SURGERY 1

Unit one Content..

Topic 1: Definition, types of surgery, surgical conditions

**Definition**  
·   Surgery is a medical specialty that uses operative, manual and instrumental techniques on a patient to investigate and / or treat a pathological condition such as disease or injury, to help improve bodily  
function or appearance.  
·   An act of performing surgery may be called a surgical procedure, operation, or simply surgery.  
·   To operate means to perform surgery  
·   Surgical means pertaining to surgery  
·   As a general rule, a procedure is considered surgical if it involves cutting of a patient’s tissues or closure of a previously sustained wound.  
·     Surgery can be used to repair broken bones, stop uncontrolled bleeding, remove injured or diseased tissue and organs, and reattach severed limbs.  
·  Surgeons are doctors who do operations – cutting tissue to treat disease.  
·  Surgery is an art or craft as well as a science.  
·  It involves making judgment, coping under pressure, taking decisive action when necessary, and teaching & training skills

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**Types of surgery**Based on timing:

1. Elective surgery – done to correct a non-life-threatening condition. It is subject to the surgeon’s and surgical facility’s availability.
2. Emergency surgery – surgery which must be done promptly to save life, limb, or functional capacity.

Based on purpose:

1. Exploratory surgery – performed to aid or confirm a diagnosis.
2. Therapeutic surgery – treats a previously diagnosed condition.
3. Cosmetic surgery – done to improve the appearance of an otherwise normal structure.

**Classification of surgical conditions**Surgery is classified according to whether it is vital to life, necessary for continued health, or desirable for medical or personal reasons.  
Surgical conditions can be classified into:

·         Emergency surgical conditions  
·         Urgent surgical conditions  
·         Elective surgical conditions

##### Emergency surgical conditions Unpredictable events that result in the need for immediate surgical attention are termed emergency surgeries. E.g.: -  Injury from:

##### • An automobile accident

##### • A fire

##### • A violent assault

##### A sudden change in a chronic medical problem such as a perforated peptic ulcer or a strangulated hernia. Emergency cases typically involve treatment of:

##### Gunshot and stab wounds

##### Fractures of the skull and other major bones

##### Head injury with intracranial hematoma and lateralizing signs

##### Severe eye injuries

##### Acute airway obstruction e.g. choking

##### Multiple injuries

##### Acute abdomen: presenting as acute onset severe pain in the abdominal area for which immediate surgery might be the remedy.

##### Acute appendicitis

##### Intestinal obstruction

##### Intussusception

##### Testicular torsion, etc.

##### Urgent surgical conditions Cases in which an operation is vital but can be postponed for a few days. E.g.  Injury with minor bone fracture Acute cholecystitis, acute diverticulitis Kidney stones Cancer of a vital organ

##### Elective surgical conditions Elective surgery can be: required, selective, or optional. 1. Required surgery cases include physical ailments that are serious enough to need corrective surgery but that can be scheduled weeks or months in advance. 2. Selective surgery covers a broad range of conditions that are of no real threat to the immediate physical health of the patient, but nevertheless should be corrected by surgery in order to improve comfort and emotional health. E.g. cleft lip and cleft palate, removal of certain cysts and benign fatty or fibrous tumors. 3. Optional surgery includes operations that are primarily of cosmetic benefit. E.g. removal of warts and other non-malignant growths on the skin, blemishes on the skin, plastic surgery undertaken for cosmetic reasons.

##### Terminology  -ectomy: Excision - starts with the name of the organ to be excised and ends in –ectomy. E.g. colectomy, gastrectomy, lumpectomy. -otomy: procedures involving cutting into an organ or tissue end in –otomy. E.g. laparotomy = cutting through the abdominal wall to gain access into the abdominal cavity. -ostomy: procedures for formation of a permanent or semi-permanent opening (stoma) in a body, end in –ostomy. E.g. colostomy, ileostomy. -oplasty: reconstruction, plastic or cosmetic surgery of a body part starts with the name of the body part to be reconstructed and ends in –oplasty. E.g. rhinoplasty. -rraphy: repair of damaged or congenital abnormal structure ends in – rraphy. E.g. herniorraphy. -oscopy: minimally invasive procedures involving small incisions through which an endoscope is inserted. End in –oscopy). E.g. laparoscopy. Amputation: surgical removal of a limb or body part A fistula

##### • Implies a tunnel connecting two epithelial surfaces.

##### A sinus

##### • Is a blind track opening on to the skin or a mucous surface

##### • A fluid may discharge from a sinus or fistula.

##### • The discharge should be examined and noted: is it blood, blood-stained, clear, bile-like, serous, faecal or purulent?

##### • The type of fluid may give a clue to the possible diagnosis.

##### Lymphangitis

##### • Is inflammation within a lymphatic vessel and appears as a red line often leading to an inflamed regional lymph node.

##### Thrombophlebitis

##### • Is a thrombosed and inflamed vein – it is more usual in superficial veins often associated with varicose veins, which are tender and hard.

##### Cellulitis

##### • Is a spreading inflammation of tissues, usually superficial or subcutaneous tissue due to bacterial infection, usually beta haemolytic streptococci or staphylococci

##### • The part affected is swollen, tense and tender.

##### • Later it becomes red, shiny and boggy.

##### • It may progress to an abscess, which is the presence of pus in the tissue concerned.

##### Inflammation

##### • Is the presence of redness, swelling, heat and tenderness, often associated with the loss of function

##### Translucency

##### • There are occasions when swellings containing clear fluid lie adjacent to the skin.

##### • When a torch is shone through the swelling it lightens the area, confirming translucency.

##### Crepitus

##### • Is a term used in a variety of conditions but in each having a fundamental diagnostic importance

##### • Bone crepitus is noted as coarse grating on movement of a bone – it is very painful to the patient, and an unmistakable diagnosis of a fracture of a bone.

##### • Joint crepitus is elucidated by one hand on a joint and passively moving the joint with the other hand: fine, evenly spaced crepitations are present in many subacute and chronic joint conditions.

##### • Coarse, irregular crepitations signify osteoarthritis.

##### • The crepitus of tenosynovitis is found over an inflamed tendon sheath when effusion has occurred into the sheath.

##### • The crepitus of subcutaneous emphysema is due to gas in the tissues; a peculiar crackling sensation is imparted to the examining fingers.

##### Ballottement

##### • Is when a swelling can be tapped away from the examining finger, often due to fluid adjacent to the swelling

##### • The term also describes the ability to palpate bimanually a renal swelling and to tap the kidney forward from the loin to the examining fingers of the other hand on the abdomen.

##### • A swelling may be balloted from the pelvis, by a finger in the vagina, to the examining abdominal hand.

##### Fluctuation

##### • Is a specific term to elucidate the presence of fluid

##### • Two watching fingers are placed on either side of a swelling and a central displacing finger presses momentarily.

##### • An impulse is felt by the watching finger confirming the presence of fluid, provided the sign is elicited in more than one place.

##### Surgical Divisions 1. General surgery:

##### Is the broadest surgical division.

##### Focuses on surgery of the abdomen, the breast, and the endocrine organs.

##### General surgeons operate on the appendix, colon, small intestine, gallbladder, stomach, pancreas, spleen, and liver.

##### 2. Neurosurgery:

##### Involves operations on the brain & spinal column.

##### These procedures include excising, or cutting out, brain tumours and removing ruptured discs in the spine, an operation known as laminectomy.

##### 3. Orthopaedic surgery:

##### Entails operations on bones, muscles, and joints.

##### Orthopaedic surgery allows for the replacement of hip and knee joints with artificial joints made of special metals and plastics.

##### Fractures in bones are repaired with the implantation of pins, metal plates, and screws.

##### These techniques greatly reduce the time needed for healing and recuperation.

##### 4. Plastic surgery:

##### Encompasses cosmetic procedures to improve appearance and reconstruct damaged parts of the body such as skin and underlying muscle.

##### Cosmetic procedures include enlarging or reducing the size of the breasts; rhinoplasty (cosmetic surgery of the nose); face lift (cosmetic surgery to tighten facial tissues); and blepharoplasty (cosmetic surgery on the eyelids).

##### 5. Cardiothoracic surgery:

##### Deals with surgery of the lungs, chest wall, heart, and large blood vessels of the chest.

##### Typical procedures include the removal of malignant cancers and correction of structural birth defects in the heart, lungs and chest.

### Topic Two: Surgical Clerkship

#### Steps in surgical clerkship

#### **1. Assemble all the available facts gathered from particulars (Bio data), chief complaints, history of presenting illness and relevant history**

#### **2. Analyze and interpret the examination details to reach the provisional diagnosis (impression)**

#### **3. Make differential diagnoses**

#### **4. Order for appropriate investigations**

#### **5. Select a closest possible diagnosis**

#### **6. Come up with an effective treatment plan**

#### Components

#### **1. Personal particulars (bio data)**

#### **2. Chief complaint(s)**

#### **3. History of presenting illness**

#### **4. Review of systems**

#### **5. Past medical and surgical history**

#### **6. Family history**

#### **7. Personal, social and economic history**

#### **8. General examination**

#### **9. Vital signs**

#### **10. Local examination**

#### **11. Other systems examination**

#### **12. Provisional diagnosis**

#### **13. Investigations**

#### **14. Final diagnosis**

#### **15. Treatment plan**

#### Self-introduction

#### **1. Greet the patient by name**

#### **2. Introduce yourself**

#### **3. Shake the patient`s hand**

#### **4. Ensure the patient is comfortable**

#### Personal Particulars

#### **They include:**

#### **1. Patient’s name:**

#### **To communicate with the patient**

#### **To establish a rapport with the patient**

#### **Record maintenance**

#### **Psychological benefits**

#### **2. Age:**

#### **Age related diseases**

#### **For diagnosis**

#### **Treatment planning**

#### **3. Sex:**

#### **Certain diseases are gender specific**

#### **Record maintenance**

#### **Treatment planning**

#### **4. Residence/ address:**

#### **For future correspondence**

#### **View of socio-economic status**

#### **Prevalence and geographical distribution**

#### **5. Occupation:**

#### **To assess socio-economic status**

#### **Prediction of different diseases in different occupations**

#### **6. Religion:**

#### **Beliefs and customs that might impact on treatment modalities**

#### **To identify festive periods when religious people are reluctant to undergo treatment**

#### **7. Patients registration number:**

#### **Maintain records**

#### **Billing purposes**

#### **Medico-legal aspects**

**Chief complaints**

Chief complaint is usually the reason for the patient’s visit. It is stated in patient’s own words (no medical terms) in chronological order of their appearance (Brief & duration). Chief complaint aids in diagnosis and treatment hence should be given utmost priority.

Common chief complaints:

1. Pain
2. Swelling
3. Ulcer
4. Vomiting
5. Abdominal distension
6. Bleeding
7. Discharge
8. Deformity

**History of presenting illness**

Elaborate on chief complaints in detail. Symptoms can be elaborated in terms of:

* Mode and cause of onset
* Course and duration of disease
* Symptoms related and relation to constitutional factors
* Special character and effects- nearby structures
* Treatment taken
* Leading questions- to help the patient
* Negative answers- more valuable to exclude the disease

**Review of systems**

* Review all the systems that are not affected and thus not covered in the history of presenting illness.
* Helps to discover any other problems the patient could be having.
* Ask specific questions in relation to each system

**Past medical & surgical history**

* Note the past history in chronological order
* All diseases-previous to present noted: pay attention to diseases like diabetes, systemic hypertension, heart diseases, bleeding disorders, tuberculosis, asthma, epilepsy etc.
* Previous operations or accidents
* Previous blood transfusions or fluid infusions
* Drug allergies and intolerances

Treatment or drug history

* Ask about the drugs the patient was on
* Special enquiry on steroids, antihypertensive drugs, contraceptives, antidiuretic drugs, ARVS etc.
* Treatment for current illness

**Gynaecological and obstetric history**

* For females
* Gynecological and obstetric history is important in determining pregnancy status
* Rules out or confirms certain conditions associated with pregnancy e.g. ectopic pregnancy.

**Personal, social and economic history**

* Marital status
* Occupation
* Education level
* Diet
* Habits of smoking and drinking alcohol
* Hobbies

**Family history**

* Family members share genes as well as their environment, lifestyle and habits
* Certain diseases run in families- diabetes, hypertension, piles, peptic ulcers, cancer (such as breast, thyroid) etc. should be noted
* Enquire about family members- alive or dead/current illnesses among family members
* **Examination**
* **General survey or examination**
* Analyze the patient entering the clinic for gait, built & nutrition, attitude and mental status
* Check for pallor, jaundice, cyanosis, finger clubbing, oedema, dehydration, lymphadenopathy and any skin eruptions
* Record the vital signs- blood pressure, pulse, respiration rate and temperature
* **Local examination**
* It is the most important part- definite clue to arrive at a diagnosis.
* It entails:
* Inspection- looking at affected part
* Palpation- feeling of affected part
* Percussion- listening to notes produced by tapping the affected part
* Auscultation- listening to the sounds produced
* Movements and measurements
* Lymph node examination
* **Inspection**
* Make sure there is good lighting
* Position and expose body parts so that all surfaces can be viewed
* Inspect each area for size, shape, colour, symmetry, position and abnormalities
* If possible compare each area inspected with the same area on the opposite side of the body
* **Palpation**
* Use the pulp (palmar surface) of the fingers to palpate for:
* 1. Texture- smooth, rough, moist or dry
* 2. Masses- size, surface, edges, mobility, tenderness
* 3. Fluid- fluctuancy
* Use the dorsum of hand to assess for local warmth or temperature
* Client should be relaxed and positioned comfortably
* Types of palpations
* 1. Light palpation
* 2. Deep palpation
* 3. Bimanual palpation
* **Percussion**
* Used to evaluate for presence of air or fluid in body tissues
* Sound waves are heard as percussion notes
* Percussion notes can be: -
* 1. Dull
* 2. Stony-dull
* 3. Resonant (chest)
* 4. Hyper-resonant (chest)
* 5. Tympanic (abdomen)
* Types of percussion
* Direct percussion- by tapping the affected area directly using flexed finger
* Indirect percussion- by placing the left middle finger over the area and its middle phalanx is tapped with the tip of the right middle or index finger
* Fist percussion- placing one hand flat against the body and striking the back of the hand with a clenched fist of the other hand
* **Auscultation**
* Done using a stethoscope
* Note the following characteristics of sounds:
* • Pitch
* • Loud or soft
* • Duration
* • Quality

**Examination of systems**

1. Head and neck

* • Cranial nerves- iii,iv,v,vi,vii,ix,xi and xii examined
* • Eyes – visual field, pupil, movement
* • Mouth and pharynx- teeth and gum, tongue, and tonsils
* • Movement of neck, neck veins, lymph nodes, carotid pulse and thyroid gland

2. Musculoskeletal system

Upper limbs

* • Arms and hands- power, tone, reflexes and sensations
* • Axillae and lymph nodes
* • Joints
* • Finger nails

Lower limbs

* • Legs and feet- power, tone, reflexes and sensations
* • Varicose veins
* • Joints
* • Oedema

Spine

* • Curvature – lordosis, kyphosis and scoliosis
* • Swellings
* • Pain and tenderness
* • Movements

3. Thorax – RS, CVS, Breasts

Examine the respiratory and cardiovascular systems using the format of inspection, palpation, percussion, and auscultation.

* • Chest symmetry
* • Dilated vessels and pulsations
* • Position of trachea
* • Apex beat
* • Lungs - percussion notes, breath sounds, air entry, ...
* • Heart - sounds, murmurs, ...
* • Breasts

4. Abdomen

Follow the formats of inspection, auscultation, palpation, and percussion.

* • Abdominal wall- umbilicus, scars, dilated vessels
* • Symmetry and movement with respiration
* • Masses, tenderness, percussion
* • Hernias
* • Inguinal lymph nodes
* • Bowel sounds
* • Rectal examination
* • Gynecological examination- if required

**Provisional diagnosis**

* • Also referred to as tentative or working diagnosis
* • It is formed after evaluating the case history and performing the physical examination
* **Investigations**
* Investigations are requested/ performed to:
* 1. Confirm the diagnosis
* 2. Rule out differential diagnosis
* 3. Aid in management of the patient
* 4. To monitor success of treatment
* **Types of investigations:**

1. **Laboratory investigations:**

**Blood tests**

* • Full blood count (complete blood count)
* • Erythrocyte sedimentation rate (ESR)
* • Renal function tests- electrolytes, urea & createnine levels
* • Liver function tests- bilirubin, liver enzyme (alanine transaminase, aspartate transaminase) serum proteins, alkaline phosphatase
* • Blood for grouping and cross matching
* • Random blood sugar
* • C-reactive proteins- elevated acute infections/inflammatory conditions
* • Coagulation tests- prothrombin test, thrombin time etc

**Aspirates/swabs- microscopy, culture and sensitivity  
Fine needle aspirate cytology (FNAC) for cytology  
Open biopsy for histology  
Urinalysis**

* **2. Radiological investigations**
* • Plain radiographs (X-rays)
* • Computerized tomographic scans (CT Scans)
* • Magnetic resonance imaging (MRI)
* • Ultrasound
* • Doppler ultrasound
* **3. Endoscopies**
* **Differential diagnosis**
* • The process of listing two or more diseases having similar signs and symptoms with the provisional diagnosis
* **Treatment plan**
* • Formulation of treatment plan depends on knowledge & experience of a competent clinician and nature and extent of treatment facilities available
* • Medical assessment is needed to identify the need of medical consultation and to recognize significant deviation from normal health that may affect management

### Medical Conditions that Affect Surgical Treatment

**Introduction**

A number of medical conditions can affect the outcome of surgical treatment. These are discussed below:

**Diabetes mellitus**

* Blood sugar levels must be under control before surgery.
* Uncontrolled diabetes can slow the healing of surgical wound
* It also makes one to be more susceptible to post-operative infection
* Surgery can cause increased stress to the body and higher blood sugar.
* Insulin dose may need to be adjusted.

Patients with diabetes mellitus are at special risk from general anaesthesia and surgery for the following reasons:

* 1. Certain complications of diabetes are associated with a higher post-operative risk
* 2. Stress (e.g. surgery, trauma & infection) causes increased production of catabolic hormones which oppose the action of insulin. This makes diabetic control more difficult.
* 3. General anaesthesia, surgery, deprivation of oral intake and post-operative vomiting disrupt the delicate balance between dietary intake, exercise (energy utilization) and diabetic therapy.
* 4. Diabetic ketoacidosis may cause an elevated leucocyte count and raised amylase level, which may confuse the diagnosis of acute abdomen. DKA may sometimes present with abdominal pain.
* 5. Diabetic patients are at greater risk of hospital-acquired infection.

