SUPER GUIDE TO PLASTIC SURGERY

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2016

Preface

The object of this **Super Guide to Plastic Surgery** is due to the need of medical students of an easy and clear reference of plastic surgery.

The main goal of this book is to provide an excellent reference for them as it attempts to present the plastic surgery course in a simple and understandable format making it easy to study.

Take care! This book does not replace the text books but should be used in conjunction with them.

It is a fact that there is no book without some mistakes. So, I have spent much time and effort in order to keep this work as free of mistakes as possible.

Ahmed Khalil,

2016

Contents

Plastic Surgery

Denomination:

- The word ˝ **PLASTIC** ˝
  - Derived from Latin ˝**plasticus**˝ and Greek ˝**plastikos** ˝**.**
  - Means to create, to shape and to mold.

Definition:

- Is a broad specialty that deals with the surgical treatment of congenital or acquired visible defects or any deformity in any part of the body in any age group.

- As the scope of plastic surgery is so broad, the plastic surgeon will be required to have a good working with other medical and surgical colleagues, particularly pediatric surgeons, urologists, ophthalmologists, otorhinolaryngologists, orthopaedic, maxillofacial surgeons, neurosurgeons and radiotherapists.

History:

- History of plastic surgery dates back to ancient Egypt and indian texts.
- Significant advances of plastic surgery dates back to World War I and II.

Aim:

- Improve and maintain function.
- Improve appearance.
- Improve psychological state of patient.

Role of plastic surgery:

- Define the problem and its psychological implications.
- Determine the motivating factors behind the patient's request and his / her expectations of the end result.
- Determine the various options of reconstructive methods available and will choose the simplest and most effective form of treatment.

Wound Healing

Definition:

- Healing means replacement of damage tissue by healthy one.

Mechanism of healing:

- **Contraction:**
  - Minimize the wound size.
- **Granulation tissue formation:**
  - Later replaced by fibrous tissue.
- **Epithelialization:**
  - Basal layer and epidermis start to migrate over the fibrous tissue.

Types of wound healing:

- **Primary intention:**
  - **Occur in:**
    - Healing of clean wounds which are well coapted.
  - **Healing mechanism:**
    - Little amount of granulation.
    - Minimal fibrosis.
    - Epithelial proliferation.
  - **Result:**
    - Fine linear scar with minimal contraction and disfigarment.
- **Secondary intention:**
  - **Occur in:**
    - Healing of septic wound or with tissue loss which prevent approximation of the edges.
  - **Healing mechanism:**
    - Extensive granulation filling the cavity from depth to surface.
    - Epithelialization from edges.
    - Marked fibrosis.
  - **Result:**
    - Weak ugly scar with much contracture and deformity.
- **Delayed primary [Tertiary] intention:**
  - **Occur in**
    - Healing after secondary sutures that applied to a wound left open for few days [as in contaminated wound].
  - **Healing mechanism and result:**
    - As in primary intention.

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Phases of wound healing:

- **Inflammatory phase:**
  - Start at the time of injury and last 2 to 3 days and may be prolonged with infection.
  - The healing process initiating by platelet activity that;
    - Stops bleeding.
    - Triggers the immune response.
    - Releases growth factors that attracting and activating the inflammatory cells.
  - After homeostasis is achieved [within 24 hours of the initial injury], vasodilatation occurs that resulting in increased capillary permeability and infiltration of inflammatory cells into the wound [neutrophils, monocytes and macrophages] that control bacterial growth and remove dead tissues.

- **Proliferation phase:**
  - Starts around day 3, as fibroblasts arrive, and continue for 21 days.
  - Characterized by :
    - Granulation tissue formation.
    - Epithelialization.
    - Collagen synthesis.
  - **Granulation tissue formation:**
    - Granulation tissue is the beefy red tissue that bleeds easily.
    - **Formation:**
      - New capillaries formation [Angiogenesis]:
        - Proliferation of endothelial cells from the blood capillaries to produce solid tubes which meet together, branch and their branches connect with each other.
      - These new capillaries generate and feed new tissue.
  - **Epithelialization:**
    - It is a prominent process in wound healing.
    - **Mechanism:**
      - Mobilization or loosening of the basal epithelial cells from their dermal attachments.
      - Migration from the wound edges to the place of defect.
      - Proliferation and replacement by mitosis of pre-existing epithelial cells which starting.

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- In large open wound, the epidermis grows for few centimeters. Then, slows down and a raw area will persist.
- In any wound type, the new formed epithelium is thinner than normal one and it has no appendage structures.

- **Function:**
  - Restoration of tissue by providing a barrier between internal & external environment to prevent bacterial invasion and fluid loss.
- **The rate of epitheliaization:**
  - **Accelerated by:**
    - Clean moist wound.
  - **Slowing by:**
    - Dry eschar (Scab).

- **Collagen synthesis [mainly type III]:**
  - Total collagen content increases for 3 weeks, until collagen production and breakdown become equal and the remodeling phase begins.

- **Remodeling [Maturation] phase [day 21 up to 2 years]:**
  - Collagen production and breakdown continues for about one year.
  - **Maturation of scar:**
    - Fibroblasts and macrophages cooperate to relapse type III collagen by type I collagen.
  - **Strength of wound:**
    - By time, collagen become thick and arranged in the lines of tension that resulting in an increase of tensile strength of the wound.

Time	Tensile strength of the wound
By stitches	70 % of its final strength
After 3 week	20% of its final strength
After 6 week	50% of its final strength
After 3 months to 6^{th} month [Normal healed wound]	80% of its original strength

  - **Angiogenesis subsides.**

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- **Contraction**
  - Contraction is the normal wound closure in an open wound:
    - Decreased by a concentric reduction in size.
    - Closes without scarring.
  - Contraction caused by and depends on number of myofibroblasts [which derived from fibroblast] within the wound.
  - All wounds contract from end to end (not from side to side).
  - Contraction is aggravated by stress on wound.

Requirement for wound healing:

- **Well-being:**
  - Both physical and emotional well-being is essential for successful wound healing.
- **Good nutrition.**
- **Adequate vascular blood supply.**
- **Clean wound.**
- **Moist environment.**
- **Thermal regulation.**
- **Wound protection from the trauma:**
  - To avoid retardation of epithelialization, granulation tissue formation and wound contraction.

Factors affecting wound healing:

General factors:	Local factors:
• Age. • Nutrition. • Hormoes. • Systemic diseases. • Peripheral vascular disease. • Drugs. • Smoking. • Radiation. • Chemotherapy.	• Arterial insufficiency. • Venous insufficiency. • Infection. • Foreign and necrotic tissues. • Movement and shearing forces, • Adhesion. • Pressure.

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General Factors:

- **Age:**
  - Slow with elderly due to decrease protein turnover.
- **Nutrition:**
  - **Protein deficiency** [< 2gm]:
    - Decrease collagen synthesis.
    - Lower resistance to infection.
  - **Trace elements deficiency:**

Zinc deficiency	Retard epithelialization and fibroblast proliferation.
Copper deficiency	Retard collagen cross-linking.
Iron deficiency	Impaired matrix synthesis.

  - **Vitamin Deficiency:**

Vitamin C deficiency	Collagen weakening. Rupture& hemorrhage of vessels.
Vitamin A deficiency	Retard epithelialization.
Vitamin E deficiency	Decrease tensile strength.
Vitamin K deficiency	Hemorrhage. Decrease protein absorption.
Vitamin B deficiency	Retard cross-linking of collagen. Impaired cellular maturation.

- **Hormones:**
  - Growth hormone, thyroxine and parathyroid improve wound healing.
- **Systemic Diseases:**
  - Anaemia, ureamia, liver disease, D.M. and malignancy causing retard wound healing.
- **Peripheral vascular disease:**
  - Tissue hypoxia.
- **Drugs:**
  - Immunosuppressive agents, anti-neoplastic agents and steriod drugs causing retard wound healing.
- **Smoking:**
  - Increase carboxy-hemoglobin.
- **Radiation:**
  - Tissue hypoxia and epithelial damage.
- **Chemotherapy.**
  - Suppress bone marrow.
  - Increase susceptibility of infection.

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Local Factors:

- **Arterial insufficiency [local ischemia]:**
  - Impair tissue vascularization.
- **Venous insufficiency:**
  - Edema and decrease oxygen diffusion.
- **Infection:**
  - Prolong inflammation and destroy collagen fibers.
- **Foreign body and necrotic tissues:**
  - Prolong inflammation and delay repair.
- **Movement and shearing forces:**
  - Wound gaping and blood supply damage.
- **Adhesion:**
  - Prevent wound contraction.
- **Pressure:**
  - Ischemia and impair vascularization.

Cells participate in wound healing:

Cell	Appearance	Function
Platelets	Early after injury.	Homeostasis. Attract and activate fibroblast, endothelial cells and macrophages.
PMNs	Peak at 24 hours.	Wound debridement. Prevent infection.
Macrophages	Between 48-72 hours post-wounding, it represent the predominant cell type within the wound.	1ry producer of growth factors responsible for proliferation & production of ECM and proliferation of endothelial cells. Play a key role in angiogenesis by release angiogenic substances.
Lymphocytes	Late in inflammatory phase.	Unknown.
Fibroblasts	At day 3.	Formation of all connective tissue of ECM. Formation of myofibroblast.
Endothelial cells	Proliferate from intact capillaries.	Angiogenesis.
Epithelial cells	Proliferate from wound edges & injured epithelium.	Epithelialization.

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Growth factors [GF] in wound healing:

- **Definition:**
  - They are proteins in nature which act on individual cells to promote cell growth, cell proliferation and cell migration.

- **Nomenclature:**
  - **Growth factors are often named according to:**
    - **Cell of origin:** platelet-derived GF.
    - **Cell on which they act:** fibroblast GF.
    - **Biological function of it:** keratinocyte GF.

- **Mechanisms of growth factors action:**

Mechanism of action	Explanation
Endocrine	Produced by a cell & then transported via the circulation to a distant cell on which they act.
Paracrine	Acts on an adjacent cell.
Autocrine	Released by & acts on the same cell.
Intracrine	Not released but acts within the same cell.

  - Most of wound healing G.F. act in autocrine or paracrine fashion.

- **Commonest growth factors:**
  - Epithelial GF [EGF].
  - Transforming GF-α and –β [TGF-α and -β].
  - Platelet derived GF [PDGF].
  - Platelet activating GF [PAGF].
  - Fibroblast GF-1 and -2 [FGF-1 and-2].
  - Keratinocyte GF [KGF].
  - Vascular endothelial GF [VEGF].

- **Functions:**
  - Stimulate epithelialization.
  - Stimulate endothelial cell proliferation.
  - Stimulate fibroblast proliferation.
  - Stimulate angiogenesis.
  - Stimulate collagen synthesis.
  - Stimulate granulation tissue formation.
  - Stimulate matrix deposition and wound contraction.

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Complications of wound healing:

Hematoma:

- **Definition:**
  - Collection of blood under the wound.
- **Prevention:**
  - Good homeostasis.
- **Treatment:**
  - Drainage.

Infection:

- **Definition:**
  - A wound contains purulent [pus] drainage.
- **Clinical presentation:**
  - **General:**
    - Fever and malaise and increase pulse rate.
  - **Local:**
    - Painful and tenderness swollen.
    - Discharge with offensive odour.
- **Investigations:**
  - Increase number of WBCs.
  - Culture and sensitivity test.
- **Treatment:**
  - Antibiotics according to culture and sensitivity test.
  - Wound care [Cleansing, debridement, and dressing].

Wound dehiscence:

- **Definition:**
  - Total breakdown of all wound layers.
- **Aetiology:**
  - Excess tension on the suture line.
- **Treatment:**
  - Patient remains in bed.
  - Warm moist sterile dressing.

Evisceration:

- **Definition:**
  - Organs protrude through an opened wound [as abdomen].
- **Treatment:**
  - The wound and contents covered by warm sterile saline dressing.
  - Surgical wound closure.

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Contracture:

- **Definition:**
  - It is a pathologic shortening [end result of excess contraction] of scar tissue resulting in deformities of the scar overlies a joint.
- **Aetiology:**
  - A wound crossing the joint.
- **Treatment:**
  - Surgical correction [Z-plasty, V-Y flap].

Unstable scar:

- **Aetiology:**
  - Inadequate coverage of wound especially over bone.
- **Diagnosis:**
  - Chronic tearing and ulceration of wound.
- **Treatment:**
  - Excision of unstable skin and scar and replaced with skin graft or flap.

Marjiolin' ulcer:

- **Definition:**
  - It is a squamous cell carcinoma that develops in a chronic wound after many years.
- **Aetiology:**
  - Recurrent ulceration of unstable scar with chronic irritation and inflammation.
- **Diagnosis:**
  - Chronic ulceration with tumor mass confirmed by biopsy.
- **Treatment:**
  - Excision with safety margin.

Hypertrophic scar.

Keloid.

See scar management.

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Wound Management

Definition:

- Wound is disruption of normal anatomical structure [tissue discontinuity].

Classification:

- **Classification according to wound chronicity:**
  - **Acute:**
    - Caused by trauma.
  - **Chronic:**
    - Caused by a wound exposed to friction, shear, moisture.
- **Classification according to cause:**
  - **Intentional:**
    - A wound results from a therapy; [e.g. surgical incision]
  - **Unintentional:**
    - A wound occurs unexpectedly; [e.g. trauma]
- **Classification according to tissue involvement [severity]:**
  - **Superficial:**
    - Involves epidermis only.
  - **Partial-thickness:**
    - Involves epidermis and dermis.
  - **Full-thickness:**
    - Involves skin, subcutaneous layer, fascia with exposed bone.
- **Classification according to wound cleanliness:**
  - **Clean:**
    - A wound containing no pathogenic organism.
  - **Clean contaminated:**
    - A wound containing harbors microorganisms under aseptic condition.
  - **Contaminated:**
    - A wound containing foreign or infected materials.
  - **Infected:**
    - A wound containing pus.
  - **Colonized:**
    - A wound containing multiple numbers of microorganisms.

  Notes: All wounds have micro-organisms, only exogenous micro-organisms can cause contamination.

- **Classification according to wound nature [status of skin integrity]:**
  - **Closed:** Intact skin surface + caused by blunt trauma.

	Abrasion	Contusion	Hematoma
Definition	Partial loss of superficial layers of skin	Extravasation of blood & exudation of plasma	Localised collection of blood in the fascial planes®
Cause	Friction against a rough surface	Blunt object resulting in damaged small blood vessels	Rupture of a sizeable vessel
Clinically	Painful raw surface oozing blood	Swelling, pain with ecchymotic skin	Painful fluctuant swelling

Heamatoma may be subcutaneous, subfascial, intramuscular or subperiosteal.

  - **Opened:** Break skin surface + caused by trauma or surgically.

		Incised	Lacerated	Crushed & devitalized	Penetrating
Definition		Clean cut edge wound	Crushed edge wound	More extensive type of lacerated wounds.	Usually deep small wound on surface which may be: **A.Perforating:** inlet + outlet **B. Punctured:** inlet - outlet
Cause		sharp cutting instrument	blunt heavy instrument		
Clinically	Tissue damage	Little or No	Severe	Crush syndrome commonly occurs.	Associated with an internal organ or vascular injuries
	Bleeding	Severe	Little		seldom severe
	Infection	Little or No	More liable		More liable

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Clinical appearance of wound:

- Depends on the type of the material present in the base of the wound;
  - Slough [Yellow].
  - Necrotic tissue [Black].
  - Infected tissue [Green].
  - Granulated tissue [Red].
  - Epithelialised tissue [Pink].

Complications:

- **General complications:**
  - **Shock.**
  - **Crush syndrome:**
    - **Cause: Crushing of muscle.**
    - **Pathogenesis:**
      - Oligaemic shock due to extravasation of blood into adjacent muscles.
      - Myohaemoglobin enters the circulation and acute renal tubular necrosis.
      - The crush muscle swells, tension develops and impair circulation with increased risk of ischemic changes.
    - **Treatment:**
      - Shock measures.
      - Urine alkalinization by I.V. Sodium bicarbonate.
      - Fasciotomy to relieve tension.
- **Local complications:**
  - Infection.
  - Gangrene.
  - Injury to vital structures.

Management:

- **First aid treatment:**
  - ABCDE.
  - Immobilization of the fracture.
  - Sterile dressing to prevent contamination.
  - 4 Anti-[Anti-shock measures, anti-tetanic serum, anti-gasgangrene, antibiotics]
- **Assessment of associated injury.**
- **Management plan:**
  - **Treatment of closed wounds**
    - **Abrasion:**

- Antibiotics + repeated dressing.

- **Contusion:**
  - Fomentation [Cold in 1st 24 hours then hot]
- **Hematoma:**
  - Antibiotics + fomentation + pressure bandage if small or aspiration if large.

- **Treatment of open wounds**
  - **Wound cleansing and irrigation**
  - **Debridement**
  - **Dressing**
  - **Closure**

Wound cleansing and irrigation

Definition:

- Application of fluid that loosens and washes any cellular debris such as exudates, slough, bacteria and residual topical agents from previous dressings.

Objective:

- Help optimization of healing environment.
- Decrease wound contamination and hence infection.

Timing:

- Initially and at each dressing changes.

Common solutions:

Solution	Antibacterial activity	Mechanism of action	Tissue toxicity
Normal saline	-	Washing	-
Povidine iodine	+	Germicide	+
Chlorhexidine	+	Bacteriostatic	+
Hydrogen peroxide	+	Bacteriocidal	+

Criteria of ideal solution:

- Warmed to body temperature.
- Not toxic to tissue.
- Not increase infection rate.
- Not delay healing.
- Not reduce tensile strength.
- Inexpensive.

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Debridement

Definition:

- Removal of devitalized, highly contaminated tissues [De-vascularized, necrotic, infected tissues] and foreign bodies with maximal preservation of critical anatomic structures as nerves, blood vessels, tendons and bones.

Why debridement?

- **Because devitalized tissues;**
  - Acts as a culture medium promoting bacterial growth.
  - Inhibits leukocyte phagocytosis of bacteria.
- **Delayed debridement cause progression of necrosis as a result of;**
  - Desiccation of surface of the traumatized wound.
  - Gradual multiplication of the contaminated bacteria at the interface between viable and non-viable tissues.

Objective:

- Reduce bacterial count and infection rates.

Techniques:

- **Spontaneous [Autolytic] debridement:**
  - Depends on the body's digestive enzymes to break down necrotic tissues.
- **Chemical and enzymatic debridement:**
  - The debriding agent is a specific chemical or enzyme to remove or digest the devitalizing materials.
  - Criteria of ideal debriding agent:
    - Applicable.
    - Painless.
    - Harmless to live tissues.
- **Mechanical debridement:**
  - Applying saline-moistened gauze to the wound and letting it desiccate. Then, remove the gauze at frequent intervals usually 2-3 times / day.
  - Can be traumatic to fragile new tissues.
- **Surgical debridement:**
  - Occur in emergency room [ER] or in operating room [OR] under anaesthesia with scalpel or scissors in combination with copious irrigation.

Difference between debriding agent and antibacterial agent:

- **Debriding agent:**
  - Materials that are used to dissolve or degrade slough or necrotic tissue present in the wound.
- **Antibacterial agent:**
  - Topical agent that is applied to open wound to treat infection.

Dressing

Objectives:

- Absorb exudates from the wound.
- As a vehicle to apply medication to the wound surface.
- Prevent wound contamination.
- Provide mechanical protection.
- Provide pressure for hemostasis.
- Help immobilization.
- Hide the wound from view.
- Eliminate pain.
- Promote re-epithelialization.

Criteria of ideal wound dressing [ABCDEFGHI]:

- **A**vailable and **A**bsorptive.
- **B**arrier [Permeable to gaseous and impermeable to bacteria]
- **C**ost effective and **C**omfortable.
- **D**ead or necrotic material removal.
- **E**pithelialization encouraged and **E**asy applied and removed with or without minimal trauma or pain.
- **F**lexible.
- **G**ranulation encouraged.
- **H**ealing promoted and **H**ydration.
- Non **I**rritant.

Types of wound dressing:

- **Open wound technique:**
  - The wound is cleansed, applied the bacteriostatic agent and kept the wound exposed.
  - Wound nursing should be done in clean environment to be free from bacteria around the patient.
  - It is associated with prolonged healing time and pain.
- **Semi-open wound technique:**
  - The wound is covered by dressing material that provides

        - Barrier against bacteria invasion.
        - Mechanical protection.
        - Permeable as to allow egress of fluid and exudates.
- **Semi-occlusive wound technique:**
    - **This type of dressing is**
        - Bacterial and wound fluid impermeable.
        - Vapor permeable [Allow exchange of gaseous and water vapor].
    - **Advantages:**
        - Promote faster healing.
        - Less pain.
    - **Disadvantages:**
        - Fluids tend to collect under the dressing and needs to be drained frequently.
- **Occlusive wound technique:**
    - **This type of dressing is**
        - Impermeable for vapor and oxygen [Water proof].
    - **Advantages:**
        - Hypoxia ----- decrease ph of exudates -----.decrease bacterial count.
        - Not adherent to bed. So, no pain.
        - Enhance the rate of epithelialization and collagen synthesis.
- **Vacuum assisted closure [VAC]:**
    - It provides a negative pressure environment that enhance granulation tissue formation and stimulate wound contraction.

Wound dressing approaches:

- **Wet-to-dry dressing approach [Pre 1980]:**
    - Using a dry piece of gauze on a sticky wet wound.
    - The gauze absorbed the exudates and wound debris.
    - Pulled off the gauze it debrided the wound but it also pulled off any formed granulation and epithelial tissues.
    - The patient said OUCH very loudly.
- **Dry dressing approach [1980 – Mid 1990]:**
    - Leave the wound to get some air.
    - Resulted in the exudates and necrotic tissue drying to form hard scab/eschar which preventing epithelisation, granulation and wound contraction.
- **Moist dressing approach [2000 – Up till now]:**
    - Assists in epithelial tissue migration, angiogenesis and wound contraction.

Difference between moist wound healing and dry wound healing

Moist wound healing	Dry wound healing
Prevent tissue desiccation and scab formation	Encourages scab formation
Reduce healing time	Delay healing
Reduce risk of infection	Increase pain
Faster re-epithelisation	Reduce rate of re-epithelisation
Better cosmetic result	May produce scar tissue

Closure

- **Methods of wound closure:**
  - Sutures.
  - Staples or clips.
  - Skin tapes.
  - Skin adhesives.

Sutures

- **Sutures techniques:**
  - **Subcutaneous Sutures:**
    - Eliminate dead space.
    - Support subcutaneous tissues.
    - Reduce tension across wound margin.
    - Approximate & evert wound edges accurately.
  - **Dermal Sutures:**
    - Reduce tension across wound edges.
    - Approximate & evert wound edges.
    - Provide strength to the closure.
  - **Skin Sutures:**
    - **Types:**
      - **Simple interrupted Suture:**
        - It is a simple loop knotted at one side of the wound.
        - Suture should include at least the whole dermis.
        - Needle should take an equal bite of each side.
        - Can adjust tension with each suture.
      - **Vertical Mattress Suture:**
        - It is used to ensure eversion of skin edges as in thin & poorly supported skin.

- It the least methods to leave suture marks if it is not tied too tightly and removed early.

- **Horizontal Mattress Suture:**
  - It provides approximation and eversion of skin edges
  - It is particularly advantageous in thick glabrous skin [feet & hand].
  - Need delayed suture removal. So, increased risk of suture marks.
  - **Half-Buried Horizontal Mattress** in which knots on one side of the suture line with no suture marks on the other side e.g. areola in breast reduction.
- **Subcuticular [Running intradermal] Suture:**
  - It is a good cosmetic method for skin closure.
  - It provides no risk of any skin suture marks.
- **Continuous Suture:**
  - It is rapidly performed and haemostatic method.
  - Increase risk of suture marks. So, not used in visible areas.

