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### **SURGERY LECTURE NOTES**

#### **OVERVIEW OF TOPICS**

- I. **Pre-operative Considerations**
- II. **Post-operative Complications**
- III. **Neck Lumps**
- IV. **Breast**
- V. **Mesenteric Ischaemia**
- VI. **Limb Ischaemia**
- VII. **Per Rectal Bleed**
- VIII. **Inflammatory Bowel Disease**
- IX. **Varicose Veins**
- X. **Lumps in the Groin**
- XI. **Hernias**
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- XIII. **Deep Venous Thrombosis**
- XIV. **Upper Gastrointestinal Bleeding**
- XV. **Acute Abdomen**
- XVI. **Procedures And Relevant Anatomy In Surgery**

#### **I. PRE-OPERATIVE CONSIDERATIONS**

##### **PRE-OPERATIVE ASSESSMENT**

These are investigations that are done before patient goes to theatre.

All patients who are fit and well must have at least full blood count done before they go to theatre. This is standard procedure.

##### **INVESTIGATIONS**

1. **Full blood count:** even fit and well patients must have at least FBC done

This is to check for Haemoglobin levels

There are 2 types of operations:

- A. Elective or planned operation
- B. Emergency operation

Normal haemoglobin levels:

- >11.3g/dl in women
- >13.5g/dl in men

##### **For emergency operations:**

- Even if Hb is low, always proceed with **emergency** operations.

- If Hb <8 g/dl then transfuse and stabilise first before proceeding.

#### For elective operations:

- Only proceed if Hb >10 g/dl.
- If Hb <10 g/dl then defer the operation and investigate first.
- If Hb <8 g/dl you must also transfuse.

#### N.B: Hb <8g/dl = do blood transfusion

1. **ECG** if you suspect atrial fibrillation or if irregular pulse (atrial fibrillation) or history of atrial fibrillation.
1. **Echocardiogram**: do it if there are signs of valvular disease or left ventricular failure
1. **Refer for specialist opinion** if severe problem e.g. recurrent angina attacks (just doing an ECG is not enough)
1. **Blood Glucose** in diabetes
1. **Blood pressure monitoring** if hypertensive
1. **Respiratory function test** if respiratory problem e.g. asthma (do PEFr) or COPD
1. All Afro-Caribbean do **sickle cell test** (sickle cell disease is common in Afro-Caribbean race)
1. IV drug abuser or homosexual: do an **HIV test** (always take consent before doing it)
1. **Chest X-Ray**: do it if cardiorespiratory function or age >65
1. **Clotting Screen**: if with history of easy bleeding after minor procedures like dental extraction.

#### PRE-OPERATIVE BOWEL PREPARATION

1. **Oesophago-duodenoscopy, ERCP, closure (reversal) ileostomy**: do not require any bowel preparation.
1. **Colonoscopy, rectoplexy, right or left hemicolectomy, pancolectomy, sigmoidectomy, anterior resection, abdominoperineal resection, Hartman's reversal** – all require full bowel preparation.
  - a. Give 1 sachet of PicoLax a day before surgery at 08:00 and 14:00. PicoLax = sodium picosulphate. You can also use magnesium citrate.
  - b. Patient can eat low residue foods whilst taking bowel preparation
1. **Haemorrhoidectomy, examination under general anaesthesia, flexible sigmoidoscopy, proctoscopy, anal fissure** – all require phosphate enema on the day of surgery

#### PRE-OPERATIVE MEDICATION

1. Aspirin can continue until operation
2. Target pre-operative INR for patients on Warfarin is INR <2.5. Warfarin must be stopped 5 days before the operation and be given heparin pre-operatively
3. In diabetic patients start insulin on the morning of surgery (sliding scale)
4. Antibiotics should not be given routinely to people undergoing a dental or surgical procedure even if they are high risk
5. Antibiotics for prevention of infective endocarditis should only be given if the operation is infected and the risk of bacteraemia is high

#### ANTIBIOTIC PROPHYLAXIS IN SURGERY

**Type of Surgery:** Gastric/oesophageal surgery

**Common Pathogens:** Enteric gram –ve bacilli, gram +ve cocci

**Antibiotic of choice:** Single dose gentamicin IV **OR** cefuroxime IV

**Type of Surgery:** Colorectal surgery

**Common Pathogens:** Enteric gram –ve bacilli, enterococci, anaerobes

**Antibiotic of choice:** Single dose gentamicin IV + metronidazole IV/PR **OR**  
cefuroxime IV + metronidazole IV **OR**  
co-amoxiclav IV alone

**Type of Surgery:** Appendicectomy

**Common Pathogens:** Enteric gram –ve bacilli, enterococci, anaerobes

**Antibiotic of choice:** Single dose gentamicin IV + metronidazole IV/PR **OR**  
cefuroxime IV + metronidazole IV **OR**  
co-amoxiclav IV alone

**Type of Surgery:** Biliary surgery (open)

**Common Pathogens:** Enteric gram –ve bacilli, enterococci, clostridia

**Antibiotic of choice:** Single dose cefuroxime IV + metronidazole IV/PR **OR**  
gentamicin IV + metronidazole IV/PR

**Type of Surgery:** ERCP

**Common Pathogens:** Enteric gram -ve bacilli, enterococci, clostridia

**Antibiotic of choice:** Single dose gentamicin IV **OR**  
ciprofloxacin IV/PO

**Type of Surgery:** Vascular surgery

**Common Pathogens:** S. aureus, S. epidermidis, anaerobes in diabetes, gangrene, or undergoing amputation

**Antibiotic of choice:** Single dose cefuroxime IV **OR** ciprofloxacin IV. Add Metronidazole for suspected anaerobe infection

**Type of Surgery:** Lower limb amputation/major trauma

**Antibiotic of choice:** Benzylpenicillin 300-600 mg qds for 5d **OR** (for penicillin allergy) metronidazole 400-500 mg tds

#### TYPE OF OPERATIONS

- A. Day case surgery (patient is not admitted)
- B. Inpatient operation

All patients can have a day case surgery except in the following situation:

1. Mentally retarded or learning disability (may not be able to recognize the complications)
2. Those who live alone
3. Infection at the site of an operation
4. People with severe heart diseases

