

Course outline:

- Mitra RAD 404 technique
- ✓ Radiographic examination of the skull
 - ✓ Dental radiography
 - ✓ Skeletal surveys
 - Radiography of the viscera and soft tissue.
 - ✓ Accident and emergency radiography
 - Introduction to investigations involving contrast media.
General radiographic technique guideline.
 1. Give brief anatomy of the region
 2. Indications i.e. reasons for tion e.g disease, injury etc.
 3. Equipment and accessories: e.g radiolucent pads and sand bags.
Right(R) and left(L) marker, grid, chair at side or end of table. Pieces of lead (pb) rubber. Overhead tube.
 4. List of basic views e.g Ap, lateral ,
 5. Patient preparation: eg patient remove rings, bracelet, and watch from affected limb it may be necessary to remove the coat sleeve or a sling. Explanation given to patient or patient relation ==> vital if a child.
 6. Positioning of patient.
 7. Film cassette tube direction.
 8. Centering point and cassette displacement
 - i. Exposure factors
 - Radiation protection! E.g.
 - Careful technique to avoid repeats.
 - Collimation of the beam.
 - Use of lead rubber, gonad shields.
 - ii. Care of patient -> before, during and after the investigation.

SKULL

1. Brief Anatomy: the skull is the skeleton of the head and includes the mandible. Cranium is the skull without the mandible, this cranium is made up of various bone compartments joined together by cranial sutures. The skull also contains a lot of cavities. Like

Diagram:

RADIOGRAPHIC LANDMARKS

Radiography of the skull is carried out with reference to visible or palpable landmarks and recognized lines and planes of the skull.

1. Outer canthus of the eye.
- Where the upper and lower eyelids meet laterally. *edge of eye*
2. Infra- orbital point: the lowest point on the inferior orbital margin.
3. Nasion- the fronto- nasal articulation
4. Glabella- a bone prominence just above the nasion.
5. Vertex – the highest point of the skull in the median sagittal plane.
6. External occipital protuberance (inion)
- A bony prominence on the occipital bone.
7. External auditory meatus- the opening into the external auditory canal.

LINES

- i. Interorbital (interpillary) line => joins the centre of the two orbits or the centre of the two pupils when the eyes are looking straight forward. This line is at right angles to the midian saggital plane.
- ii. Infra- orbital line -- joins the two infra- orbital point.
- iii. Anthropological base line- passes from the infra-orbital point to upper border of the external auditory meatus.
- iv. Auricular line- perpendicular to the anthropological base line and passing through the centre of the external auditory meatus. It is in a coronal plane.
- v. Orbito- meatal base line (OMBL) => extends from the outer of the canthus of the eye to the centre of the external auditory meatus. This line is about 10° to the anthropological base line.

Diagram

Planes: *Median Sagittal plane*

1. Medium - sagittal plane: Divides the skull into right and left halves.
2. Anthrological plane: horizontal plane containing the two anthropological base lines and the infra- orbital lines.
3. Orbito- meatal plane – contains the two orbito- meatal base lines and is at an angle of 10 degrees to the anthropological plane. *meatal*

- perpendicularly.*
4. Annular plane: is perpendicular to the anthropological plane and passes through the centre of the two external auditory meatuses. It is one of the coronal planes.

2. EQUIPMENT AND ACCESSORIES:

- Bucky table can be used, but a specialised or dedicated skull unit is used. The quality of image obtained with specialized unit is better than that obtained with ordinary bucky table. This is because there is precision in calibrations, projections (field) and focus film distance.
- Moving or stationary grid can be used. Highly ratio stationary grid is needed. R and L marker.

Basic view:

a. GENERAL SKULL SURVEY

- i. Occipito-frontal - OF
- ii. Lateral
- iii. Fronto-occipital 30 degrees caudad
- iv. Occipital frontal 30 degree cephalad

b. NEUROLOGICAL :- lateral

OF

- OF 30° caudad (for base of skull)
- Submento- vertical of 20° caudad (orbital view)

c. TRAUMA - laterally - supine (shot through)

- FO
- FO 30° caudad.

d. SELLATURCICA ALL PARTS - lateral, OF 20° floor of pituitary fossa caudad, OF 30° anterior and posterior clinoid cephalad. Processes, dorsum sellae FO, 30° caudad.

- e. Base of skull - lateral, submento-vertical FO 300 caudad.
- f. Optic foramina - Anterior obliques of both sides.
- g. jugular foramina - submento- vertical 20degrees caudad.

4. Patient Preparation:

All opacities should be removed from the head and neck. These include hairpins and clips, weapons, earrings, dentures, neck ornaments and zip fasteners. If hearing aid is to be removed, this is done when the patient has understood the necessary instructions.

5. Positioning:

Patient immobilization is very necessary. This is to ensure that high quality radiographs were obtained. Immobilize patients head with straps or

compression bands if need be. Also foam pads and sand bags are used for skull immobilization.

6. Films, cassettes and screens

Normal film size is $24 \times 30\text{cm}$ ($10 \times 12''$). For localized regions eg. Cone sella turcica $18 \times 24\text{cm}$ ($8 \times 10''$) film is used.

Cassette is placed in the film tray longitudinally for OF view and transversely for lateral view.

Type of intensifying screen is chosen bearing in mind the need for short exposure time without compromising the required resolution.

7. Radiation Protection.

The lens of the eyes is highly sensitive to radiation. Therefore, radiation close to the eye must be kept as far as possible. Therefore OF view is desirable whenever possible.

DESCRIPTION OF BL... VIEWS

1. Lateral (basic)

Positioning of patient and film

- Patient lies on the couch in a semiprone position with the side of the head in contact with the table.
- Raised shoulder is supported on pads and the knee and arm of the raised side are fluid with the patient's hand at the level of the chin but out of the primary beam.
- Median sagittal plane- parallel to the table
- A point midway between glabella and external occipital protuberance in the midline to the table
- Nasion and inion=> equidistant from the table
 - Inter - orbital line => at right angle.
- Anthropological line => along the transverse axis of the table.
- Head is immobilized with a head binder or pads and sandbags.
- Cassette is placed transversely in the bulky tray and its upper edge 5cm above the skull vertex.

Centering point

Using vertical beam, the central ray is directed to a point midway between the glabella and the external occipital protuberance.

Note: correct positioning and centering will show that the right and left sides of the base of the skull are superimposed i.e. superimposition of right and left sides of orbital plates of frontal bone and the two anterior chond processes, the two posterior chond processes and the two temporal bones.

ii. **Lateral Supine**: In using isocentric (dedicated) skull unit, the lateral supine view of the skull is taken, this is done using horizontal central ray (lateral shot through median sagittal plane => parallel to the cassette).

- It is also used in case of head injury, it is important to exclude an air fluid level in the cranial cavity, the ventricles of the brain or in the paranasal air sinuses.

Positioning- Patient supine, a small non-opaque pad under the head so that the occiput is included on the film. Median sagittal plain - rt angle to the table - external auditory meatuses => equidistant from the table.

Centering Point- Horizontal central ray directed parallel to interorbital line such that it is at rt angle to the median sagittal plane.

Cassette – Midway between glabella and exam.

iii. N:B Read up: **lateral 25-30 degrees caudad**

- Used in case of suspected of the base of the skull which is not demonstrated in the lateral view.

Iv. Occipito Frontal (OF)

Advantage: reduces radiation ^{close} close to eyes

Patient position: patient may be prone or sitting.

In prone position- patient to the midline of the table. Nose and forehead in contact with the table. Hands at the side of the head away from the primary beam => this helps to stability and immobilization of the patient. Neck is flexed thus bringing the chin towards the chest so that OMBL is at right angle to the table. EAM=>equidistant, that median sagittal plane is at right angle head can be immobilized using a head bid or pads and sandbags.

Cassette size: 30 x 24cm placed longitudinally with its upper edge 5cm above the vertex of the skull.

Structures shown: frontal bone with superimposed occipital bone. Petrons portion of the temporal bones.

*Read up 10° caudad 15° caudad and 20° caudad with structures they show.

Fronto – Occipital (Read up).

FO 30° caudad:

Patient positioning:

- Patient supine and to the midline of the couch.
- External auditory meatuses equidistant from the couch. So that median sagittal plane is at right angle to and in the midline of the couch.

- Chin is depressed so that orbito- meatal line is at right angles to the table.
 - Head immobilized using a head binder pads or sand bags.
- Cassette Size:** 30 x 24cm placed longitudinally in the bulky tray with its upper edge at the level of the vertex of the skull.

Centering point: Angle the central ray 30 degrees caudally to the orbito-meatal plane. It is directed in the midline to pass midway between the EAM.

NB: if the patient chin cannot be sufficiently depressed to bring the orbito-meatal line at right angles. Then increase tube angulation to the vertex so that it makes an angle of degrees to the orbito-meatal plane.

Interested structures: Dorsum sella.... of the sphenoid bone projected within the foramen magnum of the occipital bone.

READ UP: OF 30° CEPHALAD.

* **SUBMENTO- VERTICAL (SMV)**

Patient position:

- Patient may be supine on the table or sitting back to erect bulky.
- In supine position raise patient's shoulders on pillows.
- Neck hyper extended
- Vertex - on the table
- EAM'S - equidistant
- Median sagittal plane - rt. Angle. In sitting position. Patient sits close to the erect bulky, allow the head to fall back so that the vertex is in contact with the erect bulky.
- However SM is better demonstrated with dedicated skull unit.

Cassette size: 30 x 24cm placed longitudinally with its centre to coincide with the central ray.

Centering point: central ray is directed at right angle to the orbito- meatal plane and centered midway between the EAM's.

Structures: Mandibular heads is cleared away from petrous bone 2. Foramina of the middle cranial fossa.

SELLA - TURCICA { depression in of sphenoid bone that contains Lateral (basic) { pituitary gland

Patient position

- Patient sit with one side of the head to the erect bulky.
- Arm of the same side extended towards the trunk.
- Arm of the opposite side flexed grip the bulky.
- Median sagittal plane is parallel to the erect bulky.