- **Classification of suture materials:**

SOURCE	Natural	Synthetic
ABSORPTION	Absorbable	Non-absorbable
CONSTRUCTION	Monofilament	Multifilament [Braided]

Non-absorbable sutures

Material	**Source**	**Filament**	**Knot security**	**Tissue reaction**	**Tensile strength**
Silk	Natural	Multi	Best	Most	Least
Surgical steel	Natural	Mono	Good	Least	Indefinite
Nylon [Polyamide]	Synthetic	Mono	Good	Minimal	Good
Prolene [Polypropylene]	Synthetic	Mono	Least	Least	Best
Mersilene & Dacron [Polyester]	Synthetic	Multi	Least	Least	Best

Absorbable sutures

Material	Source	Filament	Knot security	Tissue reaction	Tensile strength	Absorption Profile [days]
Plain gut	Natural	Mono	Poor	Most	Fair	7-14
Chromic gut	Natural	Mono	Fair	Most	Fair	14-30
Vicryl [Polygalactin 910]	Synthetic	Multi	Good	Minimal	Good	50-70
Dexon [Polyglycolic acid]	Synthetic	Multi	Best	Minimal	Good	60-75
PDS [Polydiaxanone]	Synthetic	Mono	Fair	Least	Best	180-210
Maxon [Polyglyconate]	Synthetic	Mono	Fair	Least	Best	180-210
Monocryl [Poliglecaprone]	Synthetic	Mono	Fair	Least	Best	90-120

In general;

- **Natural suture materials:**
  - Initiate more tissue reaction.
  - Augment and maintain infection.

- **Monofilament sutures:**
  - Provide better passage through tissues.
  - Lower tissue reaction.

- **Multifilament sutures:**
  - Induce more tissue reaction.
  - Provide better knot security.

Staples or clips

- It is a quick & time saving method.
- It is useful in hair-bearing areas.
- **Disadvantages:**
  - Not support S.C. tissues.
  - Leave puncture marks if left more than 7-8 days.
  - Require special clip removers.

Skin tapes

- Approximate skin edges, it requires buried sutures to approximate deeper layers, relieve tension & prevent inversion of skin edges.
- Provide strength to the closure after removal of the skin sutures.
- Can be used alone or with sutures and glue.

Skin adhesives

- **They are used in areas where**
  - there is no tension on the closure or
  - strength of closure has been provided by a layer of buried dermal sutures
- **Types:**
  - Biologic [fibrin] or synthetic [acrylic glue or dermabond].
- The fibrin adhesives are not strong as the synthetic adhesives but better tolerated by the tissue.
- **Contra-indications:**
  - Lacerated, crushed or contaminated wounds.
  - Mucosal surfaces.
  - Mobilized [hand, joint] or moisture [axilla, perineum] areas.

Closure of the open wound depends on the type of wound

Wound type	Method of closure
Incised	1ry closure
Lacerated	Wound excision & 1ry closure of skin
Crushed & devitalized	Wound excision & delayed 1ry closure
Clean incised wound + skin loss	1ry grafting
Lacerated wound + skin loss	Wound excision & 1ry grafting
Crushed & devitalized + skin loss	Wound excision & delayed 1ry grafting
Wounds with exposed vital structure	Wound excision & flap

Difficulties to deal with Crushed & devitalized wounds:

- Distinguish between viable and non-viable tissues.
- Increase bacterial contamination.
- Edema.

So, attempts to close the wound by 1ry suture result in tissue tension and local ischemia.

Scar management

Definition:

- Scar is the visible result of normal wound healing of the skin.

Normal scar formation:

- **Phase of hemostasis:**
  - Fibrin is laid down to fill the wound defect.
- **Phase of inflammation:**
  - The wound is invaded by inflammatory cells.
- **Phase of proliferation:**
  - Cellular mitosis with new collagen deposition results in fibrosis.
  - From day 5, Tensile strength of the incision rises quickly as new collagen fibers are laid down and the process continues up to 3 weeks after injury.
  - At this phase, the scar is a depressed pink line then gradually begins to swell slightly to form a pink or indurated scar. This process of proliferation in hypertrophic scar formation lasts 6 months to 2 years.
- **Phase of maturation:**
  - Vascularity is decreased, excess collagen is disappeared and the scar becomes paler, flatter and softer.

Criteria of optimal scar:

- Thin flat pale line in a relaxed skin tension line that does not traverse or contract anatomical boundaries or structures.

Stages of a normal scar [Clinical course of a normal scar]:

Stage	Period	Description of the scar
I	0 - 4 w	Fine, soft, not contracted and not strong.
II	4 - 6 w	Red, thick, hard, tends to contract and strong. May feel itching. Wound strength is approximately 50 % of normal.
III	6 w - 12-18 m	Gradually soft, supple, white and tends to relax. Asymptomatic.

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Factors affecting final appearance of the scar:

- **Impaired wound healing [general or local factors].**
- **Direction of the scar** [most important factor of scar formation]**:**
  - Wounds parallel to natural crease lines and skin tension lines heal well and mature rapidly.
  - Longitudinal scars that cross joint crease tend to form thick hypertrophic scars and contractures.
- **Scar location on the body:**
  - **Areas of thin skin [eyelid, areola, genitalia]:**
    - Good scars.
  - **Areas of increase sebaceous activity [back, nose, face]:**
    - More stitch mark problems. So, prefer subcuticular sutures.
  - **Areas of decrease sebaceous activity [palm, sole]:**
    - Less stitch mark problem.
  - **Wounds on head and neck:**
    - Better healing because it has better vascularity.
- **Depth of wound:**
  - Any injury to the skin that extends into the papillary dermis or deeper will form a permanent scar.
- **Skin type:**
  - Darker skinned person produce keloids more commonly than lighter skinned person.
  - Pink-skinned or fair haired person is more likely to develop red raised scars.
- **Tension:**
  - Predispose to initial hypertrophic scar formation followed by an atrophic stretched scar.
- **Age:**
  - **In older patients:**
    - Less tendency to form hypertrophic scar and the scar becomes better because there is
      - Less skin tension.
      - Less sebaceous activity.
      - Less collagen required to knit scar together.
  - **In younger patients:**
    - More tendency to form hypertrophic scar because increase tension in wound that occurs from;
      - Growth.
      - Thick scar as a result of collagen overgrowth.
      - Increase sebaceous activity.

Clinical picture of symptomatic scar:

- Erythema.
- Discoloration.
- Pruritis.
- Painful and tenderness.
- Contracture.
- Loss of movement.
- Widening of the scar.
- Embarrassment and anxiety of ugliness scar.

Classification of symptomatic scar:

- Pigmented scar.
- Hypopigmented scar.
- Hyperpigmented scar.
- Painful scar.
- Raised scar.
- Depressed scar.
- Contracted scar.
- Bald scar.
- Hairy scar
- Hypertrophic scar.
- Keloid.

Management of the scar:

All patients should be counseled pre-operative and post-operative to expect and understand that an initial wound may thick, red and unsightly during the proliferative phase.

Although the scar may improve by maturation with the passage of time, it will never completely disappear.

While there is a large range of measures available to try to improve scars. There is no known way at present to remove a scar completely without trace

"ONCE A SCAR, ALWAYS A SCAR"

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- **Surgical measures to obtain best possible scar:**
  - Irrigation and adequate debridement of the wound.
  - Gentle handling on the tissue.
  - Minimize damage to the skin.
  - Decrease excessive use of diathermy.
  - Optimal placement of incision.
  - Tension-free closure.
  - Using proper suturing and dressing techniques.

- **Conservative treatment [Post-operative care]:**
  - **Until the 50% of the tensile strength of the wound is occur at about 6 weeks,**
    - Splinting of wound especially if the scar on mobile part of the body.
    - Correct timing of suture removal.
    - Adhesive tapes kept on across the wound after removal of the sutures to relieve tension and decrease tendency of wound separation.
    - A moisturizing cream with gentle massage [Grease massage] to keep the scar moist and supple [speed softening of subcutaneous fibrosis].
    - Prophylactic measures against such complication [hypertrophic scar, keloid];
      - Pressure therapy with elasticated garments.
      - Silicon therapy [to relax and soften the scar].
      - Steroid therapy [to relieve itching].

  - **Until the fully wound maturation is occur at least 1 year after injury,**
    - **Avoid exposure to extreme temperature;**
      - As the scar is vulnerable to changes in temperature;
        - **In cold weather,** it is blue, stiff and painful.
        - **In hot weather,** it is red and itchy.
    - **Protection from sunlight by appropriate clothing or high factor sunscreen;**
      - As sunlight will damage a fresh scar by
        - Burning a hypopigmented scar.
        - Making a pigment scar to be hyperpigmented.

- **Surgical treatment:**
  - It should be delayed until the scar has maturated [12-18months].
  - **Indications of early surgical interference:**
    - **Contracture threatening other structures;**
      - Cicatricial ectropion threatening the eye.
      - Contracture affecting a joint.
    - **Misalignment or tattooing** that scar revision in inevitable later.
  - **Basic methods of scar revision:**
    - Simple excision and resuture.
    - Flaps [Z-plasty, V to Y-plasty or W-plasty].
    - Release of contracture and skin graft or flap.

- **Treatment of symptomatic scars:**
  - **Pigmented scar:**
    - **Tattooing of single scar:**
      - Scar revision.
    - **Large area with multiple tattoos:**
      - Dermabrasion.
  - **Hypopigmented scar:**
    - Sun protection.
    - Tattooing.
    - Dermabrasion with very thin split-thickness skin graft.
  - **Hyperpigmented scar:**
    - Sun protection.
    - Skin bleach.
  - **Painful scar:**
    - Shaving and overgrafting.
    - Excision and flap repair.
  - **Raised scar:**
    - Scar revision with pressure therapy.
  - **Depressed scar:**
    - Lipofilling.
  - **Contracted scar:**
    - Scar lengthening with Z-plasty or V-Y flap.
  - **Bald scar:**
    - Hair transplantation or hair-bearing flap.
    - Tissue expansion.
  - **Hairy scar:**
    - Shaving, plucking, electrolysis or laser.

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- **Hypertrophic scar and keloid:**
  - More common in black and both differ from normal skin by:
    - Thickening of epidermal layer.
    - Increase collagen.
    - Rich vasculature.

	Hypertrophic Scar	Keloid
Definition	Scar tissue raised above the surface and remains within the original wound.	Scar tissue raised above the surface and extends beyonds the original wound.
Aetiology	Unknown. Poor wound healing due to: *Tension. *Infection. Increase inflammatory phase.	Unknown. Genetic relationship. Hormonal factor. Poor wound healing.
Familial inheritance	Positive.	Significantly positive.
Age	Any age but mainly < 20 years.	Mainly < 30 years.
Site	Shoulder. Anterior chest. Anterior neck.	Face. Anterior chest. Ear lobule.
Development	Within weeks of wound.	Within months to a year of wound.
Clinically	Raised, thickened & red patch. Itchy. Not extend beyond original wound.	Raised, thickened & red patch. Itchy. Burning sensation. Extend to the normal tissues.
Result	Can regress gradually.	Not regress.
Recurrence	Not recur after treated.	Highly tend to recur.
Collagen Synthesis	Increased.	Increased 3 times than in hypertrophic scar.

Treatment	**Non-surgical treatment:**
	• **Silicon therapy with continuous pressure:**
	  ○ **Mechanism:**
	  ▪ Ischemia of small blood vessels causing diminished fibroblast activity and diminished collagen synthesis.
	• **Intra-lesional corticosteroids (Triamcinolone acetonide):**
	  ○ **Mechanism:**
	  ▪ Collagen degradation & synthesis.
	  ▪ Softening & flattening of scar.
	Surgical treatment:
	• **Excision followed by intralesional steroid therapy.**	

Burn management

Definition:

- Injury of the tissue which occur when there is contact between the tissue and an energy source such as heat, friction, chemical, electrical or radiation.

Aetiology:

- Thermal [most common]:
  - Contact.
  - Scald [Moist heat].
  - Flame [Dry heat].
- Inhalation.
- Electrical.
- Chemical.
- Radiation.
- Cold Injuries [Frostbite].

Body response:

- **Local [Wound] changes:**
  - **Central zone [Zone of coagulation]:**
    - Area of cellular death.
  - **Intermediate zone [Zone of stasis]:**
    - Area of cellular injury. May change to cellular death with inadequate resuscitation.
  - **Peripheral zone [Zone of Hyperemia]:**
    - Area of tissue edema [least cellular injury].
    - Complete recovery within 7-10 days [unless infection].

- **Systemic changes:**
  - Massive fluid shifts [water, sodium and plasma proteins] from vascular space to interstitial space as a result from increased capillary permeability [maximum at 1st 8 hours] that continues for 48 hours causing;
    - Decrease vascular volume, decrease COP and drops of blood pressure [Hypovolemic shock].
    - Blistering formation and tissue edema.
    - Hyponatremia.
    - Hypokalemia [later due to fluid shift with inadequate K intake].

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- Water evaporation from the burnt skin [1 liter of water evaporation causing body losses 560 Kcal] resulting in dehydration.
- Increase metabolic rate and nutrition demand.
- Inflammation and exhaustion of leukocytes secondary to increase temperature that stimulate inflammatory cellular migration to the wound and release inflammatory mediators.
- Impaired both specific and non-specific immune systems resulting in the patient more susceptible to infection.
- Immediate hemolysis of RBC_S and hemoglinuria with increase hematocrite and blood viscosity.

Clinical presentation:

- **Pain:**
  - The degree of pain is not related to the severity of the burn.
  - The most serious burns can be painless.
- **Acute anxiety:**
  - From pain and disfigurement.
- **Dehydration:**
  - Due to delayed or inadequate replacement.
  - Clinical: thirst, dry skin, dizziness, or decreased urination.
- **Tachycardia:**
  - First from anxiety while later from fluid loss.
- **Local tissue edema:**
  - **In superficial burn:** will develop blister.
  - **In deeper burn:** develop edema.
  - **In the head and neck edema:** may be marked with severe swelling which may obstruct the air way.
  - **Limb edema:** may compromise the circulation
- **Coma:**
  - Inhalation injury.
  - Head injury.

Complications:

- **General complications:**
  - **Shock:**
    - **Neurogenic shock:** due to pain.
    - **Hypovolemic shock:** due to fluid loss.
    - **Septic shock:** due to tissue ischemia and breakdown of GIT barrier causing bacterial translocation to portal circulation that ends in septicemia.

- **Gastro-intestinal complications**:
  - Curling's ulcer, rarely seen with routine prophylactic use of antacids and H2 receptor antagonists.
  - Paralytic ileus.
- **Pulmonary complications**:
  - **Upper airway burns:**
    - Laryngeal edema and airway obstruction.
  - **Inhalation injury:**
    - Asphyxia.
    - Pneumonia.
    - Pulmonary embolism.
    - Respiratory failure [may occur with systemic sepsis].
- **Renal complications**:
  - Acute renal failure secondary to uncorrected hypovolemia.
- **Multiple organ failure:**
  - Secondary to major burn with sepsis.
- **Psycological complications**:
  - Psycological disturbance.
  - Loss of morale.

- **Local complications:**
  - **Early local complications:**
    - **Infection:**
      - It is the primary cause of death in burnt patient.
      - Can occur from endogenous and exogenous sources.
    - **Constricting eschar:**
      - Can occur in circumferential burn of neck, chest and limbs.
      - Require urgent escharotomy.
    - **Suffocation:**
      - Can occur in facial and neck burn.
      - Require urgent tracheostomy.
  - **Delayed local complications:**
      - Hypertrophic scar.
      - Keloid.
      - Contracture scar.
      - Unstable scar.
      - Disfigurement.
      - Burn scar squamous cell carcinoma [Marjolin's ulcer].

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Treatment:

Pre-hospital care:

- Stop burn source.
- **Cold water treatment:**
  - **Ideal temperature:**
    - 15°c [8 – 25 °c is effective] for 20 minutes
  - **Using:**
    - Tap water, cold water or milk [not iced water]
  - **Advantages:**
    - Decrease depth of burn, edema, pain and exudation.
  - **Disadvantages:**
    - Increase risk of contamination and hypothermia.
- Remove watches and jewelers.
- Transfer the patient to hospital.

Hospitalization:

A.History:

- Nature of injury.
- Age.
- Allergy.
- Past medical history.
- Associated trauma.

B.Burn assessment:

- Burn size [Extent of burn].
- Burn depth.
- Burn site.
- Burn type.
- Circumferential burns.

Burn size [Extent of burn]

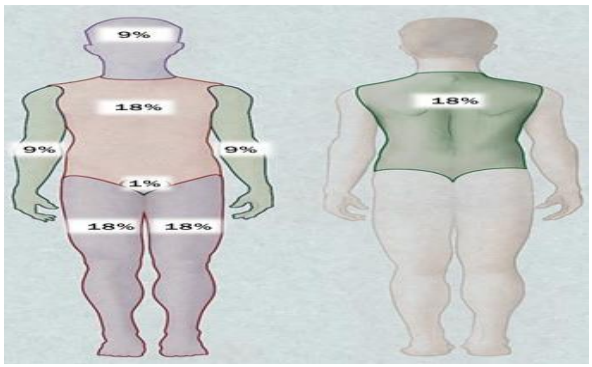
Aim:

- Determine total burnt surface area [TBSA] and mortality rate.

Methods:

- **Wallace Rule of Nine:**
  - A quick method to evaluate burn extent.

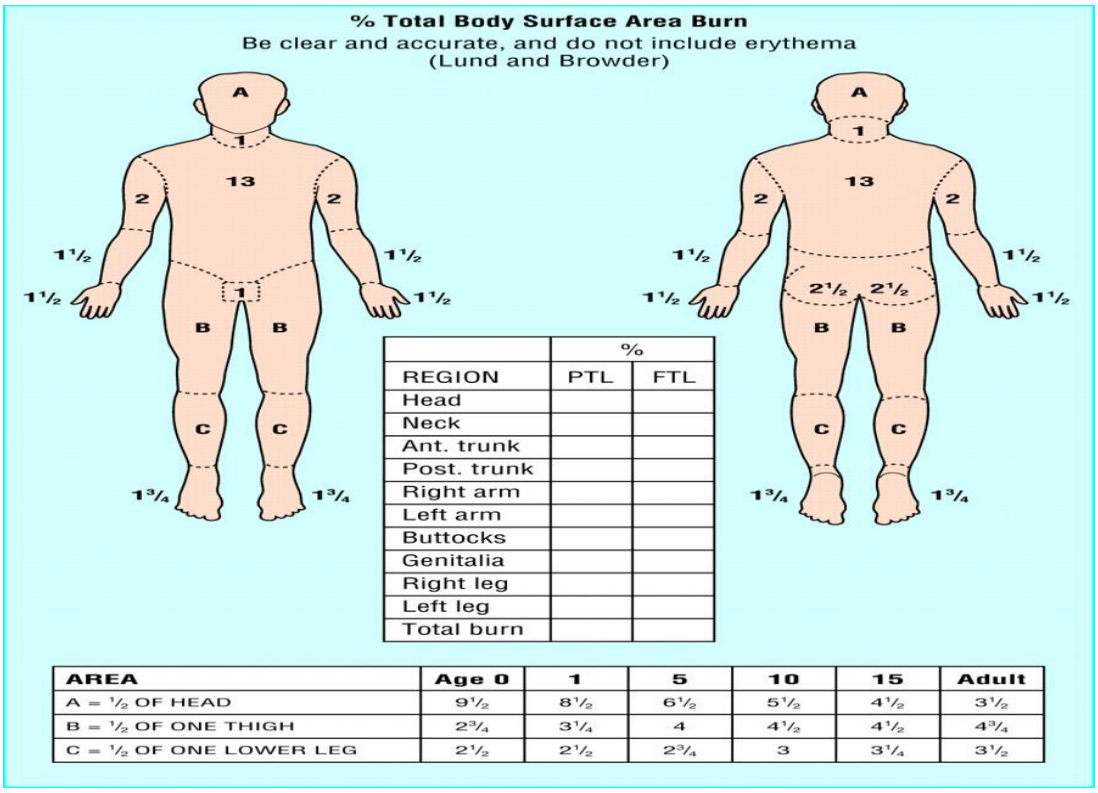
Area	Percentage [%]
Head and neck	9
Upper limb	9X2
Trunk	18X2
Lower limb	18X2
Perineum	1
Total	100



- **Rule of five [In infants and children]:**

Area	% in infants	% in children
Head and neck	20	10
Upper limb	10x2	10X2
Trunk	20X2	20X2
Lower limb	10X2	15X2
Total	100	100

- **Lund-Browder chart:**
  - Most accurate ; based on growth



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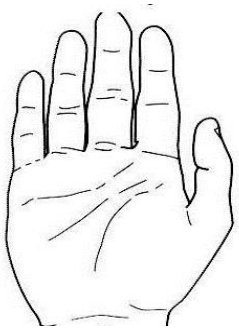
- **Palm [Rapid] method:**
  - A quick method to evaluate scattered or localized burns.
  - Surface area covered by patient's hand with fingers closed = 1%.



Burn depth

Clinical Classification	Medico-legal Classification
Superfacial Thickness Burn	**1st degree**
Partial Thickness Burn: - Superfacial [Superfacial dermal burn] - Deep [Deep dermal burn]	**2nd degree**
Full Thickness Burn	**3rd degree**
Deep Full Thickness Burn	**4th degree**

Superficial-Thickness [1st degree]:

- It involves only the epidermis.
- The area is erythematous, edematous, and tender.
- Healing: usually heals in less than 7 days spontaneously.

Superficial partial-thickness [2nd degree]:

- Destruction of the epidermis and upper dermal layer.
- The skin is red, blistered, and sensory nerve damage causes extreme pain.
- Healing: spontaneous healing in 2 weeks.
- Complication: minimal scarring and minor pigment discoloration.

Deep partial-thickness [2nd degree]:

- Destruction of the epidermis and larger dermal layer [not complete].
- The skin is red, pink or white, moist, no blistered and less severe pain.
- Healing: May heal spontaneously in 2-6 weeks.
- Complication: Hypertrophic scarring and contracture formation.
- Ideal treatment: surgical excision and skin graft.

Full-Thickness burns [3rd degree]:

- Destruction of the epidermis and dermis.
- The area is white, leathery and rigid, eschar tissue [black or brown], severe edema and pain is due to destruction of sensory nerves.

- Healing: no spontaneous healing.
- Treatment: surgical excision and skin graft.

Deep full-Thickness burns [4th degree]:

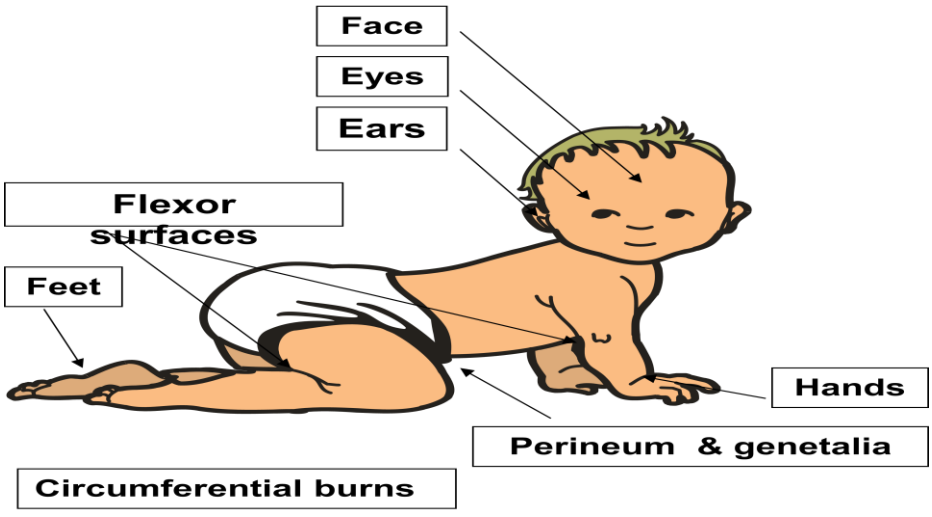
- As 3rd degree but the destruction extends to deep structure [muscle, and bone].

Difference between 2nd superficial & 2nd deep

	2nd superficial	2nd deep
Involves	Epidermis + papillary dermis	As superficial type + Extends to reticular dermis
Color	Pink or reddish	Whitish
Surface	Wet	Dry
Blister	+ve	-ve
Hair follicles	Preserved	Lost
On pressure	Blanches	Non blanches
On touch	Sensitive	Insensitive
Pin prick	Painful + Bleeds	Painless + Not bleeds
Healing By	Re-epithelialization Takes 2 weeks	Scar formation Takes > 3 weeks
Treatment	Frequent dressing	Excision + grafting
Aim of treatment	Prevent infection to prevent conversion to deep type	Prevent deformity

Burn site

- The following sites considered as critical burn:



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Burn type

- These burn types considered as major burn:
  - Inhalation burn, electrical burn, chemical burn or radiation burn

Circumferential burns

- Presence of circumferential burns considered as critical burn:
  - In neck: lymphatic and venous obstruction causing laryngeal edema and airway obstruction.
  - In extremities: restrict blood flow causing ischemia.
  - In chest: restrict chest wall movement causing respiratory failure.

