSCITATION

Adult = 0.5–1 ml kg<sup>-1</sup> h<sup>-1</sup>

Child = 1.0–1.5 ml kg h<sup>-1</sup>

### 11.6 CURRERI FORMULA FOR DAILY CALORIFIC REQUIREMENT IN BURNS PATIENTS

Adult = 25 kcal kg<sup>-1</sup> + 40 kcal per percent burn

Child = 40–60 kcal kg<sup>-1</sup>

### 11.7 CLASSIFICATION OF ZONES OF INJURY (JACKSON'S MODEL 1947) (FIG. 11.1)

*Inner zone:*

– Coagulative necrosis resulting in irreversible tissue loss

*Intermediate zone:*

– Stasis, decreased tissue perfusion potentially salvageable with adequate resuscitation

*Outer zone:*

– Hyperaemia

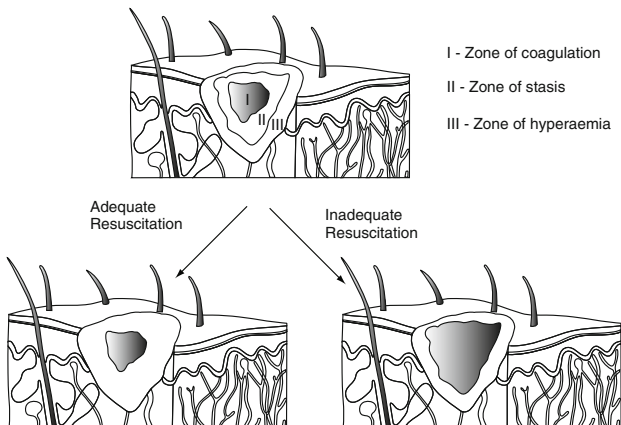


FIGURE 11.1. Jackson's zones of burn injury.

## 11.8 CLASSIFICATION OF PATHOPHYSIOLOGY

### Local Effects

1. Release of inflammatory mediators: By capillary wall, white blood cells, and platelets
2. Vessel: Vasodilatation and increased permeability
3. Oedema: Resulting from fluid (protein and trace elements) leak from the circulation into the interstitial space

### Systemic Effects (>20–30%)

CVS – Hypovolaemia, RBC destruction, flame haemorrhages of myocardium

RS – Pulmonary oedema, tracheobronchitis, pneumonia

GI – Loss of protective function, bacterial translocation, curling ulcers therefore prophylaxis

Liver – Peroxidation of hepatocytes

Immunosuppression – Decrease in the mechanical barrier, decrease in non specific and specific (humoral and cellular) immunity

Glucose intolerance – Massive catecholamine release

Clotting deranged – PE/DVT therefore prophylaxis required

## 11.9.1 CLASSIFICATION OF THE IMMUNE SYSTEM

- (a) Mechanical barriers
- (b) Non specific immune response
- (c) Specific immune response

### (a) Mechanical barriers:

Skin – Physical barrier

- Immunological cells (dendritic, langerhans, mast, macrophage, T, PMN)

RS – Mucociliary staircase

GI – Mucus, enzymes

### (b) Nonspecific immune response (independent of previous contact):

Circulating phagocytes – Polymorphonuclear cells (PMN) (neutrophils, basophils, eosinophils)

- PMN peak at 1 day and 1 week post burn
- Monocytes (antigen presenting cells associated with MHC I)

Plasma proteins:

- Opsonins (enhance phagocytosis)
- Complement–Classical pathway (Ag-IgM, Ag-IgG activated)
- Alternate pathway (microbial products activated)



(c) *Specific immune response (previous contact dependent):*

T (thymus) lymphocytes: Cell mediated immunity

Stimulated by Antigen (Ag) presented by Antigen presenting cells (APC)

T helper cells: release cytokines, attract phagocytes, stimulate B, and NK cells

T suppressor cells: Inhibit T helper cells

B (bone marrow) lymphocytes: Humoral immunity

Produce Antibody when activated by T helper cells

Natural Killer (NK) cells (Ag MHC I): affect Ig coated viruses/tumour

### 11.9.2 CLASSIFICATION OF EFFECTS OF BURNS ON THE IMMUNE SYSTEM

Burns affect each arm of the immune system causing immunosuppression at each level:

- (a) Mechanical barriers
- (b) Non specific immunity
- (c) Specific immunity

In addition:

Transfusion induced immunosuppression

Steroid induced immunosuppression secondary to endogenous glucocorticoid release

*“SIRS”*

- *Systemic inflammatory response syndrome*
  - *Two or more of the following criteria must be present for a diagnosis:*
  - *Body temperature  $>38^{\circ}\text{C}$  or  $<36^{\circ}\text{C}$*
  - *Heart rate  $>90\text{ beats min}^{-1}$*
  - *Respiratory rate  $>20\text{ min}^{-1}$  or  $\text{PaCO}_2 <32\text{ mmHg}$*
  - *WCC  $>12,000\ \mu\text{L}^{-1}$ ,  $<4,000\ \mu\text{L}^{-1}$ , or  $>10\%$  immature forms*
- (Modified accordingly in children)*

*“MODS”*

- *Multiple organ dysfunction syndrome that can be induced by SIRS*

*Cytokine*

- *A broad group of polypeptides with varied functions within the immune response*

### 11.10 NATIONAL BURN CARE REVIEW BURN CLASSIFICATION

Complex (require plastic surgical intervention)

Non complex (no immediate specialist intervention required)

### 11.11 CLASSIFICATION OF BURNS UNIT REFERRAL CRITERIA

(Complex burns)

Significant burn: – Partial thickness burn >10% adult  
>5% child

– Full thickness burn >1%

Significant area: Hands, feet, face, perineum, major joints, circumferential

Significant chemical or electrical injury

Significant other: Age extremes, comorbidity, major trauma, non-accidental injury (NAI), inhalational injury