#### II. POST-OPERATIVE COMPLICATIONS

- A. General complications
- B. Specific complications
- C. Wound problems

#### GENERAL COMPLICATIONS

1. **Fever (pyrexia)** causes could be:
  - a. **Pneumonia:** (cough, fever, shortness of breath) Usually 48 hours onwards. **Investigation: CXR, Rx: antibiotics (amoxicillin)**
  - a. **Urinary Tract Infection:** commonly due to catheterization. Causes confusion in elderly, dysuria, frequency, **Investigation: MSU, Rx: antibiotics (trimethoprim)**
  - a. **Atelectasis:** Lung collapse, common in people who smoke. Chest pain and mild fever. Usually within first 48 hours after an operation which is close to the lungs especially splenectomy, **Investigation: CXR to rule out pneumonia, Rx: physiotherapy**
  - a. **Wound infection:** Usually after 5 days post op. Presents with discharge from the wound, redness and tenderness around the wound, **Investigation: wound swab, Investigation: Microscopy, culture and sensitivity. Rx: Antibiotics**
  - a. **Intraabdominal abscess** - (Subphrenic abscess or subhepatic abscess) Usually after 5 days post op. Presents with swinging fever. **Investigation: CT abdomen, USS abdomen. Rx: Incision and drainage**
  - a. **Anastomotic leak:** usually after bowel resection. Any physiological change after bowel resection is always anastomotic leak until proven otherwise. Does not immediately occur after the operation. Develops after patient has started eating and drinking, usually on day 3-7 post op.  
**Investigation: CT abdomen. Rx: Antibiotics broad spectrum IV immediately (cefuroxime + metronidazole), Laparotomy**

2. **Intraabdominal Bleed** - usually few hours after surgery  
**Management: Laparotomy**

#### 3. Confusion

1. **Infection** – UTI & pneumonia (especially in elderly) Usually after 5 days post op.
1. **Medication** e.g opiate usually used during an operation.

#### 4. Hypoxia

1. **Alcohol withdrawal** = **delirium tremens**. Usually develops 10-72 hrs after last alcohol intake, usually there is high MCV. Symptoms: agitated, aggressive, confused, shaky, tremors, visual hallucinations usually insects crawling in blanket.
1. **Shortness of breath or dyspnea**

a. **Pulmonary embolism** = chest pain, haemoptysis, 5 days onwards after an operation

a. **Pulmonary oedema** = post operative pulmonary oedema almost always due to fluid overload

a. **Pneumonia**

a. **Pneumothorax** due to ventilation pressure especially if there was a small pneumothorax. Therefore if a patient has a small pneumothorax a chest drain must be inserted.

a. **Myocardial infarction** = chest pain radiating to the left arm.

1. **Hypotension**

a. Post operative hypotension almost always is due to **bleeding** so give **intravenous fluids**.

a. Medical conditions like Myocardial infarction, pulmonary embolism, sepsis

#### 8. **Oliguria**

Post operative oliguria is almost always due to **inadequate fluid replacement** so **give fluids**.

#### 9. **Anuria**

Post operative anuria almost always is due to **blocked catheter**, so **check catheter**

#### 10. **Post operative hyponatraemia**

1. SIADH, especially after brain surgery
2. Over hydration, especially with colloids

#### 11. **Deep venous thromboembolism**

Symptoms: unilateral calf swelling, pitting oedema, calf pain

In post operative patients we do not use D-dimer as an investigation. The investigation of choice is always **compression ultrasound scan**.

### **SPECIFIC POST OPERATIVE COMPLICATIONS**

#### 1. **Mastectomy**

Common complication is lymphoedema (arm becomes swollen)

**Management: physiotherapy and arm exercise.**

#### 1. **Thyroidectomy**

a. **Recurrent Laryngeal Nerve Palsy**, presents with hoarseness of voice, usually resolves after sometime.

**Management: Reassurance**

a. **Tracheal obstruction by haematoma** usually presents with acute shortness of breath and stridor immediately after the operation, commonly when the patient is still in the recovery room.

**Management: release the stitches on bedside**

a. **Hypocalcaemia** usually due to hypoparathyroidism which causes hypocalcaemia.

Patients presents with tetani, Checkvostek's sign and Trousseau's sign (carpopedal spasm), muscle irritability

**Checkvostek sign** = on tapping on the angle on the jaw there is twitching of the muscles of the face.

**Trousseau's sign** = on occluding the brachial artery with an inflated BP cuff the wrist and fingers flex and draw together (carpopedal spasm)

#### 4. **POST TURP (Transurethral resection of the prostate) SYNDROME**

The irrigation fluid used to visualise and distend the urethra and bladder gains intravascular access through the venous circulation causing dilutional hyponatremia.

**Management: Fluid restriction**

#### 5. **APPENDICECTOMY**

Common complication is **abdominal or pelvic abscess** especially if it's perforated or gangrene appendicitis. There is usually swinging fever. **Investigation: CT scan abdomen, or abdominal ultrasound scan. Management: Incision and drainage.**

#### 6. **SPLENECTOMY**

Spleen takes part in immune system so splenectomy causes low immune function and patients have recurrent infections. Prophylaxis vaccination is required against the following infections:

- i. Pneumococcal
- ii. Meningococcal
- iii. Haemophilus influenza

Patients also require long term antibiotics prophylaxis.

### 7. **ABDOMINAL SURGERY**

- a) **Paralytic ileus** usually presents with abdominal distention, constipation, vomiting and reduced bowel sounds. Occurs few days after the operation. No abdominal pain.  
Investigation: Plain abdominal X-ray (dilated bowel loops)  
Mgt: Nasal gastric tube and Intravenous fluid.
- a. **Obstruction secondary to adhesions.** This will occur after weeks, months or years. Cardinal symptoms: abdominal pain, vomiting, constipation, abdominal distension, increased bowel sounds.

#### 1. **ERCP**

- a. **Acute pancreatitis** – abdominal pain  
b. **Cholangitis**

### **C. WOUND PROBLEMS**

Wound swelling, bleeding or discharge needs inspection/exploration of the wound.

#### 1. **Laparotomy wound dehiscence**

Dehiscence of laparotomy wound is spontaneous opening of deep suture layers with or without superficial layer

##### **Clinical features:**

1. Serosanguinous discharge from wound
2. Usually 7-10 days post op

**Treatment: Resuture wound**

#### 1. **Wound bleeding**

Usually bleeding is minor and settles spontaneously.