C. Management protocol:

- **Minor burn [< 15 % in adults & 10 % in children]:**
  - Management at outpatient.
  - Dressing using antimicrobial agents + analgesia + antibiotics.

- **Critical burn [Indication of hospital admission]:**

Burn size, burn extent and age:		
Burn depth	**Age**	**Burn size**
Partial-thickness	**< 5 y or > 50 y**	**>10 %**
Partial-thickness	**Other age group**	**> 15 %**
Full-thickness	**Any age group**	**> 5 %**
Burn site:		
Face, ear, eye, perineum, hands, feet, flexor areas or circumferential burn		
Burn type:		
Electrical, inhalation, radiation & chemical burn injuries		
Associated medical problems or with concurrent trauma		

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Management of major burn:

General treatment:

Nursing role:

- Insertion of IV line immediately before vein collapsing.
- Insertion of foley catheter to monitor UOP.
- Warmth of the patient.

Resuscitation:

- **Goal:**
  - Maintain vital organ function and perfusion.
- **ABCDE:**
  - Airway maintenance with C- spine immobilization; if necessary.
  - Breathing & ventilation.
  - Circulation & hge control.
  - Disability: Neurological status.
  - Exposure & environmental control.

- **Fluid resuscitation:**
  - **Goal:**
    - Restore & maintain adequate tissue perfusion.
    - Prevent organ ischemia.
  - **Factors affecting fluid resuscitation:**
    - Depth and extent of burn.
    - Weigh the patient**.**
  - **Formulas for fluid resuscitation:**
    - **Colloid formulas:**
      - Evans formula.
      - Brooke formula.
    - **Crystalloid formulas:**
      - Parkland formula.
      - Modified Brooke formula.
      - Muri & Barclay [Mount Vernon] formula.

Formula	Day	Types of fluid		Volume	Glucose 5%
		Crystalloid	Colloid		
Parkland	1st	4ml/kg/BSA		No limit	2000 cc
	2nd		2ml/kg/BSA		

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- **Assessment of adequate fluid resuscitation:**
  - Urinary Output [most accurate method]:
    - Adult: ≥ 30 ml / hr , while children: 1m / kg / hr.
  - Daily Weights.
  - Vital Signs.
    - Heart rate [<120 beat/min].
    - Systolic blood pressure [>100 mmHg].
    - CVP [< 5-10 mmH2o].
  - Level of Consciousness.
  - Normal laboratory values & Ph.
- **Extra fluid resuscitation:**
  - Children.
  - Delayed resuscitation.
  - Dehydration.
  - Inhalation injury.
  - Electrical injury.

- **Pain management:**
  - Must be addressed early and often;
    - Narcotics then NSAID.
    - I.V. route only.

Correction of electrolytes and blood gases.

Nutritional Support:

- **Aim:**
  - Reduce loss of gut mucosa, subsequent bacterial contamination, sepsis & mortality:
- **Timing:**
  - Early as soon as possible post-injury [1st 24hr].
- **Routes:**
  - Oral.
  - Enteral.
  - Parenteral [TPN] [? risk of infection].
- **Requirements:**
  - High protein intake; at least 2 g of protein/kg/day.
  - Vitamins [A & C].
  - Trace elements [zinc, iron].
  - Amino acids.

Local [Wound] treatment

Wound Cleansing:

- To remove loosen skin and initial conservative debridement.

Topical Antimicrobial Agents:

- **Aim:**
  - Decrease bacterial proliferation.
- **Criteria of ideal topical antimicrobial agent:**
  - Water soluble base.
  - Not painful.
  - Non-toxic, non-allergic.
  - Bactericidal.
- **Most commonly used:**
  - Silvadene [Silver sulfadiazine].
  - Sulfamylon [Mafenide acetate].
  - Silver nitrate 0.5%.

Wound Care Methods:

	Open [Exposure] method	Closed [Occlusive] method
Advantages	Easy of wound examination. More comfortable. Early physical therapy. Inhibit bacterial growth as dry air surrounding the burn.	Control edema. Prevent cross infection. Decrease pain. Decrease fluid loss. Rapid eschar separation.
Suitable for	Face and neck. Perineum and genitalia. Extensive burns.	Outpatient. Circumferential burn. Full-thickness burn of hand.

- Both methods are equally effective.
- Exposure method requires complete aseptic environment.
- Occlusive method using a bulky dressing and changing every 2-3 days.
- **Causes of immediate changing of dressing:**
  - Soaked.
  - Presence of pain.
  - Presence of fever.

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Surgical Wound Management:

Escharotomy and fasciotomy:

- **Indications:**
  - Constricting eschar in circumferential burn to limb, neck or chest.
- **Goal:**
  - Prevent compartment syndrome & ischemia of underlying structure and allow movement.
- **Post-op care:**
  - Elevation + Check Hb + physiotherapy + dressing.

Surgical excision:

- To convert open dirty wound to a clean wound ready to coverage.

Burn Wound Coverage:

- **Temporary coverage:**
  - **Aim:**
    - Using as a biological dressing until the bed is ready for grafting.
  - **Advantages:**
    - Protection
      - Bacterial barrier.
      - Prevent mechanical trauma.
      - Prevent exposure of vital structures.
    - Decrease evaporation of water and proteins.
    - Decrease pain.
    - Increase epithelialization.
  - **Examples:**
    - Allograft.
    - Heterograft.
    - Amniotic membrane of placenta.
- **Permanent coverage:**
  - **Aim:**
    - Turn the open wound to closed one.
  - **Advantages:**
    - Complete recovery and return patient to his/her daily activity.
  - **Examples:**
    - Autogenous split-thickness skin graft.

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Special types of burn

Inhalation burn

- It is a burn that affects any areas of respiratory tract which responsible for increase mortality by 30 % than surface injury.
- **Inhalation burns are suspected in the following conditions:**
  - Facial and neck burn.
  - Burn in closed space.
  - Smoke inhalation.
  - Burnt nasal hair.
  - Burn of lip and oral cavity.
  - Wheezing.
  - Hoarseness of voice.
  - Carbonaceous sputum.
- **Management:**
  - Early intubation or tracheostomy.
  - Inspired humidity oxygenated air [100%].
  - Elevation of head to improve edema.
  - Bronchial hygiene therapy;
    - Therapeutic coughing.
    - Chest therapy.
    - Airway suctioning.
  - Fluid therapy requires more fluid resuscitation [40-75%] than patient with cutaneous injury alone especially in 1st 24 hours.

Cold injury [Frostbite]

- It is a form of thermal injury that is due to exposure to cold.
- Usually affects hands, feet, ears and nose.
- **Mechanism:**
  - **Rapid freezing:**
    - Intracellular ice crystallization causing cellular damage and death.
  - **Slow freezing:**
    - Extracellular ice crystallization causing intracellular dehydration.
- **Treatment:**
    - Warming, protecting and elevation of the affected part.
    - Anti-infective measures [Abs] for established infection.
    - Amputation when establishment of complete tissue loss.

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Electric injury

- It occurs when the electricity is converted into heat which travels through tissues.
- It classified into low voltage injury and high voltage injury.
- **It differ from thermal burn in the following points;**
  - Limited surface extent.
  - Extensive deep tissue damage.
  - High amputation rate.
  - Low mortality rate.
  - High morbidity.
- **Pathology:**
  - Muscular damage.
  - Increase compartment pressure.
  - Vascular injury.
- **Treatment:**
  - Fluid resuscitation should be double the amount that given in thermal burn.
  - Alkalinization of urine and diuretics.
  - Mannitol to improve renal perfusion.

Chemical burn

- It occur when the tissue come in contact with corrosive agents [acid or alkali].
- Infants and elderly are the highest risk factors.
- Alkali is more destructive than acids.
- Chemical burn diffuses into tissue and damage structures under the skin without immediately apparent damage to the skin.
- The severity of chemical burn is determined by;
  - Agent amount and strength.
  - Mechanism of action of the agent.
  - Contact duration.
- **Treatment:**
  - **Systemic:** proper antidote
  - **Local [1st aid measures]:**
    - Cleansed the agent.
    - Removal of the saturated clothes.
    - Irrigation of the affected areas with huge amounts of water.

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Microsurgery

Definition:

- It is an operating on tiny structures to anastomose small vessels and / or nerves under magnification by microscopes or loupes with sutures that are barely visible [8/0, 9/0 & 10/0] = Surgery with aid of magnification.

Clinical microvascular indications:

- Replantation.
- Revascularization.
- Free tissue transfer.
- Transplantation.
- Microneural surgery.

Common technique:

- **Vascular:**
  - Arterial anastomosis.
  - Venous anastomosis.
- **Lymphatic:**
  - Lymphatic anastomosis.
  - lymphatico-venous anastomosis.
- **Neural:**
  - Nerve repair or graft.

Factors affecting anastomotic patency:

- **Abnormalities of the vessel wall:**
  - **Intimal injury:**
    - Vessel clamping.
    - Dilatation.
  - **Dryness:**
    - Vessel desiccation.
  - **Pathology:**
    - Atherosclerosis.
    - Hypertension, DM,
    - Peripheral vascular disorders.
    - Infection.

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- **Abnormalities of blood flow:**
  - **Vasoapasm:**
    - Vascular disease as Reynaud's disease.
    - Intra-arterial drugs
  - **External compression:**
    - Firm wound closure or bandage.
    - Tight closure exaggerated by swelling or hematoma.
  - **Kinking of the pedicle:**
    - Extra-long vessel graft.
    - Rotated vessel.
- **Abnormalities of blood constitutes:**
  - **Increase blood viscosity:**
    - Increase coagulability.
    - Decrease blood flow.
    - Dehydration.

Microvascular troubleshooting:

- **Compromised arterial inflow:**
  - Pale and cold without caplliary refilling.
  - Poor tissue turgor and flacid.
  - No bleeding on pin prick.
- **Poor venous outflow [More common]:**
  - Bluish and cold or warm with caplliary refilling.
  - Increase tissue turgor and swollen.
  - Dark bleeding on pin prick.

Principles of microsurgery:

- **Patient condition:**
  - **Patient fit for long anaesthesia.**
  - **Careful assessment of patient with;**
    - Peripheral vascular disorders.
    - Hypertension.
    - DM.
    - Heavy smokers.
  - **The following patients are not suitable for microsurgery:**
    - Old age.
    - Patients under radiotherapy.

- **Precaution in microsurgery:**
  - Vascular anastomosis should not be under tension.
  - Conjugation between donor and recipient vessels.
  - Washing with anticoagulant to dissolve microemboli.
  - The pedicle should be in suitable length and circumference.
  - Avoid
    - Vasospasm:
      - Gentle vascular dissection.
      - Warm patient and room.
      - Avoid vasoconstricting agents.
      - Maintain adequate hydration.
    - Mismatching of vessel size.
    - Intraluminal intimal tauma.
    - Tight closure over the anastomosis.

Anastomotic techniques:

- **End-to-end anastomosis:**
  - **Halving technique:**
    - Two key sutures are placed at 160 to 180 degrees.
  - **Triangulation technique:**
    - Three key sutures are placed at 120 degree interval.
  - **Back wall up technique:**
    - The 1st suture is placed on the back wall with subsequent sutures moving around sequentially to the top.
- **End-to-side anastomosis:**
  - Preserve flow in the pedicle to distal tissue.
  - Allows anastomosis of vessels of different sizes.

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Reconstructive surgery

Definition:

- A variety of operations performed in order to repair or restore body parts to look normal or to change a body to look better.

Indications:

- Congenital anomalies.
- Trauma.
- Burn.
- Contracted scar.
- Post excised tumor.
- Ulcer and bed sore.

Factors affecting the reconstructive type:

- **Patient:**
  - General health condition.
  - Expectation.
  - Preference.
- **Defect:**
  - Site.
  - Size.
  - Depth.
  - Exposed structure.
  - Function.
- **Donor:**
  - Site.
  - Size.
  - Aesthetic.
- **Environment:**
  - Hospital facility.
  - Post-operative care.
  - Complication rate.
- **Doctor:**
  - Ability.
  - Preference.

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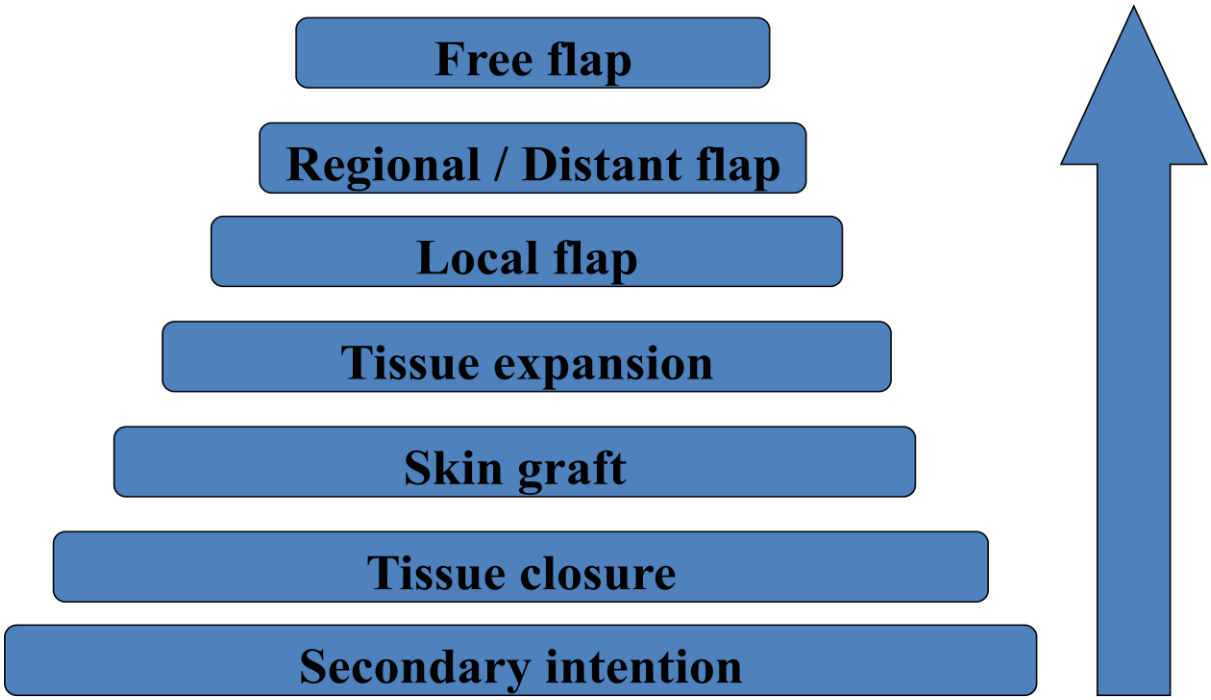
Reconstructive ladder:

- The reconstructive ladder is starting from the simplest possible procedure to the most complex procedure.



Secondary intension [Conservative treatment]

Definition:

- It is a process of wound healing of a full-thickness area of skin loss heals with granulation and epithelialization from the edges.

Advantages:

- No surgical intervention.
- No donor defect.
- No or minimal scar.

Disadvantages:

- Dressing.
- Time consuming.
- Risk of infection.

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Primary closure [Primary intention]

Definition:

- It is a process of wound healing of an Opposition of the skin edges of a wound**.**

Skin graft

Definition:

- It is a surgical procedure in which a piece of skin is transplanted from one area to another.

Indications:

- Wound can not be closed without tension.
- Skin loss.

Contraindications:

- Unhealthy granulation tissue as infected bed.
- Over pressure points for fear of ulceration.
- A vascular surfaces as:
  - Cartilage – perichondrium
  - Bones – periosteum
  - Tendons – paratenon
  - Nerves – perineurium

Classification:

- **Classification according to source of graft :**
  - Autograft: From the same patient to himself.
  - Homograft [Allograft]: From the same species.
  - Heterograft [Xenograft]: From different species.

- **Classification according to thickness:**
  - Split thickness skin[Theirsch] graft.
  - Full thickness skin [Wolfe] graft.

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Split thickness skin graft [STSG] and Full thickness skin graft [FTSG]

	STSG	FTSG
Anatomy	Epidermis + variable thickness of dermis.	Epidermis + full thickness of dermis without subcutaneous tissue.
Indications	*Resurfacing large wounds. *Cover the donor site of flaps and FTSG. *Muscle flap coverage.	*In areas where cosmoses is important. *To correct contracture.
Advantages	*Easy technique & Good take. *Resist infection. *Suitable for poor vascular area. *Can cover big areas as: • No limitation of its size. • Donor site heals rapid and spontaneously.	*Excellent cosmetic appearance: • No pigmentation. • No contracture. • No ulceration [Resist trauma]. *Good sensation.
Disadvantages	*Least cosmetic appearance: • Hyperpigmentation. • Contracture. • Ulceration. *Poor sensation.	*Need well experience. *Can cover limited area. *Need healthy vascular bed. *Donor site must be sutured or covered by STSG.
Donor site	*Thigh [Common site]. *Inner aspect of upper arm. *Flexor aspect of forearm. *Back along spine. *Buttocks and abdomen. *Legs.	*Post-auricular. *Supra-clavicular. *Inner side of arm. *Groin.
Application	*Sheet graft. *Mesh graft.	*Applied simply.
Healing	*Epithelialization.	*Direct suture. *Split-thickness.

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Stages of the graft take:

- **Adherence:**
  - Attachment of the graft to the host bed.
- **Imibition:**
  - Serum absorption by the graft.
- **Inosculation:**
  - Anastomoses between the graft and the host vessels.
- **Revascularization:**
  - Re-establishment of a blood supply.

Bad habits of skin graft applications:

- Inverted grafts (Placing wrong side down).
- Leaving clots beneath the graft.
- Mobilization [Sheering Forces]
  - Change its position or
  - Tear the graft or
  - Rupture of small vessel.

Care of the graft:

- Good preparation of recipient site.
- Application of suitable skin graft.
- Immobilization of the graft.
- Drainage holes but the best, do adequate hemostasis.
- Independency of the grafted part.
- Left exposed and used skin cream if it becomes dry and scaly.
- Application of protective creams for scars with using a crepe bandages or application of the pressure garments.
- Frequent follow up monthly up to 6-12 months.

Flaps

Definition:

- It is a surgical mobile tissue segment consists of skin [epidermis + dermis] ± variable amounts of underlying tissues that remains attached to its original blood supply except in free flap.

Indications:

- Cover avascular surfaces.
- Cover poor vascular surfaces.
- Correct contracture scar.
- Reconstruct complex sites.

Advantages:

- Acquire its blood supply through its pedicle.
- Acquire all characters of normal skin.
- Provide adequate sensation.
- Provide a bulk tissue.
- Not reduce in size.

Causes of flap failure:

- Vascular compromise;
    - Tension
    - Tight constricting dressing
    - Pressure on flap
    - Vascular thrombosis
    - Kinking of the flap
- Infection.

Post-operative care of flap:

- Good hydration.
- Avoid tight constricting dressing.
- Warmth of the patient.
- Systemic antibiotics.
- Anticoagulant medication [with free flap].

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Classification:

- **According to vascular anatomy:**
  - Randam or axial flap.
  - Pedicled or free flap
- **According to mobilization:**
  - **Local:**
    - Rotational flap.
    - Advancement flap.
  - **Distant:**
    - Direct flap.
    - Tubed flap.
    - Free flap.
- **According to composition:**
  - Single component.
  - Multiple components.

Vascular anatomy

Randam or Axial:

- **Randam:**
  - It has no named vessel.
  - It received its vascularity from subdermal plexus.

- **Axial:**
  - It has named vessel.

Pedicled or Free:

- **Pedicled:**
  - It receive its vascularity from;
    - One side [monopedicle].
    - Two sides [bipedicle].

- **Free:**
  - It receive its vascularity from a suitable blood supply at the recipient site.

Mobilization

- **Local flap:**

  [Used to close defects adjacent to the donor site]

  - **Rotational flap:**
    - Flaps that **rotate** around a fixed point to reach the defect.
  - **Advancement flap:**
    - Flaps that **advance** into the defect.

- **Distant flap:**

  [Used to close defects away from to the donor site]

  - **Direct flap:**
    - Direct transfer of tissue from a donor site to a distant recipient.
  - **Tubed flap:**
    - Tissue from the donor site is tubed to recipient site.
  - **Free flap:**
    - Complete disconnection of the underlying blood supply.

Composition

- **Single component:**
  - Skin flap.
  - Facial flap.
  - Muscle flap.
  - Osseous flap.

- **Multiple component:**
  - Fasiocutaneous flap.
  - Musculocutaneous flap.
  - Osseuo-musculo-cutaneous flap.

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Tissue expansion

Definition:

- A Mechanical process that increase the surface area of local tissue available for reconstructive procedures.

Indications:

- Breast reconstruction.
- Trunk: in chest & abdomen defects.
- Scalp: in alopecia & male pattern baldness.
- In defects of forehead.
- In Nasal reconstruction.
- In face & neck reconstruction.
- In Total & partial ear reconstruction.
- In defects of extremities.

Contraindications:

- Hands & feet.
- Expansion near.
    - Malignancy
    - Irradiated area
    - Under skin graft
    - Under very tight tissue
    - Open wound
- Psychologically unstable patient.

Advantages:

- Reconstruction with tissue matching in
    - Color
    - Texture
    - Hair bearing character
- No donor site defect.
- No special skill needed.
- Can be used many times.
- The tissue may be sensate.

Disadvantages:

- Long duration required (2-3month).
- Expensive.

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Complications:

- Infection
- Exposure
- Hematoma
- Seroma
- Pain:
    - Transient: secondary to inflation.
    - Excessive: may indicate tissue ischemia.

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Benign skin and soft tissue lesions

Dermoid cyst

Definition:

- It is a cyst lined by stratified squamous epithelium.

Types of dermoid cyst:

Sequestration dermoid cyst

Aetiology:

- Subcutaneous inclusion of portions of the surface epithelium along the lines of fusion of cutaneous dermatomes during foetal life**.**

Sites:

- The commonest site is in the face especially at the outside of the external canthus of the eye [external angular dermoid].
- Pre- and post-auricular dermoids.
- At the root of the nose.
- Along the midline of the body.
- Never in limbs.

Pathology:

- The cyst consists of well defined globular swelling which;
    - Contains sebaceous material.
    - Hairs frequently grow from the wall of cyst.
    - The underlying bone may be hollowed out & there may be an intracranial connection.

Clinical picture:

- Painless cystic slowly growing well defined hemispherical swelling since birth or later after few years when the cyst begins to distend.
- Not attached to the skin unless infected.
- Not translucent.
- May give an impulse on cough & bone defect [Intracranial connection].
- More prominent with deglutition [Sublingual infra-myelohyoid dermoid].

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Tubulo-dermoid cyst

- It is a cyst arise from distension of remnants of embryonic ducts such as;
  - Thyroglossal duct leading to thyroglossal cyst.
  - Cervical sinus leading to branchial cyst.

Implantation dermoid cyst

Aetiology:

- Forcible introduction of some epidermal epithelium in the subcutaneous tissue e.g.
  - Pricking of tip of fingers during sewing.
  - In the forehead of females carrying objects on the head.

Clinical picture:

- Mainly in fingers, palm of the hand or sole of foot.
- Small and tense slowly growing cyst at first painless later becomes painful and tender due to compression of nerve ending.

Teratomatous dermoid cyst

Cell of origin:

- Embryonic totipotent cell.

Site:

- Ovary [commonest], testes or posterior mediastinum.

Pathology:

- It is a cyst lined by squamous epithelium and contains teeth, hair, bone, cartilage or glands.

<u>Treatment of dermoids:</u>

- The only line of treatment is surgical excision.
- Its excision is more difficult than sebaceous cyst because it is deeper.
- In scalp dermoid cyst in children, it is better to wait until closure of skull closures.

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Sebaceous [Epidermoid] cyst

Definition:

- It is a retention cyst of the sebaceous gland.

Aetiology:

- Obstruction of the sebaceous duct by an insoissated sebum, dirt or scarring.

Pathology:

- The cyst consists of well defined **wall** with;
  - **Lining:** Stratified squamous epithelium.
  - **Contents:** Sebum [foul smelling, white material composed of keratin, epithelial cells and granular debris].
  - **Duct:** Block by inspissated sebum and attached to skin at one point [punctum].

Clinical picture:

- Painless hemispherical slowly growing well defined cystic swelling which;
  - May be solitary or multiple.
  - Subcutaneous.
  - Firm in consistency.
  - Usually attached to the skin at one point [punctum].
  - Movable and not tender.
  - On squeezing, sebum.

