RADIOLOGICAL TECHNOLOGY AND POSITIONING

FOR X- RAY TECHNICIAN

PART I

BY

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Contents

Chapter one

INTRODUCTION TO TECHNOLOGY AND POSITIONING

Introduction To Technology And Positioning

X - Ray : is artificial electromagnetic waves that are produced by X-ray machine.
X - Ray was discovered in November 1895 by the German scientist Roentgen , and he has got the nobel prize in physics at 1901

X-Ray machine : is the machine that produces the x ray,
Conventional X- ray machine is the machine used for general X- ray examinations as chest x- ray , abdomen , extremities …

It consists of :-

- **1. Generator :**
- It transforms the usual current to high voltage current.
-
- **2. X-Ray tube ;** (fig.1)
- It transform the high voltage current to X- ray, which emerge from the x -ray tube. The X – ray unit is called the photon
- The X – ray coming out of the tube is called primary beam (1ry beam).

- **The diaphragm (collimator);** placed in contact with the x ray tube through which the x -ray pass through. Its function is to collimate the x- ray beam according to the size of the part to be examined, to prevent unnecessary exposure to other parts of the body. The diaphragm contains light source which helps us to control the size of the emerging x- ray.

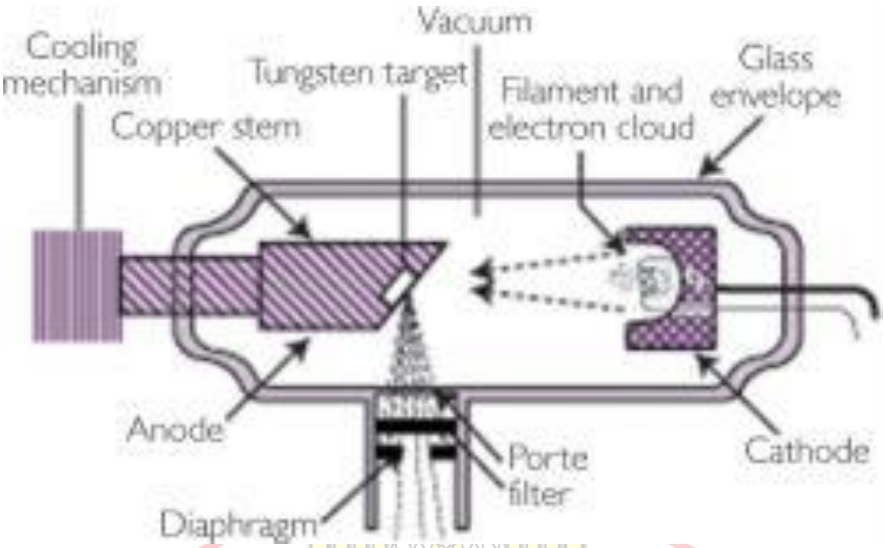


Fig.; 1; Showing X- Ray Tube , X- Ray Production, Diaphragm , Filter.

- **X-Ray filter :** is a metal sheet present in the diaphragm Immediately below the x ray tube. It absorbs the weak X -ray waves , to avoid its absorption by the human body. It is usually made of aluminum sheet 2 mm , other material may be used.

HOW IMAGE IS FORMED ON THE X- RAY FILM ?

In a simple form , when the 1ry X – ray beam pass through the body several events occurs. Most of the X- ray photons pass through the body to reach the X– ray film or image receptor .

While passing through the body , the X- ray photons are attenuated according to the structure of each part of the body e.g. while passing through air as the lung less attenuation occurs , i.e more X ray reach the X - ray film so this part will appear black . Another example, when x - ray photons pass through bones or any structure of high molecular weight it absorb more X- ray photons so in this case less or no X- ray photons reach the x ray film , so this part appear white or light gray

Our last example will be on soft tissues as muscles or abdomen , in the case while X- ray photons pass, attenuation of the X- ray photons occur according to the differential structure of this part , so this part appear grey , light gray if more x ray absorbed and dark grey if less x ray absorbed.

Some X- ray photons are scattered to the surrounding , called scatter radiation (or 2ry X- ray). For more details , please refer to physics book .

- **3. X - Ray Table : (Conventional X- Ray Machine ; Fig.2)**

- It s the table where the patient lies down during examination . it allows passage of the X- ray through it . The X- ray table may be stationary (not moving). Or moving (called floating table moving in all directions).

- **Grid , OR Bucky ;**
- The grid is plate of special material , it, s present in the table , just below the table top or in the stand bucky .
- Function ; it filters the X- ray beam and prevent scatter radiation from reaching the X- ray film or the image receptor. So it allows only the 1ry beam passing in a straight line to reach the film.
- Generally the grid is not used while examining peripheral thin parts (hands , feet), due to less scatter radiation in this case . And the grid should be used in thick parts (hip , obese knee , abdomen, chest…) with more scatter radiation .
- Figure ; 3 , show the difference between bucky and non bucky x ray pelvis

- **Bucky stand :**
- It is a metal stand at the wall, it has a bucky buit in. It s used during X- ray examination for the patients while standing. It is sometimes called chest stand, usually used for x- ray examination of the chest, erect abdomen or any other examination while standing.

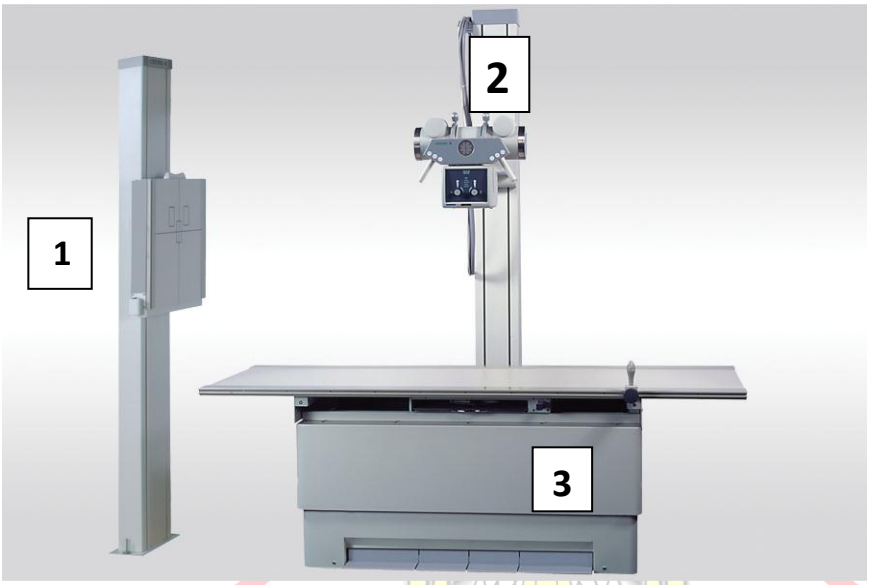
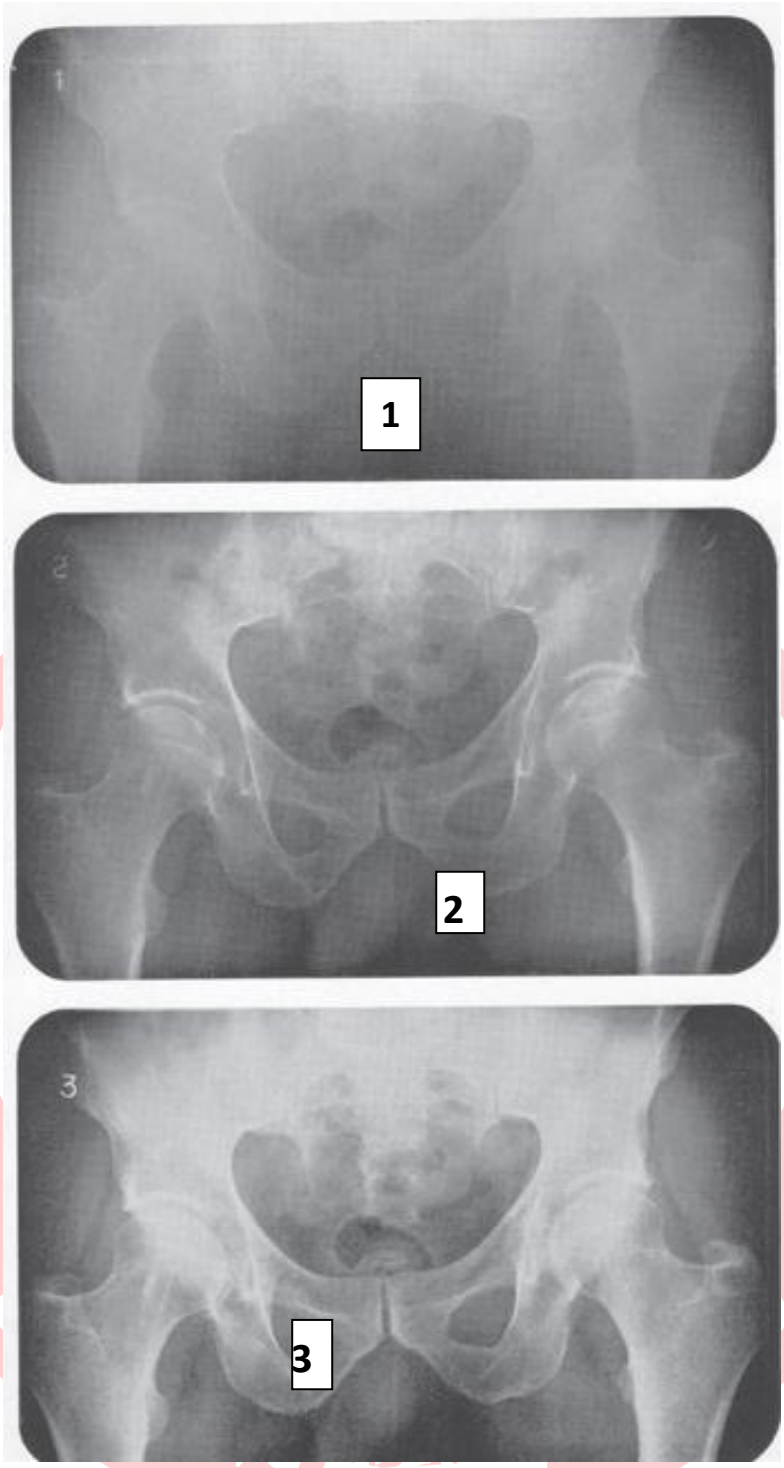


Fig.; 2: Conventional X - Ray Machine . (1: Bucky Stand, 2: X Ray Tube , 3: X Ray Table).