### 11.12 CLASSIFICATION OF BURN SURFACE AREA ESTIMATION METHODS

(a) Lund and Browder Chart: adult/paediatric

(b) Palm of patient's hand, fingers adducted approximates 1% TBSA

(c) Wallace's "Rule of 9s"

	Head and neck	1 arm	1 leg	Anterior trunk	Posterior trunk	Perineum
Adult	9%	9%	18%	18%	18%	1%
Child	18%	9%	14%	18%	18%	

\*Each year >10 year, take 1% off head and add to combined legs

### 11.13 CLASSIFICATION OF BODY FLUID COMPARTMENTS

Total Body water = Intracellular fluid (2/3) + Extracellular fluid (1/3)

Extracellular fluid = Vascular compartment (1/3) + Interstitial fluid (2/3)

Vascular compartment = Venous component (85%) + Arterial component (15%)

### 11.14 CLASSIFICATION OF AIMS OF BURN CARE

Summarized from "ABC of Burns" – Blackwell Publishing Ltd 2005 – Hettiaratchy, Papini, Dziewulski

Rescue  
 Resuscitate  
 Retrieve  
 Resurface  
 Rehabilitate  
 Reconstruct  
 Review

### 11.15 CLASSIFICATION OF TIMING OF BURNS SURGERY

Immediate: Tracheostomy, escharotomy  
 Early <72 h: Excision & Graft (a) tangential;  
 (b) fascial  
 Intermediate <1 week (initial indeterminate depth which fail to heal)  
 Late >3 weeks  
 Delayed reconstruction (contracture release, scar revision)

### 11.16 CLASSIFICATION OF BURN DISASTER TRIAGE

Summarized from "ABC of Burns" – Blackwell Publishing Ltd  
 2005 – Hettiaratchy, Papini, Dziewulski

Group I – Minor burns in a non critical site  
 Group II – Minor burns to a critical site  
 Group III – Major burn (20–60%)  
 Group IV – Extensive burn (>60%)  
 Group V – Minor burn + Inhalational or associated injury

First priority evacuation III + V  
 Second priority evacuation IV  
 Third priority evacuation II  
 First aid/Primary care referral I

### 11.17 CLASSIFICATION OF DRESSINGS FOR BURNS

Purposes: – to absorb fluid  
 – to decrease pain  
 – to act as a barrier to infection

Autograft – Split skin graft, cultured keratinocytes  
 Allograft – Cadaveric skin, fresh or cryopreserved  
 Xenograft – Porcine derivative  
 Synthetic – Semipermeable membranes, Occlusive,  
 Hydrocolloid, Absorptive

- Combined – Allogenic + synthetic membrane (e.g.,  
Transcyte: allogenic cells providing growth  
factors + scaffold)
- Topical agents – Bactroban, Polyfax, Flamazine, Flamacerium

### 11.18.1 CLASSIFICATION OF POST BURN CONTRACTURES OF THE IPJ OF THE HAND

Stern PJ et al. Classification and treatment of post burn IPJ flexion contractures in children. JHS (Am) 1987; 12(3):450–457

- I Deformity correctable by flexing MCPJ
- II Deformity not fully correctable with MCPJ flexion
- III Deformity unaffected by MCPJ position

### 11.18.2 CLASSIFICATION OF BURN CONTRACTURES OF THE MCPJ OF THE HAND

Graham et al. Classification and treatment of post burn MCPJ extension contractures in children. JHS (Am) 1990; 15(3):450–456

- I Correctable with wrist extension
- II MCPJ flexion  $<30^\circ$  with wrist extension
- III Unaffected by wrist position

*Fasciotomy:*

- *Division of the fascia to release compartment pressure*

*Escharotomy:*

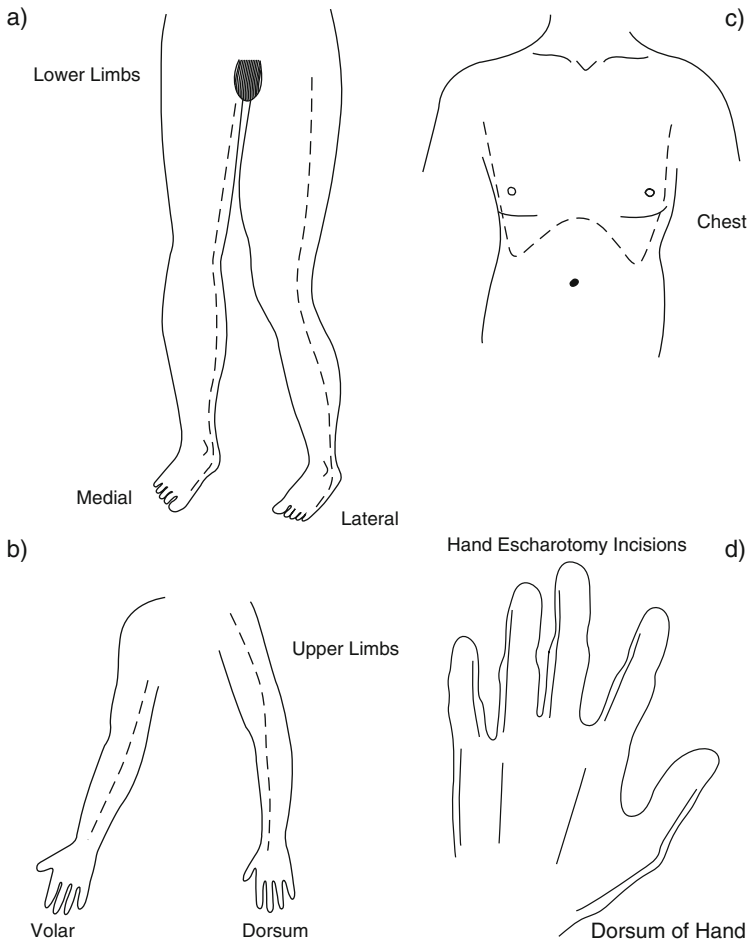
- *Division of the thick, inelastic burn eschar to aid perfusion of the limbs and ventilation of the chest (Fig. 11.2)*