Complications:

- Infection and abscess formation [common].
- Stretch of the skin of the scalp result in alopecia.
- Cock's peculiar tumor [ulceration of scalp cyst with raised edge and foul discharge].
- Sebaceous horn [dried inspissated sebum in successive layers on the skin protruding from punctum].
- Sebaceous adenoma and adenocarcinoma [rare].

Differential diagnosis:

- **Dermoid cyst:**

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	Sebaceous cyst	Dermoid cyst
Site	Anywhere, in hairy areas	Lines of fusion
Shape	Hemispherical	Round or oval
Consistency	Firm cystic	Soft cystic
Relation	Attached to skin	Not attached to skin
On squeeze	Sebum	Nothing

- **Epithelioma:**
  - It is characterized by:
    - Short duration.
    - Raised and everted edge.
    - Indurated base and may be fixed.
    - Enlarged, not tender and may be fixed lymph nodes.

Treatment:

- **Uncomplicated cysts:**
  - Complete excision through elliptical incision including punctum.
- **Infected cysts:**
  - Incision and drainage then excision.

Note:

- **Wens** mean multiple sebaceous cysts which may be part of gardner syndrome.

Lipoma

Definition:

- It is a benign tumor of adipose tissue.

Pathology:

- **Pathological types:**
  - Pure lipoma.
  - Mixed lipoma:
    - Fibrolipoma = lipoma contains excess fibrous tissue.
    - Angiolipoma = lipoma contains angiomatous tissue.
    - Myxolipoma = lipoma contains myxomatous tissue.
    - Haemangiolipoma = lipoma with increase vascularity and telangectasia of overlying skin.

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- **Capsules:**
  - **True capsule:**
    - It encircles the tumor, sending trabeculae that divides the tumor into lobes and lobules.
  - **False capsule:**
    - It is the outer one that is derived from the compressed fibrous tissue.
  - **A line of cleavage:**
    - It is a line between the capsules through which a finger can enculate the tumor.
- **Blood supply:**
  - The blood vessels enter the capsule at one pole forming a pedicle.

Presenting forms:

- **Lipomas may present as:**
  - **Solitary well defined swelling.**
  - **Multiple lipomatosis [in limbs and trunk].**
  - **Diffuse lipomatous deposition that usually occurs;**
    - Around the neck e.g. beer drinker neck, chronic alcoholism.
    - Dercum's disease [tender deposits of fat especially on the trunk, usually associated with multiple lipomata].
    - In the genital areas in hypogonadism.

Classifications:

- Lipoma occurs any where in the body where fat is found. So, it is not present in penis, scrotum or intracranial.
- According to their position, lipomas are classified into:
  - **Subcutaneous lipoma [commonest]:**
    - It is a painless slowly growing swelling.
    - **Number:** usually single, may be multiple.
    - **Site:** common in back, schoulder, buttock, thigh, scalp.
    - **Size:** any size.
    - **Shape:** sessile but may be pedunculated.
    - **Surface:** smooth lobulated.
    - **Skin over:** normal color
    - **Tenderness:** not tender except infected or turned malignant.
    - **Pulsation and impulse on cough:** negative.
    - **Consistency:** soft, firm [fibrolipoma], hard [calcification].
    - **Fluctuation:** pseudofluctuation.
    - **Transillumination:** negative.

- **Edges:** slippery, well defined.
- **Mobility:**
  - Attached to skin at multiple points by fine strands of fibrous tissue giving skin dimpling on moving the swelling.
  - Freely mobile from underlying structures.

- **Subfacial lipoma:**
  - Occur deep to the deep fascia.
  - It is not attached to the skin and it does not have a slippery edge.
  - It is difficult to diagnose due to indefinite borders and lobulation.
- **Submucous lipoma:**
  - It can arise in;
    - **Larynx:** may cause respiratory obstruction.
    - **Stomach:** DD of cancer stomach.
    - **Small intestine:** may initiate intussusception causing intestinal obstruction.
- **Subsynovial lipoma:**
  - Arise from the fatty padding around the joints, usually complicates osteoarthrosis.
  - Commonly around the knee [DD: Bakers cyst & semimembranous bursa].
- **Subperiosteai lipoma:**
  - It is under the periosteum of flat bones.
  - They are common in relation to cranial bones [pericranial lipoma].
- **Subserous lipoma:**
  - It is lying beneath the peritoneum or extends with spermatic cord.
  - Retroperitoneal lipoma is more prone to malignant change than lipomas in other areas.
- **Intramuscular lipoma:**
  - It is between the fibers of one muscle [DD from a fibrosarcoma which is hard in consistency and grows rapidly].
- **Intermuscular lipoma:**
  - It is between the muscles.
  - It is difficult to diagnose as the swelling is masked by the overlying muscles.
- **Extradural lipoma:**

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        - It is found within the spinal canal and may cause paraplegia.
    - **Intraglandular lipoma:**
        - In parotid, pancreas, under the renal capsule and in breast.
    - **Intraarticular lipoma.**

Complications:

- Compression manifestations.
- Degenerative changes leading to liquefaction and calcification.
- Malignant transformation is very rare, but it can occur in retroperitoneal lipoma.

Treatment:

- **Indications for removal of lipoma:**
    - Cosmetic.
    - Painful.
    - Trouble making according to its site.
    - Huge in size.

- **Excision:**
    - Elliptical incision.
    - Enucleation of the lipoma with its true capsule after incising the false capsule and securing the pedicle and passing into the line of cleavage.
- **Complications:**
    - **Recurrence;**
        - **Prevention:**
            - Should remove all extensions of lipoma.
    - **Hematoma [main complication] which is liable to infection;**
        - **Prevention:**
            - Ligation of feeding vessels.
            - Obliteration of dead space by sutures.
            - Drainage for 24 hours.

Notes:

- Pseudofluctuation because it is difficult to fix lipoma due to the loose connection between the tumor and its capsule.
- It may show true fluctuation in cases of haemangiolipoma or when suppuration sets in.

Warts [Verruca vulgaris]

Aetiology:

- Viral infection that invading through an abrasion.

Location:

- Any part of the body but commonly on hands and soles.

Pathology:

- Localized overgrowth of epidermis and papillae of the skin.

Clinical picture:

- It can transmit by direct contact.
- It appears as a small horny projection with a smooth or irregular surface and are often multiple.
- In plantar warts;
    - They are located in the region of metatarsal heads or over the heel.
    - Very painful and tender.

Treatment:

- Curettage and diathermy.
- Repeated paintings with glacial acetic acid.
- Cryotherapy [freezing of warts] with liquid nitrogen or nitrous oxide.
- In plantar warts, using pads to remove weight-bearing.

Callosities

Definition:

- It is an area of superficial thickening of the skin.

Aetiology:

- Continuous friction and pressure.

Pathology:

- Overgrowth of the epidermis with great thickening of the horny layer.

Location:

- Mostly; on toes and soles from wearing ill-fitting shoes.
- May be on the fingers and hands of manual workers and on the shoulders of porters.

Clinical picture:

- Usually painless unless it occurs on the sole or toes where it is often tender and forms a circumscribed yellowish white plaque.
- Sometimes an adventitious bursa may develop beneath the callosity and may become infected to form an abscess.

Treatment:

- Avoid causative agent if possible.
- Shaving with a razor blade and repeated painted with an ointment containing salicylic acid and ether.

Corn [Clavus]

Definition:

- It results from neglect or improper treatment of a callosity.

Pathology:

- Localized overgrowth of the epidermis with a central downgrowth of a hard horny plug of epithelial cells into the dermis.
- The plug causes pressure atrophy of the underlying papillae and produces much pain by pressure on the sensory nerve endings.

Location and clinical picture:

- **Hard corn:**
  - **Site:** dry situations [as dorsum of the toes].
  - **Clinical:** Painful hard swelling with a dark central plug.
- **Soft corn:**
  - **Site:** moist situation [between toes].
  - **Clinical:** extremely painful and owing to maceration by sweat.

Treatment:

- Pared the corn and painted daily with 20% salicylic acid in collodion to destroy the epidermis and loosen the central plug.

Ganglion

Definition:

- It is the most common benign tumor of the hand.
- It is a soft to hard mucin-filled cysts attached to the tendon, tendon sheath or joint capsule.

Pathology:

- It is a cystic swelling characterized by:
  - **Wall:** fibrous tissue.
  - **Lining:** no endothelial lining.
  - **Content:** jelly like-mucinous material.
  - It may be multilocular and may be rarely communicate with joints.

Clinical picture:

- **Age:** any age but commonly in 20 – 40 years.
- **Sex:** Females more than males.
- **Location:**
  - Can occur in relation to any tendon or joint.
  - The following 4 sites make up more than 90 % of hand ganglion;
    - Dorsal wrist [most common].
    - Volar wrist.
    - Distal interphalengeal joint [mucous cyst].
    - Flexor tendon sheath.
- Appears gradually or suddenly localized tense rounded painless swelling.
- It can be symptomatic causing aches or pains secondary to movement.

Treatment:

- **Non-operative treatment:**
  - Reassurance.
  - Rupture by external pressure with high incidence of reccurence.
  - Aspiration.
  - Lidocaine and steroid injection.

- **Operative treatment:**
  - Surgical excision under tourniquet control with no need to close joint capsule.

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Complications:

- Pain.
- Stiffness.
- Reccurence.
- Scar.
- Injury to surrounding structure [tendon, nerve, ligament].

Premalignant skin lesions

Senile [actinic = solar] Keratosis

- It is the most common premalignant lesion.

- **Clinically:**
  - **Age:** middle to old.
  - **Location:** sun-damaged or exposed areas.
  - It is well circumscribed, erythematous and maculopapular lesion.
  - Frequently multiple.
  - They are dry and scaly.
  - Little or no infiltration.
  - Malignant transformation to SqCC. from 20-25%) in almost all cases if the lesion is not properly treated.

- **Differential Diagnosis:**
  - Bowen's disease [squamous carcinoma in situ].
  - Inflammatory lesions e.g. psoriasis and lichen simplex.
  - Benign nevi and seborrhoeic keratoses.

- **Management:**
  - Conservative care and skin protection:
    - Using sunscreen, sun-protective creams, and vanishing cream.
  - Curettage and electrodesiccation.
  - Cryotherapy.
  - 5 Fluorouracil.
  - Chemical peel or dermabrasion.

Bowen's disease

- It represents carinoma in situ [intraepithelial SqCC].

- **Clinically**:
  - **Age**: Old patients.
  - **Sex**: Males are more affected than females.

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- **Location**: sun-exposed and non sun-exposed areas [on trunk or limbs].
- It can involve the skin or mucous membrane.
- A solitary red scaly erythematous slowly growing patch with sharply defined edge.
- If not properly excises, it becomes invasive sq.cc. and it is more aggressive than sq.cc that develop from actinic keratosis.

- **Management:**
  - Surgical either excision or curettage & electrodisiccation.
  - Topical therapy [5-FU].
  - The lesion responds poorly to x-irradiation.
  - If properly treated, the prognosis in excellent.

Erythroplasia of queyrat

- It is Bowen's disease of the mucous membrane.

- **Clinically**:
  - **Age**: old [5 and 6 decades].
  - **Location**: glans penis & vulva.
  - It is solitary or multiple well circumscribed erythematous lesion.
  - It is much more likely than Bowen's disease to become invasive with an increase tendency to metastasize.

- **Management:**
  - Curettage and desiccation.
  - Topical 5-FU.

Xeroderma pigmentosa

- It is an error in tryptophan metabolism inherited as autosomal recessive.

- **Clinically:**
  - **Age:** early childhood.
  - **Sex:** equal.
  - **Location:** It affects exposed areas [face, neck, limbs].
  - Diffuse lentigos with excessive drying & thining of skin.

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- Acule photosensitivity.
- Photophobia.
- Conjunctivitis.
- Malignant transformation into BCC, Sq.CC or malignat melanoma is in early adult life with death due to metastasize.

- **Management**:
  - Avoid exposure to sun.
  - Excision.
  - Dermabrasion.
  - 5 FU.

- **Prognosis:**
  - Poor [life expecting < 10 years].
  - Prolongation of life is possible by;
    - Absolute protection from sun exposure.
    - Continual aggressive treatment of all developing tumors.

Keratoacanthoma

- It is the "self-healing" Sq.c.c. [Now considered G1 Sq.c.c.].

- **Clinically**:
  - **Location**: sun-exposed sites.
  - Usually solitary but can be multiple.
  - The lesion is fleshy, elevated & nodular with a central hyper-keratotic core.
  - Differentiated from Sq.c.c by:
    - Short history and rapid increase in size [rapid growth over about 3 weeks] suggest keratoacanthoma rather than Sq.c.c..

- **Management**:
  - Early conservative excision of sufficient depth to remove the entire lesion.

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Leukoplakia

- Leukoplakia meaning white patch.

- **Clinically:**
  - **Age and sex:** older men with a history of smoking, ill-fitting dentures and teeth in poor repair.
  - **Location:** oral, vulvar, or vaginal mucosa.
  - It is raised sharply defined patchy areas of keratinization which is;
    - Lighter in color [white to gray] than the surrounding tissue.
    - Variable thickness.

- **Management:**
  - **Smaller lesions:**
    - Non-operative with;
      - Lip cream, emollients or ointments.
      - Cessation of smoking.
      - Refitted dentures.
  - **Persistence lesions:**
    - Biopsied.
  - **More florid lesions:**
    - Immediate biopsy.
    - Surgical excision.
    - Electrodessication and curettage.
  - **Untreated lesions:**
    - 15% to 20% undergo malignant transformation. If evidence of ulceration or underlying induration, cancer is a real possibility.

Radiation dermatitis

- **Early:**
  - Erythema, desquamation, pigmentation & ulceration.
- **Late:**
  - Atrophy, hyperpigmentation, loss of hair then Sq.c.c.

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Chronic scars [Marjolin ulcer]

- It is the malignant change in a scar, ulcer or sinus such as;
  - An unhealed burn.
  - Chronic leg ulcer.
  - Sinus of chronic osteomyelitis.

- **Clinically:**
  - Slowly growing as the scar is relatively avascular.
  - Painless as the scar contains no nerves.
  - No L.N. as the lymphatics is destroyed.

- Once the ulcer invades normal tissue surrounding the scar, the rapid growth, pain and lymphatic involvement take place.

Lupus vulgaris [TB of skin]

- **Clinically:**
  - **Age:** young debilitated children.
  - **Location:** face.
  - It has a butterfly distribution.
  - Congested skin of nose and cheeks.
  - TB ulcers progressing at one side and healing at the other.
  - TB lymphadenitis may be present.
  - Secondary infection will lead to necrosis.

- **Management:**
  - Surgical excision.

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Benign lesions of melanocytes [Pigmented mole = Naevi]

Pathological and clinical types:

- **Intra-dermal naevus "commonest":**
  - Naevus cells lie in the dermis.
  - **Site:** any where except the palms, soles and genitalia.
  - Typically dom shaped or pedunculated and may be hairy.
  - Never turn malignant.

- **Junctional naevus:**
  - Naevus cells lie at the junction between the dermis & epidermis.
  - **Site:** any where but usually in the palm, sole and genitalia.
  - Appears as pigmented macule with well defined borders.
  - Premalignant.

- **Compound naevus:**
  - Naevus cells are present in both intradermal and junctional.
  - Appears as dark brown papule with well defined regular borders.
  - Premalignant.

- **Congenital naevus:**
  - Naevus cells lies very deep in the dermis.
  - Usually dated since birth.
  - **Site:** any where cover extensive body area of the skin up to 25%.
  - Appears as darkly pigmented and may be hairy.
  - May undergo malignant changes even during childhood.

- **Blue naevus:**
  - Naevus cells lies deep in dermis.
  - Usually disappears before the age of 5 years.
  - **Site:** face, dorsum of hand and over sacrum.
  - Appears as flat deeply pigmented hairless lesion.
  - Remains benign.

- **Juvenile naevi:**
  - **Histologically:** similar to malignant melanoma.

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- **Clinically:** as a benign mole [appear as pink dome shaped smooth papule].

Signs suggestive of malignant transformation:

- **Change in symptoms:** recent pain and itching.
- **Change in the color:** fainter or darker.
- **Change in the size:** increase rate of growth.
- **Change in the shape:** showing spread [radial fashion,halo around, satellites].
- **Change in the surface:**
  - Ulceration with irregular surface.
  - Scale formation, oozing.
  - From smooth to rough [if start rough, less liable to turn malignant].
- **Change in the base:** becomes fixed and indurated.
- **Melanuria:** extensive visceral involvement.
- Presence of similar nodular lesions along draining lymphatics [Called transit deposit].

Premalignant naevi:

- Always junctional type.
- Non hairy-flat smooth neavi.
- Naevi exposed to constant irritation.

Management:

- **Indications of surgical excision:**
  - Cosmetic reasons.
  - There is suspicion of malignant transformation.
  - They lie in a site of repeated irritation [during shaving].

- Surgical excision should be associated with adequate safety margins [2mm in cosmetic reasons and 2 cm in positive suspicion of malignant transformation] and the specimen should be examined histologically.

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Malignant Skin Lesions

Introduction:

- The main types of malignant skin lesions are:
  - Basal Cell Carcinoma [BCC].
  - Squamous Cell Carcinoma [SqCC].
  - Cutaneous melanoma

- The majority of skin cancers occur in fair-skinned individuals;
  a. Who exposed to sun, radiation or UV light.
  b. Who worked outdoors.

- Any skin lesion resistant to conservative treatment for more than 2-3 weeks must be considered a **skin cancer** until proven otherwise.

- All cutaneous malignancies including melanoma have an excellent prognosis if treated early.

- BCC & SqCC are easily detected clinically and are often cured by excisional biopsy.

Basal Cell Carcinoma [BCC]

Definition:

- It is a locally aggressive invasive tumor that rarely metastasizes originating from basal cell layer of the epithelium of epidermis [pluripotential cell] or external root sheath of hair follicle.

Predisposing Factors:

- Sun exposure [major role].
- Skin complexion: [Fair skin - Blue eye - Blond hair].
- Radiation exposure: [UVA- Ionizing radiation].
- Immunosupprssion.
- Genetic factors: [Albinism].

Pathology:

- **Macroscopic Picture:**
  - Slowly growing red flattened firm nodule.

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- Its centre breaks down forming a shallow ulcer **[Rodent Ulcer]:**
  - **Margin:** smooth slightly raised & indurated.
  - **Edge:** rolled in [inverted], rounded & beaded.
  - **Floor:** shows crusts, necrotic tissue and blood.
  - **Base:** indurated but does not exceed the ulcer.
- Infection with lymphadenitis of draining L.N..

- **Microscopic picture:**
  - Cytologically a typical cells with darkly staining, large, oval elongated nuclei & scant cytoplasm, collected in irregular masses. Each mass consists of:
    - Palissade arrangement of columnar epithelium at periphery.
    - Polyhedral cells at the centre. No cell nests.
  - Stromal changes include mucin deposition & fibrosis.
- **Growth pattern:**
  - It has 3 dimentional growth pattern [alone or with each other];
    - Lateral growth.
    - Vertical upward growth.
    - Vertical downward growth.
- **Histologicaly Types:**
  - Differentiated type [Keratotic - Cystic - Adenoid]
  - Undifferentiated type [Solid BCC]
  - Basosquamous type
  - Mixed type.

Clinical types:

Type	Common features
Nodular	Most common type Usually single and mostly on face Tend to ulceration
Superficial spreading	Often multiple and usually on trunk [back] May resemble eczema or psoriasis
Sclerosing [Morpheaform]	Rare and most aggressive type Most common on keloid or contracture surface Mostly recurrence
Pigmented	Easily confused with malignant melanoma
Infiltrative	Commonly seen in recurrent cases Confused with SqCC
Cicatricial	Has no tendency to infiltration

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Clinical picture:

- **Incidence:**
  - **Age:** Middle & old age [> 40 years].
  - **Sex:** Male > females.
  - **Race:** White > Black.
  - **Site:** Any cutaneous surface but 85% on and neck mostly face usually above a line connecting the angle of mouth to the ear.
- **The lesion appears as:**
  - Small nodule.
  - **Ulcer:** slowly growing but progressive.
  - **Draining LN :** not enlarged except if:
    - 2ry infection : firm, mobile & tender.
    - epitheliomatous transformation : stony hard mobile & later fixed.

Complications:

- Spread: Direct is the only line of spread.
- 2ry infection.
- Severe hemorrhage from erosion of big vessels.
- Epitheliomatous transformation [Known by]:
  - Rapid increase in the rate of growth.
  - Edges become everted in one part.
  - Induration extends beyond the ulcer.
  - Enlarged LN [Stony hard, fixed & not tender].
  - Biopsy.
- Disfigurement.

Differential diagnosis:

- Benign tumors usually appendigeal in origin.
- Pyogenic granuloma.
- Actinic keratoses.
- Keratoacanthoma.
- SqCC.
- Malignant melanoma especially amelanotic tumors.

Investigations:

- By pathologic examination of a tissue specimen obtained by biopsy; [Shave, punch, incisional or excisional].

Treatment:

- **Treatment Modalities**
  - Radiotherapy.
  - Surgical excision with safety margins.
  - Excision by Mohs micrographic technique.
  - Cryosurgery.
  - Electro desiccation and curettage.
  - Others:
    - Laser.
    - Topical application of 5-fluorouracil.
    - Interferone alpha.

Radiotherapy:

- The tumor is radiosensitive.
- Inadvisable for patients less than 60 years old because high risk radiation induced 2ry cutaneous carcinoma & worsening appearance of the scar [i.e.it can be effective in old individual with a large tumor].
- **Recurrence rate:** 5-11%.

Surgical excision with safety margins:

- Often is the treatment of choice.
- **Indications:**
  - Small lesion.
  - Radio-resistance lesion.
  - Recurrence after previous irradiation.
  - Tumor infiltrating underlying cartilage or bone.
- **Procedure:**
  - Marking, local anesthesia, excision with adequate safety margin 0.2-0.5 cm of normal tissue and closure by direct closure, graft or flaps.
- **Recurrence rate:** 5-6%

Excision by Mohs micrographic technique:

- It is a surgical technique developed by Dr Frederick Mohs (1930s). The original name **chemo-surgery** that derived from the chemical paste containing 20% zinc chloride.
- **Principle:**
  - Application zinc chloride paste to the cancerous tissue and remain for 18-24h which fix the cancerous tissue in situ. Then, excision of the tissue and examined pathologically.

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- **Recurrence rate:**
  - Less than 1% for BCC.
  - 3-6% for recurrence BCC [Traditional treatments of recurrent BCC is associated with a recurrence rate 20-50%].
- **Contraindications:**
  - Patients with HIV virus [Human Immuno deficiency virus].
  - Tumours involving bone.

Cryosurgery:

- Used for small lesions.
- **Principle:**
  - Using liquid nitrogen [-196] applied with a cotton-tipped applicator or a spray that freezes the tumour and a 5mm area of normal tissue for approximately 30 seconds.
- **Recurance rate:** 2-6% in skilled hands.
- **Contraindications:**
  - Tumor more than 2 cm.
  - Recurrent.
  - Morpheolike.

Electro desiccation and curettage:

- **Principle:**
  - Curette is used to remove the tumor mass which easily separates from normal tissue. Then heat via electro-desiccation is used to destroy a 1-2mm rim of tissue in and about the defect.
  - Healing is by 2ry intention over a 2-6 weeks period.
- **Cure rate:**
  - For 1ry treatment of BCC <2cm appnximately 95%.
  - For lesions 2 cm or more falls to 90%.
- **Recurrence rate:** 6-10%.

Squamous Cell Carcinoma (SqCC)

Definition:

- It is a malignant tumor that originating from keratinizing or malpighian [spindle] cell layer of epidermis.

Predisposing Factors:

- Sun exposure [major role].
- Skin complexion: [Fair skin - Blue eye - Blond hair].
- Radiation exposure: [UVA - Ionizing radiation].
- Immunosuppression.
- Chemical carcinogens: [As arsenic, coat tar…].
- Genetic factors:
  - Xeroderma pigmentosa.
  - Albinism.
- Miscellaneous predisposing lesions includes:
  - Old Scar [burn, vaccine, trauma,tattoo].
  - Chronic ulceration & sinus.
  - Osteomyelitis.
  - Human papillomavirus infection.

Pathology:

- **Macroscopic picture:**
  - Rapidly growing ulcer characterized by:
    - **Margin:** indurated & slightly raised.
    - **Edge:** everted, raised.
    - **Floor:** necroted.
    - **Base:** indurated and exceeds the margin of ulcer fixed to the underlyings.
- **Microscopic picture**:
  - Masses of squamous epithelial cells invade the dermis with well-differentiated keratinization.
  - Keratin pearls surrounded by epithelial cells.
  - With poorly differentiated lesions, keratinization may be minimal or absent, and there is decreased inflammatory response in the dermis [the more inflammation that is seen, the greater is the differentiation of the tumor].
  - Intercellular bridges are absent.