- **4. Control Panel ;**
-
- Controls X- ray exposure during examination. It contains the switch button, controlling the X- ray output (e.g . kilovoltage (KV) , milliampere seconds
  (MAS) (which is the product of the milliampere and seconds). Other functions may also, be included according to the machine function.
  Kilovoltage is the penetration power of X - ray .
  MAS is the quantity of X –ray.



Figure;3 : Show X - Ray Pelvis Without Bucky "1" And With Bucky "2,3".

While doing radiographic examination the following items should be fulfilled ;-

1. **Position** of the patient or body part to be examined on the X- ray table or while standing beside the stand bucky.

2. **Examination technique including :**

A. Exposure Parameters : exposure factors: kilovoltage (kvp), Milliampere Seconds (MAS),(Milliampere x Seconds),

B - Focal Film Distance (FFD) : is the distance between the focus (or central part of the x- ray tube (anode) and x ray film. The usual distance is 100 cm, except the chest 150-180 cm to avoid magnification.

C- Object Film Distance ; is the distance between the part to examined (object) and the X- ray film. The examined part should be in contact and parallel to the cassette. (If the object film distance increased , the examined part will be magnified). (e.g. if you want to magnify any part , you have to increase the object film distance)

3. Central Ray (CR): Is the center of the X- ray beam , and it should be in the center of the examined part e.g. in X- ray elbow (AP view) the center should be in the center of the elbow. Also, the central ray should be in the center of he film.

4 . Image receptor :- is the medium which receives the X- ray photons passed through the examined part . The image may be produced either on X- ray film or through a digital system on a computer ; :

- Film Screen Cassette: Where an X - ray film is put in a cassette. After exposure to X- ray , the film is put in special chemicals (processing) , to get the final X- ray image. Size of the film should be suitable to the part to be examined. (For more detail , please refer to the dark room book).

- The Digital Image : the X- ray fall on a special phosphorous plate (which is put either in a digital cassette or the plate put within the x-

ray table). In case of digital cassette , After exposure of the plate to X-ray the plate is put is a special machine to read the image and transfer it to a computer, and the plate becomes ready to receive another x- ray exposure. In case of a table built in plate " called direct radiography OR DR " , after exposure of the plate to X- ray , the image is transferred directly to the computer system so this is called direct radiography .

Common Film sizes:

In inches : 14 x17 & 14x14 & 12 x 15 & 10x 12 & 8x 10.INCHES

In centimeter: 30 x40 & 24 x 30 & 18 x 24. CM.

5. Respiration: Instruction to the patient to stop breathing during X – Ray exposure. Generally in chest x ray , stop respiration after deep inspiration, and in abdominal examination stop respiration after deep expiration .In extremity studies , no need to stop breathing.

ANATOMIC POSITIONS

The normal anatomic position : is the standard standing position with the person facing forward , and both hands forward.

Anterior surface ,(ventral surface) refers to the front of the body or any part of the body when seen from anterior e.g. front of the chest is the anterior of the chest, front of the hand is the palmer aspect of the hand. (fig. 4)

Posterior surface (dorsal surface), is the back of the body or any part, when seen from the back e.g. back of the chest is the posterior of the chest, dorsal aspect of the hand is the posterior of the hand or finger.

Figure 4 : Anterior Or Frontal Surface Of The Body

Body Planes, Sections, and Lines

Common planes :- (fig. 5)

Sagittal Plane : longitudinal plane that divide the body into right and left parts . if in the midline it s called midsagittal plane , and it divides the body into two equal parts . If not in the midline (paramidline) called parasagittal (right parasagittal to the right of the midline or left parasagittal to the left of the midline).

Coronal Planes: longitudinal plane that divide the body into anterior and posterior parts .

Axial Plane : transverse plane (at right angle to the above two planes) passing through any body part, dividing it to superior and inferior parts.

SECTION: "CUT" OR "SLICE" IMAGE OF BODY PART:-

Cut or slice of any part of the body : this produces images of the part according to its direction (axial cut or axial slice similarly coronal

or sagittal cut or slice). The thickness of the cut or slice vary, e.g. 1mm, or more , according to the part or protocol of examination.

In Computed tomography (CT) examination the cuts are axial , from these axial cuts sagittal or coronal or oblique planes can be reconstructed.

In magnetic resonance imaging (MRI), the slices or cuts are axial , coronal and sagittal (fig.6).

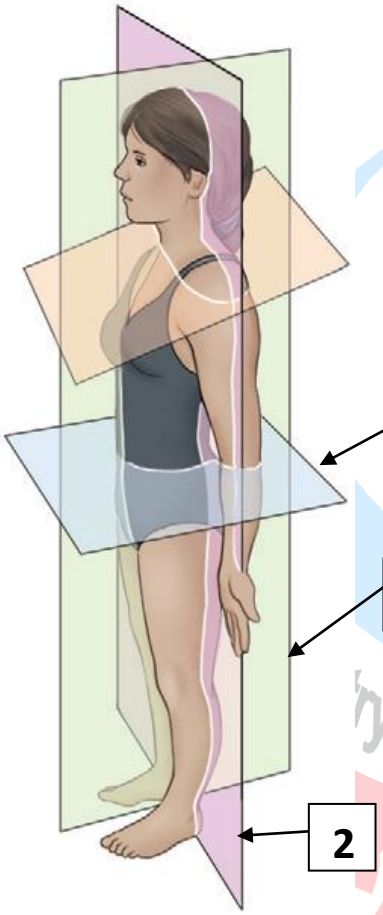


Fig.;5 ; 1; Sagittal , 2; Coronal and 3; Axial planes.

Fig. 6 A : Mid Sagittal Plane Of The Brain

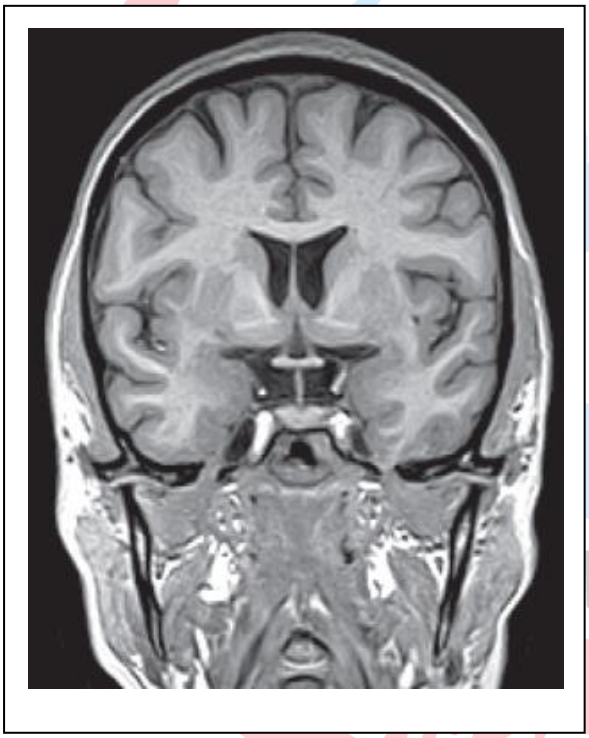


Fig. 6 B ;MRI ; Coronal Cut Of The Brain

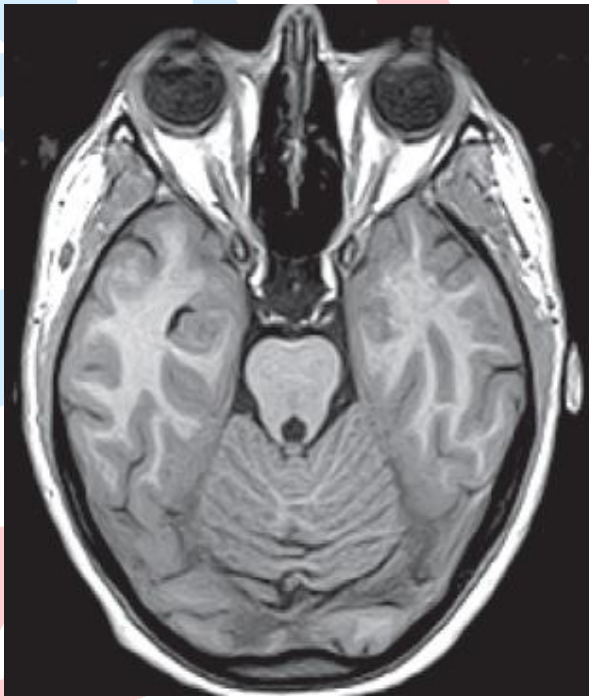


Fig. 6 C : MRI; Axial Cut Of The Brain.

Important lines :

1. Midline; longitudinal line , passing the mid sagittal plane
2. Midclavicular line; passing through the middle of the clavicle, i.e right midclavicular line,& left midclavicular line.
3. Midaxillary line , passing through the center or apex of the axilla.
4. Anterior or posterior axillary line passing through the anterior or posterior axillary folds
5. Epigastric line, passing one inch below the xiphoid process of the sternum.

Terms used for the hands ;

Palmer surface ; is the anterior or frontal surface of the hand or fingers;

Dorsal surface ; is the posterior surface of the hand or fingers. FIG. 7 .

Fig. 7 A; Dorsal or posterior aspect of the hand, when the hand in this position, this called pronation.

FIG. 7 B , Anterior or palmer aspect of the hand, when the hand in this position this is called supination.

Terms used for the foot:

Planter surface ; refers to the sole of the foot.

Dorsal surface ; is the anterior surface of the foot.

RADIOGRAPHIC POSITION

It is the position of the patient or examined part during X - ray examination.

Common positioning terms

BASIC POSITIONS : *OR BASIC VIEWS;*

This is the basic position that should be done to the part under question , Always two perpendicular views e.g. when X- ray wrist is requested, this means that you will do PA or AP and lateral views.

ADDITIONAL , OPTIONAL OR SPECIAL VIEWS *, are the views done in addition to the basic views to add more information, and will be more helpful for diagnosis..for example an important special view of the wrist i.e. PA with ulnar deviation will be done to answer a specific question or to add more data to the diagnosis.*

You should always remember that the part of interest should be close or in contact with the film. e.g. we do chest x ray left lateral view if the problem in the heart or left lung , on the other hand we do chest x ray right lateral if the patient has right sided lung lesion.