##### **Clinical features:**

1. Wound oozing
2. Wound hematoma on palpation

**Treatment: If minor bleeding, try gentle pressure for 5 minutes. If ongoing large amount of patient, patient may need to go to theatre**

#### 1. **Superficial wound Infection and Abscess**

##### **Clinical features:**

1. Wound pain
2. Pyrexia
3. Pus like discharge

**Treatment: Inspection/exploration of wound.**

**If temperature >37.5, take blood cultures, CRP, FBC, U&E.**

**If abscess    wound drainage, take swab for microscopy, culture and sensitivity**

### **III. NECK LUMPS**

Neck lumps are located either in the **anterior triangle**, **posterior triangle** or **midline**

#### **Anterior triangle lumps**

1. Branchial cyst
2. Carotid body tumour
3. Parotid tumour

#### **Midline lumps**

1. Thyroglossal cyst
2. Thyroid lump
3. Dermoid cyst

#### **Posterior triangle lumps**

1. Cervical rib
2. Cystic hygroma
3. Pharyngeal pouch
4. Subclavian aneurysm

#### **1. BRANCHIAL CYST**

Lump containing cholesterol crystals located in the anterior triangle. Usually before age of 30 years. It emerges under the anterior border of the sternocleidomastoid muscle where the upper 1/3 meets the lower 2/3.

**Investigation: USS, FNAC**

**Treatment: Surgical removal**

#### **2. Carotid body tumour aka Chemodectoma**

Located in anterior triangle. It moves side to side but not up and down.

It may be pulsatile but usually does not cause bruit. It is located just anterior to the upper 1/3 of sternocleidomastoid muscle.

**Investigation: Doppler USS, arteriography**

**Treatment: Surgical extirpation.**

#### **3. Parotid tumour**

Located in the anterior triangle at the upper posterior region at the angle of the jaw.

Usually patient age >40 years

**Investigation: USS, mumps test will be negative**

**Treatment: Surgical**

#### **4. Thyroglossal cyst**

- Transilluminating midline lump which moves on tongue protrusion but not on swallowing

**Investigation: USS**

**Treatment: surgical removal**

#### **5. Thyroid lump**

- Midline lump which moves on swallowing but not on tongue protrusion

**Investigation:**

1. **All patients with thyroid nodules must have TSH measurement. If low, then measure T4 and T3.**
2. **USS recommended in patients with atypical solitary nodules and multiple goiter**
  - a. **If it is a CYST then treatment is surgical removal**
  - b. **If it's SOLID then FNAC (Fine needle aspiration cytology). FNAC is recommended in all patients with solitary nodules.**

### **THYROID CANCER**

**Risk factors:**

- Pre-existing goiter
- Radiation of neck in childhood

### **Types including Frequency & Clinical Features**

- **Papillary** (60%) – solitary thyroid nodule
- **Follicular** (25%) – Slow-growing thyroid mass, symptoms are usually from distant metastases
- **Anaplastic** (10%) - rapidly growing thyroid mass causing tracheal and oesophageal compression
- **Medullary** (5%) – Thyroid lump, may have MEN II A (medullary thyroid carcinoma, pheochromocytoma, hyperparathyroidism) or MEN II B (medullary thyroid carcinoma, phaeochromocytoma, multiple mucosal neuromas, Marfanoid habitus) syndrome

**Management:**

#### • **Papillary**

**Surgery: total thyroidectomy & removal of involved lymph nodes**

**Adjunctive tx: L-thyroxine to suppress TSH (it stimulates papillary tumour growth)**

**Prognosis: Excellent**

#### • **Follicular**

**Surgery: thyroid lobectomy or total thyroidectomy if metastasis are present**

**Adjunctive tx: radioactive iodine for distant metastases and L-thyroxine for replacement therapy to suppress TSH**

#### • **Anaplastic**

**Surgery: only palliative to relieve pressure symptoms**

**No radiotherapy/chemotherapy**

**Prognosis: Very poor**

#### • **Medullary**

**Exclude phaeochromocytoma before treating**

**Surgery: total thyroidectomy & excision of regional lymph nodes**

#### **6. Dermoid cyst**

Midline lump that does not move on swallowing or tongue protrusion.

If patient is less than 20 years the dermoid cyst is likely.

**Investigation: USS**

**Treatment: Surgical removal**

#### **7. Cervical rib =Thoracic outlet syndrome**

Located in the posterior triangle.

It is an extension of C-7

It can cause compression of upper arm vein or nerves therefore it can cause tingling and numbness or swelling of the arm.

Symptoms depend on the compressed structure.

**Investigation: Cervical spine X-ray**

**Treatment: Surgical removal**

#### 1. **Cystic hygroma**

Located on the posterior triangle. These are massively distended lymphatic vessels. that can cause compression of airway.

They present at birth and transilluminate brightly.

**Investigation: USS**

**Management: Surgical removal**

#### 1. **Pharyngeal pouch**

Located in the posterior triangle. It is a diverticulum of the esophagus which comes out between the inferior pharyngeal constrictor muscles.

Symptoms: regurgitation of undigested food particles, halitosis, , swelling in the neck, bulging in the neck after drinking

Investigation: If it presents as a **mass** in the neck then investigation is **USS**

If it presents as a **dysphagia** then investigation is **barium meal**

**Treatment: surgical**

#### 1. **Subclavian artery aneurysm**

It is a pulsatile mass located in the posterior triangle at the base of sternocleidomastoid muscle

**Investigation: Doppler USS**  
**Treatment: Surgical repair of the aneurysm**

#### **IV. BREAST**

Symptoms of the breast;

1. Pain
2. Lump
3. Breast cancer
4. Nipple or skin changes
5. Discharge

##### **1. PAIN**

**Pain in the breast is called mastalgia**

Mastalgia can either be cyclical or non cyclical

**Cyclical mastalgia** - pain occurs every month before periods.

**Mx: reassure patient.**

**Non Cyclical mastalgia** - needs to be investigated just like a lump in the breast.

##### **1. LUMP IN THE BREAST**

All patients with breast lump must undergo triple assessments.

**First assessment:** Clinical examination of the breast including axillary lymph nodes.

**Second assessment:** Imaging

If a woman is **< 35** years then perform **USS** scan only

If she is **35 or above**, do **mammography first and then USS**

**Third assessment:** Cytology. In either case you have done an ultrasound scan which will show whether the lump is cyst or solid.

If it's a **cyst** perform **FNAC**. Further management depends on the type of fluid aspirated:

- i. if **clear fluid** just **aspirate** and **reassure the patient**.
- ii. If **blood stained**, **aspirate** send to lab for **cytology**
- iii. If **clear fluid but residual mass** perform **core biopsy**.
- iv) If the **lump** is solid perform **core biopsy**.

