HERNIA

PROF. S. Floret,
General Surgery.
DEFINITION

• A hernia is a protrusion of a viscus or a part of a viscus through an abnormal opening in the walls of its containing cavity.
Classification

A. External hernia
B. Internal hernia
Classification *continue*...

A. External hernia

Common hernia
- inguinal
- Femoral
- Umbilical
- incisional
Classification continue...

A. External hernia

Rare hernia
- Spigelian
- Gluteal
- Obturator
- Lumbar
 Classification *continue*...

B. Internal hernia

Diaphragmatic hernia
- Esophagial hernia
- Paraesophagial hernia
Etiology

• Hernias occur at sites of weakness in the wall
• This weakness may be:
  – Normal (physiological) weakness, related to the anatomical causes.
  – Congenital abnormality.
  – Acquired:
    • Traumatic
    • Diseases
AETIOLOGY

• Conditions that raise the intra-abdominal pressure
  Powerful muscle effort
    Childhood - Whooping cough
    Adult - Chronic cough
    Straining on micturition
    Straining on defecation
AETIOLOGY (contd.)

• Smokers - as a result of acquired collagen deficiency

• Obesity - Fat acts to separate muscle bundles and layers, weakens aponeuroses
  eg: Paraumbilical, direct inguinal and hiatus

• Multiparous women - Femoral hernia common owing to stretching of pelvic ligaments
AETIOLOGY (contd.)

- Remains of processus vaginalis - Indirect hernia

Remember that appearance of a hernia in an adult can be a sign of intra-abdominal malignancy
<table>
<thead>
<tr>
<th>Pre disposing factors</th>
<th>Precipitating factor</th>
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<tr>
<td>• Scar – Umblicus</td>
<td>• Chronic cough</td>
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<tr>
<td>– Operative scar</td>
<td>• Constipation</td>
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<tr>
<td>• Weakness of abdominal wall</td>
<td>• Difficulty in micturition</td>
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<td>– Malgaigne bulge</td>
<td>• Intra abdominal mass</td>
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• **Drastic weight loss** - when obese people lose weight they may be more prone to developing hernias.

• **COPD, Whooping cough** - the patient may cough a lot. Coughing raises pressure in the abdomen. Any illness that includes severe coughing can cause hernias to occur. A severe bout of flu may sometimes cause a hernia to develop.

• **Ascites** - the buildup of extra fluid in the abdomen (peritoneal cavity).

• **Benign prostatic hypertrophy** - the prostate gland enlarges, increasing pressure around it.

• **Intracranial pressure** - if intracranial pressure rises parts of the brain may develop hernias which protrude through the cranial cavity.
• **Excessive lifting** - raises pressure on the abdomen and others parts of the body.

• **Prior surgery** - some surgeries may result in the weakening of membranes.

• **Obesity** - if a person is obese his chances of developing a hernia are significantly higher, compared to people who are not obese.

• **straining** during a bowel movement or urination

• **muscles are weakened** due to **poor nutrition**, **smoking**, and **overexertion**, hernias are more likely to occur.
• **Genetic propensity** - if either or both parents had a hernia you are more likely to develop one.
• **Age** - the older you are the higher is your risk of developing a hernia.
• **Ehlers-Danlos syndrome** - a group of uncommon genetic disorders that affect humans and domestic animals caused by a defect in collagen synthesis.
• **Marfan syndrome** - a is genetic disorder of the connective tissue.
• **Pregnancy** - the muscles of the mother stretch, making it easier for tissue to poke through.
COMPOSITION OF HERNIA

Hernia consists of three parts
The sac, the coverings of the sac and the contents of the sac

• THE SAC
The sac is a diverticulum of peritoneum consisting of mouth, neck, body and fundus
Strangulation of bowel is a likely complication where the neck is narrow.
COMPOSITION OF HERNIA (contd.)

• THE BODY OF THE SACK
  The body of the sac varies greatly in size and is not necessarily occupied

• THE COVERING
  Derived from layers of the abdominal wall through which the sac passes.