Inter-orbital line is at right angle to the bulky.

Nasion and external occipital- protuberance are -equidistant to the film or bulky.

Centering point:

Using a well collimated beam the horizontal central ray is centred to a point 2.5cm vertically above a point 2.5cm along the base line from EAM that is towards the x-ray tube.

Cassette size: 18 x 13cm or 24 x 18cm is placed in the bulky tray with its centre to the centre of the bulky.

Optic foramina (Anterior Oblique).

Patient Position:

Patient lies prone. The nose, ~~chin~~ and chin of the side being examined, will be in contact with the couch.

Median sagittal plane - 55° to the table

Orbito- meatal line - 55° to the table.

Centering point: using well collimated beam centre 7.5cm above and 7.5cm behind the ~~behind~~ EAM. Both sides are taken for comparison.

Cassette size: 18 x 13 or 18 x 24 with its centre to the orbit.

READ: JUGULAR FORAMINA.

THE TEMPORAL BONES

Fronto- occipital 35° caudad

Patient positing:

May be supine or sitting with the back to the erect bulky.

EAM's - equidistant from the table

Median sagittal plane - Rt. angle and in the midline of the table.

Orbito- meatal line - at right angle.

Centering point: angle 35° caudad so that the central ray makes an angle of 350° to the orbito-meatal line.

Centre midway between the EAM's. the beam is collimated to include the mastoid and petrous parts of the temporal bones.

Cassette size: 18 x 24cm. placed transversly and is centered at a level to coincide with the angled central ray.

SMV is also used to demonstrate temporal bones.

Lateral (Mastoid air cells).

Lateral 25 degrees caudad.

Patient positioning:

May lie prone or sit facing vertical bulky. It is then turned sufficiently on to either side to allow the side of the head to rest on the table.

The auricle of the ear adjacent to the table is folded forward. If the patient is prone, the raised shoulder is supported on pads, the knee and arm of the raised shoulder is supported on pads and knee and arm of the raised side are flexed. Opposite arm is extended along side the trunk.

Median sagittal plane => parallel to the table

Anthropological plane => transverse to the table

Nasion and occipital protuberance are equidistant from the table.

Inter-orbital line => Rt. Angle to the table

Centering point: Angle central ray 25^0 caudad. It will also make an angle of 25^0 to the anthropological plane and is centred to a point 5cm above the EAM remote from the film along the auricular line.

Cassette size: 13 x 18cm or 18 x 24cm cassette is placed longitudinally so that the centre coincides with the angled central ray.

READ: profile view.

READ: Petron's, OF and anterior oblique (sterver's view).

Diagram Sinuses

Basic views

- a. Occipto-matal - OM
- b. Occipito-frontal - OF
- c. Lateral

Maxillary sinuses - is the biggest paranasal sinuses. Two in number and sometimes referred as auta (autrum). They are demonstrated in OF, OM and lateral views.

Ethmoidal found in the ethmoidal labyrinth which forms part of the medial wall of the orbit and the upper lateral walls of the nasal cavity. They are very tiny sinuses between the orbital bones. Demonstrated by OM, OF, lat and Smv. Spheroid sinuses, it lies below the sella turcica.

Demonstrated in lateral view and OF with mouth open.

One important feature with sinuses is that they contain air. Therefore they are more transradiant than adjacent structures showing increased optical densities on the radiography. Presence of pathology fluid, polyps, or thickened mucosal lining results in a decrease in optical density. So one significant objective is to look for fluid level. Therefore all sinuses must be done in erect position.

Patient preparation: As for skull.

Cassette and film sizes: 13 x 18cm or 18 x 24cm.

~~READ: Facial BONES and Orbita~~

Mandible lateral 30 degree cephalad (basic) note: in cases of injury, both sides must be examined to demonstrate a possible centre coup' fracture.

Patient positioning:

1. Patient sits facing the end of the bulky table and places the side of interest in contact with the cassette (horizontal).
 - Patient trunk rotated slightly so that the shoulder of the opposite side is not projected on the film. Interorbital line at right angle, nasion and ext. occipital protuberance equidistance
 2. Patient supine, rotated to allow the head lie comfortable. Trunk supported on foam pad. Interorbital line => rt. Angle, nasion and ext. occipital protuberance equidistant
 3. Patient spine, median sagittal plane at right angles cassette supported vertically and in contact with the side of interest.
- ⇒ Centering point: Angle 30° cranially and centre 5cm inferior to the angle of the mandible that is away from the film.
- ⇒ Cassette size: 18 x 24cm with its lower edge 1 or 2cm below the lower border of the mandible.
- ⇒ Postero -anterior (basic)
- Demonstrates body and mandibular rami.
 - To demonstrate mandibular condyles use postero- anterior 10 degree cephalad.
 - To demonstrate symphysis menti-use anterior oblique.

Pa (basic)

Patient positioning

- Patient sits or lies prone.
- Nose and forehead in contact with the table.
- Hand at the side of the head out of the primary beam.
- Orbital meatal line - rt. Angle to the table.
- EAM's - equidistant from the table
- Median sagittal plane- rt. Angle.

Centering point: Middle at the level of the angles of the mandible.

Cassette size: 118 x 24 placed longitudinally.

Temporo - Mandibular (TMJ)

(Join's mandible to the skull)

1. Lateral 25 degrees caudad (basic).

Patient Positioning

Patient sits or lies prone facing the bulky with one side of the head on the bulky.

- Arm of the same side extended by the trunk.
 - Arm of the opposite side flexed.
 - Center of the bulky is 1cm along the orbito- meatal line anterior to the EAM (i.e. adjust the head 1cm backward).
 - Median sagittal plane – parallel.
 - Inter- orbital line – rt. Angle
 - Nasion and ext. occipital protuberance equidistant.
- ⇒ Centering point: using a well- collimated beam, angle 250 caudad and centre 5cm superior to the jt remote from the film. Both sides are examined in following conditions.

1. The teeth clenched with the molars in opposition.
2. Mouth closed with jaws relaxed.
3. Mouth opens as much as possible.

Dentures should not be removed from this examination.

N: B: Three or six exposures may be made one film if the cassette is suitably protected for the separate exposures with the film labeled to indicate how each exposure was made in relation to positions 1-3 above.

2. TMJ PA 10 degree Cephalad.

Patient positioning:

- Patient sits or lies prone.
- Patient centered to the middle of the table with the nose and forehead in contact with the table.
- Hands at the sides of the head.
- Orbito- metal line => rt. Angle to the table.
- EAM's => equidistant.
- Median sagittal plane => rt. Angels.

Centering point: Angle 10° cephalad and centre midline at the angles of the mandible. It is not necessary to different exposures with the open and closed. Cassette sizes: 18x24cm placed longitudinally and centered to coincide with the central ray. READ: FO 350 caudad.

DENTAL RADIOGRAPHY

Dental radiography is important in dentistry for the detection of trauma, pathology of the teeth, for examination of the nasal cavity and maxillary sinuses, it also used for the analysis of facial form and before facial surgery. When a film is placed inside the mouth during dental examination- intra- oral radiography. Outside the mouth- extra oral radiography.

- ⇒ Intra- oral radiography

Divided into: 1. Bite wing or inter proximally demonstrates the crowns of the teeth and alveolar crests over a part of both jaw. 2. Peri-apical - demonstrates the full length of the teeth together with the surrounding bone. 3. Occlusal radiography - film is placed in the occlusal plane.

Extra- Oral Techniques:

Used in dental and orthodontic radiography.

1. Oblique lateral => demonstrates upper and lower teeth from the canine to the third molar region.
2. Lateral cephalometry: for measurement of facial features in diagnosis and planning of orthodontic treatment.
3. Orthopantomography - provides a panoramic view of the upper and lower teeth and jaws

TERMINOLOGY:

Mesial - means towards the median sagittal plane following the curvature of the dental arch.

Labial or buccal => refers to outer side of the dental arches adjacent to the lips or cheeks. Lingual or palatal refers to the inner side of the arches adjacent to the tongue or palate.

Occlusal planes: plane passing through the opposing biting surface of the teeth.

Upper occlusal plane: lies 4cm below and parallel to a line joining the tragus of the ear to ala of the nose when the mouths open. The lower occlusal plane: lies below and parallel to a line joining the tragus of the ear to the angle of the mouth when the mouth is open wide.

Dental Formula

Deciduous or temporal teeth are represented as four groups of five to correspond to left and right.

Upper and lower being represented by letter "a" to "e" from mesial first incisor to distal 2nd molar as shown the diagrams below.

'Diagram

The permanent teeth are also divided into four groups of eight and are numbered 1 to 8 from mesial first incisor to distal third molar.

Permanent teeth.

Diagram

Federation Dentaire International Formula

It identifies each tooth mouth two digits. This method is more suitable modern electronic communication.

The teeth is divided into four quadrants, for permanent teeth 1 to 4.
For deciduous teeth 5 to 8.

These numbers proceed the number of the teeth in a particular quadrant.
For permanent teeth 1 to 4.

For deciduous teeth 5 to 8.

These numbers precede the number of the tooth in particular quadrant.
For permanent teeth 1 to 8

For deciduous teeth 1 to 5 from mesial first incisor to the most distant molar.
Deciduous teeth

Diagram

Permanent teeth

Request example:

37, 38

Left lower 2nd and 3rd molars.

Intra – Oral Radiography

Adequate hygiene should be observed while carrying out intra-oral investigations.

- Hands should be adequately ^{wash} before the investigations preferably in the presence of the patient.
- Wear sterile disposable gloves.
- Use film positioning aids e.g. Spencer wells forceps, dental film holders, bite blocks surgical trolley. All these items should be sterilized after use.

- Films are contained in a damp proof pack with lead foil behind to absorb transmitted primary radiation and back scatter
- Film and pack have embossed dot to indicate tube side.
- Film sizes, 31 x 41mm for bite wing and periapical.
- 57 x 76mm for occlusal.
- 22 x 35mm for children and lower incisors of adults.
- 57 x 76mm occlusal cassette with intensifying screens will also be required occasionally.
- Disposable waterproof envelopes are ~~wax~~ ^{wax} paper to cover this cassette when in use. A flange is usually provided on which the patient bites to hold the film.