##### **EXAMINATION**

If a lump is **mobile**, not attached to underlying structure, firm in consistency, smooth surface = it's likely to be **fibroadenoma**, especially in a young patient.

If **non-mobile** lump, **hard** in consistency, **attached to underlying structure**, **irregular** surface = it's likely **carcinoma**.

If there are **lumps in the axilla** it means **carcinoma** because that is a sign of metastasis.

If there are **no palpable masses** the investigation of choice is **stereotactic biopsy**.

**Lumpiness** of the breast especially in the upper outer quadrant but **no dominant mass** = **Benign Breast Change**.

Women usually in 30's presenting with multiple cysts which may be associated with pain or green brownish discharge from the nipple.

Also called **BENIGN BREAST DISEASE, FIBROADENOSIS, FIBROCYSTIC CHANGE, FIBROCYSTIC BREAST DISEASE**,

**Management: Triple assessment**

**Family history**=if patient has got **no symptoms** but just present because she has got family history of breast cancer then do **genetic testing and counseling**.

##### **1. BREAST CANCER**

**ALL BREAST LUMPS REQUIRE TRIPLE ASSESSMENT.**

##### **Risk factors**

- Strong family history of breast cancer (genetic factors – BRCA 2 gene)
- Early menarche and late menopause
- Nulliparity

##### **Clinical Features**

- Palpable, hard, irregular, fixed breast lump, usually painless
- Nipple retraction and skin dimpling
- Nipple eczema in Paget's disease
- Peau d'orange (cutaneous oedema secondary to lymphatic obstruction)
- Palpable axillary nodes

**Investigations:** Triple assessment

**Treatment:** Early breast cancer treatment is aimed at local control with wide local excision, lymph node treatment and prevention of systemic relapse.

Treatment of **late** breast cancer is usually palliative and mostly medical

**1. SKIN CHANGES**

1. If nipple skin changes and areola area e.g eczematous changes or inflammatory changes then it's likely to be Paget's disease, especially if unilateral.

**Investigation: open biopsy or punch biopsy.**

1. If **nipple retraction or peu de orange** or ulcer then **breast cancer** is the diagnosis.

1. If there is an **ulcer** on the breast do biopsy of the ulcer. Ulcer means **cancer**.

**5. DISCHARGE FROM THE NIPPLE**

1. Blood stained discharge can be caused by :
  - a. **Paget's disease**
  - b. **Duct papilloma**, esp. if discharge is from the duct, usually single duct.

**Investigation: Ductography/ductogram**

- a. **Breast cancer**

1. Clear discharge is caused by **intraduct papilloma** (discharge from the duct).

**Investigation: Ductography/ductogram**

1. Orange, yellow creamy, green discharge is caused by **ductasia**, discharge from multiple ducts.

**Investigation: Ductogram**

1. Purulent discharge is caused by **breast abscess**, common in breast feeding mother. The causative organism is staphylococcus aureus. **Rx: flucloxacillin**.

1. Milky discharge is caused by **galactorrhoea**. Causes include prolactinoma, side effect of anti-psychotic medications, and physiologic in lactating mothers.

**MESENTERIC ISCHAEMIA****Acute Mesenteric Ischaemia****Symptoms:**

- Sudden onset of severe abdominal pain, with soft abdomen is soft, no findings on examination of the abdomen.
- Also per rectal bleed
- Severe hypovolaemia

**Risk factors:** AF, MI (mural thrombus), aortic aneurysm, valvular heart disease

**Cause:** Emboli

**Investigation:** Arteriography.

**Management: Intravenous fluids, heparin, gentamicin and metronidazole.**

**Chronic Mesenteric Ischaemia**

**Symptoms:** Post prandial pain i.e pain after eating. Patients lose weight due to fear of pain after eating.

**Risk factors:** HTN, DM, high cholesterol

**Cause:** Artherosclerosis

**Investigation:** Arteriography

**Treatment: reduce the risk of artherosclerosis.**

**LIMB ISCHAEMIA****Acute limb ischaemia**

**Symptoms:** 6 P's - painful, paralysis, pale, perishing cold, parasthesiae, pulseless

**Risk factors:** AF, MI (mural thrombus), aortic aneurysm, valvular heart disease

**Cause:** Emboli

**Investigation:** Doppler USS or arteriography.

**Management: Immediate referral to vascular surgeon for embolectomy, unfractionated heparin IV**

**Chronic Limb Ischaemia (Peripheral vascular disease)**

**Symptoms:** intermittent claudication

**Risk factors:** HTN, DM, high cholesterol

**Cause:** artherosclerosis

**Investigation:** i) Ankle Brachial Pressure Index (if <0.5 = critical limb ischemia) ii) Doppler USS iii) arteriography

**Treatment:**

- **Reduce the risk of artherosclerosis. E.g reduce cholesterol and hypertension**
- **Also bypass graft if severe symptoms**
- **Exercise to improve symptoms of claudication.**

**Differential diagnosis**

Thromboangiitis obliterans (Burger's disease) =usually in young men around 40 years with strong smoking history.

**PER RECTAL BLEED****Causes**



1. Haemorrhoids (aka Piles)
2. Anal fissure
3. Acute mesenteric ischaemia
4. Colonic cancer
5. Rectal cancer
6. Diverticulitis
7. Angiodysplasia
8. Inflammatory bowel disease
9. Trauma
10. Bleeding diathesis

### 1. HAEMORRHOIDS (AKA PILES)

- History of constipation
- Also common in liver cirrhosis
- Fresh blood per rectal which splashes in the toilet pan.
- No pain
- Itching is usually present

#### STAGES OF HAEMORRHOIDS

- 1<sup>st</sup> degree – Remains in the rectum
- 2<sup>nd</sup> degree – Prolapses during defaecation but reduces spontaneously
- 3<sup>rd</sup> degree – Prolapses during defecation but requires digital reduction
- 4<sup>th</sup> degree – Remains persistently prolapsed, cannot be reduced

#### Management:

1. **Conservative management:**
  - **First line treatment of choice**
  - **Lifestyle modifications: high fibre diet, topical anaesthetics, behaviour modifications incl. weight loss, no reading while in the toilet**
2. **Non-surgical management:**
  - **Rubber band ligation – good choice for first and second degree haemorrhoids**
  - **Injection sclerotherapy – an alternative treatment for first and second degree haemorrhoids**
3. **Surgical Haemorrhoidectomy**
  - **Used if minor procedures not effective and in external haemorrhoids (3<sup>rd</sup> degree haemorrhoids)**