## 11.19 CLASSIFICATION OF NATURE OF SUBSTANCES WHICH CAN EXTRAVASATE

- Vesicant
- Irritant
- Neutral

## 11.20 EXTRAVASATION INJURY CLASSIFICATION OF MECHANISMS OF TISSUE INJURY

- (a) Osmotic imbalance: Hypertonic solutions, 10% dextrose, hypertonic total parenteral nutrition (TPN)
- (b) Ischaemia induction: Catecholamines, vasopressin
- (c) Direct toxicity to cells: Sodium bicarbonate, digoxin, tetracycline



**FIGURE 11.2.** Escharotomy lines: (a) Lower limb, (b) Upper limb, (c) Chest, and (d) Hand.

### 11.21.1 CLASSIFICATION OF COLD INJURY

- Local: – Frostbite  
 – Non tissue freezing injury: trench foot, chilblain
- Systemic: – Hypothermia

#### *Frostbite:*

- A localized cold induced injury usually affecting digits

### 11.21.2 CLASSIFICATION OF FROSTBITE

- First degree – Whitish plaques, swelling, hyperaemia, causalgia, rare tissue loss
- Second degree – Blistering, erythema, oedema, tissue recovery
- Third degree – Full thickness skin loss
- Fourth degree – Cyanosis, gangrene of deep structures including muscle and bone

### 11.21.3 CLASSIFICATION OF PHASES OF FROSTBITE

- Prefreeze (3–10°)
- Freeze–Thaw (–6 to –15°)
- Vascular stasis
- Late ischaemia

### 11.22.1 RADIATION INJURY CLASSIFICATION

- Acute (industrial accidents)
- Subacute (previous therapeutic radiation for malignancy)
- Chronic (former therapeutic treatment of benign skin diseases, industrial exposure)

### 11.22.2 RADIATION WOUND CLASSIFICATION

- Dunne-Daly CF. Skin and wound care in radiation oncology. *Cancer Nurs* 18(2):144–162
- Erythema
- Dry desquamation
- Wet desquamation

#### *Osteitis:*

- *Demineralization of bone secondary to osteoblast radiation damage*

#### *Osteoradionecrosis:*

- *Infection of bone as a result of irradiation*

# Chapter 12

## Cosmetic Surgery

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### *Aesthetic unit*

- A functional division of tissue defined by contour lines within which the tissue shares similar characteristics in terms of colour, texture, and quality. Sutures lines should ideally correspond to the boundaries to achieve the best camouflage. If greater than 50% of the aesthetic unit is lost, it may be preferable to replace the whole unit. Some regions may be divided into subunits.

### *Body dysmorphic disorder*

- A psychiatric condition whereby a person is preoccupied with a perceived defect in appearance despite having a normal appearance which causes significant distress and may interfere with social, occupational, and interpersonal functioning. Surgery does not cure this condition.

## 12.1 THE FACE (FIG. 12.1)

### 12.1.1 Classification of Facial Changes as a Result of Aging

#### **Histological Changes**

- Loss of type III collagen
- Loss of elastin
- Dermo-epidermal junction flattening
- Decreased Langerhans cells and melanocytes

#### **Clinical Changes**

- Quality of skin: thin, wrinkled, skin cancers, pigmentation, excess, loss of elasticity
- Brow/eyelid: Ptosis
- Wrinkles: crows feet, perioral

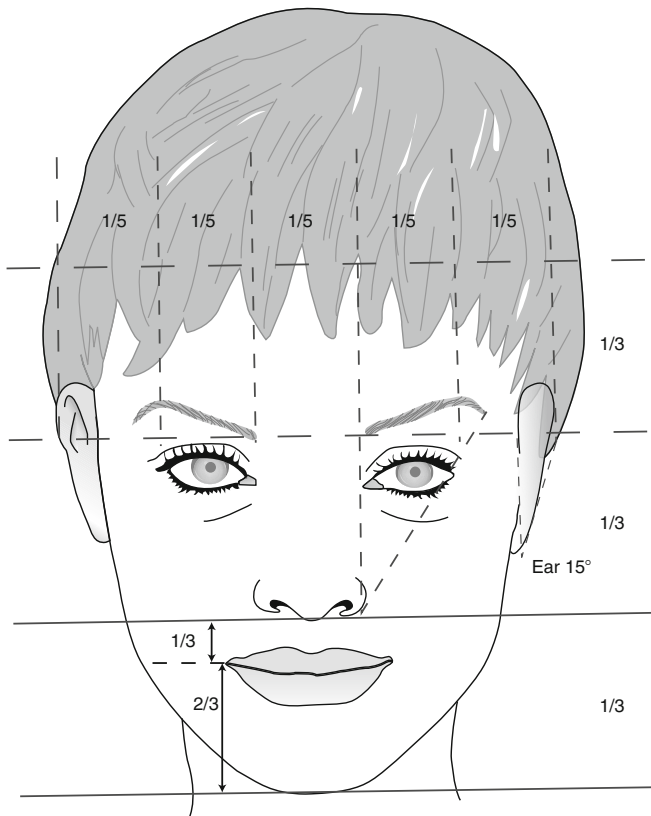


FIGURE 12.1. The ideal facial proportions.