Processing techniques: either manually or special dental automatic processor is used. Dental film hangers are also available. Patient's identification details are recorded where the radiograph will not be obscured.

Radiation protection: Dental unit will have a specified cone of 20cm when using more than 60KVP because short focus-film distance. 10cm at lower Kvp\$. Field diameter at the end of the cone should not exceed 10cm.

- **Protective lead-** rubber aprons extending from the neck to the laps are also provided for the patient.
- Staff must be at least 1.5cm from the tube and patient.

Bite wing (inter proximal).

Provides the crown of teeth and the alveolar crests for the detection of caries, internal disorders of the pulp and periodontal disease.

For premolar and molar teeth

- Patient positioning
- Patient sits with the head supported.
- Median sagittal ^{plane} plan vertical.
- Occlusal plane horizontal.
- Film is positioned with the tube side as close as possible to the lingual side of the lower teeth with the bite wing lying flat on the crowns of teeth.

Patient closes the mouth to grip the bite wing between the teeth. Spencer-wells forceps can be used to grip the buccal edge of the bite wing during this investigation so that the film does not slip out of position.

Two films are needed to include all the molar and premolar tooth crowns of each side of an adult, the first molar being included on both films.

Centering point

Centre to the centre of the film at right angles to the buccal surface of the teeth in the mesio-distal direction and to the long axis of the film to avoid superimposition of adjacent teeth. Angle 5° caudally.

Periapical view:

Shows bucco-lingual view of individual teeth and their surrounding periodontal membrane and alveolar bone. Also used to demonstrate retained tooth roots.

Two different techniques may be applied.

1. Bisecting angle technique. Central ray is centered at right angles to the bisector of the angle between the long axis of the teeth and the film plane.
2. Parallelizing technique. Centre at right angles to the film which is placed parallel to the teeth.

Diagram

Superimposition of adjacent teeth must be avoided in either technique.

Fourteen films are needed for a complete periapical examination of the entire teeth.

Read up: bisecting angle technique.

Read up: parallelizing technique. These views will be further demonstrated during practical sessions.

⇒ Occlusal radiography will also be demonstrated.

Skeletal system survey

This is essential when there is need to demonstrate the location of bone involvement by a pathological process. It helps to ascertain,

i. Diagnosis of a pathology

ii. The extent of bone involvement

iii. And whether there is progress in therapy. Some skeletal pathologies are limited to bones others may involve joints only and some may involve both bones and joints.

Other imaging modalities may be involved in the examination of the skeletal system such as CT, MRI, radionuclide scanning. These methods may be used in combination with plain film survey or may be modality of choice as the primary examination.

Indications for skeletal system survey.

Congenital - e.g. dysplasia epiphysialis multiplex.

Infective e.g. Tuberculosis.

- Malignant e.g. prostate metastases.
- Reticuloses - e.g. multiple myelomatosis, lymphoma.
- Metabolic - scurvy, rickets.
- Endocrine - hyperparathyroidism, cushings syndrome.
- Trauma - unconscious patient, battered baby (non-accidental injury).
- Miscellaneous - e.g. pagets disease.
- Arthropathies - Rheumatoid arthritis, ankylosing spondylitis.

Recommended views

1. Congenital : C x R - PA, skull lateral, thoracic vertebrae lat. Both angles AP, shoulder jt AP, both elbows AP, both hands PA.
2. Infective: C x R - PA, thoracic spine lat lumber spine lateral, site of pain, radionuclide scan.
3. Malignant: C x R- PA, skull lateral, T.spine Ap/lat, lumber spine Ap/Lat, site of pain and Radionuclide scan.
4. Reticuloses: C xR - PA, Abdomen supine, skull lateral, thoracic and lumbar spine Ap/laterals site of pain and radionuclide scan.
5. Metabolic: abdomen supine, pancreas, AP, skull lateral, thoracic / lumber spines lateral both ankles Ap, both feeth Dorsi- plantar, both hands PA, both wrists PA, site of pain.
6. Endocrine (hyperparathyroidism) CxR - PA, renal area AP, skull lateral, pituitary fossa lat, thoracic/lumber spines laterals, both hands PA, macro radiography any finger, site of pain. Endocrine (cushings syndrome). CxR – PA, Renal area AP, skull lateral, pituitary fossa lateral any tooth periapical, thoracic lateral, lumber lateral, both hand PA, site of pain.
7. Trauma (adult): C x R PA, skull lateral, cervical lateral site of pain or deformity. Trauma (Child). C x R PA, shoulder jt AP, both elbows AP/lateral, both wrists PA site of pain or deformity.
8. Miscellaneous (Paget's) skull lateral, T.spine lateral, L. spine lateral, site of deformity and radionuclide scan.
9. Arthropathy (rheumatoid arthritis) CxR PA, cervical spine lateral, both feet porsi-plantar, bpth hand PA, both hand oblique (ball catching), site of deformity.
10. Arthropathy (ankylosing spondylitis) CxR-PA, C-Spine lateral, L/Spine lateral, both ankles lateral, site of deformity.

RADIOGRAPHY OF VISCERA AND SOFT TISSUE

ABDOMEN AND PELVIC CAVITIES

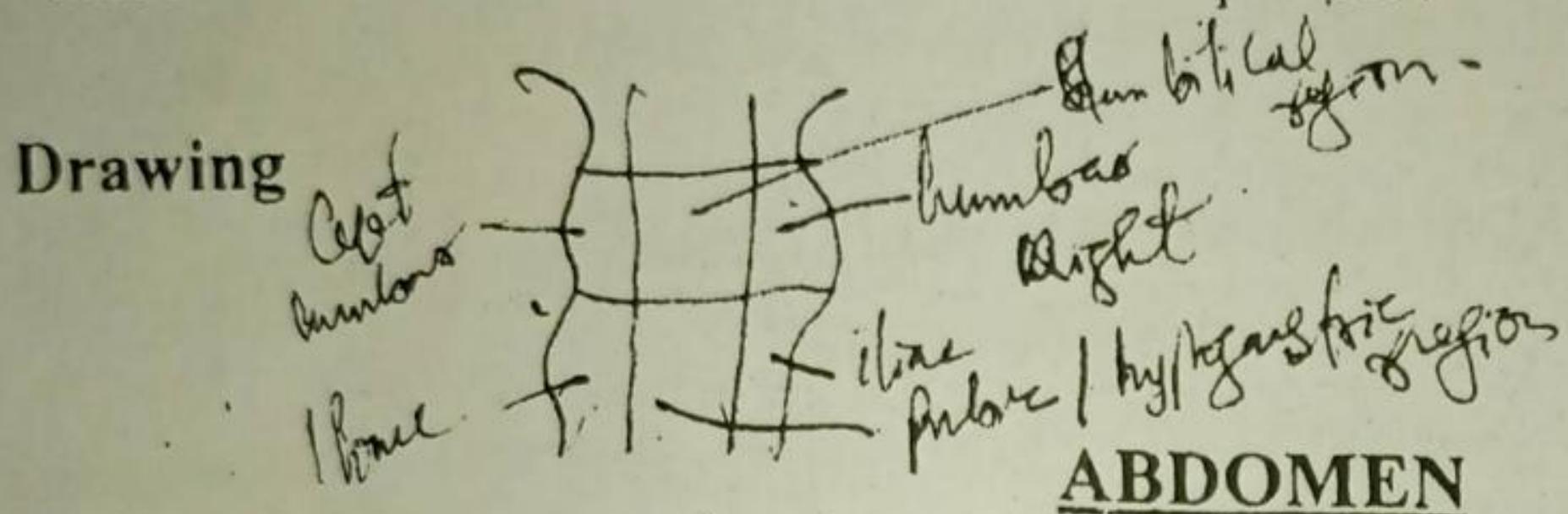
The contour of the abdomen varies with the physical type of the individual, the muscular development, the amount of food in the alimentary tract and also with sex and age.

The walls of the abdomino-pelvic cavity and most of the intra abdominal viscera are covered with a serious membrane called the peritoneum.

VISCERA:

The viscera are soft, elastic and plastic in living individuals and the peritoneum covered surfaces are smooth and glistening, the viscera alter the positions as a result of postural changes, during respiratory movement and as a result of their physical activities.

For the description of abdominal viscera in relation to the anterior surface of the body is facilitated by dividing abdomen into a number of region or zones by various vertical and horizontal lines or planes.



Boundaries: superiorly – by the diaphragm

Inferiorly – pelvic cavity and contents

Laterally and anteriority – abdominal wall i.e. peritoneum

The abdomen is divided into nine regions as can be seen above.

Preparation of Patient

Patient should remove every clothing and long necklace. Patient should then put in x-ray gown. Then briefly discuss the examination. Note that the patient property should be on his or her own risk

Indications:

Calcified abdominal aorta, gall bladder calculus, urinary bladder calculus, calcifications of pancreas, acute abdominal exposure is on full expiration. This enables more area of the abdomen to be visualized as the diaphragm moves upwards during expiration. Exposure may be full inspiration when examination of special organ is of interest. E.g. liver, renal calculus e.t.c.

Exposure on full inspiration may be required to make comparison with exposure on expiration.

Patient Positioning: patient ~~is~~ supine leg extended; median sagittal plan of patient should coincide with the midline of the couch. Place foam pads under the knees for comfort and immobilization.

Beam direction: perpendicular central ray.

Centering point: level of L3 in the midline between the lower costal margins. Along the midline of the patient, the x-ray beam should cover the diaphragm to symphysis pubis.

Radiation protection: apply gonad shield if nothing of interest is at the area.

Note: the tube must be centered to midline of the couch before positioning the patient.

Exposure factors: 75kv, 100mAs, 100- 120cm FFD, grid, fast film screen combine size 35 x 43cm (17 x 14)"

Acute Abdomen:

Radiography of the acute abdomen is an emergency examination.

