Radiological and Imaging Procedures

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Introduction

Radiological imaging of the abdomen and pelvis provides essential diagnostic information about the position, shape, and pathology of internal organs. Common methods include plain skiagrams (X-rays), barium studies, and pyelography.

Plain Skiagram of Abdomen (KUB Film)

Purpose: To visualize bones, soft tissues, gas, and calcifications.
Types:

- *Straight film*: For acute abdomen without preparation.
- *Scout film*: Taken before a contrast study.
- *KUB film*: Focuses on kidneys, ureters, and bladder.

Preparation:

- In emergencies — no preparation.
- For routine studies — fasting for 12 hours, use of antiflatulents and laxatives to reduce bowel gas.

Structures Seen:

- **Bony shadows:** Lower ribs, lumbar vertebrae, sacrum, hip bones.

- **Soft tissue shadows:** Diaphragm, psoas muscles, kidneys, liver, spleen.
- **Gas shadows:** Air under left diaphragm (stomach fundus), intestinal gas, faecal patterns.
- **Abnormal findings:** Free gas (perforation), calcified stones, abnormal soft-tissue masses

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Alimentary Canal (Barium Studies)

Contrast Medium:
Barium sulphate suspension outlines the mucosa of the gastrointestinal tract. It is **radio-opaque**, non-toxic, and not absorbed by the gut

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Barium Swallow

Procedure:

- Patient swallows 50% barium sulphate suspension 2–3 times while standing under fluoroscopy.
  Purpose: To visualize the **oesophagus**, especially its relation to the aortic arch, left bronchus, and left atrium.
  Findings: Left atrial enlargement compresses the oesophagus posteriorly

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Barium Meal Examination

Preparation:

- Patient fasts for **12 hours** before examination.

Observation:

- **Stomach:** Triangular shadow below left diaphragm, showing peristaltic waves and rate of emptying.
- **Duodenum:** Duodenal cap and feathery pattern due to mucosal folds.
- **Jejunum and ileum:** Feathery pattern in jejunum, smooth shadow in terminal ileum.
- **Large intestine:** Shows haustral markings; appendix may appear faintly

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Barium Enema

Preparation:

- Mild laxative two nights before; warm-water enema on examination day.

Contrast Medium:

- About **2 litres of barium sulphate** introduced via anus until it reaches the ileocaecal valve.

Findings:

- Colon shows **haustrations**; rectum and sigmoid colon are dilated.

- **Double-contrast method:** After partial evacuation, air is introduced to enhance mucosal details

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Pyelography (Urography)

Definition: Visualization of the urinary tract using a radiopaque dye.

Types:

1. **Excretory (Intravenous) Pyelography:** Dye injected intravenously (e.g., urografin, Conray).
    - **Preparation:** Fasting 8 hours, no fluids, bladder emptied before injection.
    - **Exposures:** Taken at 5, 15, and 30 minutes post-injection.
    - **Findings:** Minor calyces (cup-shaped), renal pelvis (funnel-shaped), ureter course visible along lumbar transverse processes, bladder (oval/triangular).
2. **Retrograde (Instrumental) Pyelography:**
    - Dye introduced **via ureteric catheter** through a cystoscope for direct visualization of the urinary tract

Radiological and Imaging Procedures (Continued)

Excretory (Intravenous or Descending) Pyelography

Definition:
This procedure demonstrates the urinary tract by intravenous injection of a **water-soluble**

iodinated contrast medium (e.g., Urografin, Conray). The contrast is excreted through the kidneys, outlining the pelvicalyceal system, ureters, and urinary bladder on X-rays.

Preparation:

- Patient fasts for **8–12 hours** before the procedure.
- Laxatives and fluids are restricted to reduce bowel gas shadows.
- The bladder should be **emptied immediately before** the study.

Procedure:

1. Inject the contrast intravenously.
2. Serial radiographs are taken at **5, 15, and 30 minutes** after injection.
3. Later films may be taken to visualize **delayed excretion** in obstructed cases.

Findings:

- **Minor calyces:** Appear cup-shaped, forming the calyceal pattern.
- **Major calyces:** Funnel-shaped structures merging into the renal pelvis.
- **Renal pelvis:** Triangular or funnel-shaped, continuous with the ureter.
- **Ureter:** Narrow tubular shadow descending along the **tips of the lumbar transverse processes**.
- **Bladder:** Pear-shaped shadow in the pelvic cavity, with filling defects suggesting stones or tumors.

Clinical Uses:

- Detection of **renal calculi, hydronephrosis, ureteric obstruction, and bladder pathology**.
- Helps assess **renal function** and the patency of the urinary tract.

Retrograde (Instrumental or Ascending) Pyelography

Definition:
In this technique, contrast medium is **introduced directly into the ureter** through a **ureteric catheter** passed via a cystoscope into the bladder. It allows visualization of the **renal pelvis and ureter** when intravenous excretion is inadequate.

Procedure:

1. Performed under **local or spinal anaesthesia**.
2. A cystoscope is passed into the bladder, and a fine catheter is introduced into the **ureteric orifice**.
3. Contrast medium is injected **slowly**, and X-rays are taken immediately.

Findings:

- Outlines the **ureter and renal pelvis** in great detail.
- Detects **strictures, calculi, diverticula**, or any structural abnormality.

Advantages:

- Provides **sharp, high-resolution images** of the collecting system.
- Not dependent on renal function.

Disadvantages:

- **Invasive** and may cause **urinary infection or trauma** to the mucosa.

Biliary Apparatus (Ultrasonography)

Principle:
Ultrasound uses **high-frequency sound waves** to create images of the liver, gallbladder, bile ducts, and pancreas. It is **non-invasive, safe, and does not require contrast media**.

Procedure:

- Conducted after **6–8 hours of fasting** to reduce bowel gas and allow gallbladder distension.
- The transducer is placed over the right upper quadrant and subcostal region.

Findings:

- **Liver:** Uniform echotexture; enlargement or focal lesions may be noted.
- **Gallbladder:** Thin-walled, anechoic sac; stones appear as **echogenic foci with posterior acoustic shadowing**.
- **Common bile duct:** Measured normally up to **6 mm in diameter**; dilatation suggests obstruction.
- **Pancreas:** Echogenic structure lying transversely below the stomach.

Clinical Uses:

- Diagnosis of **cholelithiasis, cholecystitis, biliary obstruction**, and **liver abscess or metastasis**.

Hysterosalpingography (HSG)

Definition:
A radiographic procedure to visualize the **uterine cavity and fallopian tubes** using a **radio-opaque contrast medium**.

Purpose:

- Commonly performed to investigate **infertility** and assess **tubal patency**.
- Also helps detect **uterine malformations, adhesions, or intrauterine fibroids**.

Procedure:

1. Performed after menstruation (around **day 8–10 of the cycle**) to avoid interference from endometrial shedding or pregnancy.
2. A **speculum** is used to expose the cervix, and a **cannula** is inserted into the cervical canal.
3. Contrast medium is injected slowly while radiographs are taken.
4. The dye outlines the **uterine cavity**, then flows into the **fallopian tubes**, and finally spills into the **peritoneal cavity** if the tubes are patent.

Findings:

- **Normal study:** Triangular uterine shadow with bilateral tubal outlines and free peritoneal spill.
- **Blocked tubes:** Dye fails to pass beyond the point of obstruction.
- **Uterine anomalies:** Septate or bicornuate patterns visible.

Clinical Importance:

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- Valuable for diagnosing **tubal obstruction, uterine anomalies, intrauterine adhesions**, and post-surgical evaluation of tubal ligation or reconstruction.