**Perioperative management of insulin dependent diabetics:**

* 1) Establish good diabetic control before operation
* 2) Give soluble insulin as a continuous intravenous infusion during the operative period
* 3) Give an infusion of dextrose throughout the operative period to balance the insulin given and to make up for lack of dietary intake
* 4) Add potassium to the dextrose infusion
* 5) Monitor blood glucose and electrolytes frequently throughout the operative and early post-operative period.

**Diabetics controlled on oral hypoglycaemic drugs:**

* 1. Maintain on short-acting sulphonylureas such as glipizide [omit dose on the morning of the operation]
* 2. Patients on long-acting drugs such as metformin should be changed to a short acting sulphonylurea several days before the operation
* 3. If this fails to provide adequate control, an insulin regimen can be used

**Diabetics controlled by diet alone:**

* These do not require special preoperative measures as they do not become hypoglycemic and blood glucose rarely drifts above acceptable levels.

##### Anaemia

##### Anaemia increases the risk of cardiac and wound complications during surgery.

##### Full blood count should be done before surgery. Haemoglobin level must be checked.

##### Haemoglobinopathies

##### Patients with sickle-cell disease and beta thalassaemia have a high operative morbidity and mortality.

##### They require intensive perioperative management with particular attention to avoiding hypoxia, infection, acidosis, dehydration and hypothermia.

##### Bleeding disorders 1. Thrombocytopenia 2. Haemophilia 3. Von-Willebrands disease

##### Can cause uncontrolled bleeding intra-operatively

##### Most surgical bleeding problems are caused by:

##### Poorly controlled anticoagulant therapy

##### Liver disease

##### Aspirin therapy

##### Vitamin K malabsorption such as in obstructive jaundice

##### Varicose veins, leg swelling, DVT

##### Surgery and post-operative immobility increases the risk of DVT.

##### Blood clots can be dislodged leading to embolism to the lungs.

##### Hypertension

##### Blood pressure control is necessary before surgery.

##### High blood pressure can lead to excessive haemorrhage during surgery.

##### Jaundice

##### Jaundice delays post-operative wound healing.

##### Vitamin K malabsorption in obstructive jaundice can lead to excessive bleeding.

#### Obesity

Overweight and obese patients are at increased risk of medical and surgical complications, including wound infections, pneumonia, blood clots and heart attack. Losing weight before surgery would improve the outcome of surgery.

**Surgical complications of obesity:**  
 Cardiopulmonary complications such as cardiac failure and chest infections  
 Wound complications such as infection, wound dehiscence and burst abdomen  
 Venous thromboembolism – increased risk of deep venous thrombosis and pulmonary embolism  
 General anaesthesia complications:

* • Anatomical problems, e.g. intravenous canulae are difficult to insert and intubation is more difficult. Clinical signs of dehydration and hypovolaemia are more difficult to elicit.
* • Physiological problems: metabolic problems, e.g. altered distribution of drugs

**Predisposition to various medical disorders:**

* • Hypertension
* • Ischaemic heart disease
* • Type 2 diabetes
* • Gallstones
* • Gout

**Operative difficulties:**

* • Operations take longer to perform because of difficult access and vital structures obscured by fat.
* • This leads to a higher incidence of anaesthetic and surgical complications, particularly involving the wound.

**Problems of manual handling of patients who are markedly overweight:**

* • Weight and size limitations of standard equipment, e.g. CT scanners, operating tables, beds.
* • Risks to staff involved in lifting and handling

##### Thyrotoxicosis

* Thyroid or non-thyroid surgery for a patient with uncontrolled thyrotoxicosis carries a risk of thyrotoxic crisis with attendant high mortality.
* It can increase the risk of cardiac complications.
* Hyperthyroidism must be controlled before surgery.
* The patient should be rendered euthyroid before operation using antithyroid drugs and beta-blocking drugs
* Non-selective beta-blocking drugs rapidly control the cardiovascular effects of thyrotoxicosis and can be used for urgent perioperative preparation.

#### Hypothyroidism

* Have moderate risk when undergoing surgery
* They are more sensitive to CNS depressants, have a decreased cardiovascular reserve, and are also susceptible to electrolyte disorders e.g. water retention.
* If clinical suspicion of hypothyroidism, operation should be delayed or postponed until oral replacement is commenced.

#### Arrhythmias

* A problem with the rate or rhythm of the heartbeat.
* o Tachycardia
* o Bradycardia
* o Irregular heart beat
* Can lead to operative and post-operative cardiac complications.

#### Adrenal insufficiency

* Patients with potential adrenal insufficiency must be given steroid cover during the perioperative period. I.V. hydrocortisone 25-50mg prior to operation and 50mg daily until recovery.
* Lack of additional adrenal response to the stresses of surgery or trauma may cause acute postoperative cardiovascular collapse with hypotension and shock (Addisonian crisis)

#### Cushing’s syndrome

* Results from excess secretion of cortisol.
* Long term steroid therapy for conditions such as rheumatoid arthritis or asthma is the most common cause of cushingoid features.
* The main surgical problems in cushingoid patients are hypertension, hyperglycemia, poor wound healing, infection and peptic ulceration.

## Unit Two Content..

### Topic 1: Diagnosis of orthopaedic disorders

**Introduction**

Orthopaedics is the branch of surgery that deals with diseases and injuries of the trunk and limbs. It deals with conditions affecting bones, joints, muscles, tendons, ligaments, bursae, nerves, and blood vessels. The term “Orthopaedic” is derived from Greek words meaning ‘straight child’. Orthopaedics originally dealt with the art of correcting deformities in children.

**DIAGNOSIS OF ORTHOPAEDIC DISORDERS**

Depends first upon an accurate determination of all the abnormal features from

#### **1. History**

#### **2. Clinical examination**

#### **3. Radiographic examination/ imaging**

#### **4. Special investigations**

Secondly, upon a correct interpretation of the findings.

**HISTORY**

Except in the most obvious conditions, a detailed history is always required, the exact nature of the patient’s complaint being determined. The development of symptoms is traced step by step from their earliest beginning up to the present. It is important to take into consideration the patient’s own views on the cause of the symptoms. They are often correct.

Pay attention to the following:

#### **• Relieving and aggravating factors/activities**

#### **• Effect of any previous treatment**

#### **• Presence or absence of symptoms in other parts of the body**

#### **• Whether the general health of patient affected**

#### **• History of previous illnesses**

Facts that often have an important bearing on the condition/problem are:

#### **1. Age**

#### **2. Present occupation**

#### **3. Previous occupation**

#### **4. Hobbies and recreational activities**

#### **5. Previous injuries.**

In cases that seem trivial, inquire tactfully as to why patient decided to seek advice, and to what extent he is worried by his disability.

**CLINICAL EXAMINATION**

The clinical examination should include:

#### **1. Examination of the part complained of**

#### **2. Investigation of possible sources of referred symptoms**

#### **3. General examination of the body as a whole**

### Examination of the part complained of

**Exposure for examination**

The part to be examined should be adequately exposed and in good light, and when a limb is being examined, the sound limb should always be exposed for comparison.

**Inspection**

* The bones – general alignment and position of the parts to detect any deformity, shortening, or unusual posture.
* The soft tissues – observe soft tissue contours. Compare the two sides. Note swelling and muscle wasting.
* Color and texture of the skin – look for redness, cyanosis, pigmentation, shininess and loss of hair.
* Scars or sinuses – if a scar is present, determine from its appearance whether it was caused by:
* 1. Operation (linear scar with suture marks)
* 2. Injury (irregular scar), or
* 3. Suppuration (broad, adherent, puckered skin).

**Palpation**

* Four points should be considered:
* 1. Skin temperature
* 2. The bones – general shape and outline.
* • Feel for thickening, abnormal prominence, and disturbed relationship of the normal landmarks.
* 3. The soft tissues
* • Muscles
* • Joint tissues: thickened synovial membrane; effusion
* • Local swelling: ? Cyst; ? Tumor; General swelling of the part.
* 4. Local tenderness.
* • The exact site of any local tenderness should be mapped out and an attempt made to relate it to a particular structure.

**Measurements**

* Measurement of limb length is often necessary especially in the lower limbs, where discrepancy between the two sides is important.
* Measurement of limb circumference (compare two sides at the same site) provides an index of: muscle wasting, soft tissue wasting, and bony thickening.

**Estimation of fixed deformity**

Fixed deformity exists when a joint cannot be placed in the neutral (anatomical) position. The degree of fixed deformity at a joint is determined by bringing the joint as near as it will come to the neutral (anatomical) position and then measuring the angle by which it falls short.

**Movements**

The following should be sought in the examination of joint movement:

* • What is the range of active movement?
* • Is passive movement greater than active?
* • Is movement painful?
* • Is movement accompanied by crepitation?
* • Is there any spasticity (stiff resistance of free movement)?

It is wise always to use the unaffected limb for comparison. Limitation of movement in all directions suggests some form of arthritis. Selective limitation of movements in some directions with free movement in others is more suggestive of a mechanical derangement.

The passive range will exceed the active range only in the following circumstances: -

* 1. When the muscles responsible for the movements are paralyzed.
* 2. When the muscles or their tendons are torn, severed or unduly slack.

### Examination ...

**Stability**

The stability of a joint depends partly upon the integrity of its articulating surfaces and partly upon intact ligaments, and to some extent upon healthy muscles. When a joint is unstable, there is abnormal mobility; for instance, lateral mobility in a hinge joint.

**Power**

The power of the muscles responsible for each movement of a joint is determined by instructing the patient to move the joint against the resistance of the examiner. Compare the two sides.

* Power 0 - no contraction
* Power 1 - a flicker of contraction
* Power 2 - slight power, sufficient to move the joint only with gravity eliminated.
* Power 3 - power sufficient to move the joint against gravity.
* Power 4 - power to move the joint against gravity plus added resistance.
* Power 5 - normal power.

**Sensation**

* Test for sensibility to light touch and to pin prick throughout the affected area.
* In unilateral affection the opposite side should be similarly tested.
* Any blunting or loss of sensibility should be carefully mapped out.
* Identify the nerves affected (dermatomes).

**Peripheral circulation**

Examine for the following: -

* 1. The color of the skin – normal pink or pale, cyanosed.
* 2. The temperature of the skin – cold in impaired arterial supply
* 3. The texture of the skin and nails – ischaemia causes loss of hair, thin & inelastic skin, coarse, thickened, irregular nails
* 4. The arterial pulses – lower limb (dorsalis pedis, posterior tibial, popliteal, femoral)
* 5. Capillary return

**Reflexes**

***Deep reflexes***: Determine the integrity of central nervous system or peripheral nervous system. They are exaggerated in CNS problem and depressed in PNS problem.

***Superficial reflexes***: motor responses to scraping of the skin, e.g. abdominal reflex; Cremasteric reflex; plantar reflex.

**Tests of function**

Assess how much the disorder affects the part in its fulfillment of everyday activities. E.g. observe the patient standing, walking, running, jumping, ascending and descending stairs.

**INVESTIGATION OF THE POSSIBLE SOURCES OF REFERRED SYMPTOMS**

Think of possible extrinsic disorders with referred symptoms. E.g.:

* 1. For shoulder pain, examine the neck (Brachial plexus), thorax, abdomen (diaphragmatic irritation).
* 2. For hip pain, examine the back (spine) and sacro-iliac joints.
* 3. Pain in the thigh – examine the spine, abdomen, pelvis, genito-urinary system, or hip

**GENERAL EXAMINATION**

* 1. Examine the patient as a whole.
* 2. Assess the general physical condition and psychological outlook of the patient.
* 3. Do systemic examination.

**DIAGNOSTIC IMAGING**

You can carry out the following investigations: -

* 1. Radiography
* 2. Ultrasound scanning
* 3. Computerized tomography (CT) scanning
* 4. Magnetic resonance imaging (MRI)
* 5. Radioisotope scanning
* 6. Positron emission tomography (PET CT)

#### Radiography

**Plain radiography – X-rays**

* At least two projections in planes at right angles to one another – usually AP & Lateral views
* The films should always include a good length of bone above and below the site of the injury or lesion, including the adjacent joints.

**Contrast radiography**

* • Myelography – in which the spinal theca is outlined with an oily non-absorbable contrast medium (fluid).
* • Radiculography – in which water-soluble absorbable contrast medium allows visualization of the nerve sleeves, as well as the spinal theca itself. (Especially used for lumbar spine).
* • Arthrography – outlines the cavity of a joint.
* • Arteriography or angiography- to show the arterial tree.
* • Venography – shows network of veins.
* • Lymphangiography – shows lymphatic network
* • Sinography – defines the course and ramifications of a sinus.

**SPECIAL INVESTIGATIONS**

Depend on the condition you are dealing with.

* • Haematological – e.g. haemogram, ESR
* • Serological – e.g. Widal test, V.D.R.L
* • Bacteriological – E.g. Gram stain, Culture and sensitivity
* • Biochemical – upon urine, plasma, cerebrospinal fluid
* • Histological - biopsy

### TREATMENT OF ORTHOPAEDIC DISORDERS

#### **Orthopaedic treatment falls into three categories: -**

#### **1. No treatment – simply reassurance and advice**

#### **2. Non-operative treatment**

#### **3. Operative treatment**

#### NON-OPERATIVE TREATMENT METHODS

#### REST

#### **• Is one of the mainstays of orthopaedic treatment**

#### **• This may be in the form of bed rest or immobilization of the diseased part**

#### SUPPORT

#### **• Rest and support often go together**

#### **• Support can be used to:**

#### **1. Stabilize a joint rendered insecure by muscle paralysis**

#### **2. Prevent the development of deformity**

#### **3. Support can be provided by cast, splint or orthosis**

#### **• Examples of orthoses include:**

#### **1. Spinal braces or corsets**

#### **2. Cervical collars**

#### **3. Wrist supports**

#### **4. Walking calipers**

#### **5. Knee and ankle orthoses, and devices to control foot drop.**

#### PHYSIOTHERAPY

#### **Is very useful in non-operative and post-operative management of orthopaedic conditions.**

#### **Physiotherapy can be:**

#### **1. Active**

#### **2. Passive**

#### **3. A combination of active and passive**

#### **Passive approaches are carried out on the patient by the physiotherapist**

#### **Active approaches require active involvement by the patient, either by exercising or changing behaviour.**

#### Active interventions**include: Exercises and Physical fitness.**

#### **Exercises aim to: Strengthen specific muscles; Stretch soft tissues; Mobilize joints; and Improve co-ordination of muscles.**

#### **Physical fitness programmes include aerobic exercise with an aim to improve overall cardiovascular fitness, as well as specific exercises.**

#### **Hydrotherapy is a way of allowing active pain-free movements of all joints in warm water.**

#### Passive interventions

#### **Are carried out by the therapist and do not require any active participation by the patient.**

#### **The chief use of passive movements or mobilization is to preserve full mobility when the patient is unable to move the joint actively, e.g. when muscles are paralyzed or severed.**

#### **Passive interventions include: Manual therapy; Soft tissue techniques; Traction; Electrotherapy; and Ultrasound.**

#### LOCAL INJECTIONS

#### **Indicated in two scenarios:**

#### **1. In joint affections that require intra-articular injection of drugs**

#### **E.g. injection of hydrocortisone or other steroid into the joint in osteoarthritis or rheumatoid arthritis**

#### **2. In extra-articular lesions ascribed to chronic strain such as tennis elbow, tendonitis about the shoulder, and certain types of back pain.**

### reatment of Orthopaedic conditions - Drugs

#### DRUGS

#### **Categories of drugs used include:**

#### **• Antibacterial agents**

#### **• Analgesics**

#### **• Sedatives**

#### **• Anti-inflammatory drugs**

#### **• Hormone-like drugs**

#### **• Anti-osteoporosis drugs**

#### **• Specific drugs**

#### **• Cytotoxic drugs**

#### Antibacterial agents

#### **Are used in infective lesions such as: Acute osteomyelitis; acute pyogenic arthritis; and Tuberculosis.**

#### **Treatment must be started early for best outcomes.**

#### Analgesics and sedatives

#### **Analgesics should be used as sparingly as possible**

#### **It is undesirable to prescribe analgesics continuously for prolonged periods**

#### **Sedatives may be given if needed to promote sleep, but should not be overprescribed.**

#### Anti-inflammatory drugs

#### **These are drugs that dampen excessive inflammatory response by inhibiting the cyclooxygenase enzymes responsible for prostaglandin formation. Non-steroidal anti-inflammatory drugs are to be preferred. Many of these drugs also have analgesic action.**

#### **Steroids such as cortisone, prednisolone, and their analogues should be used with extreme caution due to possible adverse effects.**

#### Hormone-like drugs

#### **These include:**

#### **i. Corticosteroids**

#### **ii. Sex hormones or analogues used for prevention of osteoporosis in post-menopausal women, and for the control of certain metastatic tumours such as hormone-dependent breast and prostatic tumours.**

#### **iii. Biphosphonates – drugs which block the resorption of bone mineral.**

#### Specific drugs

#### **• Vitamin C for scurvy**

#### **• Vitamin D for rickets**

#### **• Salicylates for arthritis of rheumatic fever**

#### Cytotoxic drugs

#### **Form the basis of chemotherapy for malignant tumours. These anticancer drugs include: Cyclophosphamide, Melphalan, Vincristine, Doxorubicin, and Methotrexate. They have serious side effects and are used only under expert supervision.**

#### MANIPULATION

#### **This is the passive movements of joints, bones, or soft tissues carried out by the surgeon – with or without anaesthesia, and often forcefully – as a deliberate step in treatment. This method has three main uses:**

#### **i. Manipulation for correction of deformity – e.g. reduction of fractures and dislocations; correction of deformity from contracted or short soft tissues e.g. CTEV.**

#### **ii. Manipulation to improve the range of movements at a stiff joint**

#### **iii. Manipulation for relief of chronic pain in or about a joint, especially in the neck or spine.**

#### RADIOTHERAPY

#### **Radiotherapy by X-rays or by the gamma rays of radio-active substances may be used for certain benign conditions or for malignant disease.**

**OPERATIVE TREATMENT**

#### **Includes:**

#### **1. Synovectomy**

#### **2. Osteotomy**

#### **3. Arthrodesis**

#### **4. Arthroplasty**

#### **5. Bone grafting operations**

#### **6. Tendon transfer operations**

#### **7. Tendon grafting operations**

#### **8. Equalization of leg length**

#### **9. Amputation**

#### Synovectomy

#### **Is the operation for removal of the inflamed lining of a joint (synovial membrane), while leaving the capsule intact.**

#### **Useful in early rheumatoid arthritis and in some types of chronic infective arthritis.**

#### Osteotomy

#### **Is the operation of cutting bone or creating a surgical fracture**

#### **Indications include: -**

#### **1. Correction of excessive angulation, bowing or rotation of a long bone.**

#### **2. To permit angulation of a bone so as to compensate for mal-alignment at a joint**

#### **3. To allow for lengthening or shortening of a bone in the lower limb in order to correct length discrepancy.**

#### **4. To improve stability of the hip by altering the line of weight transmission (abduction osteotomy)**

#### **5. To improve containment in transient avascular necrosis of the epiphysis of a long bone**

#### **6. To relieve the pain of an osteoarthritic hip.**

#### Arthrodesis

#### **This is an operation to fuse a joint**

#### **Indications:**

#### **1. Advanced osteoarthritis or rheumatoid arthritis with disabling pain, especially when confined to a single joint**

#### **2. Quiescent tuberculous arthritis with destruction of the joint surfaces, to eliminate risk of recrudescence and to prevent deformity**

#### **3. Instability from muscle paralysis, as after poliomyelitis**

#### **4. For permanent correction of deformity, as in hammer toe.**

### Arthroplasty

Arthroplasty is the operation for the reconstruction of a new movable joint. It can be carried out in the following joints: Hip, Knee, Ankle, Shoulder, Elbow, Hand joints, First metatarso-phalangeal joint.