Information Needed:

1. If there is free gas in the peritoneal cavity.
2. Free fluid in the peritoneal cavity.
3. Gaseous distension of any part of the GIT.
4. Fluid level in the intestine/peritoneal
5. Inflammatory fluid thickening of the GIT e.g. peritonitis.
6. Abdominal mass and displacement by or of the organs.
7. Calcifications of structure e.g. pancreas and gallbladder.
8. Radio-opaque for foreign body (fb)

Basic Views for Acute Abdomen

1. Antero posterior – supine as discussed in the plain abdominal radiograph.
2. Antero- posterior – erect.

Indications: in cases of suspected perforation of any part of the GIT

- Obstructed GIT
- Trauma

Positioning of patient

A tilting x-ray couch (table) with a potter Bucky diaphragm should be used. Patient lies supine on the tilting corner with the feet firmly against the step immobilization bands are tightened across the knees and chest to prevent the patient from collapsing when the table is moved towards the vertical position A 35 x 43cm cassette is placed in the bucky tray with its upper edge at the level of the middle of the body of the sternum and the bucky tray is locked.

Exposure factors:

Use high MA and short exposure and an increase of 7-10kvp above the required in supine view.

Centering point: using a central horizontal beam centre midline just above the umbilicus.

Note: As soon as the exposure is completed the x-ray tube is moved off the couch and the patient returned to normal horizontal position.

PA chest x-ray (in -acute abdominal)

Function: this will show 1. The general condition of the respiratory system of the patient and heart condition in case the patient requires undergoing surgery.

2. It will reveal any chest abnormality which is probably extending into the abdomen.
3. To exclude basal pneumonia as a cause of upper abdominal pain.
4. It also reveals subphrenic conditions like subphrenic abscess.

MODIFIED VIEWS FOR ABDOMEN

1. Lateral Decubitus: Patient lies on the side of interest, which is raised on foam pads and pillows. Hands under the head. 43x35cm (17 x 14)" film placed vertically across the abdomen. Using a horizontal beam centre L₃ stationary grid should be used.
2. Dorsal decubitus: Patient lies supine and raised on foam pads and pillows. Legs extended. 43x35(17x14)" film placed vertically at the side of the patient. Using a horizontal beam centre L3 use stationary grid.

READ

Antero-posterior – sitting know its limitation.

Urinary tract

Indications for plain radiography of the urinary tract include.

- To visualize the outline of the kidneys with their surrounding peri-renal fats.
- Lateral border of the psoas muscle
- Radio-opaque stones in the kidney areas, along the lines of ureters and in the region of the urinary bladder.
- Calcifications within the kidney or in the bladder wall.
- Presence of gas within the urinary tract.

Preparation of patient

Patient should be placed on low-residue diet at least 48hrs prior to the investigation. This is to clear the bowel gas and faecal matters which might overlie the renal tract. In cases of emergency no bowel preparation is done. The patient is changed into a clean gown.

Basic views

Antero-posterior – supine (as discussed before).

Centering point and cassette size

As for AP- Supine.

Note: Exposure is made on arrested respiration after full expiration.

Urinary bladder

To examine the bladder region, caudad angulation is required to allow for the shape of the bony pelvis.

Antero- posterior 15- degrees caudad.

Positioning of patient

Patient lies supine

Median sagittal plane at right angle and in the midline of the table.

Centering point

Central ray is directed 15 degrees caudally and centering in the midline 5cm above the upper border of the symphysis pubis.

Cassette size: use 30 x24cm (12 x 10) and place it longitudinally with its lower border 5cm below the symphysis public. This is to ensure that the symphysis pubis is not projected off the film.

BILARY SYSTEM (plain radiography)

Right posterior oblique (RPO)

Positioning:

Patient lies supine and the left side is raised rotating the median sagittal plane through 20degrees coronal plane is at 20degrees to the couch.

Support the trunk using a non- opaque pad. Right side of the abdomen should be at the centre of the couch.

Elbows and shoulders flexed with the hands rested on the head.

Centering point

Using vertical central ray central ray centre to appoint midway between the midline and the right abdominal wall 2.5cm above the lower costal margin and to the centre of the cassette exposure is made on arrested respiration after full expiration.

Cassette size

A 30x24cm cassette placed longitudinally in the bucky tray its centre 2.5cm above the lower costal margin.

Supra- renal gland

Basic view (AP – supine)

Patient supine with midline of patient to the midline of the couch.

Centering point: centre at the level T₁₂ ie 2cm below the xiphisternum.
Cassette size: 30 x 24cm placed transversely. Lower margin of the cassette to be at the lower costal margin.
⇒ RPO and LPO may be further required.

Diagram

For every examination of the liver diaphragm must be included. This is because the diaphragm is a great important landmark, during interpretation.

AP- Supine: patient supine, cassette placed transversely with its lower border at l₃. Film size 30 x 40 (12 x 15)". Centre to the centre of the cassette.

To demonstrate the liver, soft-tissue technique is used. Use relatively low KV just enough to penetrate the organ with high mAs.

Exposure is on arrested respiration. After full expiration. A previous film on full expiration must have been done. Exposure in full inspiration makes the liver more opaque in subphrenic abscess, this view is done erect to demonstrate any gas pocket above the liver under the diaphragm.

THE SPLEEN

AP- Supine: patient supine, patient is placed such that the spleen is adjusted to the centre of the table patient is rotated to a slight left posterior oblique to bring the spleen better contact with the table.

Using 12 x 10" cassette with its lower margin at the lower costal margin centre along the midclavicular line at the level of T₁₂.

SOFT - TISSUE RADIOGRAPHY

DEFINITION: Soft tissue technique is the term used for the radiography of the muscle, skin, subcutaneous and glandular tissues without the use of contrast media. it is used where normal KV will cause over penetration of the organ under investigation.

Small differential attenuation is recorded between adjacent structures; therefore subject contrast is grossly compromised.

- To demonstrate soft-tissue organs special attention must be given to
1. Radiographic contrast: use of appropriate exposure technique, reduction of scattered radiation.

Contraindications

- a. Radiation - Ten-day rule investigations to be carried out within the 10 days following the 1st day of onset of menstrual cycle.
- b. Exemption criteria.
 - i. Woman who deny recent sexual intercourse
 - ii. Menstruating women
 - iii. Women who have been taking an oral contraceptive pill for not less than 3 months and are satisfied that it has been effective.
 - iv. Women who have had an LUCD for less than 3 months and have found it effective.
 - v. Women who have had a sterilizing operation.

10-day

Chain of responsibility for ensuring that the fetus is not exposed to ionizing radiation is

- a. The referring clinician
- b. The radiologist
- c. The radiologist
- d. The radiographer.
- e. Due to contrast medium
- vi. Iodism
- vii. A previous severe adverse reaction.
- viii. Heart disease- patients with cardiac failure should not be sodium overloaded and are therefore given meglumine containing contrast media.
- ix. Hepatic failure
- x. Renal, esp. diabetic renal failure. A deterioration in renal function may follow
- xi. Thyrotoxicosis
- xii. Pregnancy, to avoid any possible teratogenic effect.
- xiii. Due to technique:

Skin sepsis at the needle puncture site.

Contrast medium: Dosage

- Volumes given are for a 70kg adult.
- In children 2mls per kg is given.

Equipment a trolley with strike upper shelf and a non-sterile lower shelf. Emergency drugs e.g. hydrocortisone and resuscitation equipment should be readily available.

Patient preparation:

1. Will admission to hospital be necessary.
2. Booking related to 10-day rule
3. Procedure explained to the patient and consent obtained when necessary.

4. Bowel preparation is used

- Prior to investigation of GIT tract
- When considerable faecal loading obscures other intra-abdominal organs.
- When opacification of an organ is likely to be poor.

5. Previous films and notes should be obtained

- 6. The area to be punctured should be shaved
- 7. Premedication will be necessary for painful procedures.

For adults- a. diazepam 10mg i.m or

b. Omnopon 10mg i.m

For children:

a. Promethazine 6-12mths - 10mg.

1- 5yrs - 15 - 20mg

5-10yrs - 20- 25mg

b. Trimeprazine - 4mg kg⁻¹

c. Brandy 5- 20ml.

Note that complex procedures on children or very uncooperative adults will be carried out under general anesthetic.

Viii the patient should micturate prior to procedure so that it will not be interrupted.

Preliminary films

Purpose:

1. To make any final adjustments in exposure factor, centering point, collimation and patients position.
2. To exclude any prohibitive factors such as residual barium from a previous examination.
3. To demonstrate, identify and localize opacities which may be obscured by contrast medium.
4. To elicit radiological physical signs.

Techniques

1. Local anesthetic used is lignocaine 1% without adrenaline.
2. Observe aseptic technique by clearing the skin with chlorhexidine 0.5% in 70% industrial spirit.
3. Apply gonad shield whenever necessary. Films: sizes of films and when they are taken are described under technique.

After care:

- Instructions to the patients.
- Instructions to the wards.

GASTROINTESTINAL TRACT (GIT)

Barium swallows:

- Indications:
- 1. Dysphagia
 - 2. Pain
 - 3. Assessment of trachea- oesophageal fistula in children.
 - 4. Assessment of left atrial enlargement
 - 5. Preoperative assessment of carcinoma of the bronchus.
 - ✓ 6. Oesophageal varies
 - 7. Assessment of site of perforation- it is essential that a water-soluble contrast medium is used e.g. Gastrografin or Dionosil aqueous.
 - 8. Foreign body e.g. Fish bone.
 - 9. Achalasia of the cardia. There is pronounced narrowing of the terminal part of the oesophagus with dilatation of the proximal part.

Diagram

It usually develops in any adult and is associated with the oesophagus. Therefore, there is a failure in the contraction and relaxation of the distal part of the oesophagus.

Contraindications: None

Contrast medium: Baritop G 150% w/v. 150ML or more as required.