Also, remember that the part to be examined should be close and parallel to the film ,e.g during X – ray the elbow (AP view), the posterior surface of the elbow in contact with the cassette , at the same time , the forearm and the arm should be in contact and parallel with the film by lowering down the shoulder

Postero anterior view or projection : (PA):

In this position the x- ray passes from posterior to anterior . The X - ray tube is posterior , and the cassette is anterior . i.e the X- ray pass from posterior to anterior .

Antero posterior view (AP):-

This is the position when the X- ray passes from anterior to posterior , the cassette is put posteriorly, and the x ray tube in front of the patient .

Lateral view :- This is the position when the x ray pass from one lateral side to the other . e.g. in lateral X- ray chest when the x ray beam pass from right to left side (the cassette at the left side) , this is called left lateral. On the other hand when the x- ray beam passes from left to right side (the cassette at the right side) , this is called right lateral view. (this means that the right side in contact with the cassette).

Oblique views :

In this case, The patient is positioned oblique mid way between frontal and lateral position, i.e .we put the patient in the lateral view then rotate 45 degree to have the oblique view. For example , If the cassette at the right side of the back , this is called right posterior oblique .

On the other hand if the cassette at right side of the front of the patient this is called right anterior oblique. . Left posterior oblique when the posterior aspect of the left side closest to the cassette

We can say there is an AP oblique view (right or left), and PA oblique view (right or left), according to the side close to the film.

BODY POSITIONS

1.Supine ; when one lies on his back.

2.Prone ; when one lies on the abdomen.

3. Erect; Standing upright. Erect AP , when the anterior surface facing the tube and the posterior surface towards the cassette . Erect PA , when posterior surface facing the tube and the anterior surface facing the cassette.

4. Recumbent; lying down ;

Supine recumbent ;lying on his back.

Prone recumbent ; lying on his abdomen.

Lateral recumbent; lying on one side (right lateral recumbent or left lateral recumbent).

5. Trendlenberg: lying supine recumbent, head lower than feet.

6. Decubitus : when patient lying down. However , its commonly used when lying on one side as mentioned in the recumbent state. In decubitus position, the X- ray beam is horizontal.

Right or left lateral decubitus : (fig.8).

Right lateral decubitus , (called also, right lateral recumbent) when the right side is down i.e lying on his right side .

Left lateral decubitus (called also, left lateral recumbent) when the left side is down i.e. lying on his left side.

Postero anterior (PA lateral decubitus), this means that when doing lateral decubitus the X- ray come from posterior to anterior,

Antero posterior (AP lateral decubitus) , this means that while doing lateral decubitus the X- ray pass from anterior to posterior.

7. Axial:- along the long axis of the part; inferosuprior or superio inferior

8. TANGENTIAL: when the X- ray pass tangential to the part.

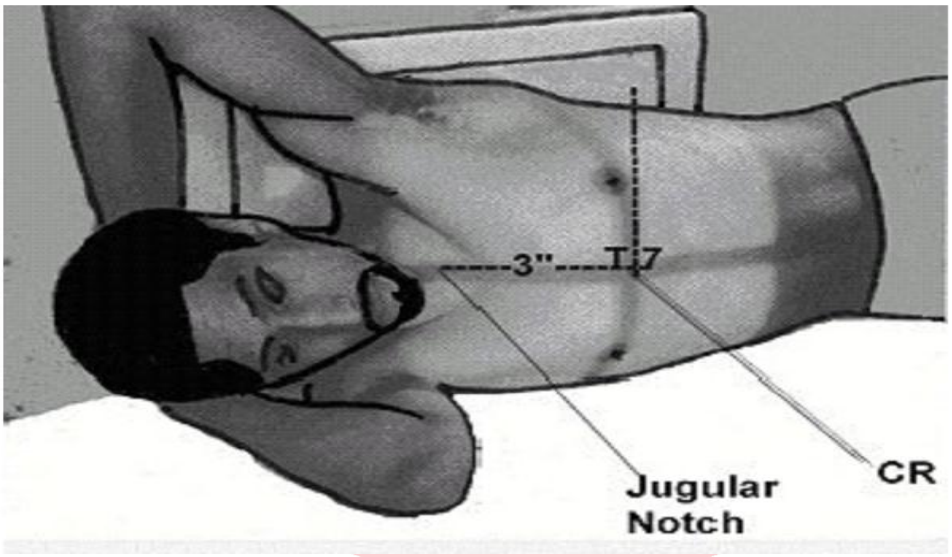


Fig. 8 : Rt. Lateral Decubitus (AP) View.

RELATION TERMS

Proximal versus distal : proximal is the part close to body e.g the knee is considered proximal than the foot. Distal is the part not close or relatively remote as related to other parts e.g. the foot is considered distal to the knee, and the knee is distal to the hip joint.

Medial versus lateral : e.g. lateral aspect of the thigh is the outer aspect .medial aspect of the thigh is the part of the thigh towards the midline .

CEPHALIC VERSUS CAUDAL ANGLE ;

- Cephalic angulation ; when the x ray beam is angled towards the head.

- Caudal angulation ; when the x ray beam is angled towards the feet.

Identification card : *should be put on the film*

- **Film mark should be used R or L to identify right or left side of the patient.**
- **Patient identification I.D. should be put on the film ; including patient name , date of the study , hospital number and part examined.**

MOVEMENT TERMS ;

- **Flexion:** flexion of a joint when the bones at both sides of the joint come close together e.g flexion of the elbow ; when the forearm and the arm come close together. Flexion of the spine ,when you bend the spine anterior so the head become close to the knee.
- **Extension :** extension of a joint to make it straight e.g . extension of the elbow to make both arm and forearms straight .
- **Abduction; e.g** abduction of the arm by moving the arm away from the body. The same apply to the legs

- **Adduction;** moving the part close to the body e.g adduction of the arm by moving it close to the body . the same apply to the legs.
- **Bending ;** while standing the body moved to one side (right bending or left bending).
-

Gonadal protection; (fig. 9 & fig. 10)

- Aiming to protect the gonads (testis and ovaries) from X - ray effects. The ovaries and the testis are covered by thin lead sheet.

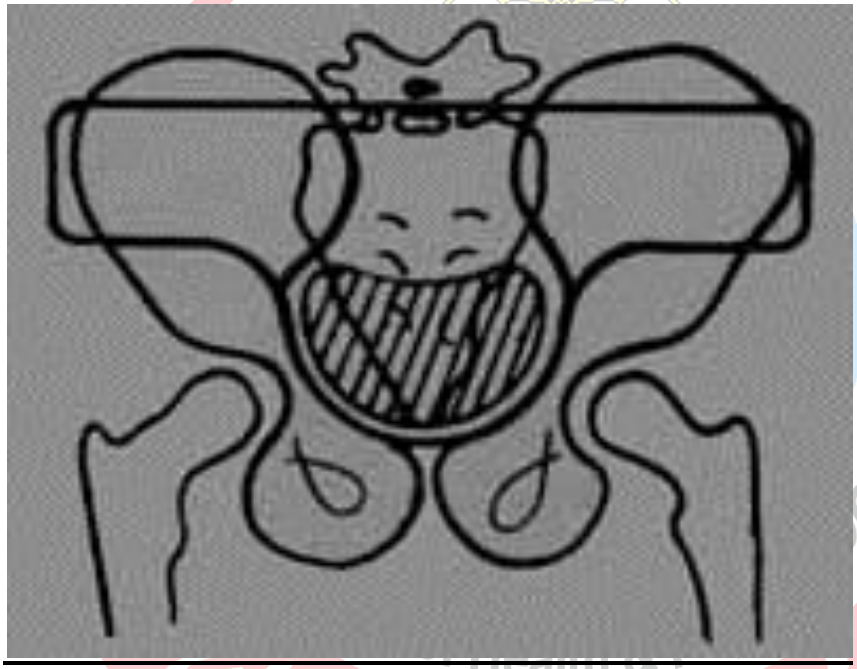


Fig. 9 ; Female Gonadal Protection

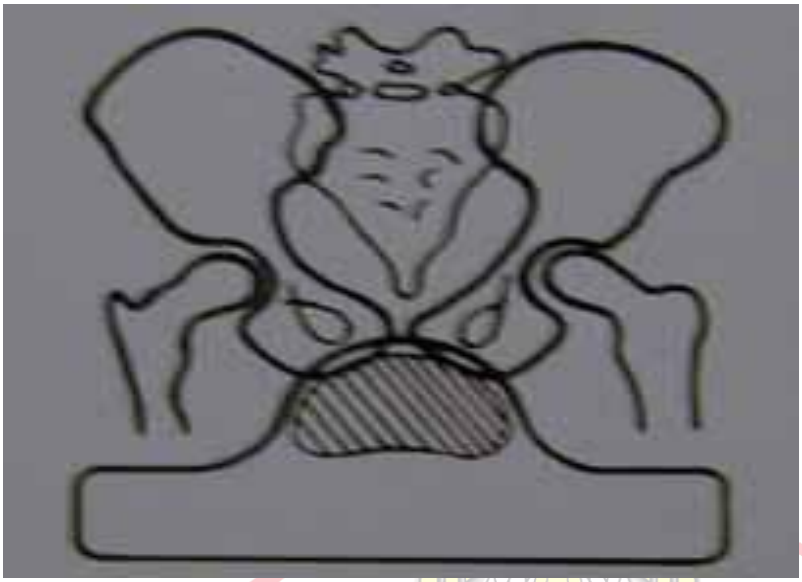


Fig. 10 ; Male Gonadal Protection

PATIENT PREPARATION:

1. Psyhological preparation.

2.Explanation of the technique to the patient or relatives.

3. Special care for very young, mentally unstable, unconscious or inco-operative patient.

4. All detachable artifacts , e.g, ear rings, long hair are removed from the X ray path.

5. it s important to have clean sterilized conditions : clean hands, clean X ray table, clean cassette and immobilization aids.

RADIATION PROTECTION

Radiation protection is essential for the radiological staff , and patients .

Patient protection:- (No relatives should be present in the X- ray room)

- Protect the gonads.
- Good technique to avoid repetition of the x-ray.