Jowls  
 Nasolabial fold prominence  
 Platysmal bands

### 12.1.2 Classification of Types of Rhytid

Animation ceases from insertions of muscles of facial expression

Fine rhytids  
 Deep rhytids

### 12.1.3 Fitzpatrick Classification System of Perioral and Periorbital Rhytidosis

Class I – Fine wrinkles



- Class II – Fine-to-moderately deep wrinkles, moderate number of wrinkle lines
- Class III – Fine-to-deep wrinkles, numerous wrinkle lines, redundant folds possibly present

Fitzpatrick correlated these three classes with the following scoring system and degree of elastosis:

- Class I (score 1–3) – Mild elastosis
- Class II (score 4–6) – Moderate elastosis
- Class III (score 7–9) – Severe elastosis

*Mild elastosis:*

- *Fine textural changes with minimal skin lines*

*Moderate elastosis:*

- *Yellow discoloration of individual papules (papular elastosis)*

*Severe elastosis:*

- *Marked confluent elastosis with thickened, multipapular yellowed skin*

#### **12.1.4 Glogau Rhytid/Photoaging Classification Scheme**

Glogau RG. Aesthetic and anatomic analysis of the aging skin. *Semin Cutan Med Surg* 1996;15(3):134–138

*Group I:*

- Mild (age 28–35 years) – Little/no wrinkling, no keratoses, no scarring, requires little or no makeup for coverage

*Group II:*

- Moderate (age 35–50 years) – Early wrinkling, sallow complexion with early actinic keratoses, requires little makeup, mild scarring

*Group III:*

- Advanced (age 50–60 years) – Persistent wrinkling at rest, discoloration of the skin with telangiectasias and actinic keratoses, always wear makeup, moderate acne scarring

*Group IV:*

- Severe (age 65–70 years) – Severe wrinkling, photoaging, gravitational and dynamic forces affecting skin, actinic keratoses with or without cancer, wears makeup with poor coverage, severe acne scarring

### 12.1.5 Facial Aging: A Clinical Classification

Shiffman MA. Simplified Facial Rejuvenation, Chap. 5. Ed Shiffman, Mirrafati, Lam. Springer; 2007:65

Stage	Tear trough depth	Cheek fat loss	Nasolabial fold depth	Jowl prominence
0	None	No loss	None	None
1	Slight: to cheek fat	No loss	Slight	None
2	Mild: into cheek fat	Slight loss medially	Mild	Slight
3	Moderate	Moderate	Moderate	Moderate
4	Severe	Severe	Severe	Severe

### 12.1.6 Classification of Facial Layers

Skin

Subcutaneous tissue

Superficial musculoaponeurotic system (SMAS)

Fascia/muscle

VII Nerve

*Superficial musculoaponeurotic system (SMAS):*

*(Mitz and Peyronie)*

- *A layer of facial fascia continuous with galea, frontalis, temporo-parietal fascia (superficial temporal) and platysma. With a couple of exceptions the motor nerves lie beneath and the sensory nerves lie above*

*Sub-SMAS plane (deep plane):*

- *The plane between the superficial and deep facial fascias which includes the deep attachments of the facial muscles, retaining ligaments of the face, areolar spaces and branches of the facial nerve*

### 12.1.7 Classification of the Retaining Ligaments of the Face

Derived from Furnas DW. Plast Reconstr Surg 1989;83:11

*Osteocutaneous:*

- Zygoma
- Anterior mandible

*Musculocutaneous:*

- Platysma – cutaneous
- Platysma – auricular

*McGregor's patch:*

- A fibrous band from periosteum of zygoma to dermis

*Pitanguy's line:*

- Surface marking of the frontal branch of the facial nerve
- Runs 0.5 cm below tragus to 1.5 cm above lateral eyebrow
- The nerve becomes superficial and lies just beneath the temporo-  
parietal fascia

*Rhytidectomy or facelift:*

- A procedure used to correct the cervico-facial changes that occur  
with aging



FIGURE 12.2. Face lift incision.

### 12.1.8 Classification of Facelift Techniques

Skin lifting alone

Skin and SMAS/ platysma

Deep plane: composite flap of skin and SMAS (Hamra PRS 1992)

MACS Lift: minimal access cranial suspension surgery

Midface suspension

Non endoscopic subperiosteal facelift

Endoscopic facelift

*Turkey gobbler neck:*

– *Divarication of platysma causing unsightly platysmal bands at the medial border*

*Witch's Chin deformity:*

– *Ptosis of chin skin and subcutaneous tissue.*

### 12.1.9 Classification of Facelift Complications

Intraoperative

Early

Late

### 12.1.10 Facelift “SCAREs” Classification

CM O'Brien

**Skin-** necrosis 1–3% (×12 in smokers), scarring, swelling, seroma, bruising

**Changes in pigmentation:** haemosiderin deposits

**Alopecia,** asymmetry

**Residual bleeding** giving rise to haematoma 3.7%

**Excessive tension:** dehiscence, infection, ear lobe deformity

**Significant nerve injury**

- Great auricular nerve (commonest sensory nerve involved)
- Buccal branch of facial nerve (commonest motor nerve involved)
- VII (0.9%)
- (Facial numbness)

### 12.1.11 Classification of Secondary Face Lifts: Goals

Relift

Remove old scars

Preserve temporal/sideburn hair

### 12.1.12 Classification of Facial Danger Zones

Zone 1: Great auricular nerve – 6.5 cm below the external auditory canal

- Zone 2: Temporal branch of VII – Pitanguy's line  
 Zone 3: Marginal mandibular branch of VII – 1–2 cm below lower border of mandible  
 Zone 4: Zygomatic/Buccal branches of VII – anterior to parotid and posterior to zygomaticus major  
 Zone 5: Supratrochlear/Supraorbital nerves – superior orbital rim above mid-pupil  
 Zone 6: Infraorbital nerve – 1 cm below inferior orbital rim mid-pupil  
 Zone 7: Mental nerve – mid-mandible below second premolar