**NB. Painful peri-anal haematoma must be treated with incision and drainage**

### 2. ANAL FISSURE

- Tear on the anus
- History of constipation
- Intense pain in the anus
- Fresh blood per rectal
- Per rectal examination may be impossible due to severe pain

#### Treatment:

1. **First try conservative treatment i.e. laxatives, ↑fluid intake, topical lubricants.**
2. **Topical glyceryl trinitrate (GTN) ointment is the first line treatment of chronic anal fissure.**
3. **Topical diltiazem**
4. **Botulin toxin used if failed response to GTN**

### 3. DIVERTICULITIS

- Inflammation of diverticulum (outpocketing of weak area of intestinal wall)
- Presents with fever and left iliac fossa pain relieved by defecation
- Usually patients are 60 years and above
- Profuse bleeding per rectal but there is no rectal pain

#### Investigation:

- **In the acute phase, CT scan is investigation of choice. Do not do colonoscopy during acute phase as it can cause perforation.**
- **Colonoscopy is best for diverticular disease, can be used in diverticular bleeding both for diagnosis and treatment.**

**Management: Antibiotics are 1<sup>st</sup> choice for acute diverticulitis (co-amoxiclav or ciprofloxacin and metronidazole)**

### 4. COLONIC CANCER

- Usually elderly patient
- Symptoms of malignancy i.e weight loss, anorexia, fatigue, anaemia.
- Left colonic cancer usually presents with per rectal blood mixed with stool
- Right colonic cancer usually presents with anaemia
- Change in bowel habits i.e alternating diarrhea and constipation

**Investigation: Colonoscopy and biopsy**

### 5. RECTAL CARCINOMA

- Elderly patient
- Symptoms of malignancy i.e. weight loss, anaemia, anorexia, fatigue, tiredness.
- Fresh per rectal bleed
- Tenesmus which is a feeling of incomplete evacuation.

- Ulcer in the rectum means cancer

**Investigation: Sigmoidoscopy (for lesions in rectum up to sigmoid colon) and biopsy**

#### **6. ANGIODYSPLASIA**

- Congenital arterio-venous malformation
- Presents in elderly patient with unexplained spontaneous bleeding per rectum with no other possible cause of bleeding

**Investigation: colonoscopy or barium enema which may show no abnormality. Capsule endoscopy may also be used.**

#### **7. PERI-ANAL HAEMATOMA**

- This is a thrombosed haemorrhoids
- There is severe pain
- It is located at the anal verge
- It is a purple blue lump.

**Treatment: Incision and drainage of hematoma**

#### **8. INTUSSUSCEPTION**

- This condition is common in **children**.
- The typical age is 5-12 months
- Intermittent abdominal pain
- Child crying while pulling the legs towards the abdominal
- Per rectal fresh bleed, currant jelly like stools
- There is a sausage shaped mass in the abdomen
- Shock

**Investigation: Air enema/barium enema**

**Management: Pneumatic reduction which is the air enema.**

### **INFLAMMATORY BOWEL DISEASE**

1. Ulcerative colitis
2. Crohn's disease

#### **ULCERATIVE COLITIS**

- Usually young patient (20-30 years) with chronic history of bloody diarrhea
- Fever
- Usually does not go beyond ileo-cecal valve
- Granular inflammation of mucosa
- Extra intestinal manifestation e.g arthritis, conjunctivitis, pyoderma gangrenosum-ulcer on the leg

#### **CROHN'S DISEASE**

- Young patient between 20-30 years
- Chronic diarrhoea
- +/- blood per rectal
- Can affect any part of the GI tract from the mouth to the anus
- Transmural granulomatous inflammation of the intestinal mucosa
- Extra intestinal manifestations can be conjunctivitis, pyoderma gangrenosum, arthritis mouth ulcers

**NB:** Typical signs of Crohn's disease are: fistula in ano, peri-anal abscess, skin tags, skip lesion pattern, granuloma formation, cobblestone appearance on colonoscopy, rose thorn appearance, colonic stricture. These signs suggest Crohn's disease whether there is per rectal bleed or not.

### **VARICOSE VEINS**

**Signs:** Eczematous changes, oedema, pigmentation, tortuous veins

#### **Pathophysiology:**

- There are 2 types of veins in the lower limb: Superficial veins and Deep veins.
- The superficial vein drains into deep veins.
- The superficial veins and deep veins are connected by perforating veins.
- The perforating veins have valves which allow blood flow only in one direction i.e from superficial to deep veins.
- If the perforating veins become incompetent they begin to allow flow in opposite direction. i.e from deep into superficial.

#### **Superficial veins**

1. **Long saphenous vein** runs on the medial aspect of the leg all the way up to the sapheno-femoral junction.
2. **Short saphenous vein** runs on the lateral aspect of the leg into the sapheno-popliteal vein at the posterior aspect of the leg.

#### **Deep veins**

1. **Popliteal vein**
2. **Femoral vein**

**Management**

1. **Lifestyle modifications (avoid prolonged standing and elevate legs)**
2. **Minimally invasive therapies:**
  - a. **Radiofrequency ablation** - uses radio frequency energy to seal the lumen of the long saphenous vein
  - b. **Endovenous laser therapy** - uses high-intensity laser
  - c. **Foam sclerotherapy** - seals the vein using foam
3. **Surgery:**
  - a. **Phlebectomy** - removal of vein in parts
  - b. **Stripping** - removal of the entire vein
  - c. **Sclerotherapy** - seals the vein using sclerosing agent
4. **Compression stockings if interventional therapy not appropriate. Always exclude peripheral arterial disease before prescribing.**

**LUMPS IN THE GROIN****1. EPIDIDYMAL CYSTS** =also called **spermatocele**

- Usually located on the upper pole of the testes.
- It is above and behind the testes, palpable separately from the testes.
- It fluctuates and transilluminates

**Investigation: USS****Management: Surgical removal if symptomatic otherwise leave it****2. HYDROCOELE** This is accumulation of fluid within the tunica mucosa.

- Whole scrotum is enlarged, it can be of very big size e.g 10cm.
- No mass palpable in the testes rather the testes are enlarged as a whole
- Testes are not palpable
- It fluctuates and transilluminates

**Investigation: USS****Management: Aspiration. If asymptomatic then reassure.****3. TESTICULAR TUMOUR**

- Long standing history of a mass in the testes.
- Mass is firm in consistency , attached to the testes.
- If age between 20-30 its teratoma
- If age between 30-40 its seminoma.