NB: The barium should be diluted with an equal volume of H₂O for the investigation of a trachea-oesophageal fistula. This is to reduce the viscosity and so allow the barium to penetrate small fistula.

Patient preparation: None

Equipment: Rapid serial radiography (6 frames/sec.)

Preliminary: None

Techniques:

Patient positioning: Patient sits or stands erect in right anterior oblique (RAO) position. This is to throw the oesophagus clear of the spine. An ample mouthful of barium is swallowed and spot films of the upper and lower oesophagus are taken.

Oesophageal varies are better seen in prone (RPO) position as they will be more distended if rapid serial radiography is required, it may be performed in the right lateral, RAO and PA positions.

To demonstrate a tracheo-oesophageal fistula in infants, a fine naso-gastric tube is introduced to the level of the mid oesophagus and the diluted barium is syringed into distend the oesophagus. This will force barium through any small

fistula. It is important to take radiography in the lateral position simultaneously with the injection of barium, otherwise the fistula may be missed.

The aim of introducing the barium through the naso- gastric tube is that infants may reflux barium into the trachea during swallowing from a bottle.

After care: Nil.

Complications: 1. Leakage of barium from an unsuspected perforation.
2. Aspiration

EZelgush

BARIUM MEAL

Methods:

1. Double contrast – this is the method of choice to demonstrate mucosal pattern.
2. Single contrast. Uses: a. In Children- Since it is usually not necessary to demonstrate mucosal pattern. B. very ill adults- to demonstrate gross pathology only.

Indications:

1. Dyspepsia
2. Weight loss
3. Upper abdominal mass
4. Gastrointestinal haemorrhage
5. Partial obstruction.
6. Assessment of site of perforation- it is essential that a water- soluble contrast medium is used. E.g. Gastrogafin or Dionosil aqueous.

Contra-indications: complete large bowel obstruction.

Contrast medium: E- Z HD 250% w/v. 135m

Patient preparation

1. Nil orally for 6hrs prior to the examination.
2. The patient must not smoke on the day of the examination as it causes increase in gastric motility.
3. Ensure that there are no contraindications to the pharmacological agents used.

Preliminary films: Nil.

Technique/ Positions: the double contrast method

- a. Production of adequate volume of gas 200- 400ml.
- b. Non- interference with barium coating
- c. No bubble product.
- d. Rapid dissolution leaving no residue
- e. Easily swallowed
- f. Low cost.

2. Patient then ~~drinks~~ the barium while lying on his left side supported by his elbow. This position prevents barium reaching the duodenum too quickly.
3. The patient then lays supine and slightly on his right side: this will bring the barium up against the gastro-oesophageal junction. This manouvre is to check for reflux, which may be revealed by asking the patient to cough or swallow water while in this position.
4. An iv injection of a smooth muscle relaxant (Buscopan 20mg or glucagon 0.3mg) is given.

5. The patient is asked to roll on to his right side quickly over a complete circle to finish in RAO position.

⇒ This roll is performed to coat the gastric mucosa with barium.

Views: there is a great variation in views recommended. But bear in mind to take fewer films as to reduce radiation close and cost.

1. Spot films of the stomach (phase lying).

- a. RAO- to demonstrate the antrum and greater curve.
- b. Supine- to demonstrate the antrum and body.
- c. LAO- to demonstrate the less curve "en face"
- d. Left lateral tilted head up 45°-to demonstrate the fundus.

From the left lateral, the patient returns to the supine and then rolls onto his left side and over into a prone position.

This is to avoid barium flooding into the duodenal loop which would occur if the patient were to roll onto his right side to achieve a prone position.

2. Spot film of the duodenal loop(lying)

- a. Prone: patient lies on a compression pad to prevent barium from flooding into the duodenum.
- RAO may be taken in addition to demonstrate the anterior wall of the duodenal loop.

3. Spot films of the duodenal cap(lying)

- a. Prone
- b. RAO
- c. Supine
- d. LAO.

4. Additional views of the fundus in an erect position may be taken if there is suspected fundal lesion.

5. Spot films of the oesophagus are taken while barium is being swallowed to complete the examination.

After care: 1. Inform the patient that bowel motions will be white for a few days after the examination. Give laxatives to avoid barium impaction.

2. Patient should not leave the dept. until any blurring of vision by the buscopan has resolved.

Complications: 1. Leakage of barium from an unsuspected perforation.

2. Aspiration

3. A partial obstruction may be converted into a complete obstruction by impaction of barium.

4. Barium appendicitis, if barium impacts in the appendix.

5. Side effects of the pharmacologist agents used.

Creeping

BARIUM FOLLOW-THROUGH

Methods:

1. Single contrast
2. In the investigation of suspected disaccharidase deficiency the examination is performed first without and then with 25g of the appropriate sugar added to the barium indications:- Pain

- Diarrhoea

- Bleeding

- Partial obstruction

Contraindications- complete obstruction

- Suspected perforation

Unless a water soluble contrast medium is used.

Contrast medium: Baritop G 100%w/v 300ml (150ml if performed immediately after a barium meal).

Equipment: Overcouch tube in addition to a fluoroscopy unit.
Patient preparation:

1. A laxative on the evening prior to the examination.
2. Metoclopramide 20mg orally 20mins before the examination.

Preliminary film: plain abdominal film

Technique/ Position: Aim: to deliver a single column of barium into the small bowel the patient lies on his right side after the barium has been ingested. The metoclopramide enhances the rate of gastric empty views: 1. P.A. prone (Abdomen) taken every 20mins during the 1st hour and every 30mins during until the colon is reached. Prone position is used because pressure in the abdomen helps to separate the films of the small bowel.

2. Supine: spot films of the terminal ileum are taken supine. Compression band is used to displace any overlying loops of small bowel that may obscure the terminal ileum.
3. Erect- to demonstrate diverticula. This view will reveal any fluid levels caused by contrast medium retained within the diverticula.

- After Care/ Complications- As for Ba. meal.

READ UP SMALL BOWEL ENEMA

Eelegwe

BARIM ENEMA:

Methods:

1. Double contrast: the method of choice to demonstrate mucosal pattern.
2. Single contrast: uses a. Children since it is usually not necessary to demonstrate mucosal pattern. B. reduction of an intussusception

Indications: 1. Change in bowel habit

2. Pain

3. Mass effect

4. Melena

5. Obstruction

Contraindications: Absolute

1. Toxic megacolon
2. Pseudomembranous colitis.
3. Rectal biopsy within the previous 3 days (it is preferable to wait for 7 days).

Relatives: 1. Incomplete bowel preparation

2. Recent barium meal.

Contrast medium: Polibar 125% w/v 500ml (or more as required).

Equipment: Disposable enema bag tube. If the patient is incontinent it is permissible to use a tube with inflatable cuff.

Patient preparation:

2 days prior to the examination

- a. At least 2 litre of clear fluids a day hydration. Diabetics must adjust their diets accordingly.
- b. Patient should be on low-residue diet.
- c. At 9pm or 1hr after dinner taken two dulcolax tablets.

A day prior to the examination do as above.

On the day of the examination

Insert dulcolax suppository by 5am this is to empty lower bowel regions. Patient should go for toilet as much as he pleases before reporting for the investigation. A 2-litre high colonic saline washout.

1st 500ml is run in with patient supine. After the patient suspine. After the patient is turned onto his left side, a further 500ml is run to fill the descending colon.

With the patient in prone position 1000ml is mn in to fill the transverse colon.

2. Image sharpness: immobilization, small focal spot, film or film/screen combination chosen according to exposure technique.
3. Avoidance of artifacts.

EXPOSURE TECHNIQUE

Normal KVP and non-standard KVP, normal KVP exposure technique.

It is divided into 3 subcategories. Use of a normal exposure technique for the part being examined.

1. In these areas there is air shadows or fat pads which will differentiate pathology or abnormality in the adjacent soft tissue structures e.g. includes A. enlarged adenoids => this causes a filling defect in the air outline contained in the nasopharynx. B. In case of synovial cavity effusion. The effusion causes a filling defect a fat pad adjacent to a joint.
2. Use of two or more films or film/screen combinations to demonstrate both bony detail and soft tissue with one exposure E.g. a. facial bones, nasal bones and soft tissues of the face. B. calcification of tendons and bny detail of the shoulder joint.
3. Use of wedge filter: the thicker part of the wedge attenuates the beam over the soft tissues. E.g. in cephalography to demonstrate bony detail of the skull and facial bones along with the soft tissue outline of the face on one film.

Non- Standard Kvp Exposure Technique:

It also divided into 3 subcategories.

- a. Subnormal Kvp, low kvp and high kvp.
 1. SUBNORMAL: When the Kvp employed is less than 45kvp which is the lowest useful Kvp available on many X - ray units. Special X-ray equipment is required which has an X-ray tube with reduced added and inherent filtration along with a focal spot size of 0.6mm or less. The use of such kvps increase differential attenuation of adjacent soft tissues and thus increase subject contrast. E.g. mammography, theatre radiography of the exposed kidney.
 2. Low Kvp: when the Kvp employed is 15-20 Kvp less than normal for a singular projection of the area being examined. Bony detail is not demonstrated in this case.
e.g. In limb calcification, calcification of arteries or tendons, parasitic calcification and superficial tumors. Profile or tangents views of these areas are carried out.
 3. High Kvp: when the Kvp in use is 20Kvp or higher than the normal Kvp used for similar projection of the same area.. This method reduces the differential attenuation of soft tissues, decreases subject contrast thus allowing a greater range of tissues to be demonstrated. Examples of areas where this technique is used include- Xeroradiography of the soft - tissue structures of the neck,

surgical emphysema (air in the soft tissue), when an area of different thicknesses of the body is included on a single exposure.

Accident and emergency radiography

Personal preparation.

In accident and emergency unit, it is normal for X-ray equipment and darkroom processing facilities to be housed within the complex. The first thing the radiographer must be concerned with is his personal preparation => put on hand gloves and face mask to avoid direct contact with the patient's blood. If the skin has an abrasion, this should be covered with clean plaster. Film monitoring badge is pinned to your dress..