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- A poorly differentiated lesion may have a pseudo-glandular appearance.
- The degree of differentiation is directly related to keratin pearl formation.

- **Growth paltern:**
  - As in BCC.

Clinical types:

	Non-invasive type	Invasive type
Growth	Slowly growth	Rapid growth
Nature	Verrocus	Noduar
Character	Exophytic in appearance	Raised everted edge with indurated base
Metastasis	May be	Greater tendency

Clinical Features:

- **Incidence:**
  - **Age:** older patient.
  - **Sex:** Males > females.
  - **Race:** white > black.
  - **Site:** sun-exposed areas [face, lower lip, back of hands].
- **The lesion appears as**
  - **Ulcer:** rapidly growing.
  - **Draining LN:** [stony hard first & later fixed].

Complications:

- Spread:
  - Direct [in 3 dimention].
  - Lymphatic.
  - Blood [rare].
- Other complications like BCC.

Differential diagnosis:

- Actinic keratoses.
- BCC.
- Pseudo-epitheliomatous hyperplasia.
- Keratoacanthoma.

Treatment:

- **Treatment Modalities**
  - Radiotherapy.
  - Surgical excision with safety margins.
  - Excision by Mohs micrographic technique.

Radiotherapy:

- As in BCC.
- It is effective in old patients specially around lips, lids &nose and for large tumor.

Surgical excision with safety margins:

- As in BCC but usrgical excision with **2cm** safety margin in face & **5cm** in other sites.

Excision by Mohs micrographic technique:

- As in BCC.
- **Recurrence rate:** less than 2 %.

If the regional L.Ns are involved:

- Block dissection + Radiotherapy.

Cutaneous Melanoma

Definition:

- It is a malignant neoplasm arising from melanocytes [clear cells in the basal layer of the epidermis].

Predisposing Factors:

- Prolonged sun exposure.
- Genetic predisportion: [Albinism - xeroderma pigmentosa].
- 90% on top of the benign neavi.

Criteria of malignant transformation of benign neavus:

- Increase in size or thickness.
- Change of pigmentation.
- Occurance of itching, tingling, ulceration or bleeding
- Development of satellite nodules.

Pathology:

- **Macroscopic features of clinical types:**

	Superficial Spreading [SSM]	Lentigo Maligno [LMM]	Acral Lentiginous [ALM]	Nodular [NM]
Incidence	70%	1-15%	60% [black] 8% [white]	12-25%
Age	Middle	Old	Old	Younger
Site	Any body part	Usually in face	Palm, sole & under nail	Area not exposed to sun
Appearance	Flat, slightly raised with irregular color, surface and border.			-Nodular with homogenous pigmentation -Itching, ulceration & bleeding are early & common
Spread	Radial	*Radial then Vertical		Vertical
LN involved	-ve	-ve	-ve	+ve
Prognosis	Best	Good	Poor	Worst

***** **Radial** = spread along epidermis, **Vertical** = dermal invasion.
The radial phase precedes the vertical one in all except Nodular type.

- **<u>Other types:</u>**
  - **Amelanotic Melanoma:**
    - Diagnosed only by biopsy.
    - Worst prognosis than nodular type.
    - Often presented with regional LN metastases.
    - Differential diagnosis: [Cystic BCC – SqCC].
  - **Occult Melanoma:**
    * Secondary melanoma without 1ry lesion.
    * Very bad prognosis.
    * Presented as LN enlargement or hematological disseminations**.**
- **Microscopic features:**
  - Malignant melanoma is composed of dyshesive, polymorphous & atypical melanocytes of epithelioid and spindle-cell type that proliferate along the dermo-epidermal junction and spread as small nests or single cells (Pagetoid array) into the upper epidermis.
  - Frequent mitoses may be present with or without lymphatic infiltrate and fibrovascular response.

Prognostic Factors:

TNM classification		Breslow classification		Clark classification		Prognosis
Stage	**Description**		**Vertical thickness of lesion**	**Level**	**Skin layer invasion**	
				I	Epidermal [In Situ Melanoma]	**Bad in this direction** ↓
IA	Local melanoma	**I**	< 0.75 thick	**II**	Dermo-epidermal junction	
IB	Local melanoma	**II**	0.76-1.5 mm	**III**	Papillary dermis	
IIA	Local melanoma	**III**	1.5-4mm	**IV**	Reticular dermis	
IIB	Local melanoma	**IV**	> 4 mm	**V**	Subcutaneous tissues	
III	Limited nodal metastases only involving one regional lymph node					
IV	Advanced regional metastases or distant metastases					

Clinical picture:

- **Incidence:**
  - It constitutes only 2% of all cancers.
  - It is the 2nd common cause of death after lung cancer in women.
  - **Race:** Commoner in white.
  - **Sex:** Females > males.
  - **Site:** Lower limbs in females and trunk in males.

- **The lesion appears as [ABCDE]:**
  - **A**symmetry.
  - **B**order irregularity.
  - **C**olor variability.
  - **D**iameter greater than 6mm.
  - **E**levated surface.

- Lesion may symptomatized with itching, bleeding, ulceration in deeply invasive tumour.

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Differential Diagnosis:

- Compound or junctional naevi.
- Pigmented BCC.
- Seborrheic keratosis.
- Pyogenic granuloma.
- Haemangioma.

Complications:

- Spread:
  - Direct: [To surrounding and deep tissues].
  - Lymphatic: [By permeation or embolism].
  - Blood [late]: [To lungs, liver, bone & brain or to any organ].
- Infection.
- With L.N. dissection, seroma, lymphoceles, hematoma & lymphydema can occur.

Investigation and metastatic workup:

- **Lesional study:**
  - The only sure method of diagnosis of Melanoma is biopsy for histological examination either:
    - Excisional
    - Incisional [must be full thickness to avoid malignant cells transfer to subcutaneous tissue & convert superficial melanoma to deep one].
- **Metastatic evaluations & investigations:**
  - **Liver**
    - **Clinically:**
      - Weight loss, anorexia or abdominal pain.
      - Abnormal level of serum alkaline phosphatase & lactate dehydrogenase.
    - **Radiologically:**
      - Liver US and/or abdominal CT scan.
  - **Brain:**
    - **Clinically:**
      - Headache, vertigo, numbness or weakness.
      - Abnormal neurological examinations.
    - **Radiologically:**
      - Head CT scan.
  - **Bone:**
    - **Clinically:**

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        - Isolated bone pain, pathological fracture.
        - Elevated alkaline phosphatase.
    - **Radiologically:**
        - Bone scan.
- **Chest:**
    - **Clinically:**
        - Chest pain, dyspnea, hemoptysis or difficult respiration.
    - **Radiologically:**
        - Chest x-ray and CT scan.
- **L.N.:**
    - Palpable L.N. demonstrated by examination.
    - Non palpable L.N. demonstrated by CT scan or MRI.

Treatment:

- **Surgical excision with wide safety margin:**

Tumor thickness	Safety margin
<0.75mm	0.5 cm
0.75-1mm	1 cm
1-4 mm	2 cm
> 4mm	3 cm

- **Lymphadenectomy:**
    - **Indications:**
        - Palpable LN.
        - Precautionary if LN is not palpable due to the microscopic metastases (50%).
    - **Types of removal:**
        - **Synchronus:** At the time of tumor excision.
        - **Asynchronus:** After 3 weeks from the operation.

- **Adjuvant therapy:**
    - **Chemotherapy**:
        - **Indications:**
            - Metastases
            - Local recurrence disease.
    - **Radiation:**
        - May provide symptomatic relief for metastasis to bone, brain or viscera.

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Precuation for high risk patients

- Ferquent re-examinations.
- Minimize sun exposune from 10 am to 4pm.
- Wear a wide-brimmed hat.
- Long-sleeved shirt and long pants when outside.
- Apply sunscreen with a sun pnotection factor [SPF] of 50 on more before any exposure to the sun & at least every two hours as long as the outdoor activity is continued.
- Water resistant sunscreens are especially helpful during sweaty or wet outdoor activites.

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Cutaneous Vascular Anomalies

Classification:

- According to cellular features, natural history, clinical presentation and radiology, the cutaneous vascular anomalies classified into:
  - **Haemangioma:**
  - **Vascular malformation:**
    - **Slow [Low] flow**:
      - [Capillary (CM), Venous (VM), Lymphatic (LM)]
    - **Fast [High] flow**:
      - [arterial (AM), arterio-venous (AVM)]

Difference between Haemangioma and Vascular malformation:

	Hemangioma	Vascular Malformation
Pathology	Benign proliferative neoplasm of endothelium of blood vessel	Abnormal structure of blood vessel due to embryological error [normal endothelium]
Time of appearance	After birth	At birth
Sex	Female : Male 3-5:1	No gender prediction
Growth	Increased in 1st year	Proportionate with the child growth and the lesion will expand with time
Regression	Regress	Never
Diagnosis	History and clinically [90%]	Doppler US MRI or MRA [most useful one] Angiography

- **Investigation:**
  - **Ultrasound:**
    - Helpful in differentiating haemangioma from low flow lesions.
  - **Doppler Ultrasound:**
    - For differentiation high flow from low flow lesions.
  - **MRI and/or MRA:** [Most accurate]
    - Feeding vessels
    - Assess extent of lesion.
    - Assess surrounding structures involvement.
    - Fatty tissue with involution.
  - **Angiography:**
    - May be useful in some cases.

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Haemangioma

Definition:

- Is the commonest benign tumor of endothelium of blood vessels with remarkable proliferation during infancy followed by invariable spontaneous regression during childhood.

Phases of haemangioma:

- **Proliferating phase [0-12 months]:**
  - The lesion appears as pale or reddish patch shortly after birth and grows rapidly for the 1st 6-12 months.
- **Involution phase [12 months – 10 years]**:
  - Starts at the end of the 1st year with central pallor and slowly fading of color with progressive decrease in size of the lesion.
- **Involuted phase**
  - The skin is approximately normal in about 50 % of patients.
  - The residual skin shows discoloration, scarring, laxity or telangectasia.

Clinical picture:

- **Appearance:** Pale or reddish patch present after birth usually in the 1st weeks and rapidly increased in size during 1st year of life.
- **Sex:** Female: Male 3 : 1
- **Race:** 10% of white infants and 1-2% in black ones.
- **Site:** 60% of all haemangiomas in head and neck.

Complications:

- Ulceration with punctate bleeding.
- Deformation & functional impairment.
- Obstruction as in periorbital haemangioma.
- Large cutaneous or visceral haemangioma may cause congestive heart failure.

Investigations:

- **History and physical examinations (90%).**
- **Careful photographic documentation** of the growth usually confirms the nature of the lesion.
- **Ultrasound.**
- **MRI.**

Treatment:

- **The majority of haemangiomas require**
  - No treatment.
  - Reassurance & observation with subsequent photographs & measurements.
- **Lines of treatment:**
  - **Antiangiogenic therapy**
    - Systemic and intralesional corticosteroids.
    - Interferon.
  - **Laser therapy.**
  - **Surgical excision [Indications]:**
    - Ulceration.
    - Obstruction.
    - Large one unresponsive to other therapy.

Vascular Malformations

Capillary malformation [CM]

Clinical picture:

- **Incidence:** 0.3-0.5% of newborns.
- **Site:** Any part of the body but the most common on the face along the distribution of one of the branches of the trigeminal nerve but the lesion not cross the middle line.
- Appears as non-fading macular patch that;
  - Present since birth.
  - Darken by time.
  - Not raised above the surface.
- May develop soft tissue &/or skeletal hypertrophy.

Treatment:

- **Laser therapy:**
  - **Pulsed Dye laser** for childhood (<18 years).
  - **YAG laser** for adult (> 18 years), the resultant scar is more obvious than that of pulse dye laser.
- **Surgical excision:**
  - Indicated if it is associated with soft tissue & skeletal hypertrophy to excise excess soft tissue and correct skeletal structure.

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Venous Malformation [VM]

Clinical picture:

- The **Pathognomonic sings** for VMs are:
  - Bluish discoloration of skin.
  - Spongy compressible with slow refill.
  - Increase size (swell) with dependency & exertion.
  - Enlarge with hormonal changes during puberty & pregnancy.

Treatment:

- **Comprsssion therapy:** may relieve pain and edema.
- **Percutaneous sclerosis [1ry line of treatment]:**
  - **Sclerosants:**
    - Hypertrophic saline or 100% alcohol.
  - **Action:**
    - Endothelial necrosis leads to thrombosis and shrinkage of malformations.
  - **Complications:**
    - Skin necrosis and ulceration [most common].
    - High recurrence rate.
- **Surgical excision** with preoperative embolization or sclerosis to facilitate intraoperative hemostasis.

Lymphatic Malformations [LM]

It may be anastomose with the venous system called lymphatico-venous malformations [LVM].

Clinical picture:

- **Site**: Anywhere in the body but mostly in head & neck region or axilla.
- **Extent**: Vary from a generalized swelling [lymphedema] to a localized multilocular cystic swelling.
- Appear as cystic swelling commonly at birth which may be classified as microcystic or macrocystic.
- LMs are the most common cause of tongue enlargement [Macroglossia], lip enlargement [Macrochelia] and ear enlargement [Macrotia].
- Cystic hygroma is an example.

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Treatment:

- **Tracheostomy:** For large cervicofacial LM.
- **Percutaneous aspiration of lymphatic fluid and intralesional sclerosing agent injection:** For large cystic LM.
- **Pain killer + Rest + Systemic antibiotics [I.V. for long period]:** For sudden enlargement of an LM.
- **Surgical Resection:**
    - It is the only potential line for cure of an LMs.
    - Surgical strategy:
        - Single excision for LMs in a single anatomic region.
        - Staged excision for extensive lesions.

Arterial Malformations [AM]

Definition:

- It is a high flow vascular malformation characterized by abnormal development of arterial structures including stenosis or hypoplasia, duplication and/or tortuosity.

Clinical picture:

- **Site:** Commonly on the scalp especially in temporal or occipital areas and may involve underlying bone.
- Often asymptomatic.
- If symptomatic, the lesion is soft, compressible & pulsating swelling with a marked bruit.

Treatment:

- Treat only if symptomatic.
- Preliminary embolization of feeding vessels may be tried.

Arterio-Venous Malformations [AVM]

Definition:

- It is a high flow vascular malformation characterized by abnormal connections between arteries and veins.

Clinical picture:

- Present at birth and often mistaken for haemangiona in childhood or become evident in infancy or childhood.
- Puberty, trauma, pregnancy and estrogen therapy trigger expansion.

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- The **characteristic cutaneous signs** are:
  - Red or violaceous skin.
  - A warm mass appear beneath the skin.
  - Palpated thrill with bruit.
- The **end stage** of an AVM whatever its anatomic site is:
  - Violaceous skin atrophy.
  - Ulceration.
  - Intractable pain.

Treatment:

- Combined of preoperative embolization of feeding vessels followed by surgical resection next day is the best line of treatment.

Complex-Combined Malformations

Klippel-Trenaunay-Weber Sybdrome (Nevus vasculosus):

- Combined capillary-lymphatic-venous vascular malformation.

Parkes Weber Syndrome:

- klippel-Trenaunay syndrome + multiple A.V fistulas.

Osler-Weber-Rendu Syndrome:

- Multiple cutaneous, visceral and mucosal AVMs

Cobb Syndrome:

- Capillary malformation in trunk + spinal AVMs

Remember:

Klipple-Trenaunay syndrome is predominantly **venous** while

Parkes weber syndrome is primarily **arteriovenous**.

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Development of the facial region

Development of the face:

- Early in the development, the face of the embryo is bounded;
  - **Cranially:** by forebrain.
  - **Caudally:** by pericardium.
- In the center of this area is a depression called **stomodeum [primitive mouth]** that covered with the buccopharyngeal membrane.
- By the 4th week of gestation, the buccopharyngeal membrane rupture and the stomodeum communicates with the foregut and bounded by 5 elevations [formed by the proliferation of mesenchyme];
  - **Frontonasal process.**
  - **Two maxillary processes.**
  - **Two mandibular processes.**

- **Frontonasal process [6 w]:**
  - Cranial to the stomodeum.
  - Local swellings develop on each side of the frontonasal process called nasal placodes which depressed to form olfactory pits.
  - Each olfactory pit divides the inferior border of the frontonasal process into median and lateral nasal swellings [processes].
  - **The lateral nasal process:** form sides and ala of the nose.
  - **Fusion of both median nasal processes:** form philtrum, premaxilla, nasal tip and nasal septum.

- **Maxillary processes [5 w]:**
  - On each side of the stomodeum
  - Each maxillary process separated from median and lateral nasal processes by a well defined marked groove.
  - Each maxillary process grows medially and compresses the median nasal process towards the midline.
  - **Each maxillary process fuse with corresponding;**
    - **Median nasal process** to form lateral part of the upper lip.
    - **Mandibular process** to form cheek [This fusion determine the mouth width].
    - **Postero-lateral process** to form palatine process.

- **Mandibular processes [4 w]:**
  - Caudal to the stomodeum.
  - The mandibular processes grow medially inferior to the stomodeum.
  - **The mandibular process fuse with ;**
    - **Other mandibular process** to form lower lip, chin and mandible.
    - **Corresponding maxillary process** to form cheek.

Development of the lip:

- **Upper lip:**
  - **Philtrum:**
    - By fusion of both median nasal processes.
  - **Rest of the upper lip:**
    - By fusion of each median nasal process with corresponding maxillary processes.
- **Lower lip:**
  - By fusion of both mandibular processes in the midline.

Development of the palate:

- Palatal development is completed by the 12^{th} week of intrauterine life.
- **The palate has two components;**
  - **Primary palate [Premaxilla]:**
    - Anterior to incisive foramen.
    - It as a small triangular [V-shaped] anterior part of the upper jaw carrying 4 incisor teeth.
  - **Secondary palate:**
    - Posterior to incisive foramen.
- **The palate developed by fusion of median and lateral palatine processes;**
  - **The median palatine process:**
    - Formed from merging of both median nasal processes.
    - Form primary palate.
  - **The lateral palatine processes:**
    - Formed from maxillary processes.
    - Form secondary palate.

Congenital anomalies of the facial region

Cleft lip.

Cleft palate.

- They are the most common congenital anomalies in head and neck.

Oblique facial cleft:

- Due to failure of fusion between the lateral nasal process and the maxillary process.

Microstomia:

- Due to excessive fusion between the maxillary and mandibular processes.

Macrostomia:

- Due to incomplete fusion between the maxillary and mandibular processes.

Periauricular sinus:

- Due to imperfect fusion of auricular hillocks.

Dermoid cyst:

- Sequestration dermoid cyst occurs at the line of embryonic fusion.

Pierre robin syndrome [sequence]:

- **Consists of:**
  - Cleft palate.
  - Micrognathia [reducing mandible].
  - Posterior displacement of the tongue.

Cleft lip and palate

Epidemiology:

- Because the lips and the palate develop separately, it is possible for a child to be born with a cleft lip only, cleft palate only or both.
- Cleft lip represent 60% either alone or associated with cleft palate.
- The ratio of cleft lip and palate to cleft lip alone is 2:1.
- Isolated cleft palate represents 40 %.
- **Incidence:**
  - **CL ± CP :** 1: 1000 live births.
  - **Isolated CP :** 0.5 : 1000 live births.
- **Sex:**
  - **CL ± CP :** More common in males.
  - **Isolated CP :** More common in females.
- **Race:**
  - **CL ± CP :** More common in white.
  - **Isolated CP :** No racial variation.

Aetiology:

- Most of time, the cause is not known.
- It may be due to;
  - **As a part of syndrome 3%.**
  - **Genetic and runs in families.**

	Probability of subsequent child with CL ± CP [%]	Probability of subsequent child with isolated CP [%]
One affected child only	4	2
One affected parent only	2-4	2-4
One affected child + +ve family history	7	7
One affected parent & One affected child	14-17	15

  - **Maternal factors [during 1st trimester]:**
    - Smoking.
    - Abuse of alcohol.
    - Irradiation.
    - Viral infection [Rubella, toxoplasmosis, CMV].
    - Medication [Anticonvulsant, antidepressant, steroids].
    - Vitamin deficiency [A, B6, Folic acid].

Cleft lip [Hare lip]

Definition:

- Separation of both sides of lip.

Pathogenesis:

- **Upper lip:**
  - Failure of fusion between medial nasal process and one [in unilateral] or both [in bilateral] maxillary process(s).
- **Lower lip [very rare]:**
  - Failure of fusion between two mandibular processes.

Pathological anatomy:

- The cleft side is bifid and has;
  - Medial and lateral segments in unilateral cleft.
  - Median and 2 lateral segments in bilateral cleft.
- The medial segment contains the philtrum.
- The lateral segment contains the main bulk muscle, markedly thinned medially and elevated upwards.
- **In complete cleft**, the orbicularis oris muscle fibers passing horizontally from the commissure toward the midline, turning upward along the cleft margins and terminate;
  - Laterally, at the base of the ala of the nose.
  - Medially, at the base of the columella.
- **In incomplete cleft**, a skin bridge across the nasal sill named simonart band.
- The cleft involve lip substance alone or with;
  - Floor of the nose [Nasal deformity].
  - Alveolar border of the maxilla [Alveolar deformity and maxillary hypoplasia].

Classification:

- **Classification according to extent :**
  - Notched vermillion.
  - Incomplete cleft.
  - Complete cleft.
  - Subcutaneous cleft [intact skin].

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- **Classification according to location:**
  - Unilateral.
  - Bilateral.
  - Median.

Clinical presentation:

- **Location:**
  - Unilateral > bilateral.
  - Upper lip > lower lip.
  - Left side > right side.
- Disfigurement.
- May interfere with suckling in complete type.
- May be associated with abnormal teeth growth.

Treatment:

- **Aim:**
  - Improve appearance.
  - Normal way of suckling in complete type.
- **Timing [3-6 months]:**
  - It can be repaired at any time after birth in a healthy infant but most surgeons prefer the Rule of 10s for anesthetic safety.
  - **Rule of 10s:**
    - **Age:** not less than 10 weeks.
    - **Body weight:** not less than 10 pounds.
    - **Hemoglobin:** not less than 10 gm%.
- **Principles:**
  - Release incision in the gingivo-buccal sulcus to relax flap.
  - Using local flap to increase length of lip on the cleft side.
  - Redirection and proper approximation of orbicularis oris muscle fibers.
  - Anatomical repair in 3 layers;
    - Mucosa to mucosa.
    - Muscle to muscle.
    - Skin to skin.
- **Treatment of CLP:**
  - **Correct the lip firstly why?**
    - Psychological for parents.
    - To retract premaxilla.
    - Avoid interference with palatal ossification center if the CP corrected before one year to avoid facial asymmetry.

Cleft palate

Definition:

- It is an opening in the roof of the mouth.

Pathogenesis:

- Failure of fusion between 2 palatal processes and between one or both palatal process with the premaxilla.

Pathological anatomy:

- Abnormal insertion of tensor veli palatine onto the posterior edge of the hard palate.

Classification:

- Cleft uvula.
- Cleft soft palate.
- Cleft soft palate and hard palate.
- Complete cleft palate with one side of premaxilla [Bipartite].
- Complete cleft palate with both sides of premaxilla [Tripartite].
- Submucous cleft [intact mucosa]:
    - Bifid uvula.
    - Palpable notch of hard palate.
    - Zona pellucid [midline translucent area of soft palate due to palatal muscles diastasis].

Clinical presentation:

- Difficult or unable suckling due to inability to establish negative intraoral pressure.
- Nasal regurgitation of food and may be aspirated resulting in aspiration pneumonia.
- Nasal tonation of voice due to oro-nasal communication.
- Eustachian tube edema and recurrent otitis media that may lead to defective hearing.
- Malgrowth of alveolus and teeth.

Treatment:

- **Aim:**
    - Normal speech.
    - Normal swallowing.

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  - Normal dental occlusion.
  - Closure of oro-nasal communication.
  - Preservation of facial growth.
- **Timing:**
  - **Soft palate:** Between 3-12 months.
  - **Hard palate:** Not before one year to avoid interference with ossification center of the palate to avoid facial asymmetry.
- **Principles:**
  - Lateral release incision of mucoperiosteum to relax flap.
  - Fracture of pterygoid hammulus to reorientation and relax the tensor veli palatine muscle.
  - Closure in midline of;
    - **Soft palate:** in 3 layers [nasal mucosa, muscle, oral mucosa].
    - **Hard palate:** in 2 layers [nasal mucosa, oral mucosa].