##### Indications of Arthroplasty include:

* 1. Advanced osteoarthritis or rheumatoid arthritis with disabling pain, especially in the hip, knee, ankle, shoulder, elbow, hand and metatarso-phalangeal joints.
* 2. Quiescent destructive tuberculous arthritis especially of the elbow or hip
* 3. For the correction of certain types of deformity, especially hallux valgus
* 4. Certain ununited fractures of the neck of the femur

##### Methods of arthroplasty:

* • Excision arthroplasty: Excision of one end or both of the articular ends so that a gap is created between them, creating a false joint or pseudoarthrosis.
* • Hemiarthroplasty or half-joint replacement: Only one of the articulating surfaces is removed and replaced with a prosthesis of similar shape.
* • Total replacement arthroplasty: Both of the articular ends are excised and replaced by prosthetic components.

### Bone grafting operations

##### Types of bone grafts:

* • Autogenous grafts or autografts: are bone grafts obtained from another part of the patient`s own body
* • Allografts or homogenous grafts or homografts: are bone graft obtained from another human subject
* • Xenografts or hetrogenous grafts or heterografts: are grafts obtained from animals

##### Indications

* • In non-union of fractures to promote union
* • In arthrodesis of joints, either to supplement an intra-articular arthrodesis or to promote extra-articular fusion
* • To fill a defect or cavity in a bone

**Techniques / Methods**

##### Strut grafts

Are obtained from strong cortical bone such as the subcutaneous part of the tibia. The graft is fixed to the recipient bone by internal fixation or by inlaying. It serves as an internal splint as well as providing a framework for the growth of new bone.

##### Strip grafts

Sliver or strip grafts are obtained from spongy cancellous bone – especially from the iliac crest. Commonly used for ununited fractures. They are laid about the fracture, deep to the periosteum.

##### Chip grafts

Are obtained from cancellous bone; are smaller pieces than sliver grafts. They are used for non-united fractures; the chips are packed firmly into or around the recipient bone and held in place by suture of the soft tissues over them.

##### Vascularised grafts

Require a suitable donor site such as the fibula, rib, or iliac crest. Anastomosis of nutrient vessels is meticulously done at the new site.

## Unit Three Content..

### Topic 1: PRE-OPERATIVE AND POST-OPERATIVE SURGICAL CARE

#### INTRODUCTION

The care of the patient with a major surgical problem commonly involves distinct phases of management that occur in the following sequence:

* 1) Pre-operative care:
* • Diagnostic work-up.
* • Pre-operative evaluation.
* • Pre-operative preparation.
* 2) Anaesthesia and operation.
* 3) Post-operative care

#### PRE-OPERATIVE CARE

General Health Assessment:  
1) A careful and accurate history should be taken to establish a correct diagnosis. The history should include a review of the patient’s previous experiences with anaesthesia, including: Any allergic reactions; Delayed awakening; or Prolonged paralysis from neuromuscular blocking agents.  
2) Full clinical examination.

* • A thorough physical examination should be done. The cardiovascular system, lungs and upper airway should be                     carefully examined. It should include measurements of heart rate and blood pressure and auscultation for cardiac                   murmurs and abnormal breathing.
* • The airway, head and neck should be examined for factors that could make endotracheal intubation difficult, e.g., fat or          short neck or limited temporo-mandibular mobility.
* • If regional anaesthesia is planned, the proposed site of injection should be examined for abnormalities and signs of                infection.

3) Investigations:

* 1. Urinalysis.
* 2. Complete blood count: A haemoglobin of 10g/dL is considered to be physiologically safe for tissue oxygen delivery.
* 3. Urea, electrolytes and creatinine - kidney function
* 4. Liver function tests
* 5. Blood grouping and cross-matching.

NB: The adequacy of liver and kidney function should be tested if impairment is suspected, as both organs play a major role in the response to and clearance of anaesthetic agents both preoperatively and intra-operatively.  
  
4) Informed consent:

* Surgery is a frightening prospect for both patient and family. Informed consent involves advising the patient of what to expect from administration of anaesthesia and of possible adverse effects and risks.
* Patient should be informed of the surgical procedure to be performed, benefits and risks and possible consequences, in understandable terms. Their psychological preparation and reassurance should begin at the initial contact with the surgeon. The potential need for blood transfusion must also be addressed.
* The patient or the legal guardian of the patient must sign (in advance) a consent form authorizing a major or minor operation or a procedure

**Summary**:  
The pre-operative evaluation should be comprehensive in order to:  
1. Assess the patient’s overall state of health.  
2. Determine the risk of the impending surgical treatment.  
3. Guide the pre-operative preparation.

**SPECIFIC FACTORS AFFECTING OPERATIVE RISK**

#### 1) Chronic respiratory disease

* • Careful attention should be given to peri-operative management in patients with chronic respiratory disease. Smoking cessation is important as this will decrease sputum production. Aim at stopping at least 2 months before the planned  procedure. Even a few days of abstinence from smoking will have a positive effect on sputum production.
* • Oral or inhaled bronchodilators along with twice-daily chest physical therapy and postural drainage will help clear inspissated secretions from the airway. Before surgery, patients should be instructed in techniques of coughing and deep breathing.
* • Peri-operative strategies include the use of epidural anaesthesia, vigorous pulmonary toilet & rehabilitation, and continued bronchodilator therapy. Early mobilisation and treatment of infection is also important.
* • The patient with compromised pulmonary function preoperatively is susceptible to post-operative pulmonary complications, including hypoxia, atelectasis (lung collapse), and pneumonia.

#### 2) Delayed wound healing:

* The following factors are of possible clinical significance in delaying wound healing:
* 1. Protein depletion.
* 2. Ascorbic acid deficiency.
* 3. Marked dehydration or oedema.
* 4. Severe anaemia.
* 5. Large doses of corticosteroids.
* 6. Cytotoxic drugs.
* 7. Irradiation.

#### 3) Drug effects:

* • Drug allergies, sensitivities and incompatibilities and adverse drug effects that may be precipitated by operation must be foreseen and, if possible, prevented. A personal or strong family history of asthma, hay fever or other allergic disorder should alert the surgeon to possible hypersensitivity to drugs.
* • Drugs currently being taken by the patient may require continuation, dosage adjustment, or discontinuation.  Medications such as digitalis, insulin and corticosteroids must usually be maintained and their dosage carefully  regulated during the operative and post-operative periods.
* • Prolonged use of corticosteroids may be associated with hypofunction of the adrenal cortex, which impairs the physiologic responses to the stress of anaesthesia and operation.
* • Anticoagulant drugs are an example of a medication that is to be strictly monitored or eliminated pre-operatively.

#### 4) Risk of thromboembolism:

* Increased risk factors for deep vein thrombophlebitis and pulmonary embolus include:
* 1. Cancer.
* 2. Obesity.
* 3. Myocardial dysfunction.
* 4. Age over 45 years.
* 5. A prior history of thrombosis.

#### 5) The elderly patient:

* • Aged patients generally require smaller doses of strong narcotics and are frequently depressed by routine doses. Sedative and hypnotic drugs often cause restlessness, mental confusion, and uncooperative behaviour in the elderly and should be used cautiously.
* • Pre-anaesthetic medication should be limited to atropine or scopolamine in the debilitated elderly patient and anaesthetic agents should be administered in minimal amounts.

#### 6) The obese patient:

* • Obese patients have an increased frequency of concomitant disease and a high incidence of post-operative wound complication.
* • Obesity increases both technical difficulties of operation and liability to post-operative chest complications and venous  thrombosis.
* • Obesity is also a risk factor for post-operative wound infection.
* • A controlled pre-operative weight loss program is often beneficial before elective procedures.

#### PRE-OPERATIVE ORDERS

On the day before operation, orders are written that assure completion of the final steps in the pre-operative preparation of the patient.

These orders will usually include the following:

**1. Diet:**

* • Starve the patient, usually from midnight if the surgery is elective and is scheduled for the following morning.
* • Omit solid foods for 6 hours and fluids for 4 hours pre-operatively.
* • Recently, there has been a shift to permit clear, non-fizzy fluids up to 2 hours pre-operatively.

**2. Enema:**

* • Need not be given routinely.
* • Given in cases of operations on the colon, rectum and anal regions or operations likely to be followed by paralytic ileus          and delayed bowel function.
* • Constipated patients and those scheduled for the above types of operations should be given a flushing enema 8 – 12            hours pre-operatively with 500 – 1500ml of warm tap water or, preferably, physiologic saline, or with 120 – 150ml of          hypertonic sodium phosphate solution conveniently available in a commercial kit.
* • When thorough cleaning of the bowel is not essential, satisfactory evacuation on the evening before operation can                usually be accomplished by use of a 10mg bisacodyl (Dulcolax) rectal suppository.
* • A hypertonic sodium phosphate enema or bisacodyl rectal suppository, or both, may also be effective in the rapid                    preparation of the colon and rectum for sigmoidoscopy.

**3. Premedication:**

* The anaesthetist will usually examine the patient and write the premedication order.
* The principal goals of pre-operative medication are:
* 1) To relive anxiety and provide sedation.
* 2) To induce amnesia.
* 3) To decrease secretion of saliva and gastric juices.
* 4) To elevate the gastric pH, and
* 5) To prevent allergic reactions to anaesthetic drugs.
* Medication is usually given 30 min to 2 hours before the induction of anaesthesia. The selection of drugs is largely subjective. Sedation can be achieved by:
* 1) Barbiturates.
* 2) Benzodiazepines or
* 3) Narcotics.
* Gastric secretion can be decreased by H2receptor antagonists such as cimetidine. For reduction of anxiety, oral short-acting benzodiazepines can be used 1 – 2 hours pre-operatively, especially for children.
* The anticholinergic agents, atropine, glycopyrronium and hyoscine, are used to reduce respiratory and oral secretions. Atropine and glycopyrronium also protect against vagal dysrhythmias.
* If indicated, prophylactic antibiotic agents are given by the anaesthetist in concert with the surgeon, either with the premedication or intravenously at induction of anaesthesia.

**4. Special orders:**

* a) Blood transfusion:
* If blood transfusion may be needed during or after operation, have the patient typed and arrange for a sufficient number  of units to be cross-matched and available prior to operation.
* b) Nasogastric tube:
* N/G tube for suction may be needed after operations on the GIT to prevent distension due to paralytic ileus. If the patient has gastrointestinal obstruction with possible gastric residual secretions, a N/G tube is passed preoperatively and the stomach aspirated or placed on continuous suction to reduce the possibility of regurgitation and aspiration during induction of anaesthesia.
* c) Bladder catheter:
* If it appears the patient will need hourly monitoring of urinary output during or after operation or if post-operative urinary retention is anticipated (as in spinal anaesthesia), a Foley catheter is inserted for constant bladder drainage. If bladder distension will interfere with exposure in the pelvis, a catheter should be placed pre-operatively.

#### PRE-OPERATIVE NOTE

When the diagnostic workup and pre-operative evaluation have been completed, all details should be reviewed and a pre-operative note written in the chart. This is usually done on the day before the operation. The note summarises the pertinent findings and decisions, gives the indications for the operation proposed, and attests that a discussion of the complications and the risks of operation has occurred between surgeon and patient (i.e., informed consent).

The following should also be noted and prominently displayed on the chart:  
i. Bleeding tendencies.  
ii. Medications currently being taken.  
iii. Allergies and reactions to antibiotics and other agents.

**Other preparations**

Shave the patient if necessary  
 Gown the patient  
 Label the patient   
        1. Name  
        2. Patient number  
        3. Ward number  
        4. Type of operation  
        5. Part to be operated on [esp. limbs]  
 Observe vital signs

#### POT-OPERATIVE MANAGEMENT

1) Observe vital signs – BP, temperature, pulse rate, respiratory rate – half hourly until the patient is fully awake, then                    continue observation in the ward 4 hourly or 6 hourly as convenient.  
2) Give intravenous fluids – normal saline and dextrose till bowel sounds return. 3 liters per day (1 liter normal saline, 2                  liters 5% dextrose)  
3) Give analgesics in the first 48 hours – pethidine or morphine (or other strong analgesics)  
4) Nil per oral till bowel sounds are heard, then start on oral sips (plain water) for 1 day.   
5) On the second day after bowel sounds appear, start on water and then light diet – soup, porridge, rice, mashed diet, etc.            avoid fluids with plenty of gases e.g. soda.  
6) Give antibiotic cover where appropriate  
7) Can catheterize for the first 24 hours to monitor urine output.  
8) Nasogastric tube suction, especially after abdominal surgery, until the volume of aspirate diminishes.  
9) Monitor any surgical drains. Remove the drain when it ceases to discharge effluent.  
10) If no complications, the wound need not be disturbed until the skin sutures have been removed.  
11) Remove alternate sutures on the 6th day and all sutures on the 7th post-operative day.  
12) Start counting 1st P.O.D 24 hours after the operation.

**POST OPERATIVE COMPLICATIONS**  
**Factors influencing post-operative complication**  
1)      Type of surgery  
2)      Patient factor  
3)      Pre-existing co-morbid illness  
4)      Procedure-related complication

**Immediate complications**  
1)      Primary haemorrhage  
2)      Basal atelectasis: minor lung collapse  
3)      Hypoxia  
4)      Haemodynamic complication – Shock due to blood loss  
5)      Reduced urine output – due to inadequate fluid replacement intra- and post-operatively.

**Early complications**  
1)      Acute confusion: exclude dehydration and sepsis  
2)      Nausea and vomiting: analgesia or anaesthetic-related; paralytic ileus  
3)      Fever  
4)      Secondary haemorrhage: often as a result of infection  
5)      Pneumonia  
6)      Wound infection  
7)      Wound dehiscence  
8)      Anastomotic leakage  
9)      Deep venous thrombosis (DVT)  
10)  Embolism  
11)  Acute urinary retention  
12)  Urinary tract infection (UTI)  
13)  Paralytic ileus

**Late complications**  
1)      Bowel obstruction due to fibrous adhesions  
2)      Incisional hernia  
3)      Persistent sinus  
4)      Recurrence of reason for surgery e.g. malignancy

#### Haemorrhage

Haemorrhage can be classified as:  
1.      Primary: occurring when a vessel is cut during surgery  
2.      Reactionary: occurring when rises in blood pressure at the end of the operation cause vessels that had previously not been bleeding to start to do so.  
3.      Secondary: normally due to infection which causes damage to a vessel days after surgery  
 Risk factors to haemorrhage include:  
1)      Drugs such as anticoagulants (heparin, warfarin), non-steroidal anti-inflammatory drugs, and antiplatelet drugs.  
2)      Congenital bleeding disorders: haemophilia, von Willebrand disease  
3)      Acquired bleeding disorders: as a result of sepsis, liver disease, or disseminated intravascular coagulation.

#### Post-operative pyrexia

Post-operative pyrexia is commonly caused by inflammatory mediators released as the response to surgery. This causes low-grade fever within 24 hours of surgery. Other common causes of pyrexia include the seven Cs:  
·         Cut wound (incisional) infection  
·         Collection of pus especially pelvic or subphrenic abscess  
·         Chest infection or pulmonary embolism  
·         Cannula infection  
·         Central venous catheter infection  
·         Catheter sepsis (urinary tract infection)  
·         Calves affection by deep venous thrombosis (DVT)  
NB: Fever can also be due to blood transfusion or drug reaction.

**Infections**  
Post-operative infections can be classified by site and cause.  
·         Surgical site infection  
·         Central venous catheter infection  
·         Urinary tract infection  
·         Abdominal collections  
·         Infected cannula sites  
·         Pneumonia

**Wound dehiscence**  
Wound dehiscence is disruption of any or all the layers in a post-operative wound. It is very distressing to the patient. It occurs from the 5th to the 8th postoperative day when the strength of the wound is at its weakest. The patient may have felt a popping sensation during straining or coughing.  
**General** **risk factors** in wound dehiscence include:  
·         Malnutrition  
·         Diabetes mellitus  
·         Obesity  
·         Renal failure  
·         Jaundice  
·         Sepsis  
·         Cancer  
·         Treatment with steroids  
**Local risk factors** include:  
·         Inadequate closure of wound  
·         Poor closure of wound  
·         Poor local wound healing due to infection or haematoma  
·         Increased intra-abdominal pressure due to: excessive coughing in chronic obstructive airway disease.  
Most patients with wound dehiscence are taken back to theatre for re-suturing. In some patients, it may be appropriate to leave the wound open and treat with dressings or vacuum-assisted closure pumps.

## Unit Four Content..

### Topic 1: Burns: Predisposing factors; Mechanisms of injury

### BURNS

##### DEFINITION

A burn is an injury due to a sudden drastic change of temperature resulting into tissue damage. It is an injury caused by thermal, chemical or physical agents, such as heat, corrosive substances or irradiation.

#### PREDISPOSING FACTORS

An individual is more likely to suffer a burn injury under the following circumstances:  
1) Epilepsy – fits, loss of consciousness near fire.  
2) Age – toddlers and other children, elderly – impaired mobility, poor coordination and diminished awareness of pain.  
3) Unguarded fires – a threat to all children  
4) Neuropathy – diminished awareness of pain.  
5) Alcoholism.  
6) Occupation – industrial workers – physicochemical burns.  
7) Abuse of drugs (opium).