  ▪ THE CONTENTS
Composition of a hernia

1. The sac

2. The covering of the sac

3. The content of the sac
Composition of a hernia

1. The sac:
   - It is a diverticulum of peritoneum and is made up of three parts:
     - The mouth,
     - The neck, and
     - The body of the sac.
Composition of a hernia

2. The covering:
   □ Coverings are derived from the layers of abdominal wall through which the sac pass

3. Contents:
   □ can be
     □ Omentum = omentocle
     □ Intestine = enterocele
     □ Portion of circumference of intestine = Richter’s hernia
     □ Portion of the bladder
     □ Ovary (with or without oviduct)
     □ Meckel’s diverteculum = Littre’s hernia
These can be:

- Omentum = Omentocele (syn. epipliocele);
- Intestine = Enterocele. Small bowel > Large intestine/appendix
- A portion of the circumference of the intestine = Richter's hernia;
A portion of the bladder may be the sole content of a direct inguinal, sliding inguinal or a femoral hernia

Ovary without the corresponding fallopian tube

A Meckel's diverticulum = A Littre's hernia

Fluid = as part of ascites or as a residuum
Irrespective of the site of the hernia. Hernia can be classified into

- Reducible
- Irreducible
- Obstructed
- Strangulated
- Inflamed
REDUCIBLE HERNIA

- Reduces itself when patient lies down
- Can be reduced both by the patient/surgeon
- Intestine – Gurgles on reduction
- First portion difficult to reduce than last
- Omentum – Doughy on reduction
- Last portion difficult to reduce than first
- Imparts an expansile impulse on coughing
IRREDUCIBLE HERNIA

- Contents cannot be returned to abdomen
- No evidence of other complications
- Due to adhesions between the sac and its contents or overcrowding within the sac
- Irreducibility without other symptoms is diagnostic of omentocele (Femoral & Umbilicus)
- Irreducibility pre disposes to strangulation
OBSTRUCTED HERNIA

• Hernia containing intestine is obstructed from within or without
• No interference to blood supply of bowel
• Features – Irreducibility, colicky abdominal pain (gradually onset), tenderness over hernia site
INCARCERATED HERNIA

• Lumen of that portion of colon in the hernial sac is blocked with faeces
• Scybalous contents of the bowel can be indented with finger like putty
Strangulated hernia

- Blood supply of the contents is seriously impaired rendering the contents ischaemic
- Gangrene occurs approx. 5-6 hours after onset of symptom
- More common in femoral hernia due to
  - Narrow neck
  - Rigid surroundings
Adhesions between sac and loop of intestine

(a) Reducible hernia

(b) Irreducible hernia
Loop of intestine held inside sac by adhesions. Intestine is healthy and has normal blood supply

(c) Strangulated hernia
Loop of intestine is caught at neck of hernia sac. Blood supply is cut off and it is black and dead
Management

- **Treatment:** hernias should be operatively repaired both to **relieve symptoms** and to **eliminate the complications.**

  - **Surgical techniques:**
    - *Herniorrhaphy:* involves some sort of reconstruction to:
      - Restore the anatomy if this is disturbed.
      - Increase the strength of the abdominal wall.
      - Construct a barrier to recurrence.
INGUINAL HERNIA AND INCISIONAL HERNIA

- DR.S.FLORET
INGUINAL HERNIA
Inguinal hernia

• **Epidemiology:**
  
  – Male : Female
    • by 9 to 1 ratio
  
  – young adults mostly have *indirect inguinal hernia*.
  