- For pregnant females ; . Review the indication with the referring doctor . During radiological examination protect the abdomen by lead apron.
- *Strict to **10 or 28 days rule:** any married female (during her reproductive life) can be exposed to x- ray only during the 1st 10 days of her menstrual cycle*

Radiological staff:-

- Never expose your hands to direct X- ray.
- Do not stand close to the x- ray table without protection.
- During exposure you should stand behind lead partition.
- Careful technique to avoid repetition.
- You should strict to ALARA (as low as reasonably achievable)
- You should use film badge
- The walls and doors in the x ray department should be isolated by lead sheets or by special materials.

CHAPTER TWO

TECHNOLOGY AND POSITIONING OF THE CHEST AND THORACIC CAGE

UPPER RESPIRATORY AIR WAY

X - RAY OF THE PHARYNX (fig.1)

Common Indication of the examination :

- Adenoid (in the nasopharynx).

Basic View : lateral view .(true lateral or dead lateral)

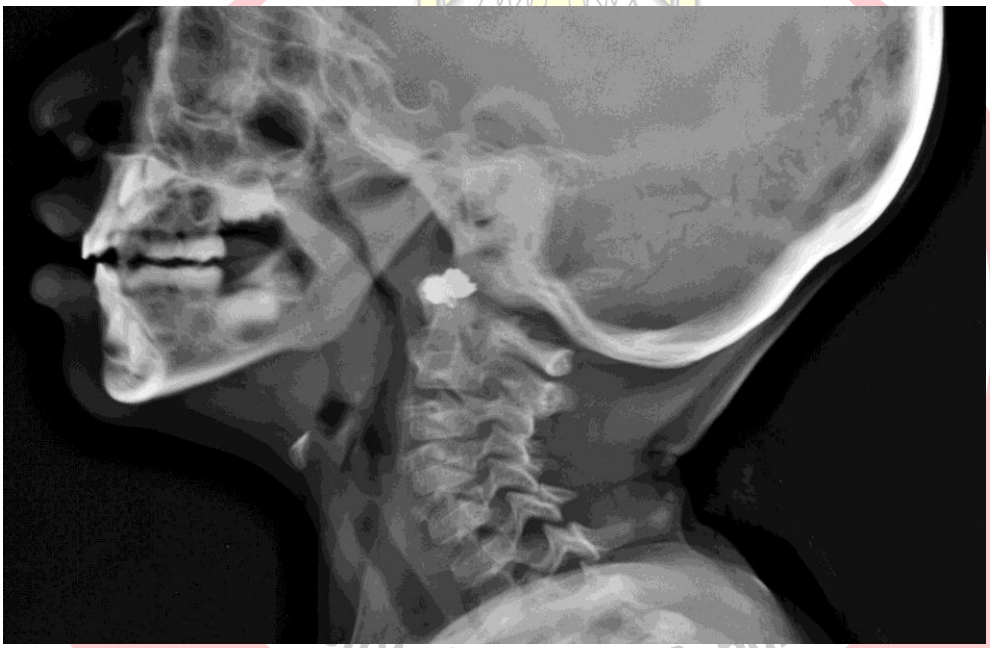


Fig. 1 : Lateral View Nasopharynx and Larynx.

Patient Position :

- Patient stands in the lateral view with the shoulder in contact with the standing bucky (containing the cassette inside).
- Patient can sit down if he could not stand.
- Both hands at both sides of the body.
- Neck extended.
- Sagittal plane parallel to the cassette tray (or standing bucky).
- Ear rings (in females) should be removed.

Central Ray:

- Perpendicular to the angle of the mandible. (horizontal beam)

Exposure Factors:

- Kv : 65 kv. MAS : 15
- FFD : 150 CM (to compensate for the distance between the pharynx and the film).
- Bucky; used.
- Film size : 8 x 10 inch or 24x30 cm.
- A soft film is done to show the soft tissue

Collimation :

Use the diaphragm to collimate the beam From the skull base to the lower neck, and from the nose to behind the cervical spine.

Good radiograph assessment criteria:

- The radiograph should be in the true lateral view.
- The following structures should be overlapped: Both mandibles both Ears and the skull base bone

Other additional views of the pharynx :

- Lateral view with barium swallow .
- A.P view .

X - RAY OF THE LARYNX (fig, 1)

Basic View : lateral view .

Position :

- Patient stands in the lateral view with the shoulder in contact with the stand bucky . (containing the cassette inside).
- Patient can sit down if he could not stand.
- Both hands at both sides of the body.
- Neck extended.

- Sagittal plane parallel to the cassette tray (or stand bucky).

Central Ray:

- The central ray is perpendicular to the laryngeal cartilage.(horizontal beam).

Exposure Factors:

- Kv : 80 kv. MAS : 30
- FFD : 150 CM (to compensate for the distance between the larynx and the film).
- Bucky; used.
- Film size : 8 x 10 inch or 24x30 cm.

Collimation :

Use the diaphragm to collimate the beam From the nose to the thoracic inlet and from the skin anterior to the larynx to behind the cervical spine.

Other additional views:

- Lateral view with barium swallow .
- A.P view .

X- RAY CHEST

Indication :-

- Lung diseases; e.g inflammation , abscess, effusion, tumors
- Pre operative and medical check up
- Heart disease.

Basic views:-

1. Chest Postro anterior view (PA view).
2. Chest lateral view.

Additional views:-

1. A.P view (antero posterior view).
2. Lordotic view;
3. Apical view.
4. Oblique views:

- Anterior oblique (right or left i.e right anterior oblique , left anterior oblique).
- Posterior oblique (right or left i.e right posterior oblique, left posterior oblique).

5. Lateral Decubitus view.
6. Chest x- ray in Infant , and paediatric age .
7. Chest x - ray for Old patients.
8. Chest x - ray for intensive care patients.

General outlines and Precautions :

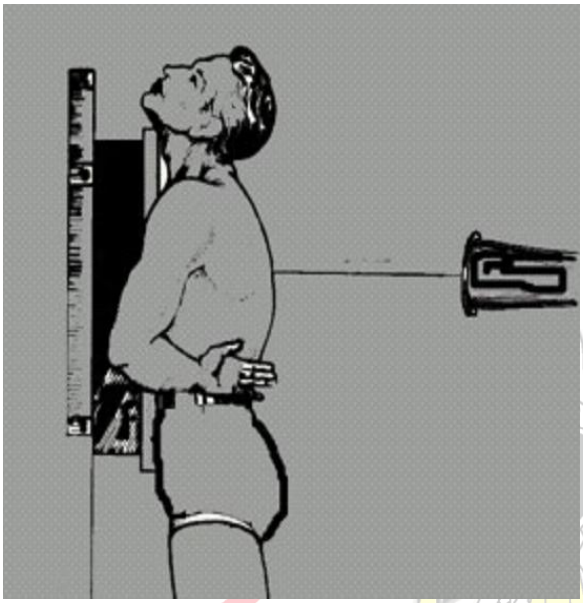
- Remove metallic or plastic objects. Remove clothes only pure cotton underwear is allowed.
- The female hair should be moved away from the x ray beam pathway.
- Put short apron (lead sheet) from the patient waist down to the upper thigh) to protect the gonads.

- Respiration : all views are done with arrested respiration (i.e stop breathing after deep inspiration , to ensure full expansion of the chest).
- In severely ill or uncooperative patient , X- ray exposure could be done after arrested respiration, decrease exposure time (yet maintaining the MAS :miliampere seconds) .
- Avoid doing chest x ray after expiration (in expiration the lungs are not expanded) .
- Collimate the x ray beam to the chest ; for better contrast of the examined area and to avoid unnecessary exposure of other adjacent parts.
- FFD : 150-180 cm to avoid cardiac magnification.
- Select KV to avoid deep penetration, in proper chest X - ray the intervertebral discs should be visible while dorsal vertebra should be fairly visualized .
-

1. CHEST X- RAY (POSTERO ANTERIOR VIEW) (P.A.) (fig.2)

Patient Position:

- Patient stands against the stand bucky in the postero anterior view
  (with the front in contact with the stand bucky and the back to the x- ray tube side).
- Both arms and hands over the lower back, and buttoks.
- Both shoulders pushed anteriorly to touch the stand buky.(for the scapula to be away from the lung fields)
- The chin above the stand bucky.
- The cassette should be 2 cm above the shoulder.



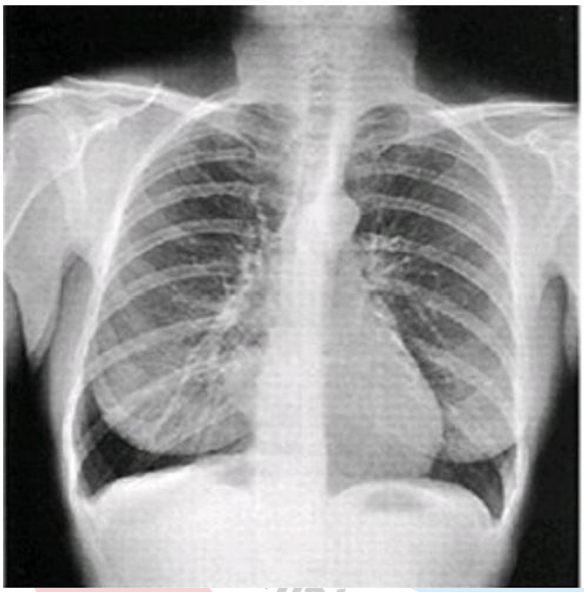


Fig. 2 : Chest X- Ray (PA View).

Central Ray:-

-Over the fifth dorsal vertebrae.

- OR first put the central ray in the center of the stand bucky before positioning the patient , and the patient stands with mid sagittal plane corresponds to the midplane of the stand bucky.

EXPOSURE FACTORS:

KV : 65-70 MAS ; 20-25

FFD; 150 -180 CM BUCKY ; USED.

FILM SIZE: according o the patient size.

For adult patient; 14 x17 inch, or 14 x 14 inch.

For young patient or infant : Smaller sizes 24x 30 cm & 8x 10 inch can be used .

Collimation :

Use the diaphragm to collimate the X - ray beam , to include from the lower neck to the upper abdomen and both sides of the chest wall.

Respiration :-

During X- ray exposure ; arrested breath after deep inspiration. (to allow better expansion of the chest).