### MECHANISMS OF INJURY

• Most burns follow accidents in the home.  
• Burns may be caused by flames, hot solids, hot liquids, steam, irradiation, electricity, chemicals (e.g. acids, alkalis), or mechanical friction.  
• Burns sustained in house fires are often accompanied by smoke inhalation, with injury to the lungs.  
• Accidental or deliberate ingestion of corrosive chemicals also causes burns of the oropharynx and oesophagus.  
• Antibody-antigen (allergic) reactions also present like burns  
• Exposure to hot sunlight (UV) can cause sunburn

#### I. SCALDS

* • Hot water produces a particularly well-defined type of skin damage. The temperature of boiling water (1000C) or steam is constant and the major determinant of the severity of injury is the duration of contact. In the home, spills from kettles or cooking pots are common injuries of childhood.
* • As with all burning accidents, those least able to protect themselves (the very young, the very old and the very drunk) are particularly vulnerable. Children reaching up to grasp the flex of an electric kettle, or a pot handle, can drench themselves in boiling water, and the larger the volume, the more severe the injury in terms of area and depth.
* • Common areas involved are the face, neck and upper trunk or limbs.
* • Immersion in boiling water, or prolonged steam exposure (as in some industrial accidents where superheated steam may have a temperature above 1000C) are particularly dangerous and likely to cause deeper burns.

#### II. FAT BURNS

* Cooking fat or oil has a much higher temperature (18000C) than boiling water and hot fat cools slowly on the skin surface. Spills therefore cause deep burns.

#### III. FLAME BURNS

* • Have a varied aetiology:

1. House fires.
2. Clothing fires.
3. Spills of petrol on the skin.
4. Butane gas fires.

* • They often occur in confined spaces and may be associated with inhalation injury.
* • It is important to know whether the clothing ignited and how the flames were extinguished (did clothing burn away?). Generally, deep burns will result if clothing ignites, since there is a prolonged flame contact with the skin.

#### IV. ELECTRIC BURNS

* The passage of electric current through the tissues causes heating that results in cellular damage. Heat produced is a            function of resistance of the tissue, the duration of contact and the square of the current.
* Bone is a poor conductor of electrical current, whereas blood vessels, nerves and muscles are good conductors. Bone   can therefore become very hot and cause secondary damage to tissues near to the bone.
* Low voltage (< 1000 V) such as from a domestic supply (240 V, 50 Hz) causes significant contact wounds and may induce cardiac arrest, but no deep tissue damage. High voltage burns (> 1000 V) cause damage by two mechanisms: -
* 1. Flash &
* 2. Current transmission.
* The flash from an electric arc may cause a cutaneous burn and ignite clothing, but will not result in deep damage. High-voltage current transmission will result in cutaneous entrance and exit wounds and deep damage.
* Lightning strikes cause very high-voltage, very short duration discharge. A direct strike has a high mortality. A side strike may cause superficial burns to the skin and deep exit burns to the feet.
* Electrical injuries, unlike thermal burns, often cause massive tissue damage underneath intact skin. Exposure of this tissue damage uncovers vital structures such as nerves, tendons and joints, which then require coverage. These injuries remain a diagnostic and therapeutic challenge during the acute post-injury period.

#### V. COLD INJURY

* • Results from exposure to extreme cold. Severe cooling can freeze tissues and ice formation is particularly likely to cause cellular disruption.
* • Tissue damage from cold can occur from industrial accidents due to spills of liquid nitrogen or similar substances. The injuries cause acute cellular damage with the possibility of either a partial-thickness or full-thickness burn.
* • Frost bite is due to prolonged exposure to cold and there is often an element of ischemic damage. Vasoconstriction reduces the resistance of the tissue to cold exposure as the warming effect of the circulation is reduced. There is therefore combined tissue damage from freezing, together with vasospasm.

#### VI. FRICTION BURNS

* The tissue damage in friction burns is due to a combination of heat and abrasion. There is generally a superficial open wound that may progress to full-thickness skin loss. Friction burns may be associated with degloving injuries where the damage is judged to be deep.
* Early surgical excision and skin cover is the best means of management.

#### VII. IONIZING RADIATION

* X-irradiation may lead to tissue necrosis. The tissue necrosis may not develop immediately. These injuries are generally limited in area, and surgical excision and flap reconstruction may be appropriate management.

#### VIII. CHEMICAL BURNS

* • Numerous chemicals in industrial and domestic situations can cause burns. Tissue damage depends on the strength and quantity of the agent and the duration of the contact. Some agents penetrate deeply or may have specific toxic effects.
* • Chemicals cause local coagulation of proteins and necrosis, and some also have systemic effects (e.g. liver and kidney damage with tannic, formic and picric acids).
* • The harmful effect will continue until the chemical is diluted or neutralized. The most important initial treatment is dilution with running water.
* **Classification of Injurious Chemicals**
* 1. Acids that cause burns are: Hydrochloric acid, Hydrofluoric acid, Sulfuric acid, Nitric acid, Phosphoric acid, and Acetic acid.
* 2. Bases - the common bases are: Hydroxides of calcium, sodium, potassium and ammonia.
* 3. Organic compounds – these are the products (by) of petroleum and phenol.
* 4. Inorganic agents – sodium sticks and chlorine gas are common examples.

##### Mechanism of Action:

* When these chemicals come into contact with the skin various kinds of reactions occur, apart from the effect of thermal burn due to the heat produced by the acid when in contact with the skin (exothermic reaction).
* • Protein denaturation occurs, resulting in corrosion of the skin.
* • Oxygen ions get into the cells and release highly reactive chemicals and these oxidation products result in severe untoward effects on the skin.
* • These corrosives are protoplasmic poisons; they form esters with the protein and by desiccation, result in full-thickness burn of the skin.
* • By being vesicants, they are poisonous to the proliferating cells. Vesication also results in blister formation. The severity of injury depends upon:
* 1) Concentration of the chemical.
* 2) Amount of the chemical in contact with the tissue.
* 3) Duration of exposure.
* 4) State of the lipid barrier of the skin.
* **General Principles of Management of chemical burn:**
* Rapid removal of all the clothing and washing with large volumes of clean cold water is very important. Any dry chemical or powder adherent to the body should be brushed away and removed before washing. Normal saline can also be used to wash the area. This procedure decreases the rate of reaction between the chemical and the tissue.
* It must be borne in mind that time should not be wasted from receiving the patient with chemical burn to initiation of treatment. The depth and magnitude of ongoing tissue necrosis is directly related to the time taken to initiate the treatment. Hence, first aid should stress on continuous irrigation of the wound with water.

### PATHOPHYSIOLOGY OF BURN INJURY

Burns cause injury in a number of different ways, but by far the most common organ affected is the skin. However, burns can also damage the airway and lungs, with life-threatening consequences.

Airway injuries occur when the face and neck are burned. Respiratory system injuries usually occur if a person is trapped in a burning vehicle, house, or aeroplane and is forced to inhale the hot and poisonous gases.

#### I. INJURY TO THE AIRWAY AND LUNGS

##### Burn injury to the airway above the larynx:

Hot gases can physically burn the nose, mouth, tongue, palate and larynx. This will lead to swelling of the linings of these structures, and in a few hours cause obstruction to the airway if action is not taken to secure the airway.

##### Burn injury to the airway below the larynx:

Steam can cause thermal damage to the lower airway. This causes rapid swelling and detachment of the respiratory epithelium from the bronchial tree. This can lead to blockage of the main upper airway.

##### Metabolic poisoning:

Many poisonous gases can be emitted from a fire, the most common being carbon monoxide, a product of incomplete combustion often produced by fires in enclosed spaces.

Carbon monoxide binds to haemoglobin with an affinity of 240 times greater than that of oxygen and thus blocks the transport of oxygen. Levels of carboxyhaemoglobin concentration in the bloodstream above 10% is dangerous and require treatment with pure oxygen for more than 24 hours. Death occurs with concentrations of more than 60%.

Hydrogen cyanide is another metabolic toxin produced in house fires. It causes a metabolic acidosis by interfering with mitochondrial respiration.

##### Inhalational injury:

Inhalational injury is caused by the minute particles within thick smoke, which, because of their small size, are not filtered by the upper airway, but are carried down to the lung parenchyma.

They stick to the moist lining, causing an intense reaction in the alveoli. This chemical pneumonitis causes oedema within the alveolar sacs and decreasing gaseous exchange over the ensuing 24 hours, and often gives rise to a bacterial pneumonia.

##### Mechanical block on rib movement:

Full-thickness burns across the chest can physically stop the ribs from moving due to thickness and stiffness of the burned skin.

#### II. LOCAL EFFECTS OF BURN INJURY

The local effect of a burn depends on the temperature of the burning agent and the duration of contact with the skin. The local effects result from destruction of the more superficial tissues and inflammation of the deeper tissues.

##### 1. Tissue Damage:

* Heating of tissue results in direct cell rupture or cell necrosis.
* In addition, collagen is denatured and damage to the peripheral microcirculation occurs.
* RBCs may be damaged in the burn & a greater number often show increased fragility and they are destroyed over the next few days.
* The severity of the local response can vary from simple reddening to destruction and charring of tissues.
* With deeper injuries, the epidermis and dermis are converted into a coagulum of dead tissue known as eschar.
* Compromise of circulation to a limb by circumferential burns acting as tourniquet as the limb swells

##### 2. Inflammation:

* There is a marked and immediate inflammatory response. In the areas least damaged by burning, this is manifest simply as erythema, the dermal inflammatory response consisting of capillary dilatation. Mild areas of erythema resolve within a few hours.
* The inflammatory reaction produced by burns leads to markedly increased vascular permeability. Water, solutes and proteins move from the intra- to the extravascular space. The volume of fluid lost is directly proportional to the area of the burn. Above 15% of surface area, the loss of fluid produces shock.

##### 3. Fluid loss:

* Occurs from the burn surface or is trapped in blisters.
* The magnitude of loss depends on the extent of injury.
* Loss is greatly increased by leakage of fluid from the circulation, where instead of the normal insensible loss of 15 ml/m2 body surface per hour, as much as 200 ml/m2/hour may be lost in the first few hours.
* Damaged capillaries become permeable to protein, and an exudate forms with an electrolytic and protein content only slightly less than that of plasma.
* Lymphatic drainage does not keep pace with the rate of exudation and interstitial oedema forms, with resultant reduction in circulating fluid volume.

##### 4. Infection:

* Destruction of the epidermis removes the barrier to bacterial invasion.
* Cell-mediated immunity is significantly reduced in large burns, leaving them more susceptible to bacterial and fungal infections.
* Sepsis may increase the amount of tissue destruction, delay healing or interfere with the `take` of skin grafts.
* Severe sepsis may lead to septicaemia and death.
* Sepsis also increases energy needs.

**III. GENERAL EFFECTS OF BURNS**

* General effects of a burn depend upon its size. Large burns lead to water, salt, and protein loss, hypovolaemia and increased catabolism.
* Plasma loss into the burned tissues leads to a marked reduction in blood volume. The blood becomes more viscous as the loss of plasma through the capillaries is greater than that of red blood cells.
* The volume of plasma loss is roughly proportional to the extent of the body surface burned. A burn of more than 10% of the body surface area in a child, or more than 15% in an adult, will cause hypovolaemic shock within a few hours. Severe hypovolaemia can damage other organs (multiple organ failure), particularly the kidney.
* Severe loss of body protein often occurs, leading to serious weight loss, pressure sores, lowered resistance to infection, delayed healing, and skin graft failure.
* Some red blood cells are destroyed immediately by a full-thickness burn, but many more are damaged and die later. This could contribute to anaemia in burns.
* Large burns increase metabolic rate as water losses from the burned surface cause expenditure of calories to provide the heat for evaporation.
* Malabsorption from the gut due to microvascular damage and ischaemia to gut mucosa, as a result of the inflammatory stimulus and shock

### CLASSIFICATION OF BURNS

Burns are classified according to depth as follows:

1. Partial thickness burns

* • In a partial thickness burn, epithelial cells survive to restore the epidermis.
* • Divided into: -
* i. Superficial partial-thickness burns and
* ii. Deep partial-thickness burns

2. Full thickness burns

* • Destroy all the epithelial elements.

#### Superficial partial-thickness burns

• Involve only the epidermis and the superficial dermis. Damage goes no deeper than the papillary dermis.   
• The clinical features are blistering and/or loss of the epidermis. The underlying dermis is pink and moist.   
• The capillary return is clearly visible when blanched.   
• Pinprick sensation is normal.  
• Pain, swelling and fluid loss can be marked.  
• New epithelial cover is provided by undamaged cells originating from the epidermal appendages.  
• The burn usually heals in less than 3 weeks, with a perfect final cosmetic result.

#### Deep partial-thickness burns

• The epidermis and much of the dermis are destroyed, damage involving the deeper parts of the reticular dermis.   
• Clinically, the epidermis is usually lost.  
• Restoration of the epidermis depends on there being intact epithelial cells within the remaining appendages.   
• The colour does not blanch with pressure.   
• Sensation is reduced, and the patient is unable to distinguish between pressure from the sharp and blunt ends of a needle.  
• Pain, swelling and fluid loss are marked.   
• The burn takes longer than 3 weeks to heal, as fewer epithelial elements survive, and often leaves an ugly hypertrophic scar.  
• Infection often delays healing and can cause further tissue destruction, making the burn a full-thickness one.

#### Full-thickness burns

• A full-thickness burn destroys the epidermis and dermis, including the epidermal appendages.   
• Clinically they have a hard leathery feel.  
• The destroyed tissues undergo coagulative necrosis and form an eschar.  
• The eschar begins to lift after 2-3 weeks.  
• There is no prospect of spontaneous epidermal cover unless the raw area is grafted.  
• Fibrosis and ugly contracture is inevitable in all but small, ungrafted injuries.

### CLINICAL FEATURES OF BURNS

1.      Pain:

* •      Pain is immediate, acute and intense with superficial burns.
* •      It is likely to persist until strong analgesia is administered.
* •      With deep burns there may be surprisingly little pain.

2.      Acute Anxiety:

* •      The patient is often severely distressed at the time of injury.
* •      It is frequent for patients to run about in pain or in an attempt to escape, and secondary injury may result.

3.      Fluid Loss and Dehydration:

* •      Fluid loss commences immediately and, if replacement is delayed or inadequate, the patient may be clinically dehydrated.
* •      There may initially be tachycardia from anxiety and later a tachycardia from fluid loss.

4.      Local Tissue Oedema:

* •      **Superficial** burns will **blister** and **deeper** burns develop **oedema** in the subcutaneous spaces.
* •      This may be marked in the head and neck, with severe swelling which may obstruct the airway.
* •      Limb oedema may compromise the circulation.

5.      Special Sites:

* •     Burns of the eyes are uncommon in house fires as the eyes are tightly shut and relatively protected.
* •     The eyes, however, may be involved in explosion injuries or chemical burns.
* •     Burns of the nasal airways, the mouth and upper airway may occur in inhalation burns.

6.      Coma:

* •     Following house fires, the patient may be unconscious and the reason for this must be ascertained.
* •     Asphyxiation or head injury must be excluded.
* •     Burning furniture is particularly toxic and the patient may suffer from carbon monoxide or cyanide poisoning.

**Determination of Severity of Injury**  
Illness and death are related to:

1. The size (surface area) and depth of the burn.
2. The age and prior state of health of the victim.
3. The location of the burn wound, and
4. The severity of associated injuries (if any) – particularly lung injury.

* Patients under age 2 years and over age 60 years have a significantly higher death rate for any given extent of burn. The higher death rate in infants results from a number of factors:

1. The body surface area in children relative to body weight is much greater than in adults. Therefore, a burn of comparable surface area has a greater physiologic impact on a child.
2. Immature kidneys and liver do not allow for removal of a high solute load from injured tissue or the rapid restoration of adequate nutritional support.
3. The incompletely developed immune system increases susceptibility to infection.

* Associated conditions such as cardiac disease, diabetes or chronic obstructive pulmonary disease significantly worsen the prognosis in elderly patients.
* Burns involving the hands, face, feet or perineum will result in permanent disability if not properly treated. Patients with such burns should always be admitted to the hospital, preferably to a burn centre.
* Chemical and electrical burns or those involving the respiratory tract are invariably far more extensive than is evident on initial inspection. Therefore, hospital admission is necessary in these cases also.

**Assessment of the Burn Area**  
A careful calculation of the percentage of total body burn is useful for several reasons:  
1.      There is a general tendency to under-estimate clinically the size of the burn and thus its severity.  
2.      Prognosis is directly related to the extent of injury.  
3.      The decision about who should be treated in a specialized burn facility or managed as an outpatient is based in part on the estimate of burn size.  
An approximate clinical rule in wide use is the **Wallace’s ‘’rule of nines’’** which acts as a rough guide to body surface area.  
A useful guide for estimating burn surface area is that the patient’s hand (fingers and palm) is 1% body surface area.  
  
Wallace’s ‘’rule of nines’’

|  |  |
| --- | --- |
| **AREA** | **PERCENTAGE** |
| Head and neck | 9% |
| Left upper extremity | 9% |
| Right upper extremity | 9% |
| Anterior trunk | 18% |
| Posterior trunk | 18% |
| Left lower extremity | 18% |
| Right lower extremity | 18% |
| Perineum | 1% |
| **TOTAL** | **100%** |

Rule of 10 is used in children:

|  |  |
| --- | --- |
| **AREA** | **PERCENTAGE** |
| Head and neck | 20% |
| Anterior trunk | 20% |
| Posterior trunk | 20% |
| Each limb (lower/upper) | 10% (total 40%) |
| **Total** | **100%** |

  The clinician should assess the total area involved and how much of the area is partial-thickness and how much full-thickness.  
 As a general rule, an adult with more than 15% of the body surface area involved or a child with more than 10% of body surface area involved will require intravenous fluid replacement.  
 However, an intravenous access line may be necessary for adequate analgesia for much smaller areas of burn and many children in particular will require fluid replacement because of vomiting.  
 For smaller percentages than the above, it is necessary to maintain an adequate oral intake of fluid.  
 The prognosis depends upon the percentage body surface area burned.  
 A rough guide is that if the age and percentage add together to a score of 100 then the burn is likely to be fatal.  
 A child may therefore survive a large burn, but even a small burn in an elderly patient is potentially fatal.

#### Assessment of Burn Depth

• Burn depth depends, in thermal injury, upon:

* 1) The temperature of the burning agent.
* 2) The mode of transmission of heat.
* 3) The duration of the contact.

• Much of this information can be obtained from taking a good history of the injury.  
• Clinical examination of the burn wound may also show characteristic features.

##### First-Degree Burns:

Involve only the epidermis (epidermal burns). They are characterized by:  
 Erythema (look red) & minor microscopic changes.  
 Minimal tissue damage.  
 Minimal skin oedema.  
 Blisters are not present.  
 Intact protective functions of the skin.  
 Pain – the chief symptom, usually resolves in 48-72 hours.  
 Rapid healing without sequelae  
 Systemic effects are rare.  
In 5-10 days, the damaged epithelium peels off in small scales, leaving no residual scarring. The most common causes of first-degree burns are over-exposure to sunlight and brief scalding. The desiccated outer layers of epidermis peels off in 1-2 weeks’ time & heals without any residual scar formation.