  – As age of patient increases, the incidence of *direct hernias* increases.
Inguinal hernia

**Risk factors:**

( increases intra-abdominal pressure )

- Chronic cough.
- Constipation.
- Pregnancy.
- Straining at micturation.
- Severe muscular effort (lifting heavy objects).
- Ascites - fluid may increase the size of an existing sac.
Inguinal Canal Anatomy

**Anterior wall:**
- aponeurosis of external oblique (along entire length),
- internal oblique on lateral one third

**Posterior:**
- fascia transversalis
- conjoint tendon on medial one third

**Roof:**
- arching fibers of internal oblique, and
- transversus abdominis

**Floor (inferior):**
- inguinal ligament, and
- lacunar ligament at the medial end
Inguinal Canal Contents:

**Male:**
- **Spermatic cord structures:**
  - vas deferens,
  - testicular artery
  - testicular veins (pampiniform plexus),
  - genital branch of genitofemoral nerve,
  - artery of the vas deference,
  - lymphatics,
  - autonomic nerves,
  - processus vaginalis.
  - Ilio inguinal nerve

**Female:**
- Round ligament of the uterus,
- genital branch of genitofemoral nerve,
- lymphatics,
- sympathetic plexus.
Inguinal hernia

**Signs & symptoms:**

- Bulge that enlarges when stand or strain, but often asymmetric.
- In general *direct hernias* produce fewer symptoms than *indirect hernias* and are less likely to complicate.
- On examination:
  - Palpable defect or swelling may be present.
  - *Indirect Hernia* usually bulge at **Internal Inguinal Ring**.
  - *Direct Hernia* usually bulge at **External Inguinal Ring**.
Inguinal hernia

There are two types of inguinal hernia:

- Direct inguinal hernia
- Indirect inguinal hernia
Indirect inguinal hernia

- An **indirect inguinal hernia** is an **inguinal hernia** that results from the failure of embryonic closure of the **deep inguinal ring** after the **testicle** has passed through it. Like other inguinal hernias, it protrudes through the superficial **inguinal ring**. It is the most common cause of **groin hernia**.
- As a result of persistent processus vaginalis.
Types

• **A) Bubonocele:** in this case the hernia is limited in inguinal canal.

• **B) Funicular:** here the processus vaginalis is closed at its lower end just above the epididymis. The content of the hernial sac can be felt separately from the testis which lies below the hernia.

• **C) complete (or vaginal):** here the processus vaginalis is patent throughout. The hernial sac is continuous with the tunia vaginalis of the testis. The hernia descends down to the bottom of the scrotum and it is difficult to differentiate the testis from hernia.
IIH result from failure of normal mechanisms that maintain the integrity of the inguinal canal, including:

- ‘shutter mechanism’ - during straining, a U-shaped condensation of transversalis fascia which passes under the cord is pulled upward and laterally, closing the deep ring around the cord and increasing the obliquity of the inguinal canal.
- ‘shutter action’ of the internal oblique and transversus abdominis muscles - contraction of these muscles draws them downwards so that the inguinal canal tends to close and become more oblique.
- integrity of the posterior wall of the inguinal canal - weakness of the conjoint tendon reduces the strength of the posterior wall of the inguinal canal and reduces support behind the superficial inguinal ring.
- oblique direction of the inguinal canal - if the deep and superficial inguinal rings enlarge, they may almost overlie each other and obliquity of the canal is lost.
Direct Inguinal Hernia

- The **direct inguinal hernia**, a type of **inguinal hernia**, enters through a weak point in the **fascia** of the **abdominal wall**, and its sac is noted to be medial to the **inferior epigastric vessels**. Direct inguinal hernias are the same in men and women.

- A direct inguinal hernia protrudes through a weakened area in the **transversalis fascia** near the **medial inguinal fossa** within an anatomic region known as the inguinal or **Hesselbach's triangle**.
• **Boundaries of Hesselbach's triangle:**
  - Medially: lateral border of rectus abdominis.
  - Laterally: inferior epigastric vessels.
  - Inferiorly: inguinal ligament.
Symptoms of inguinal hernia

• a small bulge in one or both sides of the groin that may increase in size and disappear when lying down; in males, it can present as a swollen or enlarged scrotum
• discomfort or sharp pain—especially when straining, lifting, or exercising—that improves when resting
• a feeling of weakness or pressure in the groin
• a burning, gurgling, or aching feeling at the bulge
Differences between direct and indirect hernias