Equipment: mobile X-ray unit is preferable. This is because there may be need for a abdominal radiography. A dedicated X-ray couch with bulky tray is needed. It has to be mobile such that a patient can be transported on it to main X-ray department in case of any breakdown in A/E unit. All the procedures should be carried out on the couch to reduce patient movements in case of multiple fractures or suspected cervical injury. Adequate radiation protection must be observed. People assisting the patient must be provided with lead aprons and proper tube collimation adopted.

Introduction to procedure involving contrast media

1. Barium studies => for gastrointestinal tract GIT.
 - Ba. Swallow => Oesophagus.
 - Ba. Meal and follow through => Stomach and small intestine.
 - Ba. Enema - colon (large intestine) and rectum.
2. Intravenous urography: IVU for kidney – ureters and bladder (KVB).
3. Micturating Cystourethrogram (MCU) for urinary bladder and urethra.

RADIOGRAPHIC TECHNIQUES IV

COURSE OUTLINE:

The contrast examination of the gastrointestinal system, excretory system, obstetrics and gynecological examination.

- Sialography
- Dacryocystography
- Arthrography
- Mammography
- Operating theater techniques

Lecture 1:

General information

Indications

- Finally, the patient is turned onto the right side and the remaining 500ml is used to fill the ascending colon.

- The patient then empties his bowels

Note: At least 1 hour must elapse before starting the barium enema to allow time for the colon to absorb the excess water.

Preliminary film: plain abdominal film

- a. To assess bowel preparation
- b. To exclude toxic megacolon.

Technique/positioning

The double contrast method.

1. Patient lies prone and the catheter is inserted gently into the rectum. Connections are made to the barium reservoir and the hand pump for injecting air.
2. I.V Buscopan (20mg) or glucagon (1mg) is given.
3. Infusion of barium is commenced. Intermittent screening is required to check the progress of the barium. The infusion is terminated when the barium has reached the spleen flexure.
4. Air is then gently pumped into the bowel, forcing the column barium round towards the caecum and producing the double contrast effect.
5. From the prone position, the patient rolls onto his left side and over RAO position so that the barium coats the bowel mucosat.

Views: there is great variation in recommended views. ~~Fewer~~ films may be taken to reduce radiation dose and cost.

The sequence of positioning enables the barium to flow proximally to reach the caecal pole. Air is pumped in as required to distend the colon.

1. Spot films of the rectum and sigmoid colon (lying).
 - a. RAO
 - b. Prone
 - c. LPO
 - d. Left lateral of the rectum.
2. Spot films of the hepatic flexure, splenic flexure and rectum (erect).
 - a. RAO to open out the hepatic flexure
 - b. LAO to open out the splenic flexure
 - c. Right lateral of the rectum.
3. Spot film of the caecum (lying). Patient supine, lying slightly on the right. Side and with slight head-down tilt will usually give a double contrast effect in the caecum.
4. Overcouch films to demonstrate all of the large bowel (lying).
 - a. Supine

- ASIS
- b. Prone
 - c. Left lateral decubitus
 - d. Right lateral decubitus
 - e. Prone, with tube angled 45° caudad and centered 5cm above the posterior superior iliac spines. This view separates overlying loops of sigmoid colon.

After Care:

- 1. Inform patient that his bowel motion will be white for a few days and to keep their bowels open with laxative to avoid barium impaction.
- 2. Patient should not leave the department until any blurring of vision produced by Buscopan has resolved.

Complications:

- 1. Perforation of the bowel there is increased risk of this in
 - a. Infants and the elderly.
 - b. Obstructing neoplasm
 - c. Ulceration of the bowel wall.
 - d. Inflation of a Foley catheter balloon in a colostomy, or the rectum.
 - e. Patients on steroid therapy
 - f. Hypothyroidism
- 2. **Venous extravasations:** this may result in a barium pulmonary embolus which carries 80% mortality.
- 3. Water intoxication: the symptoms are drowsiness and convulsions. There is an increased risk in mega colon because of the large area of bowel mucosa available for absorption of water.
- 4. Intramural barium
- 5. Cardiac arrhythmias due to rectal distension.
- 6. Transient bacteraemia.
- 7. Side effect of pharmacological agents use.

* **LOOPGRAM**

The investigation of the bowel proximal to a colostomy is performed by inserting the tip of a Foley catheter into the appropriate stoma. The balloon should be inflated outside the stoma to reduce the risk of perforation. It is taped firmly in position against the mucosa to provide a good seal.

The barium is run into the bowel and spot films are taken as required.

The bowel distal to the colostomy may be investigated by barium run in through the rectum in the usual manner as this is easier and safer.

- contrast media / double / single
- lubrications / contrast calbons
Preparation
Spot films
Complications
After care

Note: if there is any suspicion of an anastomotic breakdown, a water soluble contrast medium must be used.

SONOGRAM

A water-soluble contrast medium (e.g. Hypaque 45) must be used unless there is any suspicion of a connection with the pleural cavity. In this case Dionosil aqueous is a safe alternative. A preliminary film is taken to exclude the presence of a radio-opaque foreign body. A fine catheter is then inserted into the orifice of the sinus, a marker is placed. A gauze pad has to place firm over the orifice to prevent reflux of contrast.

The contrast medium is injected under fluoroscopic control. Spot films are taken as required.

URINARY TRACT

Methods:

1. Plain films
 2. Excretion urography.
 3. Nephrotomography
 4. Percutaneous renal puncture
 5. Retrograde pyelo-ureterography
 6. Micturating cystourethrography
 7. Double contrast cystography
 8. Ascending urethrography
 9. Ultrasound
 10. Radioisotopes- dynamic imaging with $^{99}\text{TC}^m$ - DTPA
- Static imaging with $^{99}\text{TC}^m$ - DMSA
 11. Computerized tomography- with and without enhancement with urographic contrast medium.
 12. Arteriography - Selective renal artery -internal iliac artery for the bladder.
 13. Venography - renal vein, may also include renal vein sampling.
- ✓ Percutaneous renal puncture*

Excretion urography i.e

Intravenous urography (IVU).

This is the basic examination of the urinary tract and usually precedes all others. It has the advantage of demonstrating the whole of the urinary tract.

Indications:

Suspected urinary tract pathology e.g. Hydronephrosis, urinary tract calculi etc.

Contraindications:

32

Iodism

A previous severe adversely reaction

Heart disease

Hepatic failure

Oliguric renal failure

Thyrotoxicosis

Pregnancy

Dehydration e.g in infants, myeloma renal failure.

Contrast medium: There are many water soluble contrast media e.g urograffin 76% conray 420, Hypaque 45 etc.

Note: if it becomes essential for IVU to be performed on a patient with suspected cardiac failure, then sodium salts should be avoided as a sodium overload may be a serious problem.

Dosage:

Adult dose: - classified intomedium and high dosages. Adult dose is 60ml.

Paediatric dose: use contrast Lower osmolality as they have lesser effect on blood volume and red cell morphology. The dose/kg should always be calculated and the injection made over at least 2min so that there are no sudden shifts of fluid between body compartments.

Using hypaque 45, 1.5 ml kg^{-1} up to 12kg 18ml + 1 ml kg^{-1} up to 54kg i.e. a maximum of 60ml. for urograffin 76%, use 2 ml kg^{-1} .

Above this adult dose should be used.

Patient preparation:

General abdominal preparation is required as in barium enema. Colonic washout is not necessary. In addition to the abdomen preparation the following preparation is needed.by mouth 5hrs prior to the examination to reduce bowel gas.

If the examination is to be performing on a patient who has previously severe contrast medium reaction hydrocortisone 100mg I.V should given 1hrs prior to the examination.

Preliminary films

1. Supine AP of the renal area in expiration. The X-ray beam is centered in the midline at the level of the lower costal margin.
2. Supine, full-length Ap of the abdomen, in full inspiration. The lower border of the cassette is at the level of the symphysis pubis. The X-ray is centered in the midline at the level of the iliac crests.
3. Note: the position of overlying opacities may be further determined by 35° posterior oblique views or

4. Tomography of the kidneys at the level of a third of the AP diameter of the patient (approx. 8-11cm) with optimal angle of swing of 25-40°. The examination should not proceed further until these films have been reviewed and deemed satisfactory.

Technique /positioning: The median antecubital vein is the preferred injection site because flow is retarded in the cephalic vein as it pierces the clavi- pectoral fascia. Use 19G scalp vein needles and give the injection rapidly as a bolus to maximize the density of the nephrogram. When venepuncture in the infant is unsuccessful, subcutaneous administration with hyaluronidase has been used as an alternative. However, the injection is painful and the result poor.

Views:

1. Immediate film (nephrogram) AP of the renal areas. This film is exposed 10-14 secs after injection.

AIM: to show the nephrogram i.e the renal parenchyma opacified by contrast medium in the renal tubules. It shows if the renal outline is regular or irregular.

- If the kidney is large or small
- If there is cystic changes.
- Is it lobulated?

The nephrogram lasts for 2mins.

Factors that affect nephrogram phase include – Radiographic factors.

- Soft tissue density on the abdomen.
- 2. Five -minute film. AP of the renal area.

Aim: To demonstrate if excretory is symmetrical and is important for assessing the need to modify technique e.g a further injection of contrast medium, if there is poor initial opacification.

A compression band is now applied around the patients abdomen and the balloon positioned midway between the anterior superior iliac spines ie precisely over the ureters as they cross the pelvic brim.

Aim: to produce better pelvi-calyceal distension.

Note: compression is contraindicated

- a. After recent abdominal surgery.
- b. After renal trauma
- c. If there is large abdomen mass.
- d. When the 5-minute film shows already distended calyces.
- e. In children.

3. 15-minutes film: AP of the renal areas there is usually adequate distension of the pelvi-calyceal systems with opaque urine by this time. Compression is released when satisfactory demonstration of the pelvi-calyceal system has been achieved.