## 12.2 THE NECK

### 12.2.1 Classification of Neck Types

Dedo D. A preoperative classification of the neck for cervicofacial rhytidectomy. *Laryngoscope* 1980;90(11 pt 1):1894–1896

- |           |  |
|-----------|--|
| Class I   | Well defined submental angle, little submental fat, good skin, and platysma tone         |
| Class II  | Early laxity of cervical skin without significant submental fat or loss of platysma tone |
| Class III | Subcutaneous layer of fat  |
| Class IV  | Platysmal abnormality is the predominant change + /- pre- and sub-platysmal fat          |
| Class V   | Retrognathia   |
| Class VI  | Abnormally low hyoid   |

### 12.2.2 The Five Youthful Neck Criteria

Ellenbogen R, Karlin V. Visual criteria for success in restoring the youthful neck. *Plas Reconstr Surg* 1980;66(6):826–837

1. Acute cervicomenal angle (105–120°)
2. Distinct inferior mandible border
3. Subhyoid depression
4. Visible thyroid cartilage
5. Visible anterior border of sternocleidomastoid

## 12.3 THE BROW

### 12.3.1 Brow Lift Classification of Approach

Endoscopic

Open

- Suprabrow excision
- Bicoronal brow lift

- Frontal hairline brow lift
- Temporal brow lift
- Transblepharoplasty brow lift
- Browpexy

Combined

### 12.3.2 Ellenbogen Criteria for the Ideal Brow

(Fig. 12.1)

Brow starts: Vertical line through the alar base

Brow ends: Oblique line joining the alar base and lateral canthus

Horizontal plane connects medial and lateral ends

Apex of brow: Vertical line through the lateral limbus

Position of apex of brow: Women – just above the supraorbital rim

Men – at the level of the supraorbital rim

### 12.4 BLEPHAROPLASTY

(Also see oculoplastic section in Chapter 5)

*Blepharoplasty:*

- A procedure to modify the appearance of the eyelids by removing excess skin and removing or redraping excess fat (Greek derivation: “blepharon” = “eyelid”) (Figs. 12.3 and 12.4)

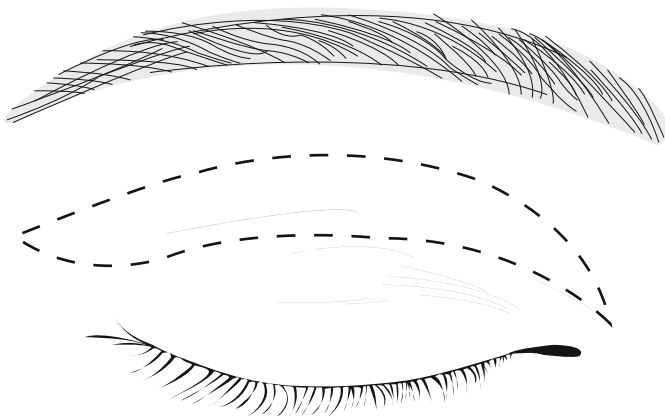


FIGURE 12.3. Upper lid blepharoplasty incision.



FIGURE 12.4. Lower lid blepharoplasty incision.

*Compensated brow ptosis:*

- Compensatory contraction of frontalis when opening the eyelids to counteract the descent of the eyebrow evident upon closure of the eyelids (Blepharoplasty worsens the appearance if compensated brow ptosis is present)

*Snap test:*

- After gentle distraction of the lower lid from the globe, it should snap back into position within a second, if not it indicates lid laxity

*Bells phenomenon:*

- Upward movement of the globe on eye closure

*Canthopexy:*

- A procedure to restore the lower eyelid to its normal position, tone and tilt

*Retrobulbar haemorrhage:*

- Bleeding behind the orbital septum which can lead to pressure on the globe and irreversible blindness. It may result from trauma or rarely as a result of iatrogenic injury during orbital surgery (0.04%)

*Chemosis:*

- Excessive oedema of the conjunctiva

*Tear trough defect:*

- Primarily a bony defect causing the appearance of deep grooves at the junction of the eyelid and cheek skin

*Nasojugal groove:*

- Primarily a muscular deficiency (*orbicularis oculi and levator labii superioris alaque nasi*) causing the appearance of deep grooves at the junction of the eyelid and cheek skin

#### 12.4.1 Classification of Differences Between the Asian and Caucasian Upper Eyelid

Adapted from Park DH, Kim YK. Blepharoplasty Techniques In Asians. In Simplified facial Rejuvenation, Ed. Shiffman, Mirrafati, Lam. Chap. 60, p. 467

Anatomy	Caucasian	Asian
Lid crease (%)	100	50
Origin of medial lid crease	Medial eyelid	Medial canthus
Tarsal height (mm)	9–10.5	6.5–8.0
Septum-levator fusion point	Above tarsus	As low as the pretarsal plane
Preseptal fat pad location	Preseptal	Preseptal, pretarsal

#### 12.5 RHINOPLASTY

1. Nasolabial angle	100–110° (women) 95–100° (men)
2. Mang's angle	110–120° (formed by the intersection of the nasal root-to-tip and nasal tip-to-chin lines)
3. Glabellar angle	35°