Palatal fistula:

Definition:

- Opening along the suture line.

Incidence:

- 0.5 %

More common in:

- Repair with single layer closure.
- Hard palate.
- Wide or bilateral clefts.

Aetiology:

- Suture under tension or suture disruption.
- Improper correction.
- Infection.

Treatment:

- **Timing:**
  - At least 6 months after the last operation.
- **Methods:**
  - 1ry closure with inverted suture.
  - Rotational flap.
  - Tongue flap.

Velopharyngeal Incompetence [VPI]:

Velo-pharyngeal Sphincter:

- Situated between oral & nasal cavities.
- **Importance:** essential for normal speech.
- **Formation:** soft palate + posterior pharynx.
- **Closure:**
  - **Achieved by:** elevate velum against posterior pharynx.
  - **Assisted by:** movement of posterior & lateral pharyngeal walls toward velum.

Definition:

- Incomplete closure of velum [soft palate] against posterior pharynx during speech.
- This leads to hypernasality, nasal emissions and misarticulations.

Aetiology:

- After CP repair in 20 %
- Submucous CP.
- Congenital short palate.
- After adenoidectomy.
- Enlarged tonsils.

Treatment:

- **Timing:**
  - From 5 years to 12 years.
- **Aim:**
  - Closure the VP sphincter by;
    - Palatal lengthening.
    - Posterior pharyngeal wall augmentation.

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Facial [Maxillo-facial] injury

Definition:

- Injury to the soft tissues of the face (including the ears), facial bony structures or both.
- 60% of patients with facial injuries associated with;
    - Mmultisystem trauma:
        - 20-50% concurrent brain injury.
        - 1-4% cervical spine injuries.
        - Blindness occurs in 0.5-3%.
    - Airway compromise.

Etiology of facial injuries:

- Traffic accidents.
- Sports.
- Falling from height.
- Gun-shot injuries.
- Occupational accidents.
- Animal bites.

Classification of facial injuries:

- Soft tissue injuries.
- Facial bony fractures.
- Combined.

Soft Tissue Injuries

Classification:

- **Wounds:**
    - Closed: [Abrasion, contusion, hematoma].
    - Opened: [Incised, lacerated, crushed, penetrating].
- **Bites:**
    - Dog bites are usually OK for primary closure.

  - Human bites require delayed surgical management.
- **Foreign bodies:**
  - Foreign bodies in the nose or ear are common in children.
  - Foreign bodies may involve in wound [glass…].
- **Accidental tattoo:**
  - Numerous small particles embedded in the dermis.

Facial bone fractures

- Facial bony fractures represent the fractures below the fractures below the supraorbital ridges.

Classification:

- **Fractures between supraorbital ridges and maxillary teeth [Middle third]:**
  - **Centralcomponent**[Nasal, ethmoidal,orbit, maxilla].
  - **Lateralcomponent** [Zygomatic arch, zygoma].
- **Mandibular fractures:**
  - Mandibular body: [Symphyseal,parasymphyseal, main body, angle].
  - Mandibular ramus.
  - Mandibular processes: [Coronoid, condylar, alveolus].

Management:

Emergency treatment [1st aid management]:

- **Airway maintenance with control of C-spine:**
  - Cleaning of blood, vomit and theet from inside of mouth with fingers.
  - Aspiration of blood, saliva, and gastric contents.
  - Early Intubation with in-line cervical immobilization or tracheostomy.
- **Circulation with hemorrhage control:**
  - Direct pressure on the wound.
  - Tying of bleeding vessels.
  - Angiographic demonstration and embolization of the bleeding point.
  - Anterior-posterior nasal packing.
- **Treat shock:**

- When a patient with facial injury is found in shock, must be suspection and evaluation of associated injuries.
- Intavenous fluids and monitoring of vital signs.

- **Evaluate Associated Injuries:**
  - Patient do not die from facial trauma but can die from associated injuries.
  - Clinical examination and radiological imagies should be done to detect associates injuries [cervical vertebrea, skull base, intracranial, thoracal, intraabdominal].
  - **Includes:**
    - Cervical x-rays, skull x-rays, chest x-rays, abdominal US.
- **Diagnosis of facial injuries:**
  - **Clinical examination [Symptoms and signs]:**
    - Facial [wound, swelling, asymmetry &/or deformity].
    - Obstructed respiration.
    - Bleeding [Wound, hematoma, epistaxis, subconjuctival, aural, intraoral].
    - Pain or localized tenderness.
    - Bony discontinuity.
    - Crepitation from areas of underlying bone fracture.
    - Hypostesia and paralysis in the distribution of specific nerve.
    - Visual disturbance [Diplopia, enophthalmos or decrease in vision].
    - Malocclusion and / or open bite.
    - Inability of mouth opening.
    - Lacerations inside of mouth.
  - **Neurological examination:**
    - **Sensory:** [Trigeminal nerve].
    - **Motor:** [Facial nerve].
  - **Diagnostic imaging:**
    - Plain x-rays.
    - CT scan [Axial, coronal, 3D].
    - MRI.

Management of facial injuries:

- **Management of soft tissues:**

A. Management of wound:

- **Wound preparation:**
  - Cleaning the wound.
  - Removing the foreign bodies & clots.
  - Minimal debridement as much as possible.
- **Wound repair:**
  - **Closed wound repair:**
    - **Abrasion:**
    - **Contusion:**
    - **Hematoma:**

    See wound management.
  - **Open wound repair:**
    - **Incised wound:**
      - Repaired in 2 layers [subcutaneous layer and skin].
    - **Transfixing wound:**
      - Repaired in 3 layers [mucosa, muscle, skin].
    - **Skin loss:**
      - Repaired by skin graft or flap.

B. Management of special areas:

- **Ear injury:**
  - **Abrasion & laceration:** Simple repair.
  - **Avulsion:**
    - **Avulsed tissue should be retrieved if possible:**
      - Wrap in moist gauze, seal in plastic and place on ice.
    - Flap or microsurgical repair.
  - **Otohematoma:**
    - Bleeding between auricular cartilage and perichondrium.
    - Needle aspiration followed by firm compression dressing.
    - Untreated, will result in “cauliflower ear” deformity.
- **Nasal injury:**
  - **Abrasion & laceration:** Simple repair.
  - **Avulsion of ala or tip:** Composite graft.
  - **Internal nasal tear:**
    - Packed with antibiotic ointment.

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        - If untreated, web formation -- airway obstruction.
    - **Septal hematoma:**
        - Septal incision, evacuation, no suturing.
        - If untreated, loss of septal cartilage --Saddle nose deformity.
- **Eyelid injury:**
    - **Abrasion & laceration:** Simple repair.
    - Lid margin should be perfectly aligned.
    - Repair levator muscle[Upper lid] to prevent ptosis.
    - Skin loss ----- FTSG.
    - Medial or lateral canthal tendon--- 1ry closure or reattached to orbital rim.
    - Repair of lacrimal sac over a silicon tube.
- **Facial nerve injury:**
    - Repaired within 72 hours by magnification.
    - No necessary to repair the terminal branches as approximation of adjacent tissues ----- nerve regeneration within one year.
- **Parotid gland and duct injury:**
    - **Gland:**
        - No need for sutured.
        - If fistula formed --- close spontaneous within 1 week.
    - **Stensen duct:**
        - Repaired a round a probe or silicon tube [as a splint] for 7 days.
        - If fistula formed --- it should be repaired.

Anatomy of Stensen duct

- Extends along a line from tragus of ear to philtrum of upper lip [traversing the middle third of this line].
- Intraoral buccal opening is opposite the 2nd upper molar teeth.

- **Management of facial bone fractures:**
    - **Non-displaced fractures:** conservative treatment.
    - **Displaced fractures:** reduction with or without fixation.

- **Comminuted fractures:** reduction with fixation.

Jaw swelling

Classification:

Odontogenic [Odontomes] [Origin: teeth remnants]

- **Epithelial odontomes:**
  - Dental cyst.
  - Dentigerous cyst.
  - Adamantinoma.

- **Connective tissue and composite odontomes:**
  - Not in man.

Non-odontogenic [Origin: gum, alveolar margin or bone]

- **Gum or alveolar margin [Epulis]:**
  - **Benign:** [Fibrous, granulomatous, heamangiomatous].
  - **Locally malignant:** [Myeloid].
  - **Malignant:** [Carcinoma, sarcoma].

- **Bony jaw:**
  - **Inflammatory:**
    - Alveolar [Sub-periosteal] abscess.
    - Osteomylitis of jaw.
  - **Neoplastic:**
    - **Benign:**
      - Osteoma.
    - **Locally malignant:**
      - Gaint cell tumor [Osteoclastoma].
    - **Malignant:**
      - **Primary:**
        - Malignant neoplasm of the mandible.
        - Malignant neoplasm of the maxilla.
      - **Secondary [e.g]:**
        - Cancer thyroid.
        - Cancer breast.
        - Cancer lung.
        - Cancer prostate.

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Odontomes

Definition:

- It is a cystic swelling related to teeth development.

Common epithelial odontomes:

- Dental [Radicular] cyst, commonest.
- Dentigerous [Follicular] cyat.
- Adamantinoma [Ameloblastoma].

Dental [Radicular] cyst

Aetiology:

- Irritation of paradental epithelial debris or malassez cells.

Pathology:

- Small sized cyst present overlying tooth lined by squamous epithelium and contains mucoid material rich in cholesterol crystals.

Complications:

- Infection.
- Recurrence.
- Pathological fracture.

Clinical picture:

- **Location:** Anterior teeth [canine] of upper jaw.
- **Age:** Adult life [around 40 years].
- It is a slowly growing painless swelling characterized by:
    - Hard in consistency with egg shell crackling sensation.
    - Covered with intact mucosa.

Investigation:

- **Plain x-ray:**
    - Rounded well defined radio-translucent area in association with a root.

Treatment:

- Extraction of affected tooth.
- Opening the cyst.

- Enucleation of the cyst with removal of lining membrane and fluid.
- Crushing of overhanging bone.

Dentigerous [Follicular] cyst

Aetiology:

- Irritation of paradental epithelial debris or malassez cells.
- Cystic degeneration of a dental follicle.

Pathology:

- Small sized cyst lined by squamous epithelium and contains mucoid material rich in cholesterol crystals.

Clinical picture:

- **Location:** Un-erupted posterior tooth [3rd molar] of lower jaw.
- **Age:** Age of 2nd dentition [7-25 years].
- It is a slowly growing painless swelling characterized by:
  - Hard in consistency.
  - Covered with intact mucosa.
  - Egg shell crackling sensation on finger examination due to thinning of bone secondary to jaw expansion.

Complications:

- Infection.
- Reccurrence.
- Pathological fracture.
- Aggressive expansion results in facial asymmetry and pain.

Investigation:

- **Plain x-ray:**
  - Well defined unilocular cyst with a tooth lying inside it.

Treatment:

- Deroofing of the cyst with extraction of the un-erupted tooth.
- Removal of lining membrane and fluid.
- Crushing of overhanging bone.

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Ademantinoma [Ameloblastoma]

Definition:

- It is a locally malignant tumor arising from
  - Dental epithelium.
  - Paradental epithelial debris or malassez cells.

Pathology:

- **Macroscopic examination:**
  - Monocystic or multicystic with
    - Lined with columnar epithelium.
    - Cointains mucoid fluid rich in cholesterol.
    - Covered with true capsule.
    - Contains trabeculae traverse the tumor dividing into lobes and lobules.

- **Grows:**
  - Slowly growing;
    - Forwards in body of the mandible.
    - Upwards in ascending ramus.

- **Microscopic examination:**
  - Basal cell carcinoma.

Clinical picture:

- **Location:** commonest tumor in the lower jaw in Egypt usually at the junction between body of the mandible and ramus.
- **Age:** 20 – 40 years
- **Sex:** female.
- It is a slowly growing painless well defined swelling at the angle of the mandible characterized by:
  - Lobulated.
  - Hard in consistency with egg shell crackling sensation.
  - Covered with overlying skin and intact mucosa.
  - Expansion of the jaw more to outside than inside. So, it is more obvious from the cheek than from the mouth.
  - Not tender.
  - No lymph nodes unless ulceration and secondary infection.

Complications:

- Infection.
- Ulceration.
- Loosing the tooth.
- Pathological fracture [rare].
- Malignant [Carcinoma – sarcoma].

Investigations:

- **Plain x-ray:**
  - Fine honey comb or soap bubble appearance.
- **CT scan and MRI.**
- **Biopsy.**

Differential diagnosis:

	Adamantinoma	**Gaint cell [Osteoclastoma]**
Location	Angel of mandible	Symphysis menti
Shape	Equal lobulation	Unequal lobulation
Color	Pink or pale	Brownish or bluish
Growth direction	Horizontal & vertical	Horizontal
Expansion	More to outside	Equal to both
X-ray: **soap bubble appearance**	Fine	Fine and coarse

Treatment:

- Resection of the part of the mandible carrying the tumor with safety margin.
- Reconstruction with;
  - Bone graft [vascularized or free rib graft].
  - Artificail prosthesis.

Non-odontogenic:

Epulis [Origin: gum, alveolar margin]

Definition:

- It a swelling overriding the gum or growing from the alveolar margin [mucoperiosteum].

Classification:

- **Benign:** [Fibrous, granulomatous, heamangiomatous].
- **Locally malignant:** [Myeloid].
- **Malignant:** [Carcinoma, sarcoma].

Fibrous epulis

Definition:

- It is the only true fibroma arising from outer fibrous layer of periosteum.

Microscopically:

- Spindle cells [Fibroblast].

Clinical picture:

- It is the commonest from.
- **Location:** neck of an incisor or premolar tooth of the lower jaw.
- It is a slowly growing painless small pedunculated swelling;
    - Firm in consistency.
    - Pink in color.
    - Covered with intact mucosa.
- May turn to fibrosarcomatous epulis.

Treatment:

- Excision of the tumor with adjacent tooth or teeth and periosteum wedge to prevent recurrence.

Granulomatous epulis [Pyogenic granuloma]

Definition:

- It is a mass of granulation tissue around the carious tooth.

Microscopically:

- Granulation tissue [Capillaries + fibroblast].

Clinical picture:

- It is the commonest from.
- **Location:** around the carious tooth.
- It is a red polypoid soft mass that bleeds easily with pus on surface.

Treatment:

- Removal of carious tooth.
- Excision of the granulation tissue with diathermy.

Haemangiomatous epulis

Definition:

- It is a submucous cavernous haemangioma of the gum.

Clinical picture:

- Bluish compressible sessile swelling covered with intact mucosa and liable for severe bleeding.

Treatment:

- Injection of sclerosing material.
- Surgical excision.

Gaint cell epulis [Myeloid]

Definition:

- It is an osteoclastoma arising peripherally in the jaw.

Microscopically:

- Multinucleated gaint cells in a matrix of fibrous tissue.

Clinical picture:

- **Location:** more in mandible than maxilla.
- It is a rapidly growing painless sessile lobulated swelling;
    - Soft in consistency.
    - Purple in color.
    - Fixed to bone.
- Ulceration and hemorrhage can occur.

Investigation:

- **Plain x-ray:** jaw shows eating up of bone.

Treatment:

- **Small swelling:** Curettage.
- **Large swelling:** Wide excision with safety margin.

Malignant epulis

Clinical picture:

- **Location:** more in mandible than maxilla.
- It is a rapidly growing painless sessile swelling;
  - Hard in consistency.
  - Intact mucosa.
  - Fixed to bone.
- Ulceration and hemorrhage can occur.

Types:

- **Carcinomatous epulis:**
  - Carcinoma of the floor of mouth infiltrating gums.

- **Sarcomatous epulis:**
  - It is actually paraosteal fibrosarcoma.
  - It may arise from outer layer of periosteum or on top of fibrous epulis
  - **Treatment:** Wide excision with safety margin up to hemimandibulectomy.

Non-odontogenic:

[Origin: bone]

- **Inflammatory:**
  - Alveolar [Sub-periosteal] abscess.
  - Osteomylitis of jaw.

- **Neoplastic:**
  - **Benign:**
    - Osteoma.
  - **Locally malignant:**
    - Gaint cell tumor [Osteoclastoma].
  - **Malignant:**
    - **Primary:**
      - Malignant neoplasm of the mandible.
      - Malignant neoplasm of the maxilla.
    - **Secondary:**
      - Cancer thyroid…..etc.

Alveolar [Subperiosteal] abscess

Pathology:

- Infection around the apex of the tooth which spread through the cortex of the mandible to form a subperiosteal abscess.
- Abscess points externally or in the maxillary antrum.
- Infection may spread to the cavernous sinus.

Clinical picture:

- Marked toxaemia.
- Painful swelling in the cheek with gum inflammation.
- Enlarged and tender regional lymph nodes.

Treatment:

- Antibiotics.
- Drainage of the abscess through an incision in the mucoperiosteum into the mouth.

Osteomyelitis of the jaw

A. Acute osteomyelitis:

- **Aetiology:**
  - History of alveolar abscess.

- **Organism:**
  - Staphylococcus aureus.

- **Clinical picture:**
  - **Location:** Commoner in the lower jaw.
  - Pain, fever and swelling.
  - Trismus may be present.

- **Fate:**
  - Resolution.
  - Chronic osteomyelitis.

- **Treatment:**
  - Antibiotics and mouth washes.

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B. Chronic osteomyelitis:

- **Aetiology:**
  - On top of acute.
  - As a complication of compound fracture of the mandible.
  - Chemical necrosis secondary to phosphorus, arsenic & mercury.
  - Radium necrosis.
  - Blood borne; rare.
  - Infectious diseases [TB, syphilis, actinomycosis]; rare.

- **Pathology:**
  - Similar to osteomyelitis in other bone + the following differences;
    - Sequestrum separation takes a long time.
    - Involucrium formation is poor.
    - Massive necrosis and sequestration if the inferior dental artery thrombosed.

- **Clinical picture:**
  - **Location:** Commoner in the lower jaw.
  - Pain and fever.
  - Thickening of the jaw.
  - Sinus discharging pus.
  - Trismus may be present if the molar region is involved.

- **Investigations:**
  - **Plain X-ray:**
    - Shows bone necrosis [sequestrum] & new bone formation.
  - **Culture and sensitivity of the discharged pus.**

- **Treatment:**
  - Antibiotics and mouth washes.
  - Drainage of abscess if present.
  - Saucerisation and sequestrectomy.

Osteoma

Definition:

- It is benign tumor that affects any facial bone or a part of Gardener syndrome [multiple polyps of colon, multiple osteomas, epidermoid cyst, and desmoids tumor].

Clinical picture:

- **Location:** lingual surface of mandibular body.
- Asymptomatic.
- Single or multiple irregular painless well defined swelling.

Investigation:

- **Plain x-ray:**
  - Irregular well circumscribed very radio-opaque mass.

Treatment:

- **Asymptomatic:** no treatment.
- **Symptomatic:** Local excision.

Gaint cell tumor [Osteoclastoma]

- It is a rare tumor of the jaw.
- Clinically and its radiological appearance are similar to adamantinoma.
- See adamantinoma [Differential diagnosis].

Aesthetic [Cosmetic] Surgery

Definition:

- It is a branch of plastic surgery in which the surgeon is able to improve on some aspect of the appearance of normal person.

Aim of Aesthetic Surgery:

- Correction of deformity.
- Improvement of appearance.
- Improvement of patient's psychological insult.

Includes:

- **Facial aesthetic surgery.**
- **Body contouring.**
- **Hair transplantation**

Facial aesthetic surgery

Surgical procedures:

- **Rhytedectomy [Face lift]:**
  - **Definition:**
    - It is a surgical rejuvenation of the aging face.
  - **Aim:**
    - Restore a youthful appearance of the face.
    - Correct the sagging of the skin and subcutaneous musculature of the face and neck.
  - **Indications:**
    - Aging face.
    - Facial palsy.

- **Brow lift:**
  - **Definition:**
    - It is a surgical procedure to perform on the eyebrow to maintain its position.
  - **Aim:**
    - Return the brow to its normal position with good shape and symmetry.
  - **Indications:**
    - Eyebrow ptosis [aging or facial palsy].

- **Blepharoplasty:**
  - **Definition:**
    - Excision of excessive skin from the upper and / or lower eyelid together with underlying accumulations of fat.
  - **Aim:**
    - Restore a youthful appearance to the peri-orbital area.
    - Create lid crease on eyelids.
    - Relieve visual field obstruction.
  - **Indications:**
    - Bagginess, fatty protrusion and lax skin around eyes.
    - Visual field obstruction caused by hanging of excess skin over upper eyelid.
  - **Types:**
    - Upper blepharoplasty.
    - Lower blepharoplasty.
    - Combined blepharoplasty.

- **Rhinoplasty:**
  - **Definition:**
    - It is a surgical procedure to perform on the nose to reshape or modify its appearance.
  - **Aim:**
    - Create or reshape a nose according the patient's desire.
    - Relieve airway obstruction.
  - **Indications:**
    - Nasal deformity [congenital or traumatic].
    - Presence of airway obstruction secondary to nasal septum deviation.
  - **Types:**
    - **Primary rhinoplasty:**
      - Augmentation rhinoplasty.
      - Reduction rhinoplasty.
      - Tip rhinoplasty.
      - Septo-rhinoplasty.
    - **Secondary rhinoplasty.**

- **Otoplasty:**
  - **Definition:**

        - It is a surgical procedure to perform on the external ear [auricle] to return it to its normal position.
    - **Aim:**
        - Return the auricle to its normal position with good shape and symmetry.
    - **Indications:**
        - Prominent [protruded] ear.

Complication of surgical procedures:

- **Post-operative complications:**
    - Infection.
    - Hematoma.
    - Prolonged swelling.
    - Pain.
- **Aesthetic complications:**
    - Asymmetry.
    - Unacceptable scar.
    - Unappealing shape.
    - Sensory changes.
    - Poor wound healing.
    - Possibility of revision surgery.

Non-surgical procedures:

- **Indications**:
    - **Soft tissue augmentation.**
    - **Facial rejuvenation:**
        - Facial wrinkles and lines.
        - Skin pigmentation.
        - Precancerous skin lesions.
        - Acne scarring.

- **Procedures of soft tissue augmentation:**

Procedure	Mode of action
Autogenous filler [Fat graft]	Fat is harvested from lower abdomen, centrifuged and placed in the subdermal plane under the relevant skin crease.
Non-autogenous filler [Hyaluronic acid, collagen]	The filler is injected intradermally that absorb water and expand to fill the lines and creases [it has temporary effect].

- **Procedures of facial rejuvination:**

Procedure	Mode of action
Chemical peels	Controlled chemical injury that extends from epidermis to differing depths.
Dermabrasion	Mechanical removing of epidermis and superfacial dermis.
Laser	Improve skin color by mechanical removal of damaged skin. Improve skin texture by collagen shrinkage and remodeling.
Botox [Botulinum toxin]	Temporary flaccid paralysis [it has temporary effect].
Platelet rich plasma [PRP]	It contains several growth factors that stimulate collagen growing, regenerate tissues causing improve skin tone and texture.
Methotherapy	
Hyaluronic acid and Vitamins	Metho-rejuvination.
Kogic acid	Metho-lightening.

Complications of non-surgical procedures:

- Skin pigmentation.
- Erythema.
- Sensitive to sunlight.
- Infection.
- Scarring.
- Edema.
- **Changing of existing skin condition:**
  - Spider telangectasia.
  - Skin pores.
  - Hyperkeratosis.
  - Sensory changes.
- **Complications of fat injection:**
  - Asymmetry.
  - Irregularities.
  - Too much or too little fat.
  - Infection.
  - Possibility to damage the underlying structures.

Body contouring

Definition:

- Are surgical procedures can remove excess sagging fat and skin and tighten muscles.

Aim:

- Changing the body shape to be;
  - More normal appearance.
  - Smoother contours.

Indications:

- Excess skin.
- Excess fatty tissue.
- Musculoskeletal laxity.

Ideal candidates:

- Individuals with stabilized weight loss.
- Healthy individuals who do not have medical conditions that can impair healing or increase risk of surgery.
- Non smokers.
- Individuals with a good expectation.
- Individuals committed to leading a healthy lifestyle including proper nutrition and fitness.