4. Release film: supine AP abdomen
Aim: this film is taken to show the whole urinary tract.
If this film is satisfactory, the patient is asked to empty his bladder.
5. Post-micturating film of the bladder with the tube angled 15° caudad and centered 5cm above the symphy pubis.
Aim: Bladder pathology may be seen better and post-micturation residue is assessed.

Additional films

1. 35° posterior oblique of the kidneys ureters or bladder.
2. Tomography- when there are confusing overlying shadows.
3. Prone - may provide better visualization of the urethers by making them more dependent.
4. Delayed films- may be necessary for up to 24hrs after injection incases of obstructive uropathy.

Additional techniques:

- a. The hypertensive patient.

The technique is modified to identify a reno-vascular cause. Rapid sequence of film is advised to assess the precise time of appearance of contrast medium in collecting systems. Therefore additional films are taken 2x3min after injection.

- b. The patient in renal failure.

1. It must be ensured that the ward will not fluid-restrict the patient.
2. Preliminary tomography is performed to determine optimum cut levels.
3. Maximum possible dose of contrast medium is used to compensate for a. poor renal function b. No fluid restriction

4. Tomography is performed during the nephrogram phrase. i.e. the 1st 3min.

5. Delayed films will be necessary.

- c. The infant: As in all paediatric work the technique should be flexible to suit the problem.

A typical basic film sequence is

- a. A 2- minute film of the renal area
- b. A 2- 5-minute film of the renal areas
- c. A 15 full length of abdominal film
- d. No compression.

Note: Optimum visualization of the upper urinary tract occurs at 1-3 hrs. Therefore if the initial 2 and 5mins films show little opacification, further films at 12 and 3hrs may provide more information than multiple films in the 1st hour. For older child the adult film sequence is used.

Complications: i). Due to contrast.

ii) Due to technique e.g malplaced abdominal compression may produce intolerable discomfort or hypotension.

=>Nephrotomography

This technique is now rarely in use i.e tomography during a bolus injection of contrastor infusion of contrast.

=>Retrograde pyelo-ureterography

Done by insertion of ureteric catheter when IVU is unsatisfactory.

MICTURATING CYSTOURETHROGRAPHY (MCU).

- Indications

1. Vesico- ureteric reflux
2. Stress incontinence
3. Study of the urethra during micturating
4. Abnormality of the bladder

Contraindications: Acute urinary tract infection.

Contrast medium: Hypaque 10% 750 2000ml urograffin 76% 750, 2000 equipment.

1. Fluoroscopy unit with spot film device.
2. Video tape recorder
3. Op... or foley catheter.

Patient preparation: the patient micturates prior to the examination
preliminary film: coned view of the bladder.

Technique/positioning:

To demonstrate vesico – ureterio reflux.

1. The patient lies supine on the X-ray table. Using asptic technique, a catheter lubricated with hibitane 0.05% in glycerine is introduced into the bladder residue urine is drained. Contrast medium is slowly dripped in and a bladder filling is observed by intermittent fluoroscopy.
2. Any reflux is recorded on spot films.
3. When the radiologist is convinced that the patient will micturate, the catheter is removed. (in children flexion of the toes os a useful sign). The patient is given a urine receiver and the table tilted vertically.(small children should remain supine).
4. A video tape recording is made of micturation and spot films are taken of any reflux that is seen. The lower ureter is best seen in the anterior oblique position of that side. Boys should micturate in as light RAO or LAO position so that spot films can be taken of the urethra.
5. Finally a 35 x 43cm supine Ap abdomen is taken to demonstrate any reflux of contrast medium into the pelvis.

To demonstrate stress incontinence

The technique is the same as for demonstrating vesico-ureteric reflux. In the condition, the catheter is left in situ until the patient is in the erect position.

Views: it has to include sacrum and symphysis pubis because bony landmarks are used to assess bladder neck descent. Do the following views.

- a. Lateral bladder straining.
- b. Lateral bladder straining
- c. The catheter is then removed
- d. Lateral bladder during micturition

In infants and children with vesical neuropathy, micturition may be accomplished by supra-pubic pressure -this is called expression cystourethrography.

After care: None

Complications or after effect .

Due to contrast medium

1. Adverse reactions may occur following absorption of contrast medium by the bladder mucosa.
2. Contrast- medium induced cystitis.

Due to technique:

1. Acute urinary tract infection.
2. Catheter trauma- e.g dysuria, frequency, haematuria and urinary retention.
3. Complications of bladder filling .eg perforation from overdistension.
This can be prevented by using a non-retaining catheter e.g jaques
4. Retention of a foley catheter.
5. Catheterization of vagina or an ectopic ureteral orifice.

Double contrast cystography

Indications: 1. Staging of bladder tumours. 2. Demonstration of a tumour in a diverticulum. However cystoscopy probably provides even more information. Thus this investigation is rarely performed.

Retrograde Urethrography (RUG)

Indications: 1. Strictures

2. Urethral tears
3. Congenital abnormalities
4. Peri-urethral or prostatic abscess
5. Fistulae or false passages.

Contraindications: 1. Acute urinary tract infection. 2. Recent instrumentation.

Contrast medium: 1. Viscous e.g. Diagnol viscous 30-40ml. 2. Non-viscous e.g. hypaque 45 or equivalent density water-soluble contrast medium.30-40ml.

Equipment: 1. Tilting radiography table with fluoroscopy unit and spot film device. (2) Penile clamp e.g. Knutsson's or foley catheter.

Patient preparation: None

Preliminary Film: coned supine PA of bladder base and urethra.

Methods: 1) Using a penile clamp and Diaginol Viscous. This provides an anatomical demonstration of the urethra and has the advantage of effecting greater urethral distension.

2) Using a foley catheter and a water soluble contrast medium. The balloon is inflated with 1-2ml of water after being inserted to lie in the jossa navicularis. The use of water soluble contrast media is regarded as demonstrating the functional element of the urethrae, but urethral distension is poorer than with viscous material.

Diaginol viscous cannot be used with a balloon catheter because the pressure created within the urethral is such that it will blow the catheter out.

Technique:

1. Patient lies supine on the X-ray table.
2. Using aseptic technique, the catheter or nozzle of the clamp is introduced into the urethra. Contrast is injected under fluoroscopic control and films are taken in the following positions.

Views: a) 30° LAO with right leg abducted and knee flexed.

b) Supine PA

c) 30° RAO, with left leg abducted and knee flexed.

RUC should be followed by MCU to demonstrate the proximal urethra. Occasionally, a urethral fistula or peri-urethral abscess is only seen on the voiding examination and reflux of contrast medium into dilated prostatic ducts is also better seen during micturition.

After care: None

Complications:

Due to contrast medium adverse reactions are rare.

Due to technique:

1. Acute urinary tract infection
2. Urethral trauma
3. Intravasation of contrast medium especially if excess pressure is used to overcome a stricture.

Obstetric and Gynaecology

Reproductive system:

Methods of demonstration of the female reproductive system.

1. Plain abdominal film.

2. Hysterosalpinography (HSG)
3. Gynaecography
4. Arteriography
5. Lymphography
6. Ultrasound
7. Computerized tomography (CT).

Hysterosalpingography

Indications: 1) Infertility

2) Recurrent abortion

3) Uterine tumours.

Contraindications:

1. Pregnancy
2. A purulent discharge on inspection of the vulva or cervix.
3. Recent dilation and curettage or abortion or immediately post menstruation.

This applies to only contrast medium because of the dangers of the increase risk of intravasation.

Contrast medium: Water soluable e.g urografin 290 or Diaginol viscous

Advantage: Rapid peritoneal spill.

Disadvantage: peritoneal spill is more painful.

Oily contrast medium (not now recommended) e.g. Lipiodol ultra-fluid.

Advantages: a) Much Denser

b) Better mucosal adherence

c) Less painful

Disadvantages: a) Peritoneal spill taken longer and so a second visit to the department is necessary.

b) More serious complications. Water soluable C.M are now the media of choice.

Volume: 10-20ml.

Equipment

1. Fluoroscopy unit with spot film device
2. Vaginal speculum
3. Vulsellum forceps, uterine sound and
4. Uterine cannula.

Patient preparation: 1) Patient should abstain from intercourse between booking the appointment and the time of the examination unless she uses a reliable method of contraception or the examination can be booking between the 4th and 10th days in a patient with regular 28-day cycle.

2) Apprehensive patients may need premedication.

3) Paracetamol 1g 1 hour prior to the examination.

Preliminary film: cones PA view of the pelvic cavity.

Technique: 1. Patient lies supine on the table with knees flexed. Legs abducted and heels together.

2. Using aseptic technique, the gynecologist inserts a speculum and cleans the vagina and cervix with chlorhexidine.

3. Uterine sound is used to obtain the direction of the uterine cavity.

4. The anterior lip of the cervix is steadied with the vulsellum forceps and the cannula is inserted into the cervical canal.

5. Care must be taken to expand all the air bubbles from the syringe and cannula which would otherwise cause confusion in interpretation contrast medium is injected slowly under intermittent fluoroscopic control. Spasm of the uterine cornu may be relieved by inhalation of octyl nitrite.

Views/ films: Using the under condition

1. As the tubes begin to fill.

2. When peritoneal spill has occurs.

After care: 1) It must be ensured the patient is in no serious discomfort nor has significant bleeding before she leaves.

2) She must be advised that there may be bleeding per vaginum for 1-2 days and analgesics may be necessary for up to 1 week.

Complications:

Due to contrast medium

Water soluable: Idiosyncratic/ allergic. Especially if the contrast medium is forced into the uterine circulation.

Oily: 1. Peritoneal granuloma- rare with normal tubes.

2. Oil embolus- pulmonary cerebral or retinal may be fatal. More likely if excess pressure is used and after dilatation and curettage, abortion or immediately post menstruation.

Due to Technique:

1. Pain may occur at the following times.

a. Using the vulsellum forceps.

b. Insertion of the uterine sound.

c. Insertion of the cannula

d. Tubal distension proximal to a block.

e. Distension of the uterus if there is tubal spasm.

f. Peritoneal irritation on walking during the following week.