Good radiograph assessment criteria:

- A good chest X- ray radiograph should have the following criteria :
- 1. The chest x- ray film should include from above the lung apex to the below the diaphragm.
- 2. The dorsal vertebrae are poorly visualized, and the disc spaces visible.
- 3.Both lateral costophrenic angles are well visualized.
- 4. Scapula away from both lung fields.
- 5. Posterior ribs are seen down to 10-11 ribs
- 6. The chest x ray film should be well centralized fulfilling the following :
- A. Trachea is centralized .
- B. Both medial ends of the clavicles should be equidistance from the spinous process or midline .

2. CHEST X- RAY (LATERAL VIEW) (figure 3, 4)

Patient Position:

- Patient stands against the stand bucky in the lateral view (the lateral chest wall in contact with the stand bucky).
- Both arms and hands over the head.
- The cassette should be 2 cm above the shoulder.
- Left lateral view: the left side of the chest in contact with cassette; this is done if there is left lung disease or heart disease or both lungs diseases.
- Right lateral view: the right side of the chest in contact with cassette, this is done in right lung disease.

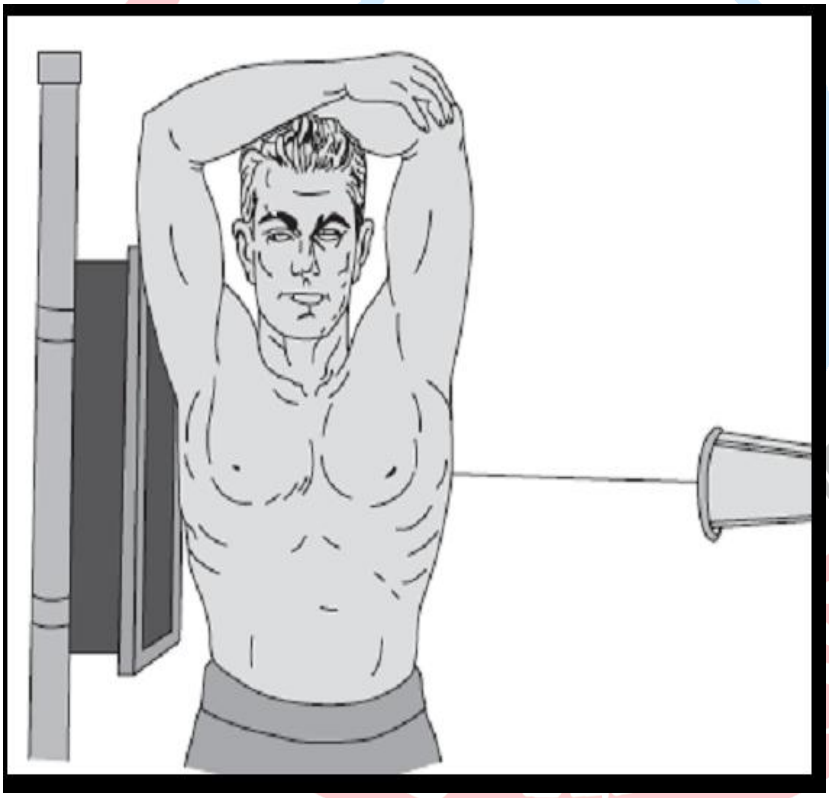


Fig. 3 : Right Lateral View Of The Chest

Fig. 4: Lateral View Chest.

Central Ray:-

- In the mid axilla.

- OR first put the central ray over the center of the stand bucky before patient positioning and the patient stands with the mid axillary plane corresponds to the midline of the bucky stand.

Exposure Factors:

KV : 75-80 MAS ; 30-35

FFD; 150 CM BUCKY ; USED.

FILM SIZE: according o the patient size.

For adult patient; 14 x17 inch, or 14 x 14 inch.

For young patient or infant : Smaller sizes 24x 30 cm & 8x 10 inch can be used .

Collimation :

Use the diaphragm to collimate the beam to the chest, to include from above the apex , to the upper abdomen .

Respiration :-

X- ray exposure ; stop breathing after deep inspiration.

Good radiograph assessment criteria:

- A good x ray radiograph should have the following criteria :
- The chest x- ray film should include from above the lung apex to the below the diaphragm and from the sternum to the dorsal spine, also, it sould be in the true lateral position.

3. CHEST X- RAY (ANTERO POSTERIOR VIEW) (A.P VIEW)

Patient Position:

- Patient stands against the stand bucky in the antero postero view (with the front of the chest facing the X – ray tube and the back in contact with the stand bucky .
- Both arms and hands in the waist .
- Both shoulders are pushed anteriorly ,(to put the scapula away from both lung fields)
- The cassette should be 2 cm above the shoulder.

Central Ray:-

-Over angle of the sternum.(corresponds to D4-5 disc space).

- OR first put the central ray over the center of the stand bucky before patient positioning and the patient stands with mid sagittal plane over the midplane of the stand bucky.

Exposure Factors:

KV : 65-70 MAS ; 20-30

FFD; 150 CM BUCKY ; USED.

FILM SIZE: according o the patient size.

For adult patient; 14 x17 inch, or 14 x 14 inch.

For young patient or infant : Smaller sizes 24x 30 cm & 8x 10 inch can be used .

Collimation :

Use the diaphragm to collimate the X- ray beam to the chest, to include from above the lung apex , to the upper abdomen (including the diaphragm ,the lung apex and lower neck and both the sternum and the dorsal spine .

Respiration :-

X- ray exposure ; stop breathing after deep inspiration.

Good radiograph assessment criteria:

- A good X- ray film should include from above the lung apex to below the diaphragm, As well as the sternum and the dorsal spine .

4. APICAL VIEW

Purpose : to show apical lesions obscured by the clavicle and upper ribs

Patient position :- we do one of the following two positions

1. Patient in the chest AP position; with X- ray beam angled cephalic (30 degree), and the central ray , below the clavicle at each side, or in the midline in the mid sternum to see both sides at the same time.
2. Patient in the chest PA position ; with X- ray beam angled caudal (30 degree) and the central ray at the lung apex .

5 . LORDOTIC VIEW (Figure 5)

Purpose : to show lesion in the right middle lobe, or pleural effusion encysted between the lobes. (in the transverse fissure of the right lung).

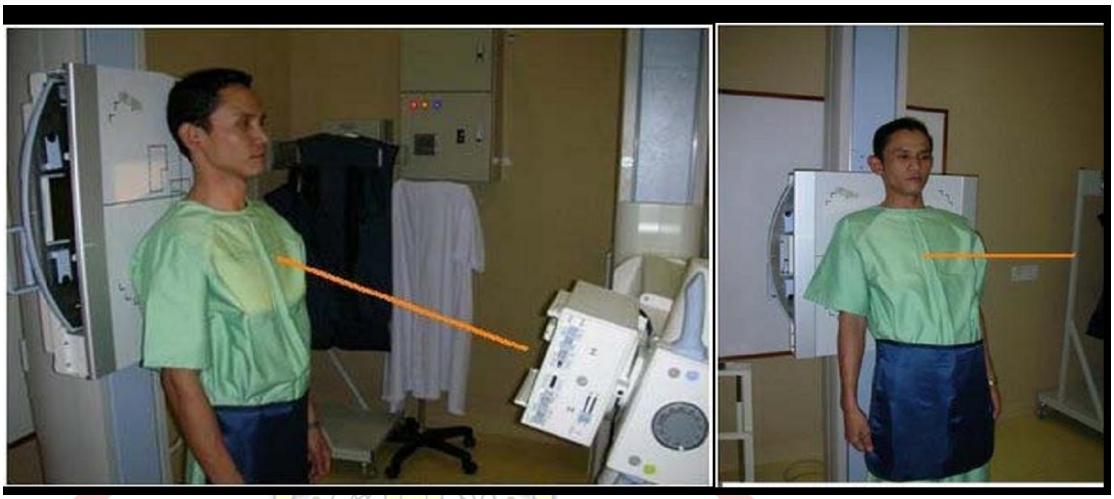
Patient position:- We do one of the following positions :

1. Patient in the AP standing , and the patent stands about 25- 30 cm, in front of the bucky stand , then the patient leans his back so that the back of the shoulders touching the bucky . The central ray is horizontal in the mid sternum.

2. Patient in the AP standing , the back in contact with bucky The central ray is horizontal in the mid sternum with cephalic angle 25-30 degree.

3. If the patient could not stand in the above two views , it could be done with the patient sitting on a chair (without back).

A B



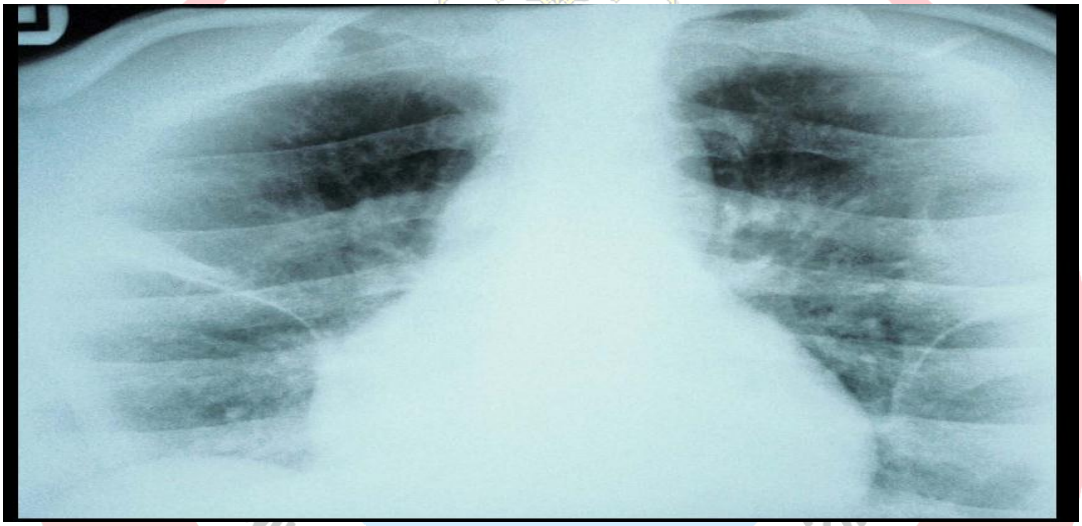


Fig. 5: Lordotic View (Patient Stands In AP View) With Angled (A) or Straight X – Ray Beam (B).

6. OBLIQUE VIEWS

AP OBLIQUE (RT. OR LT.) i.e. right anterior oblique and left anterior oblique).