##### Second-Degree Burns (Partial-thickness burns):

Are deeper, involving the entire epidermis and part of the dermis. The systemic severity of the burn and the quality of subsequent healing are directly related to the amount of undamaged dermis. Depending on the depth of injury into the dermis they are divided into two subgroups namely:

* 1. Superficial second-degree (superficial partial-thickness).
* 2. Deep second-degree (deep partial-thickness)

##### Superficial Partial-thickness Burns:

* • Consist of severe erythematous appearance of the skin with blister formation.
* • Prominent oedema causes the wound surface to be elevated above the surrounding unburned skin.
* • Superficial dermal burns are blistered and painful.
* • The erythema is due to hyperaemia of superficial dermal capillaries with occasional extravasation of erythrocytes.
* • In the absence of any complications these burns will heal spontaneously by epithelialisation within three weeks with minimal or no scaring.

##### Deep Partial-Thickness Burns:

Are characterized by:

* • A blotchy red appearance or a layer of whitish nonviable dermis firmly adherent to the remaining viable tissue.
* • A soft, dry, waxy, white appearance after devitalized material is removed.
* • No capillary return on pressure.
* • The tissue is not initially oedematous.
* • Absent sensation to pin prick, but perception of deep pressure is still intact.
* • May have blisters.
* • Blisters, when present, continue to increase in size in the past burn period as the osmotically active particles in the blister fluid attract water.
* • Deep partial thickness burns may destroy some of the adnexa structures, but the capacity for spontaneous healing though prolonged is still present.
* • Deep dermal burns heal over a period of 25-35 days with a fragile epithelial covering that arises from the residual uninjured epithelium of the deep dermal sweat glands and hair follicles.
* • Severe hypertrophic scarring occurs when such an injury heals, the resulting epithelial covering is prone to blistering and breakdown.
* • Conversion to a full-thickness burn by bacteria is common.
* • Skin grafting of deep dermal burns, when feasible, improves physiologic quality and appearance of the skin cover.

##### Full-thickness (Third-Degree) Burns:

* Have a characteristic white, waxy appearance and may be misdiagnosed by the untrained eye as unburned skin. Burns caused by prolonged exposure, with involvement of fat and underlying tissue, may be brown, dark red or black. The diagnostic findings of full-thickness burns are:
* 1) Lack of sensation in the burned skin.
* 2) Lack of capillary refill, and
* 3) A leathery texture that is unlike normal skin.
* These burns are characterized by a white to black hard, ‘’leathery’’ inelastic eschar that may have a glistening, apparently translucent surface.
* The wound is insensitive to all but deep pressure.
* Coagulative necrosis affects the entire thickness of the epidermis and dermis and usually extends into subcutaneous fat. All epithelial elements are destroyed, leaving no potential for re-epithelialization.

### MANAGEMENT OF BURNS

#### First Aid:

##### 1. Stop the Burning Process:

* Flames from burning clothing or from burning inflammable substances on the skin surface should be extinguished by            wrapping the patient in a fire blanket or any other readily available garment such as the bystander’s own clothing.
* With electrical burns it is important that any live current is switched off.
* With chemical burns the first-aid worker must avoid contact with the chemical.
* Burned or water-soaked clothing should be removed.

##### 2. Cool the Burn Surface:

* Patient continues burning for the next half hour following stopping flame.
* Therefore remove the heat already in the body using cold running tap water.
* Copious amount of clean cold water can be applied by sponges.
* It can also neutralise/dilute chemicals.
* Pain also gets reduced when cold water is applied.
* The secretion of histamine by the mast cells gets reduced by cooling, & this will reduce the oedema formation.
* With scalds, irrigation with cold water under a tap is best and scald damage can successfully be limited.
* Immediate cooling of the part should continue for 20 minutes.
* Do not use ice or iced water to avoid hypothermia.
* The ideal temperature of cooling water is 150C, but 8-250C is effective.
* The burn should then be wrapped in any clean linen or plastic ‘’cling film’’ and the patient transported immediately to            hospital.

#### Emergency Examination and Treatment:

The order of priorities in the management of a major burn injury is:

##### Primary Survey:

* A: airway maintenance.
* B: breathing and ventilation.
* C: circulation.
* D: disability – neurological status.
* E: exposure and environment control – keep warm.
* F: fluid resuscitation.

In severe facial and neck burns early endotracheal intubation or tracheostomy should be considered.  
 Early escharotomy may be needed in circumferential chest or limb burns where respiratory or circulatory disturbances is          observed.  
 An altered consciousness level may be caused by carbon monoxide poisoning.  
 If there is a possibility that smoke inhalation has occurred – as suggested by exposure to a fire in an enclosed space or              burns of the face, nares, or upper torso – arterial blood gases and arterial oxygen saturation of haemoglobin and                        carboxyhaemoglobin levels should be measured and oxygen should be administered.

Endotracheal intubation is indicated if the patient is:

* 1. Semicomatose.
* 2. Has deep burns to the face and neck, or
* 3. Is otherwise critically injured.

If the burn exceeds 20% of body surface area, a urinary catheter should be inserted to monitor urine output.  
 A large-bore intravenous catheter should be inserted, preferably into a large peripheral vein.  
 Protect burned area in order to prevent infection and reduce pain.  
 Place the patient in a comfortable position. On no account should patients with extensive burns be permitted to walk                about.  
 Ensure warmth of the patient because he/she will be shocked and the peripheral blood vessels will have contracted to              increase central circulation.   
 Give sedatives and analgesics.  
 Give oral fluids in limited quantities.

##### Secondary Survey:

* 1. Assess the extent of burn.
* 2. Assess the burn depth.
* 3. Assess the sites (special areas like the eyes).
* 4. Chart the area for calculation of the total body surface area burnt.
* 5. Smoke inhalation injury and associated trauma, like head injuries and spinal cord injuries are taken care of first.
* 6. Then the management of burn wound must be initiated.

#### Indications of admission:

1) Burns requiring fluid resuscitation (> 15% in adults & 10% in children).  
2) Burns of special areas e.g. face, hands feet, perineum, genitalia and flexure surfaces.  
3) Full-thickness burns > 5% body surface area.  
4) Circumferential limb or chest burns.  
5) Electric burns.  
6) Chemical burns.  
7) Inhalation burns.  
8) Deep burns.  
9) Burns in children or the elderly.  
10) Where non-accidental injury is suspected in the case of a child.  
11) Associated medical conditions or pregnancy.  
12) Associated other trauma e.g. fractures.

##### MANAGEMENT ON ADMISSION

##### I. Barrier Nursing

* • All patients with exposed areas of burn are nursed under aseptic conditions to prevent cross-infection.
* • Room temperature should be 24-270C.
* • Check on general condition of the patient, recording the following if possible:- pulse, blood pressure and weight.
* • Remove dressings, linen coverings and clothes, so that the extent of the body surface burned can be assessed.
* • In an extensive burn, set up an i.v. infusion if not already in position.
* • Keep the patient warm and comfortable. Use a cradle to protect the burned surfaces.
* • Burned arms and legs should be elevated to reduce the oedema.

##### II. Commence the following charts to assess progress of resuscitation:

* • Temperature 4 hourly.
* • Pulse – ½ hourly.
* • Blood pressure ½ hourly
* • Fluid in-put out-put chart: Urine output should be between 50-100ml/hr. < 30ml and > 150ml/hr. indicate inadequate          or excess respectively.

##### III. Investigations

* 1. Haemoglobin and haematocrit.
* 2. Urea and electrolytes.
* 3. Blood cross-matching.
* 4. Blood gases and blood analysis for carbon monoxide or cyanide poisoning in the unconscious patient.

##### IV. Fluid Replacement Therapy

* • Severe burns are characterized by large losses of intravascular fluid, which are greatest during the first 8-12 hours,                and are significantly diminished by 24 hours post-burn.
* • Initially, an isotonic crystalloid salt solution is infused to counterbalance the fluid loss.
* • Ringer’s Lactate (Hartmann`s solution) is commonly used, the rate being dictated by:
* 1. Urine output.
* 2. Pulse (character and rate).
* 3. State of consciousness
* 4. Blood pressure.
* • Burned patients are always thirsty, but gastric movements may be altered. It is therefore unwise to give too much                  fluid  by mouth in the first few hours or the patient may vomit.
* • Small quantities only should be given to correct the thirst, since vomiting would lead to loss of valuable electrolytes.

##### Fluid requirements

##### There are two fluid requirements:

* • Normal metabolic fluid intake. In an adult who is on fluids only, this should be 2000 ml/day. This is usually taken by                mouth even in an extensive burn. The rate of administration should be:
* 30 ml per 30 min in 0-8 hrs, then increase to
* 60 ml per 30 min from 8-36 hrs if there is no vomiting.
* • Replacement of fluid lost from the circulation - given intravenously.

#### Fluid replacement

##### Fluid Management of burns

##### Start:

* • Start replacement of fluids as at onset of burns, i.e. from 0 hours.
* • Start the fluids as if the patient presented soon after injury.
* • Stop at 48 hours when no more inflammatory response is expected.
* • Stop drips gradually over 12 hours.
* • Only reasons for giving beyond 48 hours are:

1. Infections.
2. Deep burns.
3. Diarrhoea and vomiting.
4. If patient cannot take orally antibiotics that are given in drips.

##### Amount of Fluid:

##### The simplest formula (for adults) is:

**Parkland’s Formula**

* 4ml x body weight in kg x % burn surface area in the first 24 hours.
* Half of this volume is given in the first 8 hours and the rest in the next 16 hours.
* Timings begin from the time of the burn, not the start of resuscitation.
* Hartmann`s solution is preferred, but other isotonic fluids may be used.
* Metabolic fluid requirements are also needed.

##### Parkland`s formula Example:

* • Burn surface area 20% of body surface
* • Patient`s weight  60kg
* • Total calculated fluid requirement for 24 hour period from time of burn
* 4ml x 60 X 20   = 4800ml
* 2400ml is given in the first 8 hours (from 0 hrs)
* 2400ml is given in the next 16 hours
* Total duration 24 hours.

Formulae are only a guide and the adequacy of fluid resuscitation is monitored by regular clinical assessment. A urinary catheter is essential. Urine output is the best guide to adequate tissue perfusion; in an adult one should aim for 30-50 ml per hour.

#### V. CARE OF THE BURN WOUND:

• In the management of first- and second-degree burns, one must provide as aseptic an environment as possible to prevent infection.  
• However, superficial burns generally do not require the use of topical antibiotics.  
• Occlusive dressings to minimize exposure to air have been shown to increase the rate of re-epithelialization and to decrease pain.  
• If there is no infection burns will heal spontaneously.  
• Goal of Management of Full-Thickness Burns:  
1. To clean the wound and remove dead tissue.  
2. To prevent invasive infection (i.e., burn wound sepsis).  
3. To cover the wound with skin as soon as possible.  
4. To prevent further destruction of tissue.  
5. To provide an environment in the burned area which is conducive to the natural regeneration of epithelium.  
6. To aid the separation of slough and provide a suitable surface for grafting.  
7. To maintain function in the affected parts.

##### Clean the wound

Wound is washed with tepid water and a solution of chlorhexidine or mild soap.   
 Then the excess water is sponged off with cotton sponges.   
 With deep burns the eschar is firmly adherent and should not be separated, but the whole area wiped and any loose material removed with fine dissecting forceps and scissors.  
 Blisters are snipped so that the fluid escapes and all the loose skin removed.  
 Great gentleness should be exercised so that any unburned tissue is not accidentally damaged.

##### Topical antibacterial agents

* • Silver sulfadiazine is the most widely used preparation today.
* • Mafenide
* • Silver nitrate
* • Povidone-iodine
* •  Gentamicin ointment
* • For small superficial burns a soothening emollient like paraffin tulle gras will be comfortable to the patient when applied to the surface.

##### Silver Sulfadiazine 1% (SS):

* • Is effective against a wide spectrum of Gram-negative organisms and is moderately effective in penetrating the burn eschar.
* • Delays colonization by Gram-negative bacteria for 10-14 days.

##### Mafenide Acetate (Sulfamylon):

* • Is used to help prevent and treat wound infections in patients with severe burns.
* • Penetrates the burn eschar and is a more potent antibiotic
* • It is used chiefly on burns already infected or when silver sulfadiazine is no longer controlling bacterial growth.
* • Used as a 10% concentration in a water soluble cream base.
* • Used to cover the burn wound as a thick cover.
* • Applied twice a day.

#### Methods of wound treatment

##### Exposure Therapy:

No dressings are applied over the wound after application of the agent to the wound twice or three times daily.

##### Advantages:

* • Bacterial growth is not enhanced, as the presence of light and the recommended room temperature of 24-270C discourages bacterial growth.
* • The coagulation of exudate in the presence of air provides a hard, dry, impervious surface which is resistant to external  infection.
* • The wound remains visible and readily accessible. The presence of infection is immediately detected.
* • Heat is lost normally from the body by evaporation and radiation, unlike when bulky dressings are applied.

##### Disadvantages:

* • Increased pain.
* • Increased heat loss as a result of the exposed wound.

##### Indications of exposure method:

* • Face burns.
* • Head burns.
* • Front or back trunk but not both.

##### Contraindications of exposure therapy:

* • Circumferential burns of the trunk – difficulty of keeping the undersurface dry.
* • Burns of the hand - difficulty of early restoration of function.
* • Circumferential burns of the neck because it is rarely possible to keep the area dry.
* • Circumferential full-thickness burns of the limbs because the eschar may produce a tourniquet effect.

##### Response to exposure therapy:

* • By about the 14th day after burning the superficial or partial thickness burn will have healed.
* • The deep dermal burn will have some areas healed, and the deeper areas will have firmly adherent slough.
* • The full-thickness burn will have thick adherent slough, just beginning to separate at the edges.
* • This must be removed in order to obtain a surface which will heal spontaneously or will be suitable for grafting.

#### Closed Method:

An occlusive dressing is applied over the agent and is usually changed once or twice daily.  
 May be used from the beginning or may follow a period of exposure.  
 Dressings are used on burn wounds in the acute stage.   
 As the wounds are very sensitive to the external air, they become very painful when exposed due to exposure of fine nerve terminals.   
 Superficial burns and some hand burns feel more comfortable with dressings.

##### Dressing Technique:

* • The burn area is covered with a single layer of relatively non-greasy sofra-tulle gauze.
* • This is then covered with a sufficiently thick layer of gauze and wool to ensure absorption of all transudate.
* • The dressing is held in place with crepe bandage or tape.
* • The dressing should overlap normal skin sufficiently to avoid any accidental exposure of the burn by slipping of the bandage.

##### Advantages:

* • The wound is protected and the dressing prevents desiccation.
* • It absorbs most of the exudates.
* • Pain gets relieved to a greater extent.
* • Suitable method for use after eschar separates and is removed or excised, to prevent drying of the raw ulcer bed.
* • Dressings protect the grafted areas, and immobilize the grafts.
* • Dressings also conserve body temperature by reducing evaporative water loss from the wound surface.

##### Superficial dermal burns with blistering are usually dressed to:

* 1) Absorb exudate.
* 2) Prevent desiccation.
* 3) Provide pain relief.
* 4) Encourage epithelialisation and
* 5) Prevent infection.

### COMPLICATIONS OF BURNS

##### Early Complications:

1) Anaemia – caused by:

* Direct injury.
* Reduced RBC survival time.
* Oozing of blood from burned areas and Curling’s ulcer may lead to acute haematemesis.
* Primary or secondary BM depression caused by a large raw area and hypoproteinaemia.
* Surface bleeding from: Surgery; Slough excision; and Cutting of skin grafts

2) Electrolyte imbalance  
3) Infections – local sepsis; septicaemia  
4) Organ failure – renal failure due to acute tubular necrosis following shock  
5) Uraemia  
6) Curling`s ulcer – acute duodenal ulceration – and multiple gastric erosions

#### Late Complications:

1) Keloids  
2) Hypertrophic scars  
3) Lid ectropion   
4) Organ damage e.g., liver damage.  
5) Infection and chest complications e.g., bronchitis and B/pneumonia.  
6) Deformities/depigmentation/delayed healing/contractures.  
7) Squamous cell carcinoma (Marjolin’s ulcer)  
  
**Non-specific complications include:**1) Urinary tract infection from catheterisation.  
2) Deep vein thrombosis.  
3) Pulmonary embolism.

## Unit Four Content..

### Topic 2: FURUNCLE, CARBUNCLE AND HIDRADENITIS

### FURUNCLE, CARBUNCLE AND HIDRADENITIS

#### **INTRODUCTION**

* • Furuncles and carbuncles are cutaneous abscesses that begin in skin glands and hair follicles.
* • Furuncles are the most common surgical infections, but carbuncles are rare.
* • Furuncles can be multiple and recurrent (furunculosis).
* • Furunculosis usually occurs in young adults and is associated with hormonal changes resulting in impaired skin function.
* • The commonest organisms are staphylococci and anaerobic diphtheroids.
* • Hidradenitis suppurativa is a serious skin infection of the axillae or groin consisting of multiple abscesses of the apocrine sweat glands.
* • The condition often becomes chronic and disabling.

#### **PATHOGENESIS**

• Furuncles usually start in infected hair follicles, although some are caused by retained foreign bodies and other injuries.  
• Hair follicles normally contain bacteria.  
• If the pilosebaceous apparatus becomes occluded by skin disease or bacterial inflammation, the stage is set for development of a furuncle.  
• Because the base of the hair follicle may lie in subcutaneous tissue, the infection can spread as a cellulitis, or it can form a subcutaneous abscess.  
• If a furuncle results from confluent infection of hair follicles, a central core of skin may become necrotic and will slough when the abscess is drained.  
• Furuncles may take a phlegmonous form, i.e. extend into the subcutaneous tissue, forming a long, flat abscess.

#### **CLINICAL FINDINGS**

**Furuncles**itch and cause pain. The skin first becomes red and then turns white and necrotic over the top of the abscess. There is usually some surrounding erythema and induration. Regional nodes may become enlarged. Systemic symptoms are rare.  
**Carbuncles**usually start as furuncles, but the infection dissects through the dermis and subcutaneous tissue in a myriad          of connecting tunnels. Many of these small extensions open to the surface, giving the appearance of large furuncles with          many pustular openings.The affected area is swollen brawny and painful.The overlying skin is dusky red and exhibits                  characteristic sinuses which discharge small amounts of yellow pus.Urine for sugar should be tested in all cases. As                    carbuncles enlarge, the blood supply to the skin is destroyed and the central tissue becomes necrotic. Carbuncles on the          back of the neck are seen almost exclusively in diabetic patients. The patient is usually febrile and mildly toxic. This is a              serious problem that demands immediate surgical attention. Diabetes must be suspected and treated when a carbuncle          is found.