Patient's assessment:

To achieve the precision in body contouring, these points should be addressed;

- **Local analysis:**
  - **Skin:**
    - **Laxity.**
    - **Cellulite:**
      - Accumulation of fat and fluid trapped in hardened network of connective tissue fibers leading to hold the skin down causing dimpling effect and appears as orange peel skin.
    - **Stretch marks and striae:**

- Result from disruption of the dermis with loss of continuation of elastic fibers causing loss of elastic recoil and skin tension.
- **Scars of previous operations.**

- **Subcutaneous fat:**
  - **Pinch test:** is a simple method to measure the subcutaneous fat to evaluate the ideal candidate for liposuction [at least 2 cm].
- **Muscle diastasis.**
- **Adjacent or related areas.**

- **Body mass index [BMI]:**
  - Weight in (kg) / height in (m^2).

BMI	Description
19 -24.9	Healthy weight
25 – 29.9	Pre-obese
30 – 34.9	Obese class I
35 – 39.9	Obese class II
40 or more	Obese class III

- **General condition:**
  - To evaluate her/his fitness for surgery.

Procedures:

- **Liposuction:**
  - It is aspiration of unwanted fat via small incisions using a special cannula and high powerful suction pump which generate negative pressure.
- **Excisional lifting:**
  - It is a surgical excisional procedure to achieve normal appearance through;
    - Resection of sagging skin and reduction of subcutaneous fat.
    - ± Correct muscle diastases.
  - **Includes:**
    - **Brachioplasty [Arm lift].**
    - **Mastopexy [Breast lift].**
    - **Trunk:**
      - Abdominoplasy [Abdominal lift].
      - Back lift [Upper back lift – Lower back lift].
      - Body lifts [Upper body lift – Lower body lift].
    - **Thigh lift.**

- **Augmentation**:
  - It is a surgical procedure to augment the area with autologous fat or a medical device [implant] to enhance its size.
  - As breast augmentation, gluteal augmentation, calf augmentation…]
- **Combined**

Method to choose the suitable procedure:

Grade	Deformity	Description	Ideal procedure
0	Normal	No deformity	
1	Mild	Excess fat Good skin tone with intact contractile properties.	Liposuction
2	Moderate	Excess fat Slight impaired skin tone	Liposuction ± excisional procedure
3	Severe	Permanent skin damage with striae.	Excisional lifting ± liposuction

Complication of body contouring procedures:

- **Post-operative complications:**
  - Infection.
  - Hematoma.
  - Prolonged swelling.
  - Wound disruption.
  - Pain.
- **Aesthetic complications:**
  - Asymmetry.
  - Irregular contour.
  - Unacceptable scar.
  - Unappealing shape.
  - Sensory changes.
  - Poor wound healing.
  - Possibility of revision surgery.

Hair transplantation

Definition:

- It is a surgical technique that transplants individual hair follicles from a part of the scalp [donor site] to bald part of the body [recipient site] to allow natural hair growth.

Hair growth cycle:

- Average hairs are 100000 on adult scalp.
- Rate of growth of scalp hair is 1cm/month.
- **Life cycle:**
    - **Anagen [Growing] phase:**
        - Active growing period.
        - Accounts 90 % of hair at any time.
        - **Duration:** 3 years.
    - **Catagen [Regression] phase:**
        - Base of the hair separates and moves to the skin surface.
        - **Duration:** 1-2 weeks.
    - **Telogen [Resting] phase:**
        - No growth.
        - Accounts the remaining 10 % of terminal hair.
        - **Duration:** 3-4 weeks.

Indications:

- Androgenic alopecia.
- Cicatracial alopecia.
- Traumatic alopecia.
- Restoration of eyebrows.

Contra-indications:

- Individual with poor hair density.
- Individual with extensive baldness.

- Scarring alopecia.

Procedure:

- Harvesting the intact hair follicles from within the safe donor area [occipital area] of a patient's scalp by either;
  - Follicular unit strip excision.
  - Follicular unit extraction.
- Preparation of the recipient site.
- Insertion of the hair grafts in normal angle in the recipient site.

Complications:

- **Surgical complications:**
  - Bleeding.
  - Infection.
  - Slight elevation of the graft.
- **Aesthetic complications:**
  - Improper graft positioning and angling.
  - Improper choice of hair line.
  - Excessive scarring.
  - Insufficient donor hair.

Development of the breast

Time	Development
5th week of gestation	2 ectodermal thickening [ridges] named milk line extend from axilla to inguinal area.
10th week of gestation	Cephalic ⅓ of each ridge in the pectoral area develops into infinitive precursor of breast and the remainder of each ridge disappears. An ectodermal cell grows into the underlying mesenchyme and forms about 20 mammary buds.
15th week of gestation	The mammary buds branches and developed into mammary ducts.
20th to 32nd week of gestation	Ductal development [canalization & lengthening continues under the effect of estrogen.
32nd to 40th week of gestation	Alveolar-lobular pattern developed under the effect of progesterone.
At birth	Normal breast has complete adult complement of 15-20 lobes of glandular tissue. Each lobe is a separate system of alveolar-lobular cells specialized of milk production. A system of smaller collecting ductules connect with a major duct and exiting through the nipple.
	The fatty connective tissue of the breast develops from the surrounding mesenchyme.

- The breast grows in proportion to the body size until puberty.

- **Larche:**
  - It is the earliest breast growth which is not in proportion with the body size and usually represents the 1st sign of pubery.

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Congenital anomalies of the breast

Absence of structures:

- **Amastia:**
  - Total absent of the breast.
- **Athelia:**
  - Absence of nipples.
- **Amazia:**
  - Absence of NAC and glandular tissues.

Excess structures:

- **Polymastia:**
  - Multiple breasts along milk line.
  - Axilla is the most common site.
- **Polythelia:**
  - Multiple nipples along milk line.
  - Anterior chest and abdomen are the most common cites.
- **Bifid nipple:**
  - It is an intra-areolar form of polythelia.

Variation in size:

- **Hypertrophy:**
  - Increase breast cells size.
  - Example: Massive virginal hypertrophy [Gigantism].
- **Hyperplasia:**
  - Increase breast cells number.
- **Hypoplasia:**
  - Decrease breast cells number.

Variation in shape:

- **Ptosis:**
  - Breast sagging.
- **Tuberous breast:**
  - Less breast tissues in the inferior quadrants.

Variation in nipple areola complex [NAC]:

- **Inverted nipple.**
- **Nipple hypertrophy**:
  - Excessive nipple projection.

Breast Surgery

Breast is one of the most important organs of considerable social and psychological importance in both sexes.

Main plastic surgical procedures of the breast includes:

- Breast lift [Mastopexy].
- Breast reduction.
- Breast augmentation.
- Breast reconstruction after mastectomy.
- Gynecomastia reduction.

Patient preparation for breast surgery:

- **History:**
  - Any breast disease.
  - Lump, pain, discharge.
  - Family history of breast cancer.
  - Any medical conditions.
  - Medications.
- **Physical examination:**
  - **General examination:**
    - To evaluate the general condition of the patient.
  - **Local [Breast] examination:**
    - Breast size, site and its skin condition.
    - Nipple areola complex [NAC] location.
    - Axillary tail.
    - Asymmetry.
- **Mammography:**
  - For any patient more than 35 years.
  - For younger patient with positive family history of breast cancer.
- **Preoperative routine investigations:**
  - To evaluate general condition and the fitness of patient for anesthesia:
    - Blood group, CBC, liver & renal function tests, blood sugar.
    - ECG.
- **Preoperative photography.**
- **Patient consent.**

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Breast lift [Mastopexy]

Definition:

- It is a surgical procedure to correct the breast ptosis.

- **Breast ptosis:**
  - **Definition:**
    - Sagging or drooping of the breast.
  - **Aetiology:**
    - Gravity.
    - Hormonal changes.
    - Weight loss.
    - Glandular atrophy.
  - **Changes:**
    - Nipple moves inferiorly.
    - Breast parenchyma hangs over Infra-mammary fold.
    - Stretch skin and subcutaneous tissue with loss of elasticity.

Aim:

- Elevate the ptosed breasts to its normal position.

Indications:

- Patient with;
  - Adequate breast parenchyma.
  - NAC ptosis.
  - Willingness to accept scar.

Principles:

- Skin reduction and redraping.
- Reshaping and or repositioning of the gland.
- Superior repositioning of NAC.

Breast reduction [Reduction mammaplasty]

Definition:

- It is a surgical procedure to reducing breast volume.

Aim:

- Relieve symptoms and obtain symmetrical normal breast.

Indications:

- Macromastia.
- Virginal breast hypertrophy.
- Benign breast disease as fibrocystic disease.

Principles:

- Glandular reduction and reshaping.
- Skin reduction and redraping.
- Superior repositioning of NAC.
- Creation of a pedicle for NAC.

Breast augmentation [Augmentation mammaplasty]

Definition:

- It is a surgical procedure to augment the breast to enhance the breast size.

Aim:

- **Visual aesthetic:**
  - Proper symmetry, contour and proportion.
- **Tactile aesthetic:**
  - Softness, smoothness and sensitive to touch.

Indications:

- Congenital small or absent breast or asymmetrical breasts.
- Post-lactational involution.
- Post-mastectomy reconstruction.
- Desire of the patient.

Methods of augmentation:

- Insertion of medical device [breast implant]:
  - **Implants surface types:** textured or smooth.
  - **Implants fill types:** gel, saline or combined.
  - **Implant shape:** anatomic or round.
  - **Implant placement location**: subglandular or submuscular.
- Tissue expansion followed by implant insertion.
- Musculo-cutaneous flap with or without implant.
- Lipo-filling.

Breast reconstruction after mastectomy

Definition:

- It is a surgical procedure to create a breast looks feels like the normal one.

Aim:

- Restoration of breast aesthetics through reconstitution of surface volume and symmetry.

Timing:

	Immediate	Delayed
When	On the same day with mastectomy	6 months post-mastectomy
Advantages	Improve psychic trauma Less expensive Better aesthetic	Allow the tissues to settle Final pathology results are available Fewer complications Determine the best reconstructive method
Disadvantages	Delay of adjuvant therapy May affect the reconstructive plan	Prolongs overall treatment Increase psychic trauma Sometimes technically more challenging

Methods:

	Autogenous	Implantation ± expander
Indications	*Irradiated patients *Recurrent infection *Failed implant reconstruction	*Patient unfit for major operation *Patient refuse scars of flaps *Suitable for small and moderate breast
Advantages	*Similar consistency to nature breast *No foreign body reaction	*Technically easy and simple *Minimal scar formation *No donor site morbidity *Reduce operation and recovery time
Disadvantages	*Donor site morbidity *More complex operation *Long operation and recovery time	*Foreign body reaction *Complications of implant: [rupture, extrusion, leakage,infection]
Types	*Latissmus dorsi flap *Tranverse Rectus Abdominis Myocutaneous [TRAM] flap	*Saline implant *Silicon gel implant

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Gynecomastia [Enlargement of male breast]

Definition:

- It is benign condition of glandular tissue growth in male breast

Incidence:

Newborn [60%], puberty [65%] and old [30%]

Aetiology:

- **Physiological:**
  - Gynecomastia occurs at times of hormonal change.

- **Pathological**
  - **Endocrine disorders:**
    - Hyperthyroidism [most common], hypothyroidism, hyperparathyroidism.
    - 1ry testicular failure:
      - Klinefelter's syndrome (XXY), hermaphroditism, cryptorchidism.
    - 2ry testicular failure:
      - Orchitis, trauma and bacterial infections [leprosy, TB].
  - **Metabolic disorders:** Liver cirrhosis.
  - **Neoplasm**: Pitutary tumor, hepatoma, adrenal tumor, testicular tumor.
  - **Idiopathic.**

- **Pharmacological:**
  - Exogenous estrogen, testosterone, or anabolic steroids.
  - Spironolactone, cimetidine, digitalis, methadone.
  - Tranquilizers, and chemotherapeutic agents.

Investigations:

A. Laboratory studies include:

- Liver function studies.
- Thyroid function tests.
- Renal function tests.
- Sex hormone levels.

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- Urinary markers for 17-ketosteroids, androgens, and gonadotropic hormones.
- Karyotyping to exclude Klinefelter's syndrome.

B. Radiological investigations:

- Abdominal and testicular ultrasound.
- Mammography to exclude breast carcinoma.

Classification:

- **Simon classification:**

Classification	Description
Grade I	**Small enlargement + No skin excess**
Grade II A	**Moderate enlargement + No Skin excess**
Grade II B	**Moderate enlargement + Skin excess**
Grade III	**Marked enlargement + Skin excess**

Treatment:

- **Medical treatment:**
  - Mostly, no need treatment.
  - Danazol, tamoxifen or clomiphene may be useful.

- **Surgical treatment:**
  - **Surgical procedures:**
    - Liposuction.
    - Excision.

Common possible complications of breast surgery

- **Post-operative complications:**
  - Infection.
  - Hematoma.
  - Seroma.
- **Aesthetic complications:**
  - Asymmetry or irregular contour.
  - Skin or nipple loss.
  - Sensory changes.
  - Unacceptable scar.
  - Unappealing shape.
- **Implant related problems if used:**

- Implant rupture or exposure.
- Implant mal-position.
- Capsular contracture.
- Mammographic interference.

Congenital hand anomalies

Aetiology:

- **Intrinsic [endogenous] factors:**
  - Genetic [Dominant, recessive or sex-linked]
- **Extrinsic [Exogenous] factors:**
  - Environmental [Nutrition, chemical, infection, irradiation, toxic]
- **Combination of intrinsic and extrinsic factors.**

Incudence:

- Syndactyly and polydactyly are the most common congenital anomalies of the hand.

Syndactyly

Definition:

- Fusion or webbing of the finger

Incidence:

- Occurring once in every 1000 – 3000 live births.
- It is twice more common in males.
- Familial in 20 – 30 % of cases.
- Most common site is the 3rd web space.
- Often symmetrically bilateral.
- Often associated with other deformities of the same upper limb, including hypoplasia and polydactyly.

Classification:

- **Complete versus incomplete:**
  - **Complete:** Fusion extends to the tip of finger.
  - **Incomplete:** Fusion does not extends to the finger.
- **Simple versus complex:**
  - **Simple:** Only soft tissue fusion.
  - **Complex:** Bony fusion.

Treatment:

- **Timing :**
  - Surgery is not usually performed before 1 year of age.

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- **Indication of early surgical intervention:**
  - **1st and 4th web space syndactyly:**
    - Due to length discrepancy that may result in increased deformity with growth.
  - **Complex syndactyly:**
    - Because the bony connections can affect growth.
- **Principles of tratment:**
  - Release incisions to separate syndactyly.
  - Dorsal skin flap to cover web space.
  - Skin flaps in digit and skin graft to cover the digit.

Polydactyly

Definition:

- Extra digit.

Classification:

- **Ulnar [Post-axial] polydactyly:**
  - Most common single hand malformation.
  - Its incidence is eight times that of polydactyly of the other fingers.
  - Often bilateral.
  - **Stelling classification:**
    - **Type 1:** an extra digit attached by a skin bridge only.
    - **Type 2:** an extra digit contains normal components [tendons, bone, nerves]
    - **Type 3:** an extra digit articulating with an extra metacarpal.
  - Extra digits are usually treated with simple excision.

- **Central polydactyly:**
  - Duplication of middle fingers and usually occurs in conjunction with syndactyly.
  - Often autosomal dominant.
  - Frequently bilateral.
  - **Treatment:**
    - Release of the syndactyly.
    - Excision of the excess tissue.
    - Repair and soft-tissue reconstruction.

- **Radial [Pre-axial] polydactyly:**
  - Usually unilateral.
  - Represents one-third of all congenital hand anomalies.
  - **Wassell classification:**
    - **Type I:** bifid distal phalanx.
    - **Type II:** duplicated distal phalanx.
    - **Type III:** duplicated distal phalanx + bifid proximal phalanx.
    - **Type IV [most common]:** duplicated proximal and distal phalanx.
    - **Type V:** Type IV + bifid metacarpal.
    - **Type VI:** duplicated metacarpal, proximal and distal phalanx.
    - **Type VII:** triphalangeal thumb.
  - **Surgical options:**
    - Removing one duplicate and reconstructing the other.
    - Removing equal parts of both digits and combining the remaining tissue to form a single finger.
    - Removing unequal parts of both digits and combining the remaining tissue to form a single finger.

Macrodactyly

Definition:

- True macrodactyly is localized enlargement of all structures of a finger.
- It distinguished from conditions such as haemangiomas, vascular malformations in which only part of the finger is enlarged.

Incidence:

- Usually unilateral.
- Index finger is most commonly affected.

Classification:

- Two separate forms of macrodactyly have been described.
  - **Static macrodactyly:**
    - Enlarged finger grows in proportion to the rest of the child.
  - **Progressive macrodactyly:**
    - Enlarged finger grows out of proportion to the rest of the child.

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- **Surgical options:**
  - Soft-tissue and bony reduction
  - Amputation.

Constriction ring [band] syndrome

Definition:

- Tight bands involving all or part of the circumference of hand or digit of the limb.
- The bands are similar to normal skin creases but may extend deeply down to bone.

Incidence:

- It is not clear but may be due to amniotic bands encircling the limb in utero. So, it is also named **amniotic band syndrome.**

Classification:

- **Group 1:** a groove in the skin which may be partial or complete.
- **Group 2:** ring constriction with distal lymphoedema.
- **Group 3:** ring constriction associated with fusion of distal digits.
- **Group 4:** intra-uterine auto-amputation of the affected parts.

Surgical correction:

- Excision of the constriction band + soft-tissue release with Z-plasties is used in most cases.
- Traditionally, no more than half of the circumference of the band was released at one time to reduce the risk of distal ischaemia.
- Fused digits should, if possible, be released in the 1st year of life to allow each digit grow independently.

Hand injuries

Classification:

- **Open injury:**
  - **Tidy:**
    - **Aetiology:**
      - Mostly caused by knife or broken glass.
    - **Result:**
      - Clean cut incised wound with minimal contamination and a good blood supply.
  - **Untidy:**
    - **Aetiology**:
      - Mostly caused by crushing forces [machinery].
    - **Result:**
      - Poorly perfused wound edges & often contaminated.
- **Closed injury:**
  - **As:**
    - closed crush injury of a fingertip
    - Body fracture with or without rupture of tendon.
- **Complex injury:**
  - Includes amputation, avulsions or burn.
  - **Result:**
    - Extensive deep damage to multiple tissues and potential loss of circulation.

Clinical picture:

Finding	Significant
Scar.	**Previous trauma or operation**
Wound with or without skin loss.	**Soft tissue injury**
Change of temperature or color.	**Arterial or venous insufficiency**
Diminish or absent pulsation.	
Painful with flexion.	**Tendon injury**
Abnormal posture.	
Decrease range of motion.	
Swelling.	**Bone injury**
Deformity.	
Decrease active or passive movement.	
Loss of stability	**Joint injury**

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Preoperative principles:

History:

- **Patient:**
  - Age.
  - Hand dominance.
  - Occupation.
  - Past medical history, including anesthetic experiences,
    - Bleeding disorders.
    - Prior operations.
    - Current medications.
  - Allergy and tetanus immunization status.
- **Trauma:**
  - Previous hand problems.
  - Date, time, mechanism and circumstances [e.g. contaminated].
  - Position of the limb during the injury [e.g., fall on outstretched hand, hand open or grasping].
  - Prior treatments.

Physical and radiological examinations:

Examination of vascularity:

- Observe the color of the skin and nail beds.
- Check temperature of the skin and the timing of capillary refill after blanching the skin with light pressure.
- Palpate brachial, radial, and ulnar pulses.
- **Allen test** [to determine patency of both ulnar and radial arteries].
  - The patient should raise and clench the fist to exsanguinate the hand while the physician compresses both radial and ulnar arteries at the wrist.
  - As the patient opens the hand, the examiner releases pressure on the radial artery and observes the capillary refill across the hand.
  - The test is repeated, releasing pressure on the ulnar artery, and filling from the ulnar side is observed.
  - Incomplete refill across the hand may occur in 10% to 15% of patients, and may indicate an incomplete superficial palmar arterial arch or occlusion of the radial or ulnar arteries.

Examination of neural status:

- There are three autonomous areas on the hand, each of which is innervated by only one of three major nerves;
    - The autonomous zone for the median nerve is the index fingertip.
    - The autonomous zone for the ulnar nerve is the small finger's tip.
    - The autonomous zone for the radial nerve is the dorsal side of the first web space.

Examination of soft-tissue coverage:

- Examination of any skin deficits or devitalized areas.

Examination of bone skeleton:

- A fracture should be described according to location, shape, type and displacement.

Evaluation of joint condition:

- Examination of loss of stability of any finger.

Examination of muscle-tendon unit function:

- Observing the resting posture of the hand.
    - In the supine position, the resting hand should have the fingers in a partially flexed position, falling into a smooth cascade of progressively more flexion from the index to the small finger.
    - A complete tendon laceration will cause the injured digit to fall out of line at rest.
- **Tendon testing:**
    - Assess full range of motion [ROM] of each tendon against resistance and compared with the uninjured side to assess strength.
        - Pain or weakness against resistance suggests a partial tendon laceration.
    - Flexor digitorum profundus is tested by flexing the distal interphalengeal joint against resistance while the middle phalanx and proximal interphalangeal joint held in extension.
    - Flexor digitorum superficialis is tested by flexing the proximal interphalangeal joint against resistance while fingers are held.

Treatment:

- Rule out injuries to other parts of the body.
- Emergency care; an amputated hand or finger should be keot in a clean bag and is placed in cold water [4°].
- Triage injuries into three categories according to severity and urgency:
    - **Severe injuries that require immediate treatment:**
        - Life-threatening situations and injuries that have resulted in ischemia and threaten survival of the parts [amputations, vascular injuries, crush injuries, and electrical injuries].
    - **Severe injuries that require early treatment:**
        - Tendon injuries.
        - Nerve injuries.
        - Open fractures.
        - Joint injuries.
    - **Less-severe injuries:**

Reconstructive planning:

- Planning of surgical reconstruction should begin with the initial treatment, even though the reconstruction may take operations over many months to complete.
- It is generally better to have a few things work well than many that work poorly.
- The first step is to identify all of the injured structures by history, physical examination, and operative exploration.

Principles of hand surgery:

- Using s tourniquet to provide a bloodless field [released within 1 hour].
- Using a magnifying loops or microscope.
- Debridement of devitalized tissues in untidy injury.
- Wound toilet with saline and removes FB and debris.
- Hemostasis.

Reconstructive priorities:

- **Restore circulation:**
    - An injured radial or ulnar artery can be ligated without affecting viability of the hand.
    - Repair of an injured artery is a better alternative.

- **Obtain good soft-tissue coverage**:
  - It is vital as raw areas predispose to infection and fibrosis [big enemy of hand surgery].
- **Align and stabilize the skeleton**.
- **Restore nerve function .**
- **Mobilize joints.**
- **Restore tendon function.**
- **Replantation is an example of combining all of the steps into one operation.**

Postoperative principles:

- Antibiotics and pain medication.
- Dressing and hand banding in functioning position.
- Immobilization.
- Hand elevation to decrease edema.
- Physiotherapy,

Skin and soft tissue injuries

A. Fingertip injuries

Definition:

- Fingertip injuries involve distal end of distal [terminal] phalanx with its subcutaneous tissue [pulp] and nail and its bed.

Aim of repair:

- Preserve length with sensibility.
- Preserve nail function.

Classification of pulp injuries and their management:

- **Tip skin loss without exposed bone:**
  - Secondary intention.
  - Primary closure.
  - Skin graft.
- **Tip skin loss with exposed bone:**
  - **Bone shortening with 2ry intention or 1ry closure.**
  - **Finger tip flaps:**

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- **Local flaps:**
  - Lateral V-Y advancement flap.
  - Volar V-Y advancement flap.
- **Regional flaps:**
  - Cross finger flap.
  - Thenar flap.
  - Abdominal flap.

Classification of nail bed injuries and their management:

- **Nail bed hematoma:**
  - **If less than 50 % of visible nail:**
    - Conservative with hand elevation.
    - If painful, evacuation [small opening over hematoma] with light dressing for 2 days and the residual hematoma migrate distally as nail grows.
  - **If more than 50 % of visible nail:**
    - Remove nail plate with repair of nail bed if injured.
- **Nail bed laceration:**
  - Remove nail plate.
  - Repair of nail bed.
  - Maintain eponychium fold.
- **Nail bed avulsion:**
  - **Avulsed nail bed with adherent to nail plate:**
    - Remove nail plate.
    - Replace the nail bed as onlay graft.
  - **Composite avulsion of nail bed with eponychium:**
    - Sutured back in place.
  - **Composite avulsion of nail bed with hyponychium:**
    - Replace it as composite graft.
    - Convert amputated tip into full-thickness skin graft.

B. Injuries of the rest of

- **Wounds without skin loss:**
  - Skin closure should be done without tension.
  - In contaminated wound, it should be left open.
- **Wounds with skin loss:**
  - **Without exposed vital structure:**
    - Skin graft.
    - Local or regional flaps [in flexed areas].

- **With exposed vital structure:**
  - Local or regional flaps.

Tendon injuries

- **Classification:**
  - **Flexor tendon injury.**
  - **Extensor tendon injury.**
- Extensor tendons are more suitable for direct repair than flexor tendons because they have not rigid sheath and not crowded in tunnel.
- Treatment:
  - Primary repair by suturing with non-absorbable sutures.
  - Tendon graft for complicated cases with loss of tendon tissue and in recurrent cases.
- **Mallet deformity:**
  - Drop of finger into flexion at distal interphalengeal joint [DIP] with inability to extend the distal phalanx fully.
  - Due to acute injury of extensor mechanism secondary to a direct blow to tip of finger.
  - Classification and management:

Type	Injury	Treatment
I	Rupture of tendon	Extention splinting
II	Laeation	Repair + Extention splinting
III	Abrasion + loss of tendon	Tendon repair or graft + coverage
IV	Avulsed distal phalanx fracture	Reduction + Extention splinting

Postoperative therapy:

- Immobilization in a location which will minimise tension on the repaired tendon.
- Ealy active motion with limitation of immobilization.

Nerve injuries

- **In tidy wounds:**
  - It is better for primary repair of cutaneous nerve.
- **In untidy wounds:**
  - It is better for postponding repair after wound healing and resolution of inflammation.

Skeletal injuries

- **Skeletal fractures may involve phalangeal or metacarpal bones.**
- **Classification:**
  - **Shape:** Transverse, oblique, spiral or comminuted.
  - **Site:** Shaft, base, neck or head.
  - **Type:** Closed or opened.
  - **Displacement:** Displaced (dorsal, volar, radial, ulnar), undisplaced.
  - **Stability:** Stable or unstable.
- **Investigation:**
  - Plain x-ray [P-A, lateral and oblique views].
- **Treatment:**
  - **Undisplaced fracture:**
    - Immobilization.
  - **Displaced fracture:**
    - **Reducible:**
      - **Stable [Remain in position after reduction]:**
        - Immobilization.
      - **Unstable [Redisplace again after reduction]:**
        - Reduction and fixation.
    - **Irreducible:**
      - Reduction and fixation.

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Hand infections

Aetiology:

- Woumds [abrasion, pricks, …etc].
- Cracks or callosities.

Organism:

- Staphylococcus aureus [Commonest].
- Others;
    - Streptococci, gram-negative bacteria, anaerobes and fungi.

Clinical picture:

- Features of inflammation:
    - General: fever.
    - Local: warm, redness, pain and swelling and loss of function.
- Progress from cellulitis to abscess.
- Cardinal signs of flexor sheath infection [see later].

Investigations:

- Plain x-ray to detect FB and gas.
- Wound culture.

Treatment:

- **Medical:**
    - Intravenous antibiotics and analgesics.
    - Elevation, splint, hot fomentation.
    - Exercises to maintain mobility and rest in between.
- **Surgical [Incision and drainage of pus collection]**
- Incision should be done over maximum tenderness point.
- Do not wait for fluctuation, drain once pain is throbbing.

Complications:

- Tendon adhesions, necrosis, rupture, stiffness and loss of function.

Post-operative care:

- Light dressing with continuous irrigation with saline.
- Elevation, splinting.
- Physiotherapy and exercises.

Classification:

Local infections

Digital infections:

- Paronychia.
- Felon.
- Apical space infection.
- Middle volar space infection.
- Proximal volar space infection.
- Herpetic whitlow.
- Synovial sheath infection.

Palmar and dorsal infections:

- Fascial space infection:
  - Mid-palmar space infection.
  - Thenar space infection.
  - Hypothenar space infection.
  - Parona's space infection.
- Web space infection.
- Subcutaneous palmar infection.
- Subcutaneous dorsal infection.

Bone and joint infections:

- Septic arthritis.
- Osteomyelitis.

General infections

Any general infection that may involve hand.
Commonly includes:

- Cellulitis.
- Lymphangitis.
- Infection requiring emergent surgery:
  - Necrotising fasciitis.
  - Gas gangarene.

Paronychia

Definition:

- Infection of the nail fold [perionychium].

Clinical picture:

- Representing the most common hand infections.
- Painful, tenderness, red swelling of tissue surrounding the nail.

Types:

- **Acute paronychia:**
  - **Aetiology:**
    - Pulling a hangnail usually by using one's teeth.
  - **Organism:**
    - Staphylococcus aureus [most common].
  - **Pathology:**
    - It is only cutaneous and begins beneath eponychium.
    - Pus tracks around the cutaneous margin and the abscess is horse-shoe shaped.
    - Pus may;
      - Extends under the nail [subonychia].
      - Floats and separates the whole nail.
  - **Treatment:**
    - Drainage with partial [if the pus extends under the nail] or complete [if the whole nail is floating] nail plate removal.
    - Dressing with oral antibiotics.

- **Chronic paronychia:**
  - It develops over many months and affects many fingers.
  - **Aetiology:**
    - Fungal [70-90%]: candida albicans.
    - Mixed bacterial infection [sometimes].
  - **Treatment:**
    - **Bacteria cases:**
      - As acute paronychia.
    - **Fungal cases:**
      - Topical nystatin ointment [nails may be removed to help the locally acting ointments].

Felon [Pulp-space infection]

Definition:

- It is a closed space subcutaneous infection of the volar fingertip pulp.

Atiology:

- Often follows a minor puncture wound.
- Flexor tendon sheath infection spreading distally.

Clinical picture:

- The pulp is tense, indurated and tender.
- Central pointing in late cases.

Complications:

- Osteomyelitis of distal phalanx especially its distal ⅔
  - Common complication in neglected cases.
  - Bone is affected by:
    - Direct spread of infection.
    - Thrombosis of terminal branches of digital arteries.
  - Base [epiphysis] of terminal phalanx remains intact because
    - It is not in relation to the infected compartment.
    - It is supplied by a branch given before the digital artery enters the pulp space.
  - Presenting by persistent swelling, discharge and failure of healing after incision.
  - Plain x-ray: destroyed terminal phalanx.

Treatment:

- Drainage and should divide enough fingertip septa.
- Intravenous antibiotics.

Apical-space infection

Definition:

- It is an infection of the space between subungual skin and periosteum.

Aetiology:

- Prick beneath the nail.

Clinical picture:

- Tender beneath the free edge of nail.
- Pus may extend under the nail as a white area.

Treatment:

- Drainage through excision a small wedge [V-shaped] of the free edge of the nail and the underlying skin.
- Intravenous antibiotics.

Middle volar space infection

Definition:

- It is an infection of the closed subcutaneous volar space between skin and fibrous sheath of tendons on the middle phalanx.

Clinical picture:

- Semi-flexed finger which is painful on straightening.
- Swelling and tenderness of middle segment.

Treatment:

- Drainage and intravenous antibiotics.

Proximal volar space infection

Definition:

- It is an infection of the subcutaneous volar space between skin and fibrous sheath of tendons on the proximal phalanx.
- This space is separated from middle volar space but communicates with the related 2 web spaces.

Clinical picture:

- Semi-flexed finger which is painful on straightening.
- Swelling and tenderness of proximal segment.

Treatment:

- Drainage and intravenous antibiotics.

Herpetic whitlow

Definition:

- It is a viral infection involving the finger or fingertip.

Organism:

- Herpes simplex type 1.

Risk group:

- Dental and medical personnel.
- Children secondary to maceration from finger sucking.

Clinical picture:

- Intense pain, erythema and small rash.
- Self-limited which usually resolved in 3 -4 weeks.

Treatment:

- Antiviral treatment.
- Avoid drainage to avoid secondary bacterial infection.

Synovial sheath infections

Definition:

- Infection of the flexor tendon sheath.

Aetiology:

- Puncture wound in one of palmar creases of a digit where the skin in contact with sheath.
- Spread to the sheath from a neglected subcutaneous infection.

Clinical picture:

- **Four cardinal signs [by Kanavel's]:**
  - Pain on passive extension of finger [earliest & most reliable sign].
  - Tenderness over the flexor sheath.
  - Symmetrical fusiform swelling of the whole finger.
  - Semi-flexed finger posture.

- **Types [according to its location]:**
  - **Digital tenosynovitis:**
    - Affect finger.
  - **Ulnar bursitis:**
    - Affect little finger with fullness in palm and above wrist.
  - **Radial bursitis:**
    - Affect thumb finger with fullness in thenar eminence and above wrist.

Complications:

- Tendon sloughing in neglected cases.
- Suppurative arthritis in related joint.
- Persistent suppuration;
  - Spread of infection to fascial space and another tendon sheath.
  - Tendon sloughing.
  - Missed foreign body.
- Stiff joint secondary to adhesions.
- Median nerve palsy secondary to compression.
- Parona's space infection;
  - It results from ruptured ulnar and radial bursitis in the space between flexor digitorum profundus and pronator quadratus and interosseous membrane.
  - Clinically: signs of infection in the forearm.

Treatment:

- **Drainage and intravenous antibiotics.**
  - **In finger tenosynovitis,**
    - If the pressure on distal part of sheath, incision is made at distal finger crease.
    - If the pressure on proximal part of sheath, incision is made at distal palmar crease.
  - **In ulnar bursitis,**
    - Add incision above medial half of front of wrist.
  - **In radial bursitis,**
    - Add incision above lateral half of front of wrist.
  - **In any case,**
    - Synovial sheath is opened by at least 2 transverse incisions with insertion of a catheter for continuous irrigation.

Fascial spaces infection

Midpalmar space infection

Aetiology:

- Skin infection of the palm.
- Sequel to neglected tenosynovitis of the middle or ring finger.

Clinical picture:

- Palmar tenderness.
- Pain on moving the middle and ring fingers.
- Flexion of ulnar 3 fingers to relax palmar aponeurosis.
- Extending metacarpophalangeal joints are painful but extending interphalangeal joints are painless [This sign excludes tenosynovitis].
- Obliteration of the normal hollow of the hand.
- Dorsal swelling [greater than any hand infection producing Frog Hand].

Treatment:

- Drainage and intravenous antibiotics.

Thenar and hypothenar space infections

	Thenar space infection	Hypothenar space infection
Aetiology	Infection of thumb or index fingers	Infection of little finger
Clinical Picture	* Pain and swelling over the thenar eminence and web of thumb. *Exacerbated by flexion of the thumb and index fingers. *Abduction of the thumb.	*Pain and swelling over the hypothenar eminence. *Exacerbated by flexion of the little finger
Treatment	Drainage and intravenous antibiotics.	

Web space infection [Collar button abscess]

Definition:

- It is an infection of web space.

Aetiology:

- Spread from proximal volar space infection.
- Enter of organisms through wounds.

Clinical picture:

- Painful swelling of the involved web space and adjacent distal palm.
- Related two fingers are widely separated [abducted posture].

Treatment:

- Drainage through volar and dorsal incisions.
- Intravenous antibiotics.

Osteomyelitis

Definition:

- It is an infection of the bone.

Clinical picture:

- Present in 1 – 6 % of all hand infections.

Treatment:

- Drainage and intravenous antibiotics.
- All infected and necrotic bone must be removed.
- Amputation may be required in advanced cases.

Septic arthritis

Definition:

- It is an infection of the joint.

Aetiology:

- Penetrating injury.

Clinical picture:

- Commonly seen in little and ring fingers.
- **Fight bite** [metacarpophalangeal joint infection after first contact with teeth].

Treatment:

- Drainage and intravenous antibiotics.

Cellulitis

Definition:

- It is an initial inflammatory lesion of the skin that may resolve or suppurate.

Aetiology:

- Very minor skin break with infection by streptococci or staphylococci.

Clinical picture:

- Painful, tenderness, redness swelling.
- No collection formation.

Treatment:

- Intravenous antibiotics.

Lymphangitis

Definition:

- It is an infection of lymph nodeswhich may occur alone or secondary to other infection.

Aetiology:

- Always due to streptococci entering through an abrasion.

Clinical picture:

- Fever.
- Painful swelling maximum on dorsum.
- Red streaks coursing up the arm.
- Enlarged tender drainage nodes;
    - Lesion of ulnar half of hand, epitrochlear lymph node.

- Lesion of middle finger, supraclavicular lymph node.
- Lesion of thumb and index fingers, axillary lymph nodes.

Treatment:

- Intravenous antibiotics.

Infection requiring emergent surgery

Necrotising fasciitis

Definition:

- It is a life and limb threatening.

Risk group:

- Diabitic, immunocompromised and elderly patients.

Organism:

- β-hemolytic streptococci [commonest].
- Often polymicrobial.

Treatment:

- Emergent radical debridement with left the wound opened and repeated drainage and irrigation.
- Intravenous antibiotics [empiric coverage].
- Monitoring in ICU.
- Mortality: 30 %.

Gas gangarene

Definition:

- It is a severe infection that developed in contaminated wounds with extensive tissue damage.

Organism:

- Clostridium species commonly clostridium perfringes.

Treatment:

- As necrotizing fasciitis.

Development of penis and urethra

Development of the penis:

- At the end of the 5th week of gestation, the embryo develop the following swellings around the cloacal membrane:
  - **Genital tubercle:**
    - Present in front of cloaca [caudal dilated part of hindgut].
    - It elongates to form cylindrical phallus and develops its tip into glans.
  - **Urethral [Urogenital] folds:**
    - Present on each side of cloacal [urogenital] membrane which covered the urogenital groove.
    - They fuse over the urogenital groove to form the penile urethra.
  - **Genital swelling:**
    - Present lateral to the urogenital folds.
    - It differentiates into the scrotum.
- At the end of the 2nd month, the anterior part of cloacal membrane rupture provides the urogenital sinus opens onto the surface.
- The endodermal cells of the urogenital sinus proliferate and grow into the root of the phallus forming a urethral plate.
- Ingrowth of the ectodermal cells on the tip of the glans backward to join with the endodermal cells of the penile urethra. This cord of cells later becomes canalized to form external urethral meatus at the tip of the glans.

	Male	Female
Genital tubercle	Penis	Clitoris
Urethral folds	Penile urethra [fuse]	Labia minora [not fuse]
Genital swelling	Scrotum	Labia majora

Development of the urethra:

Urethral part	Development
Posterior	From wallfian duct.
Penile	From fusion of both urethral folds.
Glandular	By Canalization of column of tissue proceeding from the tip of the glans backwards.

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Congenital anomalies of penis and urethra

Congenital anomalies of penis:

Aphilia [Penile agenesis]:

- No penis and the external urethral meatus placed just under pubis or on the perineum with a small tag of skin.

Microphallus [Micropenis]:

- Small penis with or without hypogonadism.

Macrophallus:

- Large penis as a part of neurofibromatosis, hemangioma or congenital lymphedema.

Diphallia [Penile duplication]:

- Ranging from small accessory penis to true paired duplication.

Penile torsion:

- Rotation of the penis that usually noted after retraction of the foreskin at circumcision.

Penoscrotal web [Webbed penis]:

- Incomplete or complete fusion between ventral penile skin and scrotal skin.

Hemihypertrophy of the penis:

- Lateral angulation of the penis on erection due to corporal asymmetry.
- Confused with **Peyronie disease** [Aquired angulation of the penis due to focal scarring of corporal body].

Chordee without hypospadias:

- Congenital downward curvature of penis without hypospadias which often encountered in old children or adults with erection.

Phimosis:

- Contracted prepuce that will not retracted over the glans [Pin hole meatus].

Para-phimosis:

- Tightly retracted prepuce beyond the base of the glans.
- If the retraction is not relieved causing necrosis of the glans.

Meatal stenosis:

- Stenosis of external urethral meatus [Pin hole meatus] causing chronic retention.

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Congenital anomalies of urethra:

Megalo-urethra:

- Large urethra that associated with congenital absence of corpora spongiosum to complete absence of both corporae.

Urethral stenosis.

Congenital valve of posterior urethra.

Hypospadias:

- Most common congenital anomaly.
- External urethral meatus is placed on ventral surface of the penis proximal to its normal position.

Epispadias:

- External urethral meatus is placed on dorsal surface of the penis proximal to its normal position.
- **Types:**
    - **Complete:**
        - Associated with ectopia vesica [Incomplete development of anterior wall of the bladder].
    - **Incomplete:**
        - Associated with normal bladder.

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Hypospadias

Definition:

- It is a congenital anomaly in which the external urethral meatus [EUM] is located on the ventral aspect of the penis proximal to its normal location.

Incidence:

- 1:300-350 live male births.
- More common in white, jews and monzygomatic twins.

Aetiology:

- **Genetic and runs in families:**
  - If father affected, 7% of sons are affected.
  - If siblings affected, 14% of sons are affected.
- **Hormonal factors:**
  - Insufficient circulating androgen due to decrease number and / or activity of androgen receptors.
  - Inadequate local conversion of testosterone to dihydrotestosterone due to decrease 5 alpha reductase enzyme.
  - Abnormal response of local genital tissue to androgen.

Pathogenesis:

- Distal failure of fusion of 2 genital folds.

Associated anomalies:

- Undescended testis 9%.
- Inguinal hernia and hydrocele 9%.
- Urinary tract anomalies.
- Intersex.
- Others [Imperforate anus, tracheomalacia or racheo-oseophageal fistula].

Classification:

- **Classification according to meatal location after correction of chordee:**
  - **Anterior hypospadias [50%]:** Glandular, coronal, subcoronal.
  - **Middle hypospadias [30%]:** Distal shaft, mid shaft, proximal shaft.
  - **Posterior hypospadias [20%]:** Penoscrotal, scrotal, perineal.

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- **Classification according to chordee association:**
  - Chordee with hypospadias.
  - Chordee without hypospadias.

Chordee:

- **Definition:**
  - It is an abnormal congenital fibrous tissue extends from abnormal EUM to the base of the glans.
- **Effect:**
  - Ventral curvature and bow string of distal penis [C-shaped].
  - Prevent or hinder normal sexual activity.

Clinical presentation:

- **Infant:**
  - Abnormal location of EUM [Noticed by mother].
- **Child:**
  - Inability to micturate.
  - Abnormal direction of stream.
  - Disfigurement or rudimentary of penis.
- **Adult:**
  - Infertility.
  - Difficult of sexual activity.

Investigations:

- **Routine investigations:**
  - To evaluate general condition and the fitness of the patient to anesthesia.
  - Blood group, CBC, liver & renal function tests and bleeding & clotting times.

- **Chromosomal studies to detect sex:**
  - Buccal smear, hormonal assay, gonadal biopsy.

- **Radiological investigations:**
  - Renal US.
  - IV Pyelography [UUT anomalies].
  - Cyto-urethrography [LUT anomalies].

- **Clinical [Operative] investigation:**
  - **Artificial erection test:**
    - **Aim:**
      - Determine extent of chordee.
      - Determine the possible site of EUM after its release.
    - **Technique:**
      - Apply tourniquet at the base of the penis.
      - Inject a saline into corpora cavernosa till full penile erection.

Treatment:

- **Timing:**
  - **6-18 months of life due to:**
    - Decrease anesthetic risk.
    - Decrease psychic impact of surgery.
    - Complete repair before school age.
    - Penis is large enough for surgery.

- **Pre-operative penile preparation:**
  - **Testosterone stimulation:**
    - **Aim:**
      - Enlargement of infant penis.
      - Improve blood supply of skin flaps.
    - **By:** 5% testosterone cream daily for 3 weeks.
      Testosterone propionate 25mg, i.m. for 3 weeks.

- **Urinary diversion:**
  - **Advantages:**
    - Immobilization of suture lines.
    - Decrease tissue traction.
    - Urinary diversion with drainage of the neourethra.
  - **Disadvantages:**
    - Bladder spasm and infection.
    - Pressure ischemia of the neourethra.
    - Reduction of patient mobility and long hospital stay.
  - **Methods:**
    - Surgical suprapubic cystostomy.
    - Suprapubic trocar cystocatheter + silicone urethral stent.
    - Transurethral bladder catheterization.
    - Fenestrated silicone tube.
    - Silicone stent.

- **Phases and objectives:**
  - The following phases can be applied sequentially or in combination to achieve surgical success.

Phase	Objective
Meatoplasty	Correction of meatal stenosis
Glanuloplasty	Molding of a conical glans
Orthoplasty [Straightening]	Correction of chordee
Urethroplasty	Correction of a new urethra of sufficient caliber and length Placement of EUM at the tip of the glans.
Skin cover	Normal cosmetic appearance
Scrotoplasty	Correction of the scrotum
	Normal voiding & erection

Lines of surgical treatment:

- **Meatoplosty:**
  - **Aim:**
    - Correction of the meatal stenosis [dilatation of the meatus].

- **Surgical correction of hypospadias:**
  - **Orthoplasty [Straightening of the penis]:**
    - **Aim:**
      - Correction of the chordee.
    - **Technique:**
      - Artificial erection.
      - Degloving of the penis.
      - Tunica albuginea is dissected from the chordee down to the penoscrotal junction and adequate excision of it allowing the meatus to retract proximally.
      - Artificial erection continues to demonstrate curvature, corporal disproportion which if present, should be corrected by performing tunica albuginea plication.

- **Glanduloplasty:**
  - **Aim:**
    - Molding of a conical glans.
  - **Includes [classifications]:**
    - Meatal Advancement and Glanduloplasty [MAGPI].
    - Modified MAGPI [Arap technique].
    - Glans Approximation procedure [GAP].
    - M inverted V glanduloplasty.
    - Urethral mobilization techniques

- **Urethroplasty:**
  - **Aim:**
    - Creation of a new urethra of sufficient caliber & length.
    - Placement of EUM at the tip of the glans.

  - **Includes [classifications]:**

    Vascularized meatal-based flaps:
    - Parameatal-based flap [Mathieu repair].
    - Perimeatal-based tube repair [Mustarde repair].
    - Barcat-Redman Procedure.
    - Devine-Horton (flip flap) technique.
    - Ombredanne flip flap technique.
    - Denis-Browne technique.
    - Cecil-culp technique.
    - Tubularized incised plate [Snodgrass technique].

    Vascularized preputial flaps:
    - Transverse preputial island flap [Duckett procedure].
    - Onlay island preputial flap [Elder procedure].

    Grafts:
    - Buccal or bladder mucosa can be used as onlay or tubular grafts.

- **Skin Cover**
  - **Aim:**
    - Normal cosmetic appearance.

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- **Includes:**

  Button-hole method:

  - Circumferential incision 2-3 mm from the coronal sulcus.
  - Degloving of the peins.
  - Make hole in the dorsum of the penile skin.
  - Transfere the penis through the hole.
  - Reflect the remaining skin on the ventral surface.

  Byars method:

  - Retraction of the prepuce.
  - Circumferential incision 2-3 mm from the coronal sulcus.
  - Degloving the penis.
  - Splitting the skin vertically on the dorsal aspect [V-shaped].
  - Its apex [of V-shaped] sutured with the remnant of the prepuce at coronal sulcus.
  - Two wings of V-shaped are reflected on the ventral surface of the penis.

- **Scrotoplasty** :
  - **Aim:**
    - Creation of the scrotum.
  - This phase depends on the presence of the rotational skin flaps adjacent to the penile skin. So, it is best to perform it in a 2nd stage after healing of the urethroplasty and orthoplasty.

Options of Treatment:

- According to:
  - **Degree of chordee** and **Urethral defect,**

  there are 2 options of treatment:
  - **One stage repair**
  - **Two stage repair**

	One stage repair	Two stage repair [6m later]
Chordee	Slight	Moderate or severe
Urethral defect	**Half** of The penile length	**More** than the penile length
Indications	Glandular Coronal Anterior penile Mid penile	Proximal penile Penoscrotal Perineal
Advantages	Single anaesthesia Virgin tissue with good blood supply	More easily & safe Simple Good results Suitable in non-experianed doctors
Disadvantages	Fistula (25%)	Hazard of anaesthesia Operate on recurrent tissue with adhesion and decrease blood supply.

Complications of surgical correction:

- **General complications:**
  - Infection.
  - Hematoma.
  - Edema.
- **Meatal complications:**
  - Stenosis.
  - Encrustation.
- **Urethral complications:**
  - Fistula.
  - Stricture.
  - Diverticulum.
- **Persistent chordee.**

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