1. **Age:**
   - **Direct:** older
   - **Indirect:** young

2. **History:**
   - **Direct:** reduced on lying down. mostly bilateral
   - **Indirect:** Reduced by manipulation starts unilaterally

3. **Inspection:**
   - **Direct:** hemispherical shape on deep ring occlusion swelling appears
   - **Indirect:** pyriform shape on deep ring occlusion swelling does not appear
Direct inguinal hernia

Indirect inguinal hernia
4. Palpation:

- **Direct:**
  - finger invagination-impulse felt at pulp of little finger.
  - ziemann’s technique- impulse at superficial ring.

- **Indirect:**
  - finger invagination-impulse felt at tip of little finger.
  - ziemann’s technique- impulse at deep ring.

5. Sac:

- **Direct:** *posteromedial to cord.*
  - medial to inferior epigastric vessels

- **Indirect:** *anterolateral to cord.*
  - lateral to inferior epigastric vessels
6. Origin and coarse:
   - **Direct**: Develops in the area of *Hasselbach's triangle*. The origin is **medially** to the inferior epigastric vessels.
   - **Indirect**: Develops at the *internal ring*. The origin is **lateral** to the inferior epigastric artery.

7. Content:
   - **Direct**: Retroperitoneal fat. *less commonly*, peritoneal sac containing **bowel**.
   - **Indirect**: Sac of peritoneum coming through internal ring, through which **omentum** or **bowel** can enter.

8. Etiology:
   - **Direct**: weakness of the posterior floor of the inguinal canal (acquired).
   - **Indirect**: patent processus vaginalis (Congenital).
Inguinal hernia

- Differential diagnosis:
  1. Tendonitis
  2. Muscle tear
  3. Lymphadenopathy
  4. Lipoma of cord
  5. Varicose vein
  6. Hydrocele
  7. Epididymitis
  8. Spermatocele
  9. Encysted hydrocele of cord
  10. Femoral hernia
  11. Incomplete descended testis at inguinal region
Inguinal hernia

• **Complications:**
  
  – **Irreducibility**, but without signs of obstruction or strangulation
  
  – *Small Bowel Obstruction*, Usually urgent surgical repair
  
  – *Strangulation*, Surgical emergency 50% indirect, 3-10% direct.
An incarcerated hernia is caused by swelling and can lead to a strangulated hernia, in which the blood supply to the incarcerated small intestine is jeopardized. A strangulated hernia requires immediate medical attention.

**Symptoms of a strangulated hernia include**

- extreme tenderness and redness in the area of the bulge
- sudden pain that worsens in a short period of time
- fever
- rapid heart rate
- Left untreated, nausea, vomiting, and severe infection can occur. Surgery is performed condition can become life threatening, and the affected intestine may die. Then that portion of the intestine must be removed.
Management of strangulated hernia

• Provide immediate treatment to patient. Begin an intravenous infusion with an electrolyte solution.

• Hydrate the patient.

• Insert a nasogastric tube and aspirate the stomach.

• If your patient has been vomiting, establish baseline serum electrolyte levels and correct any abnormalities.
Surgical repair

• Open the skin, subcutaneous tissue and external oblique. The internal ring may have to be divided to relieve the obstruction in indirect hernia and the inguinal ligament in femoral hernia. In both cases, divide the ring on the superior aspect to avoid underlying blood vessels.
• Open the sac, being careful to prevent gut from returning to the abdomen, then carefully inspect it for viability. Give particular attention to constriction rings. If bowel falls back into the abdomen prior to assessment of its viability, perform a laparotomy.