*Rhinoplasty:*

- A surgical procedure to alter the appearance of the nose

*Bony vault:*

- Area overlying the nasal bones

*Cartilaginous vault:*

- Area overlying the upper lateral cartilages

*In fracture:*

- Medial movement of nasal bones to correct an open roof deformity

*Infratip lobule:*

- Area from the tip to the start of the columella

*Lobule:*

- Area overlying the alar cartilages



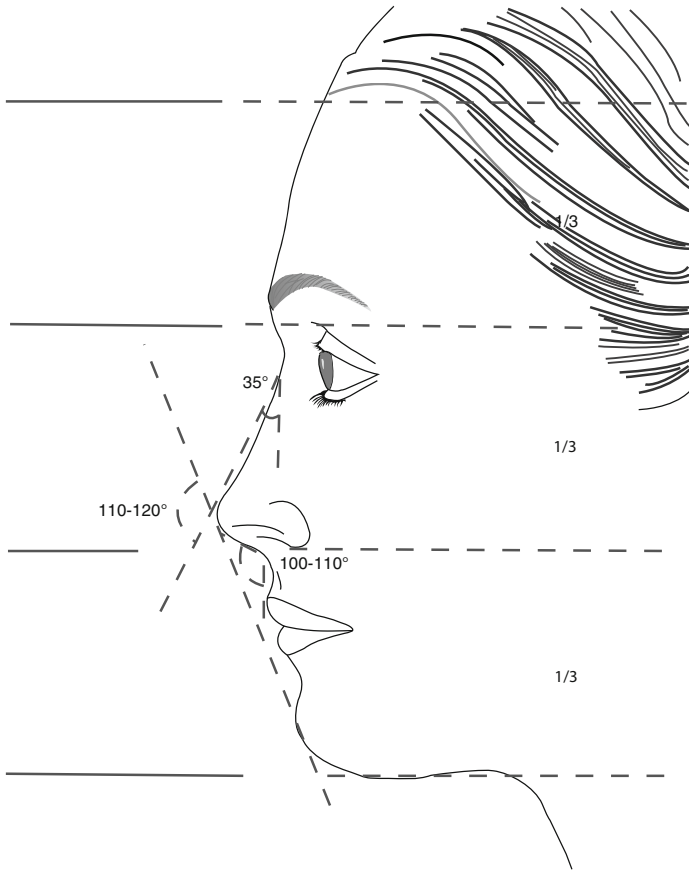


FIGURE 12.5. The ideal nasal dimensions and angles.

*Nasal length:*

- Distance between the nasofrontal groove (root of the nose) and nasal tip

*Open roof deformity:*

- The flat, wide appearance of the dorsum after removal of a dorsal hump without in fractures

*Out fracture:*

- A fracture which mobilizes nasal bones prior to in fracture

*Soft triangle:*

- Rim of nose that does not contain cartilage and separates the dome from the nostril border

*Supratip:*

- Area just above the domes of the alar cartilages

*Tip defining points:*

- Most prominent areas of nasal tip: domes (right and left), supratip, columella break point

*Tip projection:*

- Distance from the nasal spine to the nasal tip

### 12.5.1 Classification of Nasal Anatomy

- Upper third – Nasal bones
- Middle third – Upper lateral cartilages (lie posterior to nasal bones and alar cartilages)
- Lower third – Lower lateral (alar) cartilages

### 12.5.2 Rhinoplasty: Classification of Technique

- Open
- Closed

### 12.5.3 Classification of Rhinoplasty Incisions (Fig. 12.6)

- Rim (vestibular border)
- Intercartilaginous: between the upper and lower lateral cartilages
- Intracartilaginous: splitting of the lateral crura of the lower lateral cartilage
- Transfixion: through the membranous septum
- Alar base excision

### 12.5.4 Classification of Osteotomies Performed During Rhinoplasty (Fig. 12.7)

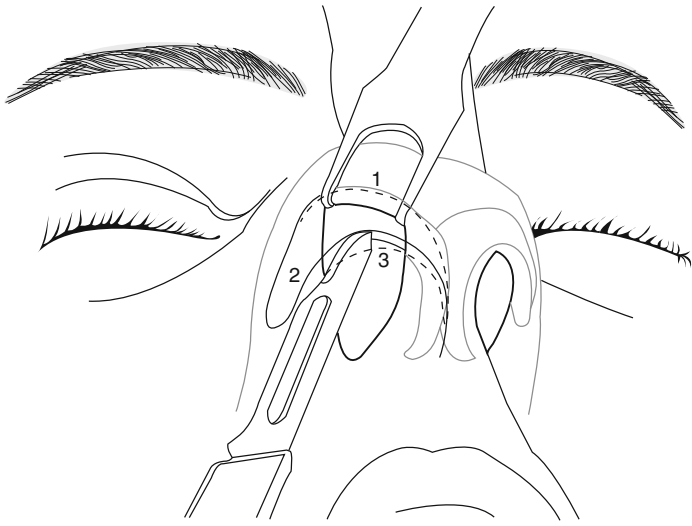
- Low to high
- Low to low
- Double level

*Internal nasal valve angle:*

- The angle between the upper lateral cartilages and the septum (10–15°)

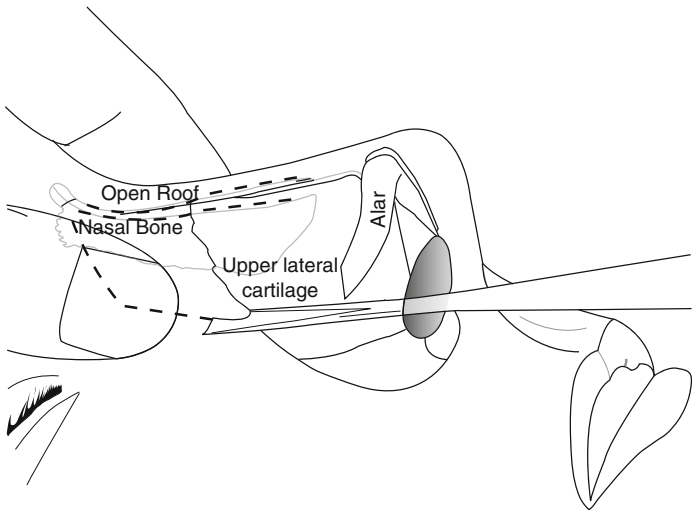
*Valve area:*

- Circumference of airway at the level of the internal nasal valve



- 1 Vestibular border incision (Rim incision)
- 2 Intracartilaginous incision
- 3 Intercartilaginous incision

**FIGURE 12.6.** Rhinoplasty incisions. 1 Vestibular border incision (rim incision). 2 Intracartilaginous incision. 3 Intercartilaginous incision.