#### **DIFFERENTIAL DIAGNOSIS**

• When lesions are located near joints or over the tibia or when they are widely distributed, one must consider:

* • Gout.
* • Bursitis.
* • Synovitis.
* • Erythema nodosum.
* • Fungal infections.
* • Some benign or malignant skin tumours.
* • Inflamed (but not usually infected) sebaceous or epithelial inclusion cysts.

• Hidradenitis is differentiated from furunculosis by skin biopsy, which shows typical involvement of the apocrine sweat glands.  
• One suspects hidradenitis when abscesses are concentrated in the apocrine gland areas, i.e. the axillae, groin and perineum.  
• Carbuncles are rarely confused with any other condition.

#### **TREATMENT**

The classic therapy for furuncle is drainage, not antibiotics.  
 Invasive carbuncles, however, must be treated by excision and antibiotics.  
 Between these two extremes, the use of antibiotics depends on the location of the abscess and the extent of infection.  
 Patients with recurrent furunculosis may be diabetic or immune-deficient.  
 Frequent washing with soaps containing hexachlorophene or other disinfectants is advisable.  
 It may also be necessary to advise extensive laundering of all personal clothing and disinfection of the patient’s living quarters in order to reduce the reservoirs of bacteria.  
 Furunculosis associated with severe acne may benefit from tetracycline, 250mg orally once or twice daily.  
 When an abscess fails to resolve after a superficial incision, look for a small opening to a deeper and larger subcutaneous  abscess, i.e., a collar-button abscess.

##### Hidradenitis:

* Hidradenits is usually treated by drainage of the individual abscess followed by careful hygiene.
* The patient must avoid astringent antiperspirants and deodorants.
* Painting with mild disinfectants is sometimes helpful.
* Fungal infections should be searched for if healing after drainage does not occur promptly.
* If none of these measures are successful, the apocrine sweat-bearing skin must be excised and the deficit filled with a skin graft.

##### Carbuncles:

Carbuncles are often more extensive than the external appearance indicates.  
 Incision alone is almost always inadequate, and excision with electro-cautery is required.  
 Excision is continued until the many sinus tracts are removed – usually far beyond the cutaneous evidence of suppuration.  
 It is sometimes necessary to produce a large open wound.  
 This may appear to be drastic treatment, but it achieves rapid cure and prevents further spread.  
 The large wound usually contracts to a small scar and does not usually require skin grafting, because carbuncles tend to occur in loose skin on the back of the neck and on the buttocks, where contraction is the predominant form of repair.

#### **COMPLICATIONS**

1. All these infections may cause suppurative phlebitis when located near major veins. This is particularly important when the infection is located near the nose or eyes. Central venous thrombosis in the brain is a serious complication, and abscesses on the face usually must be treated with antibiotics as well as prompt incision and drainage.  
2. Hidradenitis may disable the patient but rarely has systemic manifestations.  
3. Carbuncles on the back of the neck may lead to epidural abscess and meningitis.

### CELLULITIS

#### **DEFINITION**

Cellulitis is a spreading inflammation of connective tissues as a result of infection. The term usually refers to subcutaneous infection.

#### **CAUSATIVE ORGANISMS**

The common organism is the beta-haemolytic streptococcus which usually gains entrance through a scratch or prick. Staphylococcus aureus is also usually implicated. Clostridium perfringens is also a causative organism.

#### **PATHOGENESIS**

• Cellulitis is usually located at the point of injury and subsequent tissue infection. The microscopic picture is one of severe inflammation of the dermal and subcutaneous tissues. There is no gross suppuration except perhaps at the portal of entry. In addition to the cardinal signs of inflammation, there is poor localisation.  
• Spreading infection is typical of organisms such as:

* 1. β-haemolytic streptococci.
* 2. Staphylococci and
* 3. Clostridium perfringens.

• Tissue destruction and ulceration may follow, caused by release of streptokinase, hyaluronidase, and other proteases. The spreading invasiveness of Streptococcus pyogenes is due to its ability to produce hyaluronidase which dissolves the intercellular matrix, and a fibrinolysin called streptokinase which is able to destroy the fibrin inflammatory barrier to bacterial spread.  
• Systemic signs (toxaemia) are common and include chills, fever and rigors. These follow release of exotoxins and cytokines but blood cultures are often negative.   
• Cellulitis is frequently accompanied by lymphangitis and lymphadenitis, painful red streaks in affected lymphatic channels and the regional glands becoming enlarged and tender. Lymphangitis is often accompanied by painful lymph node groups in the related drainage area.  
• There is sometimes associated septicaemia, which originates either from a septic thrombophlebitis in the affected area or from spread of bacteria from the lymphatics to the blood stream by way of the thoracic duct.

#### **CLINICAL FEATURES**

1. Cellulitis usually appears on an extremity as a brawny red or reddish-brown area of oedematous skin  
2. It advances rapidly from its starting point, and the advancing edge may be vague or sharply defined (e.g., in erysipelas)  
3. A surgical wound, puncture, skin ulcer, or patch of dermatitis is usually identifiable as a portal of entry  
4. The disease often occurs in susceptible patients, e.g. alcoholics with post-phlebitic leg ulcers  
5. A moderate or high fever is almost always present  
6. Lymphangitis arising from cellulitis produces red, warm, tender streaks 3 or 4 mm wide leading from the infection along lymphatic vessels to the regional lymph nodes  
7. There is usually no suppuration  
8. Cutaneous gangrene with ulceration occurs in advanced cases.  
  
Summary of clinical features:  
• Dusky red skin around the site of inoculation  
• Local swelling  
• Raised local temperature  
• Severe pain and tenderness  
• Vesicles may appear  
• Fever   
• Lymphangitis   
• Cutaneous gangrene in advanced cases.

#### **INVESTIGATIONS**

1. Blood culture is sometimes positive.
2. Fluid exudate for culture and sensitivity
3. Full haemogram - leukocytosis

#### **DIFFERENTIAL DIAGNOSIS**

1. Thrombophlebitis is often difficult to differentiate from cellulitis, but phlebitic swelling is usually greater, and tenderness may localize over a vein. Fever is usually greater with cellulitis, and pulmonary embolization does not occur in cellulitis.  
2. Contact allergy may mimic cellulitis in its early phase, but dense non-haemorrhagic vesiculation soon discloses the allergic cause.  
3. Chemical inflammation due to drug injection may also mimic streptococcal cellulitis.  
4. The appearance of haemorrhagic bullae and skin necrosis suggests necrotizing fasciitis.

#### **TREATMENT**

1) Hot packs actually elevate subcutaneous temperature, and if regional blood supply is normal, they can raise local oxygen tension (local heat by short-wave diathermy).  
2) Rest – immobilisation of the affected part may necessitate bed rest.  
3) Elevation  
4) Antibiotics – Penicillin. Start with injectable drugs e.g. crystalline penicillin and gentamicin; could use flucloxacillin, or a cephalosporin.  
5) Incision & drainage  
6) Analgesia

#### 

##### NB: If a clear response has not occurred in 12-24 hours, one should suspect an abscess or consider the possibility that the causative agent is a staphylococcus or other resistant organism. The patient must be examined one or more times daily to detect a hidden abscess masquerading within or under cellulitis.

#### **COMPLICATIONS**

* 1. Lymphangitis
* 2. Lymphadenitis
* 3. Septicaemia
* 4. Osteomyelitis
* 5. Gangrene and ulceration

**Assignment Activity**

Write a brief case summary of a patient who has been in the surgical ward with cellulitis.

* • Presenting complaints and progression up to date
* • Investigations done
* • Drug treatment
* • Supportive treatment
* • Any complications?

### PYOMYOSITIS

#### **DEFINITION**

Pyomyositis is an acute bacterial infection of skeletal muscles that results in localized abscess formation.

It usually affects gluteal, quadriceps or calf-muscles and occurs mostly in hot climates and after intense muscular activity.

#### **PREDISPOSING FACTORS**

Skeletal muscle usually enjoy an immunity to pyogenic infections. Since normal muscle is very difficult to infect, some predisposing event or condition is suspected. The factors which cause a break in this immunity may be:

1. In the Patient:

* • Chronic ill health and debility.
* • Vitamin C deficiency.
* • Septic spots – very common in the feet and legs of a largely shoeless population and provide a ready entry for the staphylococcus.
* • Race.

2. In the Muscle:

* • Haematoma – after injury.
* • Toxic degeneration of Zenker’s type
* • Vascular change

3. In the Environment:

* • Filariasis – the death of these and similar parasites in muscles may provide a suitable focus of necrosis for colonisation by staphylococcus.
* • Virus – Coxsackie virus can produce hyaline degeneration in skeletal muscle.

#### **AETIOLOGY**

Causative organisms include:

* 1. Staphylococcus aureus - > 90% of the patients
* 2. Staphylococcus albus
* 3. Streptococci
* 4. Escherichia coli.

#### **PATHOGENESIS**

Neither the pathogenesis nor the source of the bacteria is entirely clear. The usual portal for entry of bacteria is a local injury, but spread via the bloodstream into a fatigued or injured muscle has also been postulated.

#### **CLINICAL FEATURES**

##### The most common form, usually due to Staphylococcus aureus, begins insidiously with

* • Localized pain progressing to
* • Fever
* • Induration, and
* • Abscess formation.
* • An acute variety, caused usually by streptococci, may progress in hours or days and resembles infection with non-gas forming clostridial organisms.
* • Sex – more men than women.
* • Age – peak is during the 3rd and 4th decades, although it is often seen in children.

##### Site:

Pyomyositis can occur in any voluntary muscle but has a predilection for the heavy powerful muscles of the trunk and root of the limbs, such as:

* 1. Trapezius.
* 2. Latissimus dorsi.
* 3. Biceps.
* 4. Brachialis.
* 5. Sacrospinalis.
* 6. External and internal oblique.
* 7. Quadriceps.
* 8. Hamstring.
* 9. Gastrocnemius.
* 10. Soleus.

##### Pyomyositis typically demonstrates the progress of inflammation as follows:

1. The Invasive Stage:

* • The illness may start suddenly with pyrexia and cramp-like pains in the muscle which on palpation feels tender and indurated. The condition may resolve or progress to suppuration.

2. The Suppurative Stage:

* • Presents with abscess formation and the classical signs of inflammation.
* • These may, however, be modified by the anatomical position of the muscle.
* • NB: redness as a sign of inflammation is replaced by shininess in dark skinned people.

3. The Late Stage:

* • Over a period of 2-3 months the signs of inflammation subside, the patient becomes bed-ridden and the muscle is completely replaced by a large bag of pus.

##### Clinical Types:

##### 1) Fulminating:

The patient is admitted with a high temperature in a semi-comatose condition; resents handling and especially resents pressure on particular areas of muscles.

##### 2) Pyrexia with Many Abscesses:

These patients are ill and abscesses appear in one muscle after another with much pain. Eventually most of them form pus but some resolve.

##### 3) Pyrexia with Minimal Abscesses:

These patients are not ill and rarely more than 3 muscles are affected. If seen early and treated, resolution may take place without drainage.

##### 4) Solitary Abscess:

This may simulate a traumatic muscle haematoma. Enlargement of the regional lymph glands is not normally a feature.

#### **DIFFERENTIAL DIAGNOSIS**

##### Right Upper Quadrant:

* • Hepatoma.
* • Kidney swelling.
* • Amoebic abscess.

##### Left Upper Quadrant:

* • Splenic abscess.
* • Perinephric abscess.
* • Subphrenic abscess.

##### Right Lower Quadrant:

* • Appendix abscess.
* • Suppuration of iliac glands.
* • Psoas abscess.

##### Inguinal Region:

* • Lymphosarcoma.
* • Strangulated inguinal hernia.

##### Calf:

* • DVT.
* • Sickle cell crisis with acute infarction of bone.

##### Thigh:

* • Acute osteomyelitis
* • Osteosarcoma
* • Fibro-sarcoma
* • Pathological fracture.

#### **INVESTIGATIONS**

1. Ultrasound.  
2. CT scan.  
3. Aspiration – pus has often a pink colour due to the digestion of muscle, haemoglobin, and several authorities have commented on the fact that it does not smell.  
4. Haemoglobin estimation.  
5. X-ray of the affected part

#### **MANAGEMENT**

Admit to hospital

##### The Invasive Stage:

* • Rest in bed.
* • Tetracycline/cephalosporin (Duracef) + lincomycin
* • Avoid intramuscular injections.
* • Antibiotics effective against staphylococci and streptococci are given empirically until culture and sensitivity test results are reported.
* • Prompt treatment may prevent abscess formation.

##### Suppurative Stage:

* • Surgical drainage is usually required in the acute form (I & D under G/A).
* • Delays in surgery have led to loss of limb or even to death due to sepsis.

##### Late Stage:

* • Operation contraindicated until the anaemia – often profound, is corrected by transfusion.
* • I & D + antibiotics – 2nd place.
* • Pyrexia and rigors following I&D indicate the formation of new abscesses which should be looked for and treated without delay.

#### **COMPLICATIONS**

1. Severe anaemia  
2. Septicaemia  
3. Multiple abscesses  
4. Death – this is unusual except in the fulminant type.

### NECTROTIZING FASCIITIS

#### **DEFINITION**

• Necrotising fasciitis is an invasive infection of fascia.  
• Is usually due to multiple pathogens.  
• Is characterized by infectious thrombosis of vessels passing between the skin and deep circulation, producing skin necrosis superficially resembling ischemic vascular or clostridial gangrene.

#### **BACTERIOLOGY**

##### The infection usually involves a mixed microbial flora, often including:

• Microaerophilic streptococci  
• Staphylococci  
• Gram-negative bacteria  
• Anaerobes, especially peptococci, peptostreptococci, and Bacteroides.  
• Clostridia may be present, and the disease may clinically resemble clostridial cellulitis.

#### **CLINICAL FEATURES**

• Fasciitis usually begins in a localized area such as:

* o Puncture wound.
* o Leg ulcer, or
* o Surgical wound.

• The infection spreads along the relatively ischemic fascial planes, meanwhile causing the penetrating vessels to thrombose.  
• The skin is thus devascularized.  
• Externally, haemorrhagic bullae are usually the first sign of skin death.  
• The fascial necrosis is usually wider than the skin appearance indicates.  
• The bullae and skin necrosis are surrounded by oedema and inflammation.  
• Crepitus is occasionally present, and the skin may be anaesthetic.  
• The patient often seems alert and unconcerned but appears toxic and has fever and tachycardia.

#### **INVESTIGATIONS**

1. Blood for haemoglobin level  
2. Blood glucose levels  
3. Blood urea and electrolyte concentrations  
4. Aspirates, swabs and excised tissue for Gram-stained smears and bacteriologic cultures are helpful for diagnosis and treatment.  
5. Blood for culture  
6. At surgery, the finding of oedematous, dull-gray, and necrotic fascia and subcutaneous tissue confirms the diagnosis. Thrombi in penetrating vessels are often visible.  
7. Intra-operative frozen-section biopsy examination showing dense inflammation, arteritis, or obliterative thrombosis of arteries and veins may confirm the diagnosis.

#### **DIFFERENTIAL DIAGNOSIS**

• Cellulitis  
• Localized abscecess  
• Phlebitis  
• Clostridial myositis   
• Vascular gangrene   
• Meleney’s gangrene (progressive bacterial cutaneous gangrene) - advances slowly. Fasciitis advances rapidly.

#### **MANAGEMENT**

##### Treatment consists of:

* • Surgical debridement.
* • Antibiotics, and
* • Support of the local and general circulation.

##### Surgical Treatment:

* • Debridement – under general or spinal anaesthesia – must be thorough, with removal of all avascular skin and fascia.
* • This may require extensive denudation.
* • Where necrotic facia undermines viable skin, longitudinal skin incisions (not too close together) aid debridement of facia without sacrificing excessive amounts of skin.
* • It is often difficult to distinguish necrotic from oedematous tissue.
* • Careful daily inspections of the wound will demonstrate whether repeated debridement will be necessary.
* • If possible, all obviously necrotic tissue should be removed the first time.
* • It is essential to avoid confusing fasciitis with deep gangrene.
* • It is a tragic error to amputate an extremity when removal of dead skin and fascia will suffice.
* • A functional extremity can usually be salvaged in fasciitis; if not, amputation can be safely performed later.
* • When viability of the remaining tissue is assured and the infection has been controlled, the resulting defect in the skin and deep fascia, which is frequently very large, may require skin grafting.

##### Antibiotics:

* • Benzylpenicillin, high-dose (20-40 million units/day) intravenously, is begun as soon as material has been taken for smear and culture.
* • Metronidazole intravenous infusion 500mg 8-hourly to cater for anaerobes
* • An aminoglycoside (e.g., gentamicin, 5mg/kg/day; amikacin, 15mg/kg/day) should be added to eradicate Gram-negative bacteria that are so often seen in this disease.
* • Antibiotic regime can be changed if indicated by reports of antibiotic sensitivity.

##### Circulatory Support:

* • Blood volume must be maintained.
* • Debridement often leaves a large raw surface that may bleed extensively.
* • Since tissue oxygenation is critical, early transfusion with fresh blood is a rational procedure.
* • Diabetes mellitus, if present, must be treated appropriately.

### Soft tissue injuries: Surgical aspects of injury and repair

#### SURGICAL ASPECTS OF INJURY AND REPAIR

#### WOUNDS

A wound may be defined as disruption of the normal continuity of bodily structures due to trauma, which may be penetrating or non-penetrating.

##### Local Response to injury:

The local result of an injury is a wound. Healing depends upon the severity and extent of the wound. A clean-cut incision will heal with minimal scarring (by first intention) provided that certain conditions are met:

* 1) There is minimal damage to adjacent tissue
* 2) Loss of tissue is minimal
* 3) The wound is not contaminated by foreign material
* 4) Bleeding is controlled
* 5) Infection is prevented
* 6) The edges of the wound are carefully apposed without tension

##### Principles of wound healing

Wound healing is a mechanism by which the body attempts to restore the integrity of the injured part.

##### Normal wound healing

Normal wound healing can be divided into three phases according to the development of tensile strength.

**Phase 1** (Inflammatory, preparative or exudate phase; 2-3 days).

* • Following injury, the space between the edges of the wound quickly fills with blood clot and the wound is sealed with fibrin.
* • This phase is characterized by an inflammatory response to injury, during which capillary permeability increases and a protein-rich exudate accumulates. This occurs within a few hours after injury, and the exudate quickly forms an impermeable coagulum.
* • Inflammatory cells (leucocytes and macrophages) invade the wound. Macrophages are activated to release factors which stimulate the growth of fibroblasts and blood vessels. Macrophages remove devitalised tissue and microorganisms.
* • At the same time there is a rapid increase in chondroitin sulphate in the wound which forms the ground substance.