PA OBLIQUE (RT. OR LEFT) i.e, right posterior oblique and left posterior oblique.

RIGHT ANTERIOR OBLIQUE:- (i.e. right postero anterior oblique) (fig.6 A & 6B) :

From the right lateral view the patient is rotated toward the cassette ,so that the anterior aspect of the right shoulder in contact with cassette and the left shoulder away from the cassette , making an angle with cassette about 60 degrees. The X – ray pass from posterior to anterior in the oblique position.

LEFT ANTERIOR OBLIQUE :- (i.e. left postero anterior oblique Fig. 7)

From the left lateral view the patient is rotated so that the front of the left shoulder touching the cassette and the right shoulder away from the cassette making an angle with cassette 60 degrees.

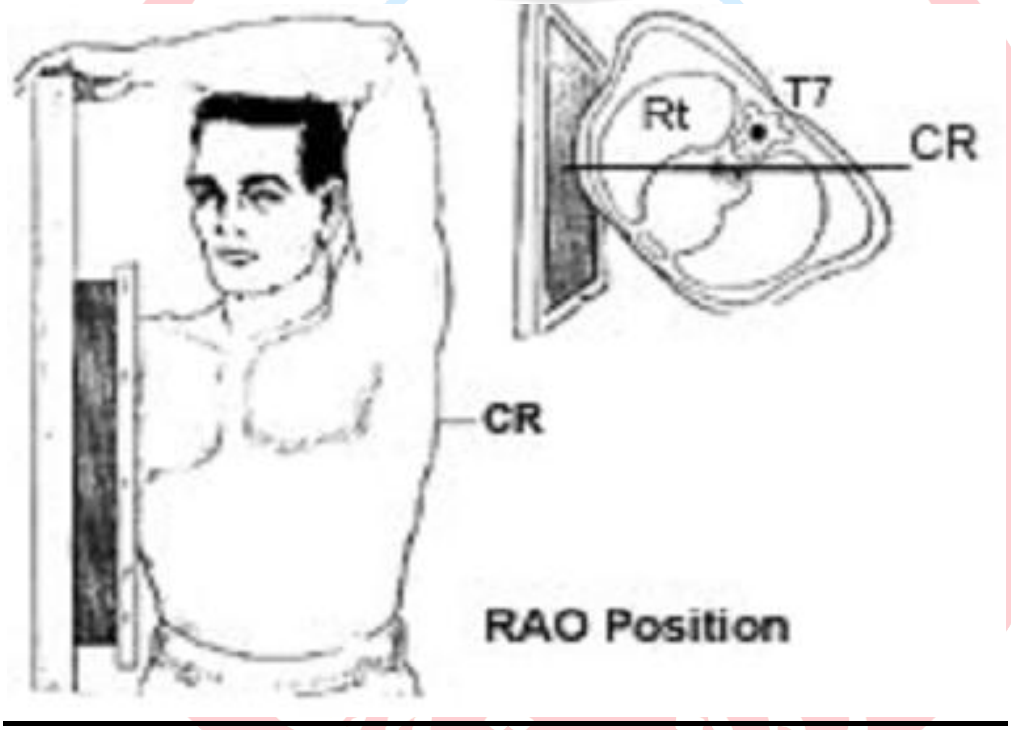


Fig.6 A : RT. ANT. OBLIQUE

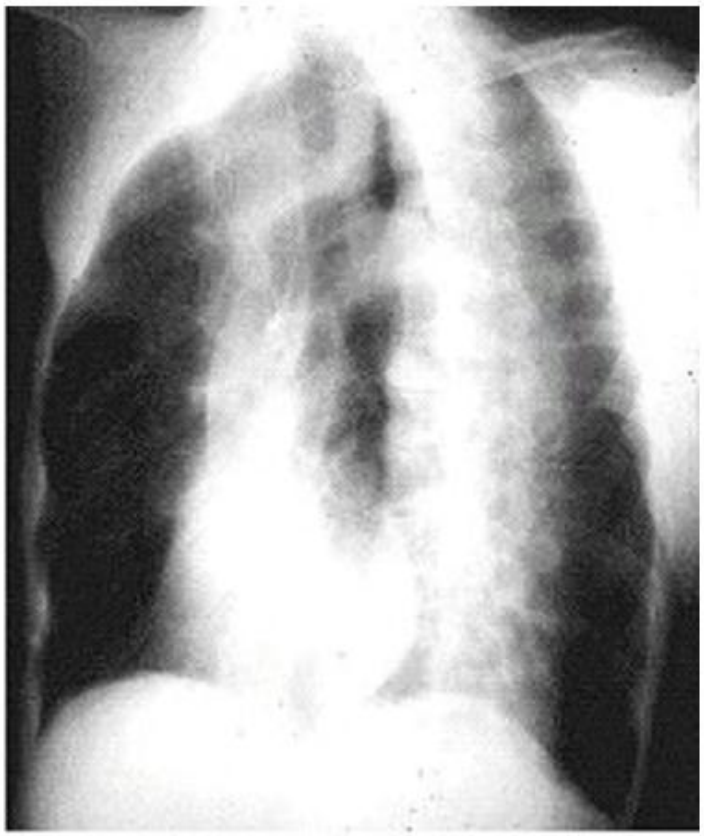


Fig. 6 B : RT. ANT. OBLIQUE

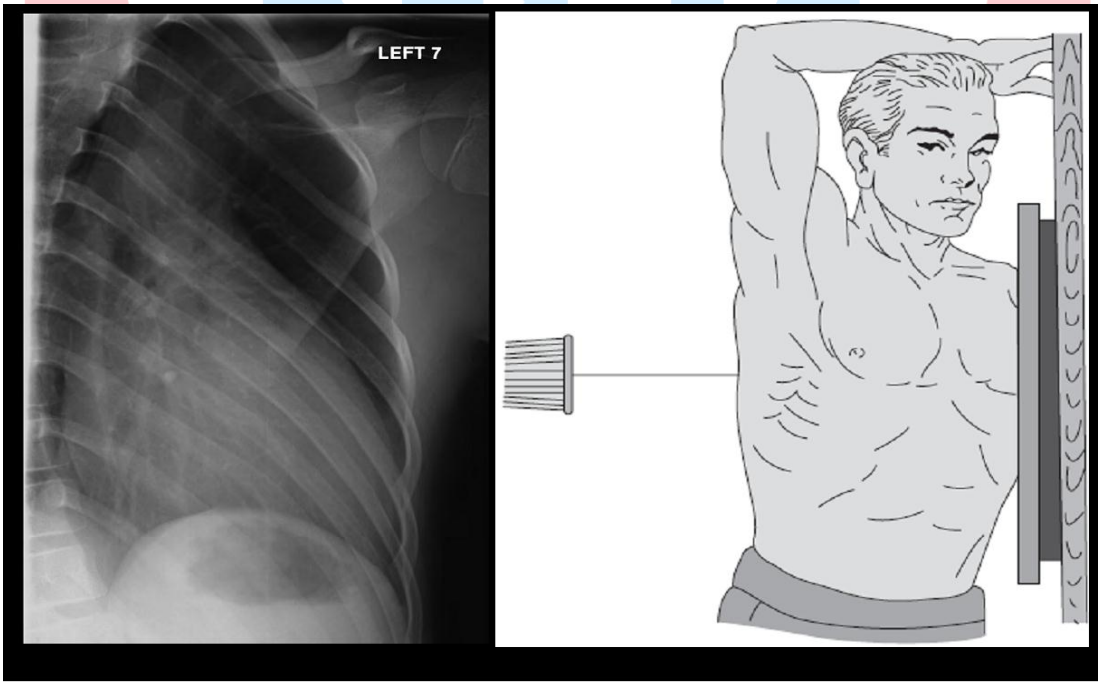


Fig. 7 :LT. Postero-Anterior Oblique.(Lt. Anterior Oblique).

RIGHT POSTERIOR OBLIQUE (i.e RT. Antero posterior oblique):-

From the right lateral view the patient is rotated toward the cassette ,so that the posterior aspect of the right shoulder in contact with cassette and he left shoulder away from the cassette , making an angle with cassette 60 degrees.

LEFT POSTERIOR OBLIQUE (i.e LT Antero posterior oblique) :-

From the left lateral view the patient is rotated so that the back of the left shoulder touching the cassette and the right shoulder away from the cassette making an angle with cassette 60 degrees.

Exposure factors :-

KV: 70 MAS 30

FFD " 150 CM BUCKY : used

Central ray:- (for any oblique view) :-

- In the mid clavicular line of the side away from the film
-

7. LATERAL DECUBITUS (figure 8)

Purpose;

To detect mild effusion , to see obscured diaphragm

Patient Position:

- Patient lie on one side (if the left side is down this is called left lateral decubitus, if the right is down this is called right lateral decubitus)
- This could be Postero anterior (PA) , OR Antero posterior (AP).
- In suspected pleural effusion the affected side is down.
- Central ray and exposure factors as in the chest x ray PA view,
- The dependent side preferred to be raised above the table by few centimeters (using e.g soft pillow).