**Investigation: Initial investigation is USS and blood tests for markers****Definitive: biopsy by doing orchidectomy.****4. TESTICULAR TORSION**

- **Sudden onset of severe testicular pain is always testicular torsion until proven otherwise.**
- Common in young patients especially adolescents
- May have vomiting as well
- Pain may start while riding a bicycle or playing football or any other sports but there usually no history of trauma

**Investigation and Treatment: Exploratory surgery.****5. HERNIA**

- The mass is usually above and medial to pubic tubercle
- +/- cough impulse
- On examination you cannot get above the mass.

**6. VARICOCELE** This is due to dilated veins of the scrotum

- Feels like a bag of worms
- Bluish in colour
- Disappears when patient lies flat
- Can be itchy and have an aching pain.

**Investigation: USS****Management: If asymptomatic then reassure  
If symptomatic then perform surgery.****7. EPIDIDYMO-ORCHITIS**

- Fever, dysuria, frequency of micturition.
- Swelling and redness on the testes

**Investigation: MSU****Management: antibiotics****INGUINAL HERNIAS****CLASSIFICATION**

1. **Reducible hernia**
  - Contents can be replaced completely into the peritoneal cavity
  - Presentation: Painless lump that disappears on lying flat and with cough impulse

2. **Irreducible hernia**
  - Due to adhesions if its contents to the inner wall of the sac
  - **Presentation:** Painless lump, no cough impulse and the lump is not reducible on examination
3. **Strangulated hernia**
  - Contents of the hernia are constricted by the neck of the sac to such an extent that their circulation is cut off.
  - Unless relieved, gangrene is inevitable and perforation will eventually occur
  - **Presentation:** Often with signs of intestinal obstruction i.e vomiting, constipation and distended abdomen plus the lump is tender, not reducible hernia and bowel sounds are increased.

**TYPES:****1. INDIRECT INGUINAL HERNIA**

Enters the internal inguinal ring, transverses the inguinal canal. If large enough it emerges through the external ring and descends into the scrotum. The hernia can be controlled by pressure with one finger over the internal inguinal ring.

**1. DIRECT INGUINAL HERNIA**

Pushes through the posterior wall of the inguinal canal media to the internal ring. It is not controlled by digital pressure over the internal ring.

**Treatment**

1. **In children below 12 years of age you do herniotomy**
2. **If presentation is below 1 year, wait until 1 year to do herniotomy.**
3. **In adults you do herniorrhaphy or also called hernia repair.**
4. **If it is REDUCIBLE OR IRREDUCIBLE HERNIA then you do elective (planned) hernia repair**
5. **If it is STRANGULATED HERNIA then you do immediate hernia repair.**

**1. FEMORAL HERNIA:**

More common in women and it commonly strangulates.

**Treatment: Because of high risk of strangulation, all must be treated surgically as soon as possible.**

**ANATOMY**

- The inguinal canal is 4 cm long.
- It passes downward and medially from deep to superficial from the internal to the external ring.
- It lies parallel to and immediately above the inguinal ligament.
- The internal ring represents the point at which the spermatic cord pushes through the transversalis fascia. The internal ring lies above and lateral to pubic tubercle and it is 1-2 cm above the femoral pulse.
- The external inguinal ring is a defect in the external oblique aponeurosis and lies immediate above and medial to pubic tubercle
- The inguinal canal contains the spermatic cord and the ilio-inguinal nerve.

**LEG ULCERS****1. DIABETIC ULCERS**

- Painless ulcer on the base of heel or base of the metatarsal
- History of diabetes or history of polyuria, thirst and weight loss

**Investigation: Blood glucose**

**1. VENOUS ULCER**

- Ulcer on the medial malleoli
- On examination there are varicose veins
- History of standing for long time due to venous stasis, e.g. people who work as waiters or guards.

**1. PYODERMA GANGRENOSUM**

- History of inflammatory bowel disease

**Investigation: Biopsy for pyoderma gangrenosum**

**1. MELANOMA**

- Usually middle aged or elderly patients with an ulcer over the shin or any other exposed area.
- The ulcer is pigmented, increasing in size with irregular margins and changing in shape.

**Investigation: biopsy for melanoma**

**1. ARTERIAL ULCER**

- History of intermittent claudication
- Painful ulcer

**DEEP VENOUS THROMBOSIS**

**Signs**

- Calf tenderness
- Calf warm to touch
- Swelling of the calf
- Mild fever
- Pitting oedema

**WELL'S SCORE**

- Active cancer (treatment within last 6 months or palliative): +1 point
- Calf swelling  $\geq 3$  cm compared to asymptomatic calf (measured 10 cm below tibial tuberosity): +1 point
- Swollen unilateral superficial veins (non-varicose, in symptomatic leg): +1 point
- Unilateral pitting edema (in symptomatic leg): +1 point
- Previous documented DVT: +1 point
- Swelling of entire leg: +1 point
- Localized tenderness along the deep venous system: +1 point
- Paralysis, paresis, or recent cast immobilization of lower extremities: +1 point
- Recently bedridden  $\geq 3$  days, or major surgery requiring regional or general anesthetic in the past 12 weeks: +1 point
- Alternative diagnosis at least as likely: -2 points[4]

1. 0 or less than zero points is low probability
2. 1-2 points is intermediate probability
3. 3 or more points is high probability

**Management of Deep venous thrombosis**

1. **IF LOW PROBABILITY do D-dimer as initial investigation**
  - a. **If D-dimer -ve it means DVT has been ruled out.**
  - b. **If D-dimer +ve then start treatment with heparin and investigate with compression US. If confirmed DVT then add warfarin and continue both warfarin and heparin until INR is 2. When INR is 2 stop heparin and continue warfarin. Maintain INR between 2-3.**
1. **IF INTERMEDIATE OR HIGH PROBABILITY, DO NOT PERFORM D-DIMER. START TREATMENT with low molecular weight heparin then Investigate with compression ultrasound scan**
  - a. **If +ve then add warfarin and continue both warfarin and heparin until INR is 2 then stop heparin and continue warfarin maintaining INR 2-3.**

**UPPER GASTROINTESTINAL BLEEDING****CAUSES:**

1. **Peptic ulcer disease**
2. **Mallory weiss tear**
3. **Oesophageal carcinoma**
4. **Gastric carcinoma**
5. **Gastric erosions due to medications ( NSAIDs, Aspirin, steroid, biphophanates)**
6. **Curling ulcers**
7. **Oesophageal varices**
8. **Renal failure**

Symptoms: the two main symptoms of upper GI bleeding are haematemesis and melena(black stool)

**1. PEPTIC ULCER:**

-There are 2 peptic ulcers we need to know: gastric and duodenal ulcers.