**Phase 2** (Reparative or proliferative phase; 3 days -3 weeks):

* • This phase consists mainly of the production of collagen and ground substance by fibroblast activity, the growth of new blood vessels and capillary loops (angioneogenesis), and the re-epithelialization of the wound surface.
* • New capillaries sprout from the sides of existing ones, and fibroblasts appear and align themselves to the capillaries.
* • The wound tissue formed in the early part of this phase is called granulation tissue; this becomes vascular, bleeds easily but affords some protection against bacterial invasion.
* • Fine fibrils appear in the intercellular space and aggregate to form collagen fibres. Increase in collagen contributes to an increase in tensile strength of the wound. The collagen is at first deposited randomly and is type III collagen.
* • At the same time epithelialisation takes place.

**Phase 3** (Remodelling or contraction or maturation phase; 3 -12 weeks, up to 6 months):

* • The remodelling phase is characterized by maturation of collagen, type I replacing type III until a ratio of 4:1 is reached. The hyperplastic wound tissue begins to be reabsorbed.
* • Collagen fibres become larger, longer and intertwined.
* • There is realignment of collagen fibres along the lines of tension, decreased wound vascularity and wound contraction due to fibroblast and myofibroblast activity.
* • The red scar of the wound is replaced by a silver, flat hairline one.
* • Tensile strength continues to increase and attains normal strength after about 3 months.

##### Classification of wound closure and healing

##### Wounds may heal by:

* 1) Primary intention
* 2) Secondary intention
* 3) Tertiary (delayed primary) intention

##### Primary intention:

Wounds may heal by primary intention if the edges are closely approximated or apposed. This type of healing is also known as healing by first intention. Because of minimal surrounding tissue trauma, it causes the least inflammation and leaves the best scar.

##### Secondary intention:

Healing by secondary intention occurs if the wound is left open and allowed to heal by granulation, contraction and epithelialization. The restoration of epidermal continuity takes much longer, and usually results in delayed healing, excessive fibrosis and an ugly scar.

##### Tertiary / Delayed primary intention:

Healing by delayed primary intention occurs when the wound edges are not apposed immediately, and the wound is left open initially. This may be the case in contaminated or untidy wounds. Later, when healing conditions are favourable, often when the inflammatory and proliferative phases are well advanced, closure of the wound is carried out by apposing its edges. It results in a less than satisfactory scar than after healing by primary intention.

#### FACTORS INFLUENCING WOUND HEALING

##### 1. Factors that Decrease Collagen Synthesis:

* • Starvation (protein depletion)
* • Steroids
* • Infection
* • Associated injuries
* • Hypoxia and hypovolemia
* • Radiation injury
* • Uraemia
* • Diabetes
* • Drugs:
* Dactinomycin
* Fluorouracil
* Methotrexate
* • Advanced age.

##### 2. Operative Factors:

* • Tissue injury.
* • Poor blood supply – damage to an artery or suture of the wound under excessive tension.
* • Poor apposition of surrounding tissues:
* Inaccurate anastomosis.
* Unreduced fracture.
* Unclosed dead space.

##### 3. Factors that Increase Collagen Lysis:

* • Starvation
* • Severe trauma
* • Inflammation
* • Infection
* • Steroids.

##### 4. Local factors:

* • Site of the wound and its orientation relative to tissue tension lines
* • Structures involved
* • Mechanism of wounding – incision; crush; crush with avulsion
* • Inaccurate skin apposition
* • Loss of tissue - a large tissue defect leaving a large gap to bridge
* • Presence of dead or damaged tissue
* • Presence of foreign bodies (contamination) or blood clot in the wound
* • Impaired blood supply - slows healing, inhibits fibroblasts and weakens the defence against infection.
* • Local infection
* • Increased mechanical stress / pressure on a wound e.g. abdominal distension after abdominal surgery.

##### 5. General/ systemic factors

* • Protein deficiency – delayed repair due to lack of collagen in the wound.
* • Lack of vitamin C – leads to defective formation and maintenance of collagen
* • Zinc deficiency – retards healing. Zinc is a co-factor for important enzymes involved in healing.
* • Anaemia – delay occurs in association with hypoproteinaemia.
* • Age – the young heal better than the elderly
* • Presence of other disease – diabetes mellitus, uraemia, jaundice, Cushing`s disease and disseminated neoplasia
* • Immune deficiencies (e.g. chemotherapy, AIDS)
* • Smoking

#### CLASSIFICATION OF WOUNDS

* 1. Tidy Wounds
* 2. Untidy wounds
* 3. Bruise, contusion and haematoma.
* 4. Puncture wounds
* 5. Bites
* 6. Abrasions and friction burns
* 7. Laceration
* 8. Degloving injuries
* 9. Crush
* 10. Incised wounds or cuts

#### TIDY WOUNDS

• Are inflicted by sharp instruments and contain no devitalised tissue.  
• Such wounds can be closed primarily with the expectation of quiet primary healing.   
• Examples are: Surgical incisions, cuts from glass and knife wounds.  
• Skin wounds will usually be single and clean cut.  
• Tendons, arteries and nerves will commonly be injured in tidy wounds, but primary repair of these structures is usually possible.  
• Fractures are uncommon in tidy wounds.

#### UNTIDY WOUNDS

• Usually result from: Crushing, tearing, avulsion or burns. They are generally contaminated and contain devitalised tissue. Skin wounds will often be multiple and irregular, and often there is tissue loss.   
• Tendons, arteries and nerves may be exposed, and might be injured in continuity, but will usually not be divided.  
• Fractures are common and may be multi-fragmentary.  
• Such wounds must not be closed primarily; if they are closed wound healing is unlikely to occur without complications, such as: - Wound dehiscence, infection, delayed healing, and gas gangrene.   
• The correct management of untidy wounds is excision of all devitalised tissue to create a tidy wound. Once the untidy wound has been converted to a tidy wound by the process of wound excision it can be safely closed (or allowed to heal by second intention).

#### BRUISE OR ECCHYMOSIS, CONTUSION & HAEMATOMA

• These result from a blunt force disrupting superficial capillaries, the overlying skin remaining intact. There is bleeding into the tissues and visible discoloration. Where the amount of bleeding is sufficient to create a localised collection in the tissues, this is described as a haematoma. Initially this will be fluid, but it will clot within minutes or hours. Later, after a few days, the haematoma will again liquefy. There is a danger of secondary infection.   
• Bruises require no specific management, and no treatment is of proven value. The patient should be advised that the time required for bruising to clear is extremely variable and in some individuals, in some sites, discoloration may persist for months.  
• A haematoma should be evacuated by open surgery if large or causing pressure effects (such as intracranially), or aspirated by a large-bore needle if smaller or in a cosmetically sensitive site. It may be necessary to await liquefaction (which may take several days) and to perform repeated aspirations, with appropriate antiseptic precautions. A haematoma will generally reabsorb without scarring, but on occasions there may be persistent tethering of the skin.

#### PUNCTURE WOUNDS

A Puncture Wound is an open injury caused by a pointed object that pierces or penetrates the skin, and through which foreign material and organisms are likely to be carried deeply into the underlying tissues. Common causes are standing on a nail or other sharp object. There may be little to see on the surface. Radiological examination may detect metal fragments or glass.

##### Management of puncture wound:

• Wound irrigation  
• Antibiotic treatment  
• Tetanus prophylaxis  
• Large foreign bodies should be removed, but small particles may be surprisingly difficult to find without a destructive dissection and are better left undisturbed. A metal detector may be helpful during exploration.  
• The danger of puncture injuries is that they may give rise to an abscess deep within the tissues and on such occasions drainage may be required. It is likely that it will take 24-48 hours for an abscess to declare itself and arrangement should be made for review.  
• Needle-stick injuries are a particular cause for concern. Discarded needles from drug abuse are becoming increasingly a cause of accidental injury in the community.

#### BITES

• Bites are a particular type of puncture wound associated with a high incidence of infection, presumably from mouth organisms.  
• Animal bites may result in small, sharp, incised wounds or in severe tissue crushing as in horse bites.  
• Dog bites may also be associated with a degree of tissue avulsion, and often there are puncture wounds from upper and lower teeth and contusion of the intervening tissue.  
• Human bites may be associated with avulsion of pieces of the nose or ear. An accidental type of ‘’bite’’ injury may result from an attacker striking the victim’s incisor teeth with the knuckles. This injury presents with a puncture wound over the metacarpophalangeal (MP) joints. It is important to recognize the nature of the injury as the history is often less than truthful.

##### Management:

• Open surgical exploration and excision of skin margins.  
• Thorough cleaning of the wound and irrigation of any involved joint.  
• Antibiotic therapy.  
• Tetanus toxoid injection

#### ABRASIONS & FRICTION BURNS

An abrasion or graze is a shearing injury in which the surface is rubbed off.  
 Most are superficial and will heal by epithelialisation, but some may result in full-thickness skin loss.  
 Abrasions may be dirt-ingrained and if this dirt is not removed at the time of primary treatment permanent tattooing of the skin will result.  
 Treatment is by cleaning with a scrubbing brush, gently brushing along the grain of the scratch lines.  
 A friction burn is similar, but there will be an element of thermal damage as well as abrasion.  
 Treatment is as for other types of burn.

#### LACERATION

• A laceration is a cut produced as a result blunt forces that tear, shear or crush skin and soft tissues.   
• The wound edges are irregular and often abraded or contused, as are the surrounding tissues. They are characterized by jagged edges and possible bruising or bleeding.  
• The clinical examination must therefore assess the integrity of all structures in the area:

* Arteries.
* Nerves.
* Muscles.
* Tendons &
* Ligaments.

• As a general rule, the damage to nerves and tendons is generally greater than suspected pre-operatively.  
• Once all of the damaged layers have been identified, each structure must be repaired individually by the appropriate technique.  
• Haemostasis must be ensured throughout the exploration.  
• There are precise suture placement techniques for nerves, tendons and blood vessels.  
• Muscles can be apposed in layers by mattress sutures and fascia, and subcutaneous fat should be opposed by interrupted absorbable sutures to allow a firm platform for skin closure in such a way that the skin margins do not invert.  
• It is an important principle to prevent collections of blood or other fluids in a wound as they separate tissues and act as a nidus for infection.  
• A corrugated or suction drain may be required.  
• All patients sustaining open wounds should have prophylaxis against tetanus, and antibiotics should be administered where there is significant contamination, commencing generally with a broad-spectrum antibiotic active against Gram-positive organisms.

#### INCISED WOUNDS OR CUTS

These are produced by sharp edges, such as knives or glass shards, and have characteristically clean edges with clear margins. The greatest dimension of an incised wound is its length.

• The ideal form of management of an incised wound is:

1. Surgical inspection.
2. Cleaning &
3. Closure.

• The wound must be thoroughly inspected to ensure that there is no damage to deep structures or, where encountered, these must be repaired.  
• In a simple incised laceration, a method of wound closure should be selected which is appropriate for the needs of function and appearance.  
• On the face, fine (5 / 0 or 6 / 0) nylon sutures should be placed near to the wound margins, to be removed on the fifth day.  
• Alternatively, subcuticular (intradermal) sutures avoid suture marks and can be left in place longer (2 weeks or more).  
• An alternative to suturing is the application of adhesive tape strips.  
• It is necessary to apply these with the same care as sutures ensuring that all bleeding has stopped and that the skin is dry.  
• For limb and trunk wounds, a heavier suture is required but it is rarely necessary to use more than 4 / 0 or 3 / 0 sutures for skin closure.  
• Monofilament sutures, such as nylon, leave less obvious suture marks than braided material such as silk, but other factors also contribute to stitch marks, such as: 

* Inflammation (from infection or reaction to organic material such as silk),
* Wound tension and
* Late removal.

#### DEGLOVING INJURIES

• These result from shearing forces that cause parallel tissue planes to move against each other. Such injuries occur when hands or limbs are trapped in moving machinery, such as in rollers, producing a degloving injury.  
• Degloving is caused by shearing forces that separate tissue planes, rupturing their vascular interconnections and causing tissue ischemia.   
• Degloving soft tissue injuries are a form of avulsion of soft tissue, in which an extensive portion of skin and subcutaneous tissue detaches from the underlying fascia and muscles. This most frequently occurs between the subcutaneous fat and deep fascia. Degloving injuries can be open or closed.  
• Similar injuries occur as a result of run-over road traffic accident injuries where friction from rubber tyres will avulse skin and subcutaneous tissue from the underlying deep fascia.  
• The history should raise the examiner’s suspicion and it is often possible to pinch the skin and lift it upwards revealing its detachment from the normal anchorage.  
• The danger of degloving or avulsion injuries is that there is devascularisation of tissue and skin necrosis may become slowly apparent in the following few days.  
• Even tissue that initially demonstrates venous bleeding may subsequently undergo necrosis if the circulation is insufficient.

##### Management:

• Identify the area of devitalised skin.  
• Carefully assess the extent of the devitalized tissue and the blood supply to the affected tissues  
• Remove the skin.  
• Defat the skin.  
• Reapply it as a full-thickness skin graft.  
• Avulsion injuries of hands or feet may require immediate flap cover using a one-stage microvascular tissue transfer of skin and/or muscle.

#### CRUSH INJURIES

• Crush injuries are a further variant of blunt injury and are often accompanied by degloving and compartment syndrome.  
• Injury to tissues within a closed fascial compartment leads to bleeding, exudate and swelling of these tissues, and increased interstitial pressure. As the interstitial pressure rises above capillary perfusion pressure the blood supply to the viable tissues is reduced, resulting in further ischemic tissue injury and swelling. This cycle causes a worsening compartment syndrome with muscle ischemia and nerve ischemia progressing to muscle necrosis, skin necrosis and limb loss.  
• This process can be arrested by early recognition and decompression of the affected compartment(s) by fasciotomy.  
• The most reliable clinical sign of compartment syndrome is pain worsened by passive stretching of affected muscles.  
• Loss of peripheral pulses is not a sign of compartment syndrome, but indicates major vessel damage.  
• Where compartment syndrome is suspected or confirmed fasciotomy is advised. Longitudinal incisions are made in the deep fascia and it may also be necessary to make extensive longitudinal releases in the skin.  
• It is important to release the fascia over each individual compartment in a limb.

## Unit Five Content..

### Topic 1: Obstruction of the Airway

### OBSTRUCTION OF THE AIRWAY

##### Objectives

• State the causes   
• Describe the pathology   
• Outline the clinical features  
• state the investigations   
• State the management

#### CAUSES

##### 1. Intraluminal:

* • Inhaled foreign body.
* • Neoplasm.

##### 2. Intramural:

* • Congenital stenosis.
* • Fibrous stricture (post-intubation or tuberculosis)

##### 3. Extramural:

* • Neoplasm (thyroid cancer, 2o deposits).
* • Aortic arch aneurysm.

#### PATHOLOGY

Inhaled foreign bodies are a common occurrence in small children. Surprisingly large objects can be inhaled and become lodged in the wider calibre and more vertically placed right main bronchus. If not removed, an obstructive emphysema may result but, if there is total occlusion of the bronchus, the air distally will be absorbed and the secretions may become infected.

#### CLINICAL FEATURES

##### In upper airway:

* 1. Choking which may be persistent or come to pass
* 2. Cyanosis

##### There are three possible presentations of lower airway obstruction:

* 1. Asymptomatic.
* 2. Wheezing (from airway narrowing) with a persistent cough and signs of obstructive emphysema.
* 3. Pyrexia with a productive cough from pulmonary suppuration.

#### INVESTIGATIONS

1. Chest x-ray

* Is vital as the object may be radio-opaque. Often it is not or is obscured by the cardiac shadow or the inflammatory response.

2. Bronchoscopy

* May be both diagnostic and therapeutic.

#### MANAGEMENT

##### 1. Upper airway obstruction

* Heimlich manoeuvre: Give 5 back blows between the shoulders using the heel of your hand. If the foreign body does not dislodge, do abdominal thrust

##### 2. Failed upper Heimlich manoeuvre and lower airway obstruction

* Remove foreign body by bronchoscopy
* Bronchotomy: If bronchoscopy fails
* If the object has caused chronic lung damage it may be necessary to remove the affected lobe.

#### EMPYEMA THORACIS (Pyothorax)

##### DEFINITION

Empyema is a collection of pus within the pleural cavity.

##### AETIOLOGY

• Underlying lung diseases such as bronchiectasis, pneumonia, carcinoma of the lungs and rarely tuberculosis  
• Penetrating wound on the chest wall or following a transthoracic operation  
• Perforation of the oesophagus  
• Trans-diaphragmatic infection from sub-phrenic abscess  
• Haematogenous from distant focus  
• Repeated aspiration of pleural effusion  
• Secondary infection of a clotted haemothorax  
 Common causative organisms include:  
1. Pneumococcus  
2. Streptococcus  
3. Staphylococcus

##### PATHOLOGY

• Empyema commonly follows a pneumonia due to infection of a reactive parapneumonic effusion.  
• The infected fluid is initially thin and may be completely evacuated by a low intercostal drain.  
• The empyema quickly becomes thick and loculated due to fibrin deposition. This stage requires formal surgical drainage.  
• The pus collection is typically placed posteriorly towards the base of the pleural cavity and causes a D-shaped shadow on the lateral chest X-ray.

##### CLINICAL FEATURES

1. Chest pain (pleuritic pain).  
2. Shortness of breath – respirations may be grunting.  
3. Fever – temperatures may reach 40.6°C  
4. Weakness.  
5. Haemoptysis.  
6. Weight loss  
7. Cyanosis.  
8. Chronic ill health.  
9. Finger clubbing  
10. Anaemia  
11. Physical signs of pleural effusion are common.

##### INVESTIGATIONS

1) Full haemogram: reveals leukocytosis  
2) Chest X-ray: demonstrates an effusion and there may evidence of underlying lung disease  
3) Bronchoscopy: it is vital in determining the primary pathology  
4) Aspiration of the chest: confirms diagnosis and identifies the causative organism through microscopy culture & sensitivity

##### MANAGEMENT

• Repeated aspiration with antibiotic therapy given both systemically and into the pleural cavity (in early acute cases)  
• If above fails: Drainage is done by means of excision of a segment of rib overlying the lowest part of the empyema, an intercostal tube is inserted and suctioning and curetting the cavity clean is done.   
• In more chronic cases: Decortication (excision of the fibrous wall of empyema cavity) is done through open thoracotomy.