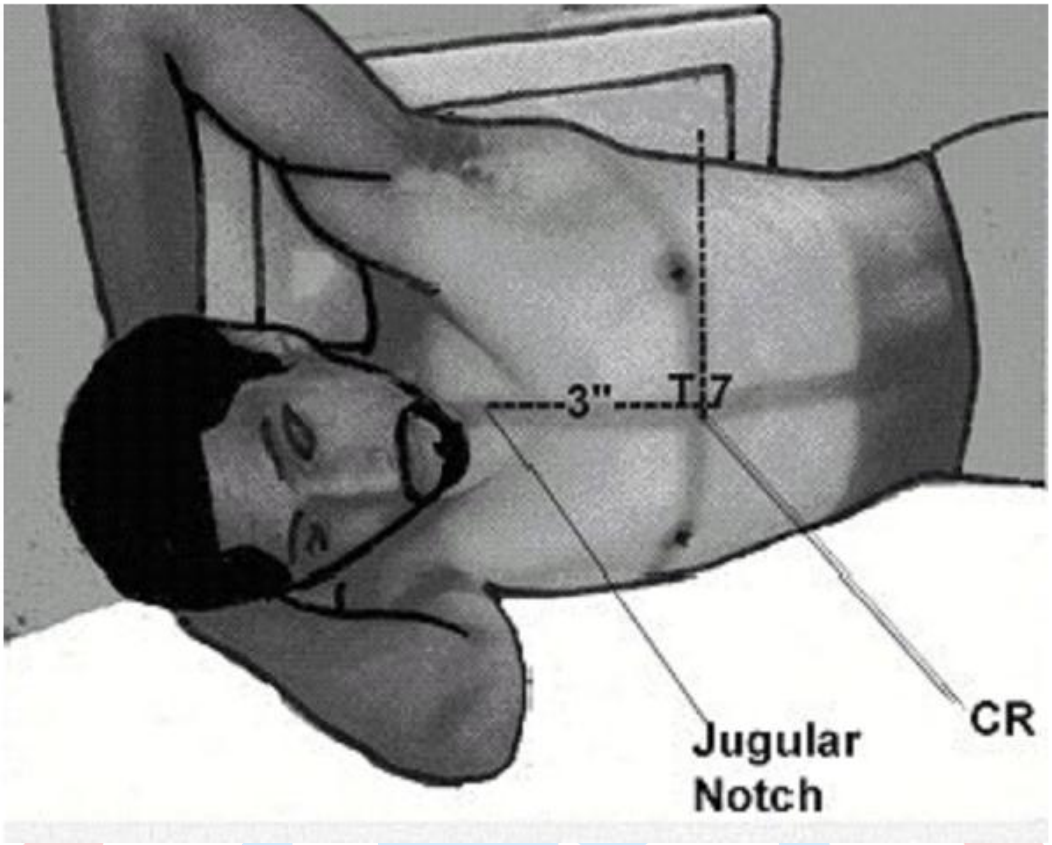
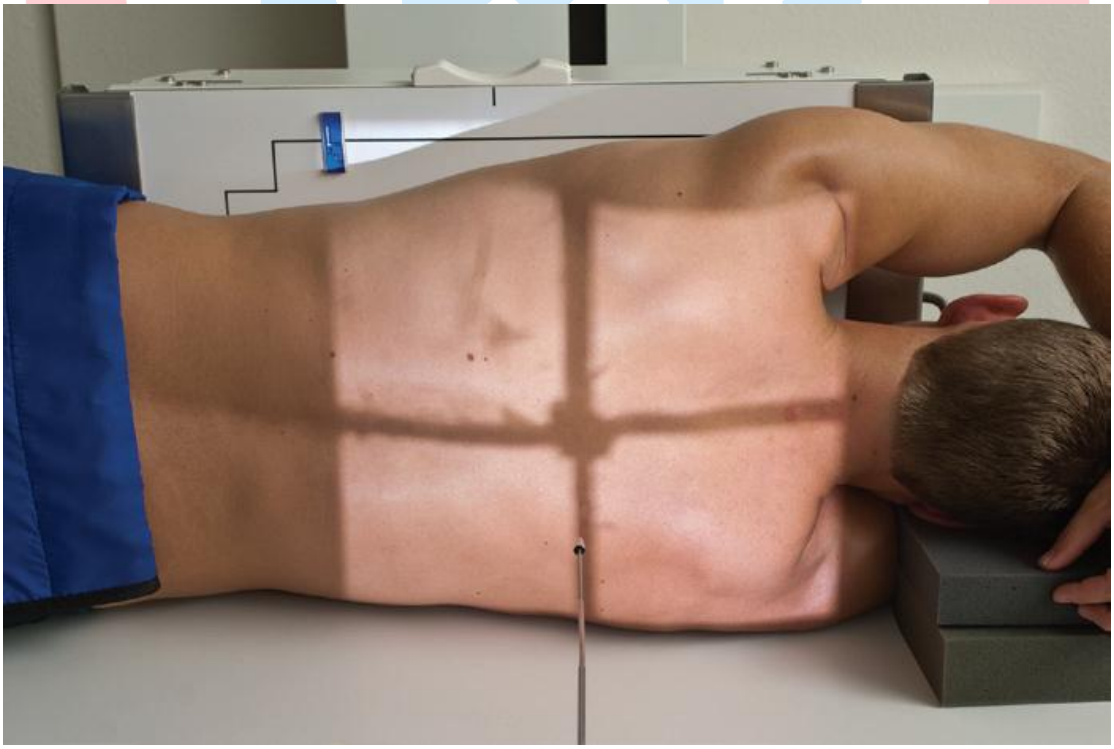


Fig. 8 A: Right Lateral Decubitus In AP View.



Figure; 8 B ; Right Lateral Decubitus (PA)

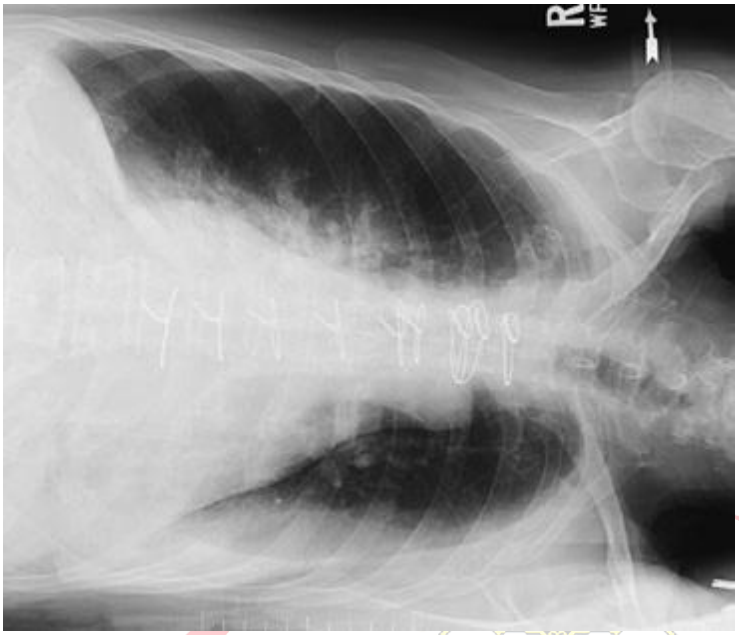


Figure 8 C : Left Lateral Decubitus PA

8. CHEST X - RAY FOR INTENSIVE CARE AND OLD PATIENTS

- Patient could not stand or sit down.
- Chest x- ray can be done in the recumbent position (supine), AP view.
- It can be done in the semisitting position, if tolerated by the patient.
- Lateral view can be done with the cassette at the side of the patient (right or left).
- FFD 120 CM .
- As the patient could not hold breath short exposure time is used. (with the same MAS (milliampere seconds)
- The X –ray should be done accurate from the first time to avoid repeat.

8. CHEST X- RAY FOR INFANTS AND NEWBORN

- - According to the age of the infant it can be done in the standing PA view, or we can use special support for the infant to be done in the standing PA, OR AP.

- AP supine view (with both hands above the head) can be done for young infant or new born.

- It should be done accurate from the first time to avoid repeat.

- Short exposure time as possible. Maintaining the same MAS.

Thoracic cage

STERNUM;

1. **Postero anterior view with angle.**
2. **Oblique postero anterior view**
3. **Lateral view**

The sternum lie anteriorly where the anterior parts of the ribs are connected. so that in the chest x ray it is concealed by the dorsal spine

.

1. Postero Anterior View With Angle.

-Patient position:-

- Patient is prone in the middle of the table , or standing in the Postero anterior view as in the chest PA.

Central Ray:

- 10 cm paramidline , at the level of the axilla , (right or left paramidline) with beam directed medially towards the sternum.

- **Collimation:** from the lower neck to the upper abdomen

Exposure Factors:-

KV: 60 MAS 50

FFD 100 BUCKY used

FILM SIZE: 30 x 40 cm or 14 x14 inch.

2. Oblique Postro Anterior View:

-Patient position:-

- patient in the PA view , the right or left sides are raised to make an angle 30 degree with the cassette.

-Central Ray: 10 cm paramidline on the side away from the cassette.

3. **Lateral View:-** (It,s considered the basic and most important view)

Patient Position:-

- Patient stands in the lateral view against the stand bucky (right or left side towards the cassette).
- Both shoulders are pulled back, and both hands behind the back.

- **Central Ray :-** direct in the middle of the sternum

- **Exposure Factors:-**
- KV : 80 MAS 25
- FFD : 150 CM (to avoid magnification since there is a wide distance between the sternum and the cassette.

THE RIBS

From first to 10th ribs.

1. **Anteroposterior view for upper ribs.**
2. **Postero anterior view for the upper ribs.**
3. **Oblique views for the upper ribs.**

From ninth to the 12th ribs:

1. **Antero posterior view**
2. **Oblique view.**

From first to 10th rib:-

1. **Anteroposterior View:**

-Patient position:-

- Patient stands in the AP view with the back in contact with the cassette.

- This view is used when there is injury of the posterior ribs so the posterior ribs are in contact with the stand bucky
- Both shoulders are pushed forwards , and both hands put on the back to remove the shadow of the scapula .
- The upper border of the cassette is 5 cm above the shoulders to include the lower 7^{th} cervical vertebra.

- **Central Ray:** on the sternal angle (junction between the manubrium and the body of the sternum).

Exposure factors:-

KV: 70 MAS 40

FFD; 100 BUCKY; used

FILM SIZE: 14 X 14 0R 14 X 17 INCH

2. **Postero Anterior View:-**

-Patient Position:-

- This view is done if there is injury to the anterior ribs
- Patients stands in the PA view as described in the chest X- ray ,

Central Ray: over the 4^{th} dorsal vertebra

Exposure Factors:- as in the AP view.

3. **OBLIQUE VIEW FOR THE UPPER RIBS:-**

-Patient Position:-

- This is done to show rib injury in the lateral axillary part of the rib.

- From the AP view , the patient is tuned 45 degree with the examined side in contact with cassette, and the healthy side away from the cassette (i.e.towards the X- ray tube.)

- The nearby arm is put above the head, while the remote one is pushed back.

- **Central Ray: -** on the side away from the cassette at 4th dorsal vertebra level at the mid clavicular line away from the cassette

Exposure Factors:-

KV: 80 MAS 35

FFD 100 cm BUCKY used

RIBS FROM 9TH TO 12TH :- these ribs lie in the upper abdomen , so the exposure parameters as in abdominal radiographs

1. Anteroposterior View:-

-Patient Position:-

- Patient lie supine in the middle of the table or standing in the AP view with his back to the stand bucky.
- The cassette is placed to extend from the nipple down to the iliac crest level.

Central Ray: at the center of the cassette. Or in the midline over the lower end of the sternum or xiphoid process,.

Exposure Factors:-

KV: 80 MAS 100

FFD 100 BUCKY used

FILM SIZE: 14 x 14 inch

- Exposure is done at the end of expiration . (as in any abdomen X- ray radiograph).

2. Oblique View Of The Lower Ribs:

-Patient Position:-

- From the AP view the patient is rotated 45 degrees so that the lower ribs of the examined side in contact with the cassette
- The cassette extends from below the nipple down to the iliac crest level.

Central Ray: in the center of the cassette

Exposure factors:-

KV: 85 MAS 120

FFD 100 BUCKY used

FILM SIZE: 14 x 14 inch or 30 x 40 cm.

Exposure is done at the end expiration .

STERNOCLAVICULAR JOINT

This is the joint between the manubrium and both clavicles,

1. Straight PA , central ray at D1,D2.
2. Oblique view (right oblique &left oblique:
   From the PA VIEW Patient is rotated 20 degree for each side both sides are done for comparison.
   Central ray vertical over the raised side at D1,D2 level.

All views are done in arrested respiration.

CHAPTER THREE

TECHNOLOGY AND POSITIONING OF THE UPPER LIMB

1. TECHNOLOGY AND POSITIONING OF THE SHOULDER AND HUMERUS

SHOULDER

BASIC VIEWS

1. **ANTERO POSTERIOR VIEW (AP)**
2. **AXIAL :**
   - **A. SUPERO INFERIOR.**
   - **B. INFERO SUPERIOR.**

SPECIAL VIEWS

1. **OUTLET VIEW**
2. **Y PROJECTION.**
3. **AP WITH INTERNAL AND EXTERNAL ROTATION**
4. **AP OBLIQUE**

- **Acromio Clavicular joint.**
- **Clavicle**

BASIC VIEWS

1. **Antero Posterior View (AP) (figure; 1)**

-Patient Position:-

ž -The patient stands or sit down in the AP position with the back of the diseased shoulder in contact with the cassette .

-The patient is rotated 15-30 degrees so that shoulder becomes closer to the cassette.

ž -The arm is supinated and slightly abducted away from the body.

ž The medial and lateral epicondyles of distal humerus should be parallel to the cassette.

ž - The cassette is positioned with the upper border 5 cm above the shoulder, so that the upper border of the shoulder , and the soft tissue are included

ž - Arrested respiration (to avoid rib movement).

- Central ray: coracoids process of the scapula.

Collimation: use the diaphragm to collimate the beam to include the shoulder joint , inferior angle of the scapula proximal humerus, acromio -clavicular joint (AC joint) as well as the soft tissue forming the shoulder contour.

Exposure Factors:-

KV: 65 MAS ; 30 FFD ; 100 cm

BUCKY ; not used , may be sued in obese patients.

FILM SIZE: 24 x 30 cm or 10x 12 inch

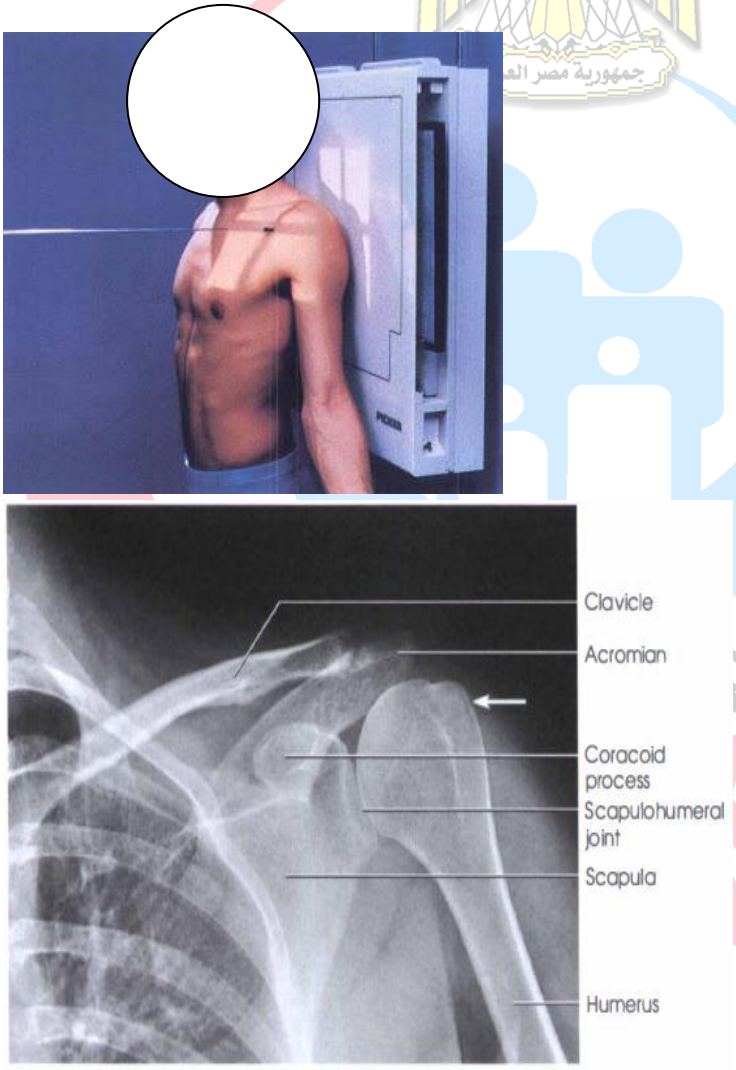


Fig. 1 : AP View Of The Shoulder.

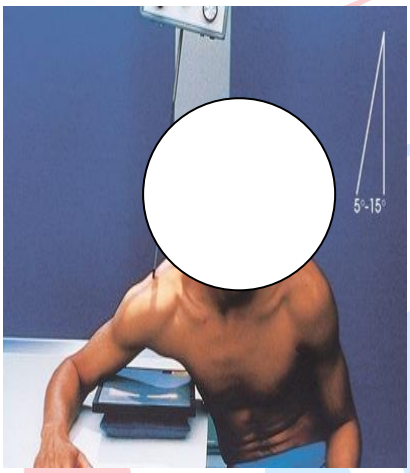
2. **Axial view :**

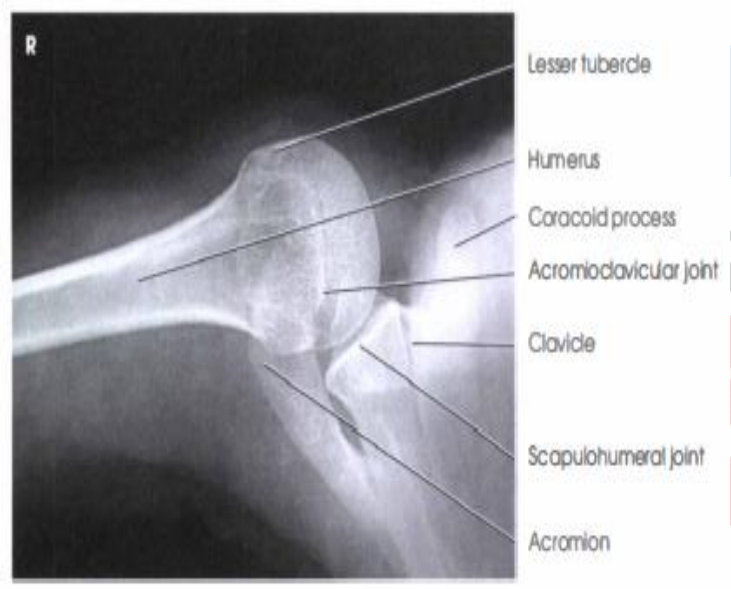
A. Axial Supero Inferior; (figure; 2)

-Patient position:-

- ž - The patient sit down at the side of the table.
- ž -The arm is abducted (45 degree) and the elbow is flexed - - The cassette placed below the axilla on the table or a curved cassette may be used if available.

Central Ray: vertical X- ray from superior to inferior directed towards the humeral head.





Fig,2 : Axial View Of The Shoulder Superior Inferior.

B. Axial Infero Superior (figure ; 3)

-Patient Position:

- The patient lies supine on the X- ray table.

-The arm is abducted and supinated.

-The affected shoulder and arm are raised on non-opaque pads.

-The cassette is put vertically in contact with the upper aspect of the shoulder.

- X - Ray is horizontal to the axilla with slight medial angulation.

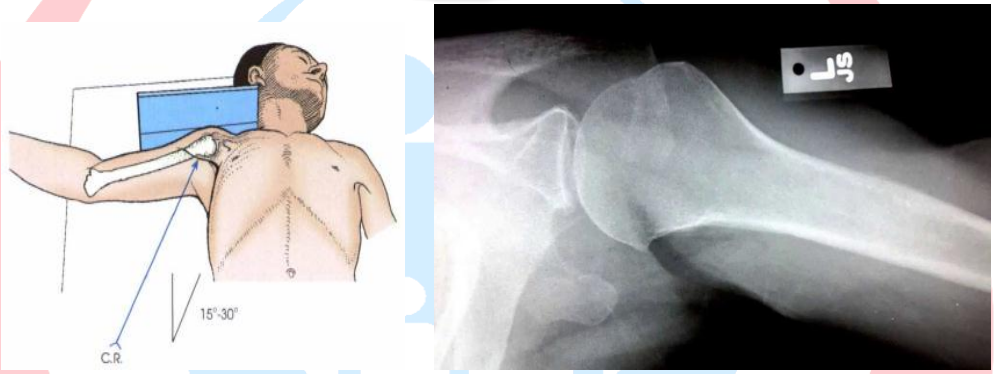


Fig . 3 ; Axial View Infero Superior.

SPECIAL VIEWS

1. Outlet View: (figure; 4)

- **Patient Position:**
- The patient stands in the PA view with the lateral aspect of the affected shoulder in contact with the cassette.
- The arm is extended backwards,with the dorsum of the hand resting on the patient's waist.

- The patient is rotated forward until a line joining the medial and lateral borders of scapula is at right angles to the cassette.

- **Central Ray:** posteriorly over the shoulder passing through the superior margin of the humeral head with 10-15 degree caudal.
-
- **Exposure Factors:-**
- KV: 80 MAS ; 80 FFD ; 100 CM