**Gastric Ulcers**

- stomach ulcers
- epigastric pain worse with meals
- relieved with anti-acids
- history of indigestion
- patient may lose weight due to fear of eating.

**Duodenal Ulcer**

- epigastric pain relieved with food and anti-acids
- worse at night due to fasting
- also called hungry ulcers.

**2. GASTRIC CARCINOMA**

- Elderly patient
- Symptoms of malignancy i.e weight loss, anorexia, tiredness, fatigue.
- Early satiety
- Epigastric pain or discomfort which may radiate to the back.
- Metastasis to the supraclavicular lymph nodes called Virchow's nodes.
- Common in Japanese.

**Investigation: Gastroscopy and biopsy**

**Management: Surgery if no metastasis**

**3. MALLORY WEISS TEAR**

- Usually young patient after binge drinking
- Patient needs not to be a alcoholic. Alcoholics usually suffer from oesophageal varices
- Usually they vomit small amount of blood after retching.
- Usually haemodynamically stable

**Investigation: monitor vital signs and FBC**  
**Management: Check full blood count 24 hrs after**

#### **4. OESOPHAGEAL CARCINOMA**

- Old age of the patient
- Dysphagia for solid initially then liquids.
- Weight loss, anaemia, anorexia, fatigue

**Investigation: Oesophago-gastroscopy and biopsy**

**Management:**

- **If there is no metastasis then treatment is resection of the oesophagus**
- **If there is metastasis treat with radiotherapy.**

#### **5. OESOPHAGEAL VARICES**

- Usually in alcoholics or patients with long standing liver disease e.g primary biliary cirrhosis or chronic viral hepatitis
- Massive bleeding
- Patient is in shock
- Repeated haematemesis
- On examination there can be stigmata of liver disease( spider naevi )
- Patient may smell of alcohol

#### **Primary Management of Oesophageal Varices:**

1. **Oesophago-duodenoscopy (OGD) is recommended in all patients when diagnosis of cirrhosis is made.**
2. **If patient has liver cirrhosis but no oesophageal varices the ne needs OGD every 3 years.**
3. **Cirrhotic patients with small varices need repeat OGD every 1-2 years. Use beta blockers for prophylaxis of bleeding. Use both beta blockers or endoscopic variceal ligation.**
4. **Nitrates may be used together with beta blockers.**
5. **Sclerotherapy has no role in the primary prophylaxis of variceal bleeding.**

#### **Management of Active Oesophageal Bleeding:**

1. **Take care of the ABC's of the patient**
2. **Get IV lines and send bloods including Group and Save**
3. **Cross match 6 units of blood**
4. **Emergency endoscopy (OGD)**
  - a. **Treatment of choice is band ligation**
  - b. **Sclerotherapy should be used if ligation is technically difficult.**
5. **Short term (<1 week) antibiotic prophylaxis should be prescribed e.g. ciprofloxacin, in any patient with cirrhosis and GI bleeding.**
6. **Somatostatin or its analogue must be prescribed e.g. octreotide**
7. **If bleeding does not stop with above measures, the balloon Sengstaken tube tamponade**
8. **If all fails consider Transjugular Intrahepatic Porto-systemic Shunt (TIPS)**

#### **Prevention of Secondary Bleeding (Rebleeding)**

1. **Use of band ligation (or sclerotherapy) plus beta blockers.**
2. **Band ligation is the first method.**
3. **Sclerotherapy should only be used if band ligation is technically difficult**
4. **TIPS is more effective than endoscopic procedures but does not increase survival**

#### **6. GASTRIC EROSIONS**

- Common in patient who are long term use of non steroidal anti-inflammatory drugs e.g ibuprofen, naproxen, aspirin, a
- Also steroid especially if patient is allergic to NSAIDs then is more likely to have been using steroid since he/she can not use NSAIDs.
- Also bisphosphonate. E.g alendronic acid.
- There can be history of back or joint pain or rheumatoid arthritis or osteoarthritis which indicate that patient has been taking NSAIDs

#### **7. CURLING ULCERS**

These are usually after burns.

**Treatment: Treat with proton pump inhibitors (PPI) if ulcers are severe**

#### **8. CHRONIC RENAL FAILURE**

Can also cause ulcers due to reduced excretion of gastrin

#### **MANAGEMENT OF UPPER GI BLEEDING**

1. **FBC to check for Hb**
2. **If you suspect patient of having oesophageal varices then needs urgent upper GI endoscopy**
3. **Usually all patient with upper GI bleeding will need UGI endoscopy except in cases of Mallory Weiss tear where there small amount of bleed.**
4. **Banding and sclerotherapy may be performed during endoscopy.**

#### **ACUTE ABDOMEN**

**RIGHT UPPER QUADRANT****1. ACUTE CHOLECYSTITIS**

Inflammation of the gall bladder usually with pre-existing gallstones.

**Signs & Symptoms:**

- Fever
- Pain in the right quadrant radiating to the right scapula worse with fatty foods.
- Nausea and vomiting
- Murphy's sign is positive

**Investigation:**

1. **USS is the investigation of choice (look for gallstones)**
2. **MRCP (Magnetic resonance cholangiopancreatography) is indicated if no evidence of gallstones found despite classical biliary pain.**
3. **ERCP should not be used as a routine investigation but in those patients who are likely to require intervention.**

**Management:**

1. **Symptomatic gallstones are most effectively treated with laparoscopic cholecystectomy.**
2. **Asymptomatic gallstones should be managed conservatively unless in the following situations when laparoscopic cholecystectomy is recommended**
  - a. **Big stones in the gall bladder**
  - b. **Small stones in the gall bladder but in very young patients**
  - c. **High risk of complications like in a diabetic patient**

1. **CHOLANGITIS** - This is inflammation of the common bile duct.

**Signs & Symptoms:**

**Charcot's triad of cholangitis:** right upper quadrant pain, fever and jaundice

**Reynold's pentad of ascending cholangitis:** Charcot's triad + shock and altered mental status

**Investigation: USS**

**Management: cefuroxime and metronidazole.**

1. **BILIARY COLIC** - Usually presents with intermittent pain in the right upper quadrant due to pain caused by the stones in the gallbladder.

**Signs & Symptoms**

- Pain in the RUQ
- Radiating to the right shoulder
- Jaundice but there is no fever.