• Apply warm, wet packs to the gut for a few minutes. Gangrenous or nonviable gut will be black or deep blue without peristalsis. The mesenteric veins of the loop will appear thrombosed. There may be no arterial pulsation and the serosa will have lost its shiny appearance.
• Resect any gangrenous loop of bowel and make an end-to-end anastomosis (see pages 6–10 to 6–11). If the resection of gangrenous bowel can be performed easily and well through the groin incision, continue with that approach. Otherwise, make a lower midline abdominal incision and do the resection using an abdominal approach. Excise the hernial sac and complete the repair as appropriate.
Inguinal hernia management

Herniotomy

- Separation of sac from cord structures.
- Reducing the contents.
- Transfixation and ligation of sac.
- Excise the redundant sac.
- Done only for indirect inguinal hernia
Herniorraphy

- Herniotomy
- Narrowing of the deep ring (Lytle’s repair)
- Approximation of conjoint tendon with inguinal ligament
- Types: -original and modified bassini
  - shouldice repair
  - mcvay’s repair
Hernioplasty

- Prolene mesh is used to bridge the gap between the conjoint tendon and inguinal ligament
- Lichtensteins hernioplasty
- Stoppas procedure
- Laproscopic repair
- Kuntz procedure- recurrent hernia
Complications of surgery for inguinal hernia

- Risk of general anesthesia.
- Hernia recurrence.
- Bleeding.
- Wound infection.
- Painful scar.
- Injury to internal organs.
Inguinal hernia

- Both types (direct and indirect inguinal hernia) may occur at the same time and straddle the inferior epigastric artery.
NATURAL HISTORY OF HERNIAS

- Irreducible hernia – Risk of strangulation at anytime
- Obstructed hernia – Usually go on to strangulation
- Strangulated hernia – Gangrene can occur within 6 hours
• There is no clear distinction clinically between obstruction and strangulation

• The safe course is to assume that strangulation is imminent and treat accordingly
Morphology

• Inguinal hernia peculiarly occurs only in man among the mammals

• Predisposition to hernia is due to evolutionary changes in the inguinal region as a result of upright posture

• Important changes are as follows
Change - 1

- Iliac crest has grown forwards into the lower digitations of external oblique.
- Inguinal ligament can no more be operated by fleshy fibers of the muscle which now helps in balancing the body.
- In all other mammals external oblique has no attachment to the iliac crest.
Change - 2

- Initially internal oblique and transversus originated from anterior border of the ileum and sheath of ilio psoas
- Thus acting as powerful sphincter of the inguinal canal
- Shift of their origin to the inguinal ligament and iliac crest has minimised their role
Change - 3

• Crural passage between the hip bone and the inguinal ligament has become much wider in man than any other mammal
• This is due to peculiar growth of hip bones and pelvis
• Predisposing to femoral hernia
INCISIONAL HERNIA

VENTRAL HERNIA OR POSTOPERATIVE HERNIA
DEFINITION

• Defined as
  - Herniation of peritoneal sac through old operative scar
Clinical feature

- Bulging in vicinity of scar
- May be localised or diffuse all along scar
- Become more prominent on standing or coughing.
- Reduce on lying down
- which may be partial or complete
- Expansile cough impulse positive
ETIOLOGY

• EARLY
• LATE
EARLY

- EARLY CAUSES
- General conditions
- Surgical techniques
  - Type of operation
  - Post op complications
  - Post op wound dehiscence
LATE

Hernia developing in a perfectly healed wound, 5–10 or more years later

- CAUSES:
  - Tissue failure: not related to surgical technique
  - Result of failure of collagen in the tissue
  - Collagen abnormalities like decrease in hydroxy prolene and change in diameter of collagen fibre
• In general, if the muscles and aponeurotic layers of the abdomen doesn’t heal properly an incisional hernia can result.