2. Haemorrhage from trauma to uterus or cervix.

3. Infection- may be delayed.

4. Abortion, it must be checked the patient is not pregnant.

GYNAECOLOGY

Indications: Ovarian pathology, especially stein-leventhal syndrome and ovarian agenesis.

Laparoscopy is the investigation of choice if available.

SALILOGRAPHY(Radiography of salian glands ducts after introduction of cm into the ducts)

Indications: 1. Pain

2. Recurrent swelling

Contraindication: Acute infection or inflammation.

Contrast medium: READ UP.

DACRYOCYSTOGRAPHY

Indications: Epiphora- to demonstrate the site and degree of obstruction.

Contraindications: None.

Contrast medium: Lipidol 0.5-2.0ml/side

Patient preparation: None

Equipment:

1. Skull unit (using macro radiography technique).
2. Silver dilator and cannula or 18G blunt needle with polythene catheter (the catheter technique has the advantage that the examination can be performed on both sides simultaneously and films can be taken during injection).

Skull: 1. Occipito- mental.

2. lateral (centred to the inferior orbital margin).

Technique: 1. The cornea is anaesthetized with ophthaine. The lacrimal sac is then massaged to express its contents prior to injection of the contrast medium. The lower eyelid is everted to locate the lower canaliculus at the medial end of the lid. The lower canaliculus is dilated and the cannula or catheter is inserted. The lower lid should be drawn laterally during insertion to straighten the bend in the canaliculus and so avoid perforation by the cannula.

3. The contrast medium is injected, and radiographs are taken immediately afterwards (or during the injection of a catheter is used).

Films: The preliminary views are repeated.

After care: the eye must be closed for 30min after the investigation to exclude dust, until the anesthetic wears off.

Complications: perforation of the canaliculus.

ARTHROGRAPHY

Methods of demonstrating joints

1. Plain films

2. Tomography
3. Arthrography
4. Radioisotopes - $^{99}\text{TC}^m$ methylene diphosphonate
5. Computerized axial tomography.

General points to note:

1. The plain films should always be reviewed prior to the procedure. This is to demonstrate any abnormality that should be obscured by cm.
2. Effusion should be Aspirated to avoid dilution of contrast medium and to enhance optimal image appearance.
The aspirate should be sent for
 - a. Microscopy, culture and sensitivity (MCS). Or
 - b. Crystal analysis or
 - c. Cytology or
 - d. Biochemistry
3. Meglumine salts e.g couray 280 should be used instead of cm containing salts because it causes less pain.
4. In suspected loose body delayed film is necessary (interval of 1/2hr). This may show absorption of cm into a cartilaginous loose body.

Indications:

1. Cartilage, capsular or ligamentous injuries
2. Loose body
3. Baker's cyst.

Contrast Medium: 1. Conray 280.5ml

2. Air, 50ml.

Equipment: 1. Fluoroscopy unit with a spot film device and a finefocal spot (0.3mm^2)

2. overconch tube.

Patient preparation: None

Preliminary Films: Knee. 1. Ap
2. lateral

Additional films.

1. Axial view of the patella (skyline)
2. Intercondylar view (tunnel).

Technique: Patient supine. A media approach is used.

2. Using a strile technique, the skin and underlying soft tissues are anaesthetized at appoint 1-2cm posterior to the midpoint of the medial border of the patella.
3. A 21G needle is inserted into the joint space from this point.

4. Any effusion is aspirated: If a satisfactory position is demonstrated the full volume of contrast medium and air may then be injected.
5. The needle is then removed.

Films: Spot films: a. The knee jt divided into quadrants for the purpose of the examination.

b. Traction is applied to the joint to open up the compartment under investigation.

c. Four views of each quadrant are taken in varying degrees of rotation.

After Care: The patient is advised or warned that there may be some discomfort in the joint for 1-2 days after the procedure and to refrain from strenuous exercise during this time.

READ: Hip Artherography

Shoulder Artherography

Elbow Artherography

Wrist Artherography &

Ankle Artherography.

MAMMOGRAPHY

Soft-tissue radiography as we have known is the term used for radiography of muscles, skin, subcutaneous and glandular tissues without the use of contrast medium. Thus mammaography inclusive.

Factors consider in mammography include sharpness, contrast and resolution and at the same time to minimize radiation dose.

To obtain adequate contrast it is essential to use a subnormal KVP technique in the 25-35KVP range high resolution is achieved by correct choice of film/screen combination any by good breast compression which eliminates movement unsharpness.

Geometric unsharpness must be minimized by the use of ultra fine focus tube, if possible (certainly less than 0.6mm) secondary/scattered radiation can be minimized by the use of special designed grid. (e.g 80lmcs per cm, ratio 3:5:1).

A single back screen should be used.

A vaccum evacuated plastic envelope or specially designed cassette should be used.

- Patient gonad dose is negligible, so additional lead protection is unnecessary.

- "Pregnancy Rule" can be ignored.

- Equipment should be a purpose designed mammography unit.

Qualities of purpose designed units:

- A fixed beam with central ray at right angles to a film holder/breast support table, the breast support table usually contains n ionization chamber.

- The beam is designed so that the more perpendicular rays pass through the thicker portions of the breast. Thus
- Anode heel effect is used to expose the periphery.
- The FFD is constant in most units.
- It must have an effective compression device must be comfortable for the patient.
- It is important to use K-edge filters to lower radiation dose.

Patient preparation

- The patient should not use any tale, deodorant or antiperspirant prior to the examination.

PROJECTIONS OR VIEWS

2 views are recommended:

- a. Oblique &
- b. Cranio-caudal of each breast. Screening for breast Ca. a single view is sufficient for subsequent examinations. Supplementary views should be employed if the basic technique fails to demonstrate a clinically detected lesion or when it is necessary to demonstrate a lesion more clearly.

Positioning terminology:

Vertically breast attachment extends from the 2nd to the sixth rib and at the level of the fourth costal cartilage. It extends transversely from the side of the sternum to the mid axillary line.

- A line drawn from the centre of the breast circle to the nipple is termed breast axis.
- Axial plane: Divides the breast into inner & outer portions.
- Transverse plane: lies at right angles to the vertical axial plane intersecting (cutting it) along the breast axis.

Thus these planes divided the breast into 4 quadrants.

- a. Upper outer
- b. Lower outer
- c. Lower inner
- d. Upper inner

In the normal erect resting position, the axial plane makes an angle of 20-30° with the saggittal plane of the body and the transverse plane an angle of 30-50 degrees with the horizontal.

Basic views

1. Oblique
- Positioning
- Patient stands or sits facing the machine

- The height of the apparatus is adjusted such that the upper angle of the table support lies high in the patients' axilla with the edge of the table firmly against the chest wall.
- The hand on the side to be examined is elevated with the arm in extension.
- The radiographer holds the breast with the transverse plane of the breast lifted to the horizontal and places it on the table support rotating the patient slightly towards the side to be examined.
- Ensure that the angle of the examination table remains in the axial and the edge. against the chest wall.
- The breast is elevated slightly as compression is applied to a degree where there is equal thickness of tissues interiorly and posteriorly.
- During compression the nipple must be kept in profile and creasing of the skin must be avoided.
- Ionization chamber is adjusted according to breast size and the beam collimated to include the whole of the breast.
- Place film markers to the side closest to the axilla.

Centering: A medio-lateral beam with the central ray at 45° to both the vertical and transverse planes passing through the glandular tissue to its longest diameter is used. This demonstrates the gland disc and the axillary breast tail.

Cranio caudal (basic view)

Patient positioning:

- Patient stands or sits leaning forward with the chest wall firmly pressed against the table support upon which the breast is resting.
- Adjust the height of the table support to bring the transverse plane of the breast parallel to the film.
- Rotate patient such that the vertical plane of the breast under investigation is angled 10° with the nipple medial to the midline of the film.
- Compress the breast firmly until there is an equal thickness of tissue anteriorly and posteriorly .
- Ensure that no skin creases are created during compression
- Ionization chamber is adjusted according to breast size.
- Collimate x-ray beam to ensure complete coverage of the breast.
- Place film makers on the side closest to the axilla.

Operating theatre technique:

Liaison: Radiographers should have a working knowledge of the duties of each person in the operating theatre. He should check on the specific requirements of the surgery performing the operation. He should contact the theatre superintendent on arrival.

Personal preparation:

Before entering an aseptic controlled area.

1. Uniform and any jewellery is removed and replaced by theatre wear.
2. Hair is completely covered with a disposable hat and theatre shoes or boots worn.
3. Wash your hands using soap paying particular attention to the nails with a scrubbing brush.
4. A face mask is put on.
5. If skin has abrasion this should be covered with a clean plaster.
6. Monitoring badge is pinned to the theatre garment.

Equipment:

Theatre suits should have x-ray equipment and darkroom facilities within the complex.

Portable or mobile x-ray units are selected depending on the requirement of the radiographic procedure. This may mean a high-powered mobile unit for abdominal radiography or a mobile image intensifier for screening of orthopaedic procedures such as hip nail pinning.

Note: before a unit is removed from its store, it is switched on and tested. It is then disconnected from the electrical supply and dusted.

Using a cloth moistened with a suitable antiseptic solution in alcohol; base, all parts of the mobile unit are cleaned with special attention to cables and wheels. After the unit has dried, it is transferred to the theatre; tested again and if functioning, positioned ready for use.

Select appropriate exposure/factors for screening or taking of x-ray films.

Darkroom Facilities:

Processing equipment should be switch on and tested. Adequate levels of replenisher solutions should be prepared. Cassettes and films made available. Accessory equipment: cassette holders, stationary grids, cassette tunnels or serial changer devices should be cleaned and checked if required.

Operating theatre table with an adjustable cassette tray should be checked for movement.

Contrast medium if required should be made available.

Radiation protection: this specifically is the responsibility of the radiographer.

Sterile areas: the radiographer should avoid the contamination of sterile areas equipment should be positioned before any sterile towels are placed in place.

Read: Hip pinning, Kidneys and operative cholangiography.