**FIGURE 12.7.** Nasal bone and cartilage relationships with osteotomy lines indicated.

*Spreader grafts:*

- Cartilage grafts between the septum and upper lateral cartilages which increase the internal nasal valve angle improving respiration

*Umbrella graft:*

- A strut of vertically placed cartilage between the medial crura from the nasal spine to the nasal tip on top of which is placed an onlay graft

*Nasal cycle:*

- The normal 3 hourly congestion decongestion cycle

*Cottle sign:*

- Lateral cheek traction opens the nasal valve and improves air entry

*Pinocchio tip:*

- Excessive nasal tip projection

*Parrot beak deformity:*

- Inadequate nasal tip projection in association with a high supratip

### 12.5.5 Classification of Suture Technique to Adjust the Nasal Tip

Transdomal

Interdomal

Lateral crural mattress

Intercrural

Columella – septal

## 12.6 ABDOMINOPLASTY

### 12.6.1 Abdominoplasty Classification System of Diagnosis and Treatment

Matarasso A. Clin Plast Surg 1989

	I	II	III	IV
Skin laxity	Minimal	Mild	Moderate	Severe
Fat	Variable	Variable	Variable	Variable
Musculofascial system flaccidity	Minimal	Mild lower abdominal	Moderate lower or upper	Significant lower or upper
Treatment	Liposuction	Mini	Modified abdominoplasty	Standard

### 12.6.2 Huger Classification of Zones of Arterial Supply to the Abdomen (Fig. 12.8)

Huger WE Jr. The anatomic rationale for abdominal lipectomy. *Am Surg* 1979;45:612

Zone I Deep superior and inferior epigastric arteries

Zone II Superficial epigastric, superficial external pudendal, superficial circumflex iliac systems

Zone III Segmental perforators: intercostals, subcostal, lumbar arteries

### 12.6.3 An Aesthetic Classification of the Abdomen Based on the Myoaponeurotic Layer

Nahas FX. *Plast Reconstr Surg* 2001;108:1787

- A. Rectus diastasis secondary to pregnancy  
Treatment: Plication of anterior rectus sheath
- B. Rectus diastasis and laxity of the infraumbilical aponeurotic layer  
Treatment: Plication of anterior rectus sheath and L-shaped plication of the external oblique aponeurosis
- C. Congenital lateral insertion of the recti muscles  
Treatment: Release and undermining of the recti muscles from the posterior sheath and midline advancement
- D. Rectus diastasis and poor waistline  
Treatment: Plication of anterior sheath and advancement of external oblique

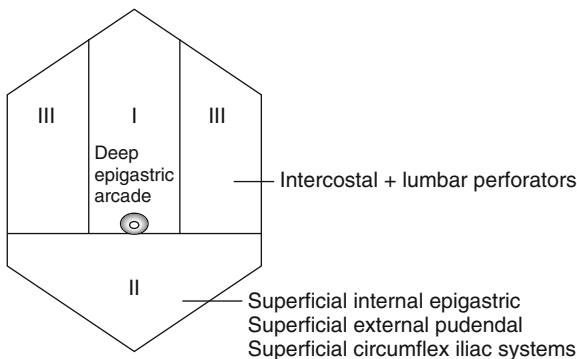


FIGURE 12.8. Blood supply to the abdominal wall.

### 12.6.4 Classification of Types of Abdominal Contour Deformity and Treatment

#### *Bozola and Psillakis*

Bozola AR, Psillakis JM. Abdominoplasty: a new concept and classification for treatment. *Plast Reconstr Surg* 1988;82:983

- Type 0 Normal contour  
Treatment: None
- Type 1 Excess fat only  
Treatment: Suction assisted lipectomy
- Type 2 Infraumbilical skin excess, + /- fat excess, muscle taut  
Treatment: Mini-abdominoplasty
- Type 3 Infraumbilical skin excess, + /- fat excess, may have infraumbilical musculoaponeurotic layer laxity  
Treatment: Mini-abdominoplasty
- Type 4 Infra + /- mild supraumbilical skin excess, + /- fat excess may have overall laxity of musculoaponeurotic layer  
Treatment: Limited, modified or extended mini-abdominoplasty
- Type 5 Infra- and supraumbilical skin excess, + /- fat excess, + /- laxity musculoaponeurotic layer  
Treatment: Traditional, Classic abdominoplasty including umbilical translocation

#### 12.6.5 Pitman

Pitman GH. In *Grabb and Smith's Plastic Surgery*. Eds Aston, Beasley, Thorne. Philadelphia: Lippincott-Raven 1997:676

- I Excess fat, taut skin, and muscle  
Treatment: Liposuction
- II Lax infraumbilical skin, taut muscle, +/- excess fat  
Treatment: Resect lower abdominal skin and subcutaneous tissue
- III Infraumbilical lax skin and muscle, +/- excess fat  
Treatment: Infra-abdominal abdominoplasty + muscle tightening
- IV Lax muscle, minimal, or no excess skin, +/- excess fat  
Treatment: Complete abdominoplasty without umbilical translocation
- V Lax supra- and infraumbilical skin, lax muscle, +/- excess fat  
Treatment: Complete abdominoplasty with umbilical translocation
- VI Circumferential skin laxity severe (secondary to massive weight loss), +/- residual fat, +/- muscle laxity  
Treatment: Circumferential abdominoplasty