• Predisposing factors include:
  - Infection
  - Bowel obstruction
  - Obesity
Early --- GENERAL CONDITIONS

- GENERAL CONDITIONS:
- Age - Increase age – Decrease turn over protein – poor wound healing
- Obesity
- Wasting
- Starvation and malnutrition
- Deficiency states:
  - anemia
  - A vitaminosis
  - hypoprotenimia
- ---- Protein – synthesis of collagen
- -----Vitamin C – hydroxylation of proline and lysin
- -----Vitamin A – Promote epithelialisation, inflammation and production of collagen.
- -----Vitamin D – Bone formation.
- -----Zinc – Enzymes are zinc dependent – ex-Metallo enzyme
- DNA & RNA polymerase.
SYSTEMIC DISORDERS:
- Jaundice
- DM
- Renal failure
- Alcoholism
- Liver failure
- Ascities

IMMUNODEFICIENCY:
- Prolonged steroid therapy, immunosuppression
  - Hematological disturbance
    - WBC – Defective chemotaxis
    - Phagocytosis – inc. wound infection – poor wound healing
- Renal Failure – growth of fibroblast inhibited
- Jaundice – affects fibroblast and cell formation
Continue... systemic

Malignancy – inhibit wound healing directly by depleting nutrition.
Steroid – inhibit fibroblast and granulation tissue formation.
  - Epithelial component more affected than musculofacial component.
Cyto toxic drug – Derrangement of collagen metabolism.
Radiation - Derranges DNA and hampens wound healing
SURGICAL TECHNIQUE

• Incision:
  Paramedian- not along the Langerhans line. Nerves damaged.
• Midline- upper
• lower- more incisional hernia  
  because less wider, thin, deficient rectus sheath
Figure 2.8. Structure of anterolateral abdominal wall. A. Bilaminar aponeuroses of the external and internal oblique muscles. B. Transverse sections of the wall superior and inferior to the umbilicus showing the makeup of the rectus sheath.
SUTURE MATERIAL

• Healed wound gain maximum strength in one year
• Approximately 80% final strength reached after 6 months
• So suture material that remain and maintain its strength for this time is ideal
  Stainless monofilament is ideal
  Polypropylene and polyamide also good
SUTURE TECHNIQUES

• Widely spaced loosely tied suture-less ischemia to tissues less necrosis-healthy scar
• Tension should be less
• Drains that are brought through main wound are potent cause for hernia
• Sepsis –dead space –infection-poor healing
Satisfactory haemostasis

- Choose a right suture material in the right place - if not - infection - pus formation - early absorption of suture material - wound dehiscence
Respect of tissues

Avoid rough handling and blunt dissection
Less trauma -- Better and quicker healing—Healthy and Strong Scar
CLOSURES

- Layered closure more chance
- Mass closure less chance
- Tissue planes approximated properly avoiding deadspace-
  - collection of blood (hematoma), serum (seroma) – infection- poor healing – unhealthy scar.
Type of operation

Surgery on patients with
- peritonitis
  - Malignancy
  - Inflammatory bowel disorder
- pancreatitis
- re-operation
  - High chance of inci. Hernia
Post-op complication

- Abdominal Distension.
- Pulmonary complication:
  - COPD
  - Collapse
  - Bronchopneumonia
  - Emphysma
  - High chance of incision Hernia
TREATMENT

• Palliative Abdominal belt
• Surgical-
  • Pre Op-Preparation
• Weight reduction why?
• Return of contents has risk of paralytic ileus because of visceral compression
• Elevation of diaphragm- pulmonary complication
• Failure of hernia repair
SURGERY

- KEELS OPERATION  Hernial sac  not  opened
- MESH  REPAIR---Complication
  - Bleeding
  - Infection
  - Migration of Mesh
WOUND HEALING
Wound healing is a complex
- biochemical & cellular event
- which can be affected by
- Local and systemic factors.
FACTORS AFFECTING WOUND HEALING

➢ LOCAL FACTORS
  • Infection
  • Adequate blood supply
  • Foreign body
  • Tissue characteristics

➢ SYSTEMIC FACTORS
  • Age
  • Nutrition
  • Hematologic disturbance
  • Diabetes, Renal failure, jaundice
  • Malignancy
  • Steroids, cytotoxic drugs
  • Whole body irradiation
  • Marfan’s syndrome
LOCAL FACTORS

- **INFECTION:**
  - most important factor causing delayed wound healing.
  - Leads to increased collagenolysis
  - Shortage of essential nutrients for fibroblast

- **ADEQUATE BLOOD SUPPLY:**
  - Arterial & venous disease causing ischemia results in poor or delayed healing.
  - Seen in patients having peripheral arterial disease who have poor healing.
  - Facial wounds heal rather well, as the blood supply is plentiful.
FOREIGN BODY:
- Foreign body like broken glass, grit & small pebbles hampers healing by causing a foreign body reaction & infection.
- Suture material, needles, gauze pieces left in the wound can all impair healing due a similar effect.

TISSUE CHARACTERISTICS:
- Tissue composed of labile cells like surface epithelium of skin, oral cavity, columnar epithelium of gut, transitional epithelium of urinary tract heal rapidly well.
- In contrast, nerve cells & cardiac muscle, once injured, are permanently lost.
AGE: with increasing age, there is decreased protein turnover and consequently poorer wound healing.

- NUTRITION: Various nutrients are essential for the process of wound healing and they are as follows:
**NUTRIENT**
- Proteins
- Vit C
- Vit A
- Vit D
- Zinc

**FUNCTION**
- synthesis of collagen
- Hydroxylation of proline&lysine
- Essential for epithelialisation
- For bone formation
- Many enzymes are zinc dependent like metalloenzymes, DNA&RNA polymerase
HEMATOLOGIC DISTURBANCE: diminution of granulocytes leads to a defect of chemotaxis and phagocytosis, with an increased likelihood of wound infection and poor wound healing.

DIABETES: causes decreased neutrophil chemotaxis and phagocytosis, hence diabetes are more liable to develop wound infection and delayed wound healing.

RENAL FAILURE: growth of fibroblasts is inhibited.

JAUNDICE: affects fibroblast and capillary formation.

MALIGNANCY: inhibits wound healing directly & also due to depletion of nutrients.
- **STEROIDS**: wound healing is impaired due to their inhibitory effect on fibroblast & granulation tissue formation.
  - the epithelial component is affected more than the musculo-fascial component.
- **Vit A**: which promotes epithelialisation is used to counter this effect.
- **CYTOTOXIC DRUGS**: affect wound healing due to deranged collagen metabolism.
- **RADIATION**: damages DNA & hampers wound healing.
• Vit A promotes epithelialisation, inflammation and also the production of collagen in the wound.
• Therapeutic doses used can be as high as 50,000 units/day for 3 days followed by 50,000 units/day for 2 weeks.
Wounds can be of various types like:
- incised wounds
- crushed wounds
- lacerated wounds
CLASSIFICATION OF WOUNDS

➢ CLEAN WOUND:

• Elective, primarily closed
• No acute inflammation encountered
• GIT, oropharyngeal, genitourinary, biliary, tracheal, bronchial tracts not entered
• No break in sterile technique.
CLEAN CONTAMINATED WOUND:

- Nonelective case
- Clean controlled opening of a normally colonized body cavity eg: GIT, Oropharynx etc.
- Minimal break in technique
- Appendicectomy
- Mechanical drainage
CONTAMINATED WOUND:

- Major spillage from hollow organ
- Major break in sterile technique
- Penetrating trauma <4 hrs old
- Acute nonpurulent inflammation encountered
DIRTY WOUND:

- Pus encountered
- Perforated viscera encountered
- Penetrating trauma > 4hrs old
Wounds can heal by two principal mechanisms which are:

- Healing by first intention (primary union)
- Healing by second intention (secondary union)
NORMAL WOUND HEALING

- Four phases
  - 1. Haemostatic phase.
  - 2. The inflammatory phase.
  - 3. Proliferative phase
  - 4. Remodelling phase – maturing phase
STAGE OF SCAR FORMATION

- Scar is a metabolically active and dynamic tissue.
- Difference stages of scar formation
  - Stage 1: 0-4 wks – soft, fine & weak scar.
  - Stage 2: 4-12 wks – Red, hard & strong scar.
  - Stage 3: 12-40 wks - Soft, white & supple scar.
THANK YOU!