**Investigation:**

1) **USS**

2) **ERCP-if obstructive jaundice and worsening LFT or if there is a stone in the common bile duct.**

**Management: Conservative treatment is first line treatment for small stones.**

**1. PYELONEPHRITIS****Signs & Symptoms**

- Loin pain
- Fever
- Dysuria and frequency
- Rigors and vomiting

**Investigation: MSU**

**Management: Antibiotics: cefuroxime or cefotaxime**

**1. LOWER LOBE PNEUMONIA****Signs & Symptoms:**

- Fever
- Cough
- Shortness of breath
- Sputum
- Chest pain

**Investigation: CXR**

**Management: Antibiotics**

**1. RENAL COLIC****Signs & Symptoms**

- Intermittent loin pain
- Haematuria

**Investigation: IVU**  
**Management: rehydration or stone removal.**

#### 1. AMOEBIIC HEPATIC ABSCESS

- History of travel to tropical areas and diarrhea
- Right upper quadrant pain and jaundice

**Investigations: USS, Stool antigen**  
**Treatment: Metronidazole +/- Incision and Drainage**

#### 1. ACUTE VIRAL HEPATITIS A (HAV)

- History of travel e.g to India
- Upper quadrant pain
- Jaundice
- Diarrhoea

**Investigation: Hepatitis serology**  
**Management: Interferon**

### LEFT UPPER QUADRANT

#### 1. SPLENIC RUPTURE

- Usually is due to trauma
- On examination there are bruises on the abdomen

**Investigation: USS abdomen**  
**Management: Laparotomy.**

1. PYELONEPHRITIS=same as in RUQ.
2. RENAL STONE=same as in RUQ
3. LOWER LOBE PNEUMONIA=same as in RUQ

### EPIGASTRIC PAIN

#### 1. PERFORATED PEPTIC ULCER

- Pain and tenderness in the epigastrium or upper abdomen
- May be history of indigestion or use of NSAIDs or history of rheumatoid arthritis or back pain because people with these conditions usually use NSAIDs.

**Investigation: Erect CXR=to see gas under the diaphragm (pneumoperitoneum)**  
**Management: Laparotomy**

#### 1. ACUTE PANCREATITIS

- Epigastric or upper abdominal pain which radiates to the back
- Profuse vomiting
- Abdominal pain may quickly become generalized
- Reduced bowel sounds
- Patient is in shock i.e low BP and tachycardia.

**Investigations:**

1. **Investigation of choice is serum amylase to confirm diagnosis.**
2. **Plasma lipase can also be used and is more sensitive than amylase**
3. **USS to look for gallstones**
4. **CT abdomen is the gold standard if diagnosis is not clear after checking amylase and lipase**

**Treatment:**

1. **IV fluids and NGT if vomiting**
2. **Prophylactic antibiotics**
3. **Gallstone-related pancreatitis needs urgent ERCP and laparoscopic cholecystectomy should be performed within 2 weeks.**

#### 1. MYOCARDIAL INFARCTION

- Epigastric pain
- Elderly patient
- Nausea
- Sweating in the palms
- History of ischaemic heart disease.

**Investigation: ECG & Cardiac enzymes.**

### RIGHT ILIAC FOSSA



**1. APPENDICITIS**

- Central abdominal pain which then moves to right iliac fossa
- Vomiting, fever, anorexia
- On examination there rebound and guarding
- **THIS IS A CLINICAL DIAGNOSIS**

**Investigation: FBC****Management: Appendicectomy****1. SALPINGITIS** This is Pelvic Inflammatory Disease

- It is due to sexually transmitted infection, commonly Chlamydia
- Per vaginal discharge

**Investigation: Endocervical swab****Management: Antibiotics.****1. TUBO-OVARIAN ABSCESS** Complication of pelvic inflammatory disease

- Usually there is swinging fever
- On examination there is a mass in the in the iliac fossa.

**Investigation: USS****Management: Incision and drainage.****1. URETERIC COLIC** Due to stones in the ureter.

- Right or left iliac fossa pain which radiates to the groin.
- Haematuria

**Investigation: IVU****Management: Rehydration or depending on the size of the stone may use lithotripsy or open surgery.****LEFT ILIAC FOSSA****1. DIVERTICULITIS** See Diverticulitis under section of **PER RECTAL BLEED**.

- 1. URETERIC COLIC** - same as in RIF
- 2. SALPINGITIS** – same as in RIF
- 3. TUBO-OVARIAN ABSCESS** - same as in RIF

**CENTRAL ABDOMEN****1. INTESTINAL OBSTRUCTION**

The four cardinal signs of intestinal obstruction

- Vomiting
- Abdominal pain
- Distended abdomen
- Absolute constipation

**Investigation: Plain abdominal X-ray=dilated bowel loops****Management: Surgery****1. ABDOMINAL AORTIC ANEURYSM-**

- Usually middle aged or elderly patient
- Pulsatile mass in the abdomen
- Absent femoral pulses bilaterally
- Patient is in shock i.e low BP and tachycardia
- Abdominal pain which radiates to the back

**Investigation: CT abdomen****Management: Laparotomy.****3) ACUTE MESENTERIC ISCHAEMIA**

- Sudden onset of abdominal pain, with no signs of peritonism i.e no rigidity or guarding.
- There is per rectal bleed
- History of IHD or AF or valvular heart disease
- Cause is an emboli

**Investigation: Arteriography****Management: Heparin and antibiotics.****SUPRAPUBIC AREA****1. UTI** - urinary tract infection.

- Dysuria

- Frequency of micturition
- Fever

**Investigation: MSU**

**Management: Antibiotics, usually Trimethoprim**

1. **BLADDER STONES:**

- Pain on urination
- Haematuria
- Usually suprapubic pain

**Investigation:**

- **KUB x-ray is the initial investigation**
- **IVU is the most appropriate investigation**

**Management: Rehydration or stone removal.**

**XVI. PROCEDURES AND RELEVANT ANATOMY  
IN SURGERY**

1. **Needle Cricothyroidotomy** – Cricothyroid membrane will be the last structure pierced before reaching the desired anatomical space, the trachea.
1. **Chest drain** – 4<sup>th</sup> to 6<sup>th</sup> intercostal space at the mid axillary line through the "safe triangle". Pierce the intercostal muscles. The structure likely to be damaged is the intercostal nerve.
1. **Lumbar puncture** – Inserted between L3 & L4, landmarks is the plane between the iliac crests. Pierces the dura mater before reaching CSF

Resource start date 2013-06-30 05:31  
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