#### 12.6.6 Other types of abdominoplasty:

Vertical abdominoplasty

Reverse abdominoplasty

## 12.7 LIPOSUCTION

*Liposuction:*

- *Aspiration of subcutaneous fat through small incisions by cannulae of varying diameter attached to a vacuum system*

### 12.7.1 Classification of Technique

Traditional

Ultrasonic assisted

Power assisted

### 12.7.2 Classification of Liposuction Technique According to Subcutaneous Infiltration Volumes

- |           |  |
|-----------|--|
| Dry       | – No infiltrate                          |
| Wet       | – 200–300 cc infiltrate per treated area |
| Superwet  | – 1 cc infiltrate: 1 cc aspirate         |
| Tumescent | – 2–3 cc infiltrate: 1 cc aspirate       |

*Pre-tunnelling:*

- *Creation of channels in the allocated area prior to suction to establish an even plane.*

*Cross tunnelling:*

- *Creation of channels at an angle to those created by pre-tunnelling*

*Fountain effect:*

- *The jet of infiltrate emerging from a small incision under pressure once tumescence has been achieved*

*Feathering:*

- *A technique to eliminate steps between suctioned areas and non treated areas*

### 12.7.3 Classification of Liposuction Complications

CM O'Brien. "LIPOPROBLEMS"

- |   |                                  |
|---|----------------------------------|
| L | Loss of symmetry                 |
| I | Infection                        |
| P | Perforation (abdominal/thoracic) |
| O | Oedema                           |
| P | Parasthesiae/dysaesthesiae       |
| R | Reactive discoloration           |
| O | Osmotic fluid shift              |
| B | Bleeding                         |
| L | Lignocaine toxicity              |
| E | Ecchymoses                       |
| M | Mal contour                      |
| S | Seroma                           |

## 12.8 UPPER EXTREMITY BODY CONTOURING

### 12.8.1 Classification of Brachial Fat Deposits and Skin Laxity

Vogt P. Body Contouring: Upper Extremity in Plastic Surgery, vol 6. Ed Mathes, Saunders Elsevier; 2006:293

- Group 1 Minimal to moderate subcutaneous fat  
Minimal skin laxity
- Group 2 Generalized accumulation of subcutaneous fat  
Moderate skin laxity
- Group 3 Generalized obesity  
Extensive skin laxity
- Group 4 Minimal subcutaneous fat  
Extensive skin laxity

## 12.9 THE BREAST

(See Chapter 7 for breast augmentation, reduction, mastopexy and nipple reconstruction)



# Abbreviations

---

AJCC	American Joint Committee on Cancer
AFX	Atypical fibroxanthoma
Ag	Antigen
AK	Actinic keratosis
AN	Accessory nerve
APL	Abductor pollicis longus
APC	Antigen presenting cell
APB	Abductor pollicis brevis
BCC	Basal cell carcinoma
BMI	Body mass index
CMN	Congenital melanocytic naevus
DCIS	Ductal carcinoma in situ
DFSP	Dermatofibroma sarcoma protruberans
DIPJ	Distal interphalangeal joint
DVT	Deep venous thrombosis
DXT	Radiotherapy
EAM	External auditory meatus
ERCL	Extensor carpi radialis longus
ECRB	Extensor carpi radialis brevis
EPB	Extensor pollicis brevis
EIP	Extensor indicis proprius
EDC	Extensor digitorum communis
EDM	Extensor digiti minimi
ECU	Extensor carpi ulnaris
FDP	Flexor digitorum profundus
FDS	Flexor digitorum superficialis
FNCLCC	French Federation Nationale des Centres de Lutte Contre Le Cancer
FPB	Flexor pollicis brevis
FPL	Flexor pollicis longus
FTSG	Full thickness skin graft
GI	Gastrointestinal
HPF	High power fields

Ig	Immunoglobulin
IJV	Internal jugular vein
IPJ	Interphalangeal joint
ISSAV	International Society for the Study of Vascular Anomalies
IV	Intravenous
LCIS	Lobular carcinoma in situ
MACS	Minimal access cranial suspension
MCPJ	Metacarpophalangeal joint
MFX	Malignant fibrous histiocytoma
MHC	Major histocompatibility complex
MM	Malignant melanoma
MODS	Multiple organ dysfunction syndrome
MRI	Magnetic resonance imaging
MTPJ	Metatarsophalangeal joint
NAC	Nipple areolar complex
NF	Neurofibromatosis
NICH	Non-involuting congenital haemangioma
NK	Natural killer cells
PA	Postero- anterior
PABA	Para-amino-benzoic-acid
2PD	Two point discrimination
PE	Pulmonary embolus
PIPJ	Proximal interphalangeal joint
PVNS	Polyvillonodular synovitis
RBC	Red blood cell
RS	Respiratory system
RSD	Reflex sympathetic dystrophy
RLD	Radial longitudinal deficiency
RICH	Rapidly involuting congenital haemangioma
SA	Surface area
SCC	Squamous cell carcinoma
SCM	Sternocleidomastoid
SIRS	Systemic inflammatory response syndrome
SLAC	Scapholunate advanced collapse
SMAS	Superficial musculoaponeurotic system
TBSA	Total body surface area
TFL	Tensor fascia lata
TMJ	Temporomandibular joint
TNM	Tumour, node, metastasis
TNMG	Tumour, node, metastasis, grade
TMJ	Temporomandibular joint

UCL	Ulna collateral ligament
V	Volts
VPI	Velopharyngeal incompetence
WHO	World Health Organisation
X-ray	Radiograph

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