##### COMPLICATIONS

1. Empyema necessitatis (invasion of the chest wall).  
2. Bronchopleural fistula.  
3. Pericardial extension.  
4. Mediastinal abscess.  
5. Osteomyelitis of the ribs.  
6. Septicaemia.  
7. Chronicity.  
8. Metastatic abscesses, particularly to the brain –unusual when antibiotic coverage is adequate.  
9. Amyloid deposition, particularly in the liver and kidneys – 2o to prolonged suppuration.

### Topic 2: CHEST INJURIES

### CHEST INJURIES

#### INTRODUCTION

Ventilation of the lungs depends on a patent airway and pulmonary alveoli, a rigid rib bony skeleton of the thorax, and integrity of nerves and muscles that control the movement of the ribs and the diaphragm. Traumatic disruption of the chest wall is likely to be lethal unless treatment is instituted rapidly. Chest injuries commonly involve rib fractures, injuries to the pleura and lung parenchyma.

##### Dangerous complications of chest injuries include:

* Flail chest: paradoxical breathing
* Pneumothorax
* Haemothorax
* Penetrating lung injury
* Cardiac tamponade due to laceration of the heart
* Damage to large blood vessel

### FRACTURES OF THE RIBS

Mostly caused by direct blow on the chest  
 The most commonly affected are the 7th, 8th and 9th ribs in which fractures occur on the region of mid axillary line

#### CLINICAL FEATURES

Pain in the chest overlying the fracture which is aggravated by breathing or movement  
 Shortness of breath  
 Tenderness

#### INVESTIGATIONS

1. CHEST X-RAY

* Confirms the fracture/s
* Identifies underlying lung damage or haemorrhage

2. BONE SCAN

* More sensitive at detecting fractures especially pathological fractures where it reveals metastatic deposits

**TREATMENT**  
• Pain relief by:

* Analgesics esp. NSAIDs
* Injection of local anaesthetic in the paravertebral region to block the intercostal nerves or by thoracic epidural block

• Vigorous physiotherapy encourage deep breathing  
• Strapping of the chest- but discouraged since it inhibits thoracic movement and encourage pulmonary collapse

### FLAIL CHEST

#### DEFINITION

Flail chest is a life-threatening surgical condition that occurs when a segment of the rib cage breaks due to trauma and becomes detached from the rest of the chest wall. It occurs when multiple adjacent ribs are fractured in multiple places, separating a segment, so a part of the chest wall moves independently. Flail chest occurs when three or more adjacent ribs are fractured in at least two locations; when several adjacent ribs are fractured in two places either on one side of the chest (segmental) or either side of the sternum.

#### PATHOLOGY

The flail segment moves in opposite direction to the rest of the chest wall; it moves inwards during inspiration while the rest of the chest is moving out, and vice versa. This is called paradoxical breathing. Flail chest is usually accompanied by pulmonary contusion, a bruise of the lung tissue. Hypoxia is caused by restricted chest wall movement and underlying lung contusion.

#### CLINICAL FEATURES

##### Symptoms

1. History of blunt chest trauma
2. Severe chest pain
3. Difficulty in breathing
4. Uneven chest movement when breathing

##### Signs

1. PARADOXICAL BREATHING

* On inspiration, the flail part of the chest becomes indrawn by the negative intrathoracic pressure
* On expiration, the flail part of the chest is pushed out whilst the rest of the bony cage becomes contracted

2. Dyspnoea with resultant:

* Hypoxia
* Cyanosis
* Hypercapnoea
* Acidosis

2. Cardiovascular embarrassment: 

* Patient gets rapidly and progressively shocked

3. Tenderness over the fracture sites on the chest

#### INVESTIGATIONS

1. Chest X-ray

* Will show fractured ribs, lung collapse on the flail side, and hyperventilated opposite lung.

2. Arterial blood gas analysis- for severely anoxic patients

#### TREATMENT

1. Support the flail segment in an emergency by means of firm pad held by strapping- it stops paradoxical breathing and air shunting
2. On admission: endotracheal intubation and positive-pressure ventilation which stops the paradoxical movement as the chest wall moves as one unit.
3. Positive pressure ventilation is continued for 10 days until fixation of the chest wall occurs
4. In cases of gross instability, wire fixation of the chest wall may be necessary
5. Tracheostomy- may be indicated for prolonged periods of intubation
6. Pain management – analgesics e.g. morphine

### PNEUMOTHORAX

#### DEFINITION

Pneumothorax is the accumulation of air or gas in the pleural cavity (potential space between the visceral and parietal pleura) with secondary lung collapse. It occurs through either an external chest wound or an internal air leak. It is referred to as ‘closed’ when the chest wall is intact or ‘open’ when a breach in the chest wall exists.

#### CLASSIFICATION

1. Spontaneous

* • Primary
* • Secondary

2. Traumatic  
3. Iatrogenic

#### SPONTANEOUS PNEUMOTHORAX

Occurs due to spontaneous rupture of lung alveoli and the visceral pleura with escape of air into the pleural space. It may occur in any age but is most common in males 15-35 years of age, especially young tall male smokers. A high incidence is reported in patients with Marfan’s syndrome. Spontaneous pneumothorax is more common on the right side. Less than 10% are bilateral.

Spontaneous pneumothorax is described as primary or secondary. Primary spontaneous pneumothorax is one that occurs without an apparent cause and in the absence of significant lung disease. Secondary spontaneous pneumothorax occurs in the presence of existing lung disease.

Primary pneumothorax typically occurs in young individuals (15-35 years) with essentially normal lungs apart from a few apical bullae or blebs. Secondary pneumothorax is common in elderly patients with emphysema and chronic obstructive pulmonary disease. It is caused by rupture of a large bulla.

##### Causes of secondary spontaneous pneumothorax

1. Diseases of the airways:

* • Chronic obstructive pulmonary disease (COPD) - most common cause of 20 pneumothorax.
* • Acute severe asthma
* • Cystic fibrosis

2. Infections of the lung, including:

* • Staphylococcal pneumonia.
* • Lung abscess.
* • Tuberculosis
* • Pneumocystis pneumonia

3. Malignancy

* • Bronchogenic carcinoma.
* • Metastatic lung cancer (sarcoma and lymphoma)

4. Interstitial lung disease

* • Sarcoidosis
* • Histiocytosis X.
* • Lymphangioleiomyomatosis.
* • Idiopathic pulmonary fibrosis

5. Connective tissue /Collagen diseases:

* • Systemic sclerosis
* • Ehlers-Danlos syndrome
* • Scleroderma.
* • Marfan’s syndrome

6. Miscellaneous 

* • Endometriosis (Catamenial pneumothorax).

#### TRAUMATIC PNEUMOTHORAX

A traumatic pneumothorax may result from either blunt trauma or penetrating injury to the chest wall. The most common mechanism is due to penetration by the sharp ends of a fractured rib, which damages lung tissue. It may be classified as open or closed.

##### Open pneumothorax:

There is a passage from the external environment into the pleural space through the chest wall.  
When air is drawn into the pleural space through the opening, it is referred to as a sucking chest wound.

##### Closed pneumothorax:

This is when the chest wall remains intact.

##### Causes of Traumatic pneumothorax

1. Blunt trauma to the chest wall may result in a lung laceration from a rib fracture i.e. fracture ribs with lung puncture/valvular lung puncture causing tension pneumothorax.  
2. Ruptured trachea or main bronchus causing tension pneumothorax.  
3. Rupture of the oesophagus or stomach.  
4. Penetrating/open chest wound causing a sucking pneumothorax.  
5. Surgical operations of the thorax causing iatrogenic pneumothorax.

#### IATROGENIC PNEUMOTHORAX

##### Procedures often complicated by pneumothorax include:

1) Thoracocentesis.  
2) Placement of a percutaneous vein catheter (subclavian, internal jugular) for central venous pressure monitoring or hyperalimentation.  
3) Operations on the chest wall, neck, back or upper abdomen.  
4) Lung or pleural biopsy.  
5) Brachial plexus block  
6) Arteriography  
7) Intercostal nerve block  
8) Assisted/artificial ventilation

#### CLINICAL FEATURES OF PNEUMOTHORAX

1. Sudden onset of chest pain referred to the shoulder or arm of the involved side.  
2. Dyspnoea (sudden onset).  
3. Tachypnoea.  
4. Cough.  
5. Hyper-resonant affected hemithorax/increased percussion note.  
6. Ipsilateral decreased chest wall motion/movement.  
7. Air in the tissues (surgical emphysema) affecting the chest wall, neck and face.  
8. Decreased/absent breath sounds on the affected side.  
9. Decreased vocal resonance and vocal fremitus.  
10. Pleural rub.  
11. Tachycardia  
12. Mediastinal shift away from the involved side in the case of tension pneumothorax.  
13. The trachea may be pushed over to the opposite side

#### INVESTIGATIONS

1. P/A chest x-ray usually diagnostic - reveals retraction of the lung from the parietal pleura.  
2. CT scan gives an accurate estimate of size of pneumothorax and is useful for assessment of remaining lung parenchyma and contralateral lung.

#### TENSION PNEUMOTHORAX

• Results if the pleural tear is valvular allowing air to be sucked into the pleural cavity at each inspiration but preventing air returning to the bronchi on expiration  
• May occur as a result of: fractured rib, ruptured trachea or bronchus, or penetrating wound on the chest producing sucking wound

See the radiograph of Tension pneumothorax

#### Clinical Features

1. Rapidly increasing dyspnoea  
2. Tracheal deviation to the opposite sidet3. Displacement of the apex beat  
4. Reduced chest expansion on the affected side  
5. Bulging of intercostal space on the affected side  
6. Hyper-resonant percussion note on the affected side  
7. Reduced/ absent air entry on the affected side

#### TREATMENT OF PNEUMOTHORAX

1. Emergency Treatment (esp. for tension pneumothorax)

* • Treat with immediate decompression.
* • Pad and strap the sucking wound to prevent more air from entering the pleural cavity
* • Don’t wait for an X-ray
* • Take a 12G cannula/the largest needle you can find and insert into 2nd or 3rd intercostal space mid clavicular line
* • The air will hiss out of the needle, trachea will return to the midline, and the patient will immediately breathe more easily.

2. Underwater seal drainage (chest drain)

* • Inserted into 5th intercostal space mid axillary line
* • In most cases of primary pneumothorax, air leakage stops within 48 hours or so, after which the drain can be removed.
* • Secondary pneumothorax may not settle rapidly due to poor quality of the underlying lung tissue.
* • Observe for 1-2 weeks to see if the air leak stops spontaneously.
* • Videothoracoscopy is done if leakage does not stop, to inspect the lung for a leaking bulla and to close it by stapling.

3. Antibiotic   
4. Analgesics  
5. Chest physiotherapy to encourage deep breathing  
6. Thoracotomy and repair is performed if pneumothorax persists

#### HAEMOTHORAX

#### DEFINITION

Haemothorax is the accumulation of blood in the pleural cavity. Massive haemothorax is accumulation of ≥ 1500ml of blood in the pleural cavity.

#### AETIOLOGY (CAUSES)

• The primary cause of haemothorax is sharp or blunt trauma to the chest.  
• Iatrogenic haemothorax often occurs as a complications of:

* 1. Cardiopulmonary surgery,
* 2. Placement of subclavian or jugular catheters and
* 3. Pleural biopsies.

• Spontaneous haemothorax is generally caused by: 

* 1. Rupture of pleural adhesions,
* 2. Neoplasms invading the pleural cavity,
* 3. Pleural metastases, and
* 4. As a complication of anticoagulant therapy.

The bleeding may be as a result of: -

* 1. Rupture of parietal vessels (intercostal, internal mammary), when continued haemorrhage is likely.
* 2. Rupture of pulmonary vessels in association with lung trauma, when low pressure haemorrhage usually ceases spontaneously.
* 3. Diaphragmatic and sub-diaphragmatic trauma, when blood from a ruptured diaphragm and/or upper abdominal viscera is sucked into the pleural cavity.
* 4. Rarely due to an unusual manifestation of endometriosis.
* 5. Other benign reasons for haemothorax include:
* Ruptured pulmonary cysts
* Rupture of pulmonary arteriovenous fistulae
* Ruptures of aneurysmal disease within the subclavian
* Rupture of the innominate and aortic vessels
* Rupture of aortic aneurysm.

#### CLINICAL FEATURES

##### If a patient has a large haemothorax, the patient will have the following features:

• Breathlessness (difficulty in breathing)  
• Chest pain  
• Shock:

* Sweaty, pale, cool and clammy skin.
* Rapid, thready pulse.
* Collapsed neck veins
* Cyanosis

• Affected side of chest is stony dull to percussion.   
• Reduced chest movement and expansion on the affected side  
• Reduced or absent breath sounds.

#### INVESTIGATIONS/Diagnosis

1. Chest x-ray

* A diffuse opacity of the affected half of the thorax, more clearly seen in an erect film.
* Obliteration /blunting of the costophrenic angle

2. Ultrasonography: is more sensitive than chest X-ray in detecting haemothorax. Can provide rapid, reliable results at the bedside  
3. CT scan: can detect much smaller amounts of fluid than plain chest X-ray.  
4. MRI can be used to differentiate between a haemothorax and other forms of pleural effusion.  
5. Thoracocentesis: 

* The diagnosis is established by thoracocentesis (aspiration of the pleural fluid)
* A haemothorax is defined as having a haematocrit of at least 50% of that found in the patient`s blood.

#### MANAGEMENT

• Simultaneous restoration of blood volume (fluid resuscitation) and decompression with a chest drain (tube thoracostomy)  
• Continuing blood loss in excess of 200ml/hour and need for persistent blood transfusion may require urgent thoracotomy within the first few hours, or a video-assisted thoracoscopic surgery (VATS)  
• If blood is not drained urgently, it will clot, organize, and prevent lung re-expanding. When this happens, it can only be made to expand again by decorticating it at thoracotomy.  
• Additional treatment options include:  
• Antibiotics to reduce the risk of infection  
• Fibrinolytic therapy to break down clotted blood within the pleural space. Streptokinase or urokinase is given directly into the pleural space 7 to 10 days after the injury.  
• Thoracostomy   
• This is the insertion of a drain (chest tube) into the pleural cavity to remove the blood.  
• Large-bore chest drain with a diameter of 24 -36 F should be used so as to reduce the risk of blood clots obstructing the tube.  
• Drainage is essential because re-expansion of the lacerated lung compresses the torn vessels and reduces further blood loss.  
• Drainage will also allow the mediastinal structures to return to the midline and relieve compression of the contralateral lung.

#### COMPLICATIONS

1) Are more likely to occur if blood is not adequately drained from the pleural cavity.  
2) If infected, empyema will result.  
3) A dense fibrothorax will result, if retained blood irritates the pleura causing scar tissue formation.  
4) Entrapped lung results from fibrothorax

#### CARDIAC TAMPONADE

##### DEFINITION

• Cardiac tamponade is compression of the heart caused by fluid collecting in the pericardium (e.g. bleeding into the patient’s pericardial cavity).  
• Cardiac tamponade puts pressure on the heart and keeps it from filling properly, with resultant dramatic drop in blood pressure that can be fatal.

##### CAUSES

• Penetrating chest injury - usually.  
• Blunt chest injury – occasionally.

##### PATHOLOGY

• As blood leaks out of the injured heart, it accumulates in the pericardial sac. Because the pericardium is not acutely distensible, the pressure in the pericardial sac will rise to match that of the injured chamber. Since this pressure is usually greater than that of the right atrium, right atrial filling is impaired and right ventricular preload is reduced.  
• This leads to decreased right ventricular output and increased central venous pressure (CVP).  
• Increased intrapericardial pressure also impedes myocardial blood flow, which leads to sub-endocardial ischaemia and a further reduction in cardiac output.  
• This vicious cycle may progress insidiously with injury of vena cava or atria, or precipitously with injury of either ventricle.  
• With acute tamponade, as little as 100ml of blood within the pericardial sac can produce life-threatening haemodynamic compromise.

##### CLINICAL FEATURES

• Patients usually present with a penetrating injury in proximity to the heart.  
• Hypotension/shock (rapid weak pulse).  
• Grossly distended neck veins (raised JVP).  
• Elevated central venous pressure (CVP).   
• Severe distress.  
• Apex beat can neither be felt nor seen (faint heart sounds).  
• The classic findings of Beck’s triad –   
1. Hypotension  
2. Distended neck veins  
3. Muffled/faint heart sounds and sometimes pulsus paradoxus (abnormally large decrease in stroke volume, systolic blood pressure and pulse wave during inspiration)  
 Normally, the peripheral pulse becomes stronger on inspiration, because the lower intrathoracic pressure increases the venous return.  
 In pulsus paradoxus the peripheral pulse is stronger on expiration.

##### INVESTIGATIONS

• Ultrasonography using a subxiphoid of parasternal view is extremely helpful if the finding is clearly positive; shows diminished excursion of the borders of the heart.  
• X-ray shows a widening of the heart shadow, especially in the cardiophrenic angle.  
• CT Scan/MRI

##### MANAGEMENT

• If critically ill with suspected temponade perform ‘blind’ pericardiocentesis and call cardiothoracic or general surgeons to consider emergency thoracotomy.   
 Insert a needle into the patient’s pericardial cavity from just under his xiphoid.  
 Alternatively, and less satisfactorily, approach it through the 4th left intercostal space 5cm from the midline, so as to avoid his internal mammary vessels.  
• Refer the patient for urgent thoracotomy  
• Pericardial sac is opened and blood is evacuated  
• Cardiac laceration is repaired

#### SURGICAL EMPHYSEMA

##### DEFINITION

Surgical Emphysema is a pathological accumulation of air in the tissues.

##### GENERAL CONSIDERATIONS

Surgical emphysema is common, but it is rarely serious in itself, and soon disappears.  
Air in the mediastinum is much more serious and may indicate the rupture of a bronchus.

##### CAUSES

1. Chest trauma  
2. Rib fracture – when a fractured rib punctures a lung  
3. Pneumothorax  
4. Bowel perforation

##### CLINICAL FEATURES

Surgical emphysema is manifested by:  
• Alarming swelling of the face.  
• Crepitant swelling under the skin and muscles of the neck.  
• Sometimes swelling may extend upwards from the pelvis to the forehead.

##### MANAGEMENT

1. If the eyelids are swollen and the patient has difficulty seeing, he can milk the air out of them.  
2. Where necessary, treat the underlying cause – this may be a leak from a lung that requires an underwater seal.  
3. Small quantities of air can be removed by massaging it into a few pockets, and then aspirating it with a syringe and needle.  
4. If surgical emphysema spreads or is life-threatening, tracheostomy can be performed. This abolishes coughing and the large rises in intrathoracic pressure it causes.  
5. If air escapes into the mediastinum and pleura from tears in the trachea, oesophagus, or bronchi, it may press on the veins at the base of the neck and congest the veins of the head.  
6. Insert an underwater seal drain and remove the air trapped in the pleura. This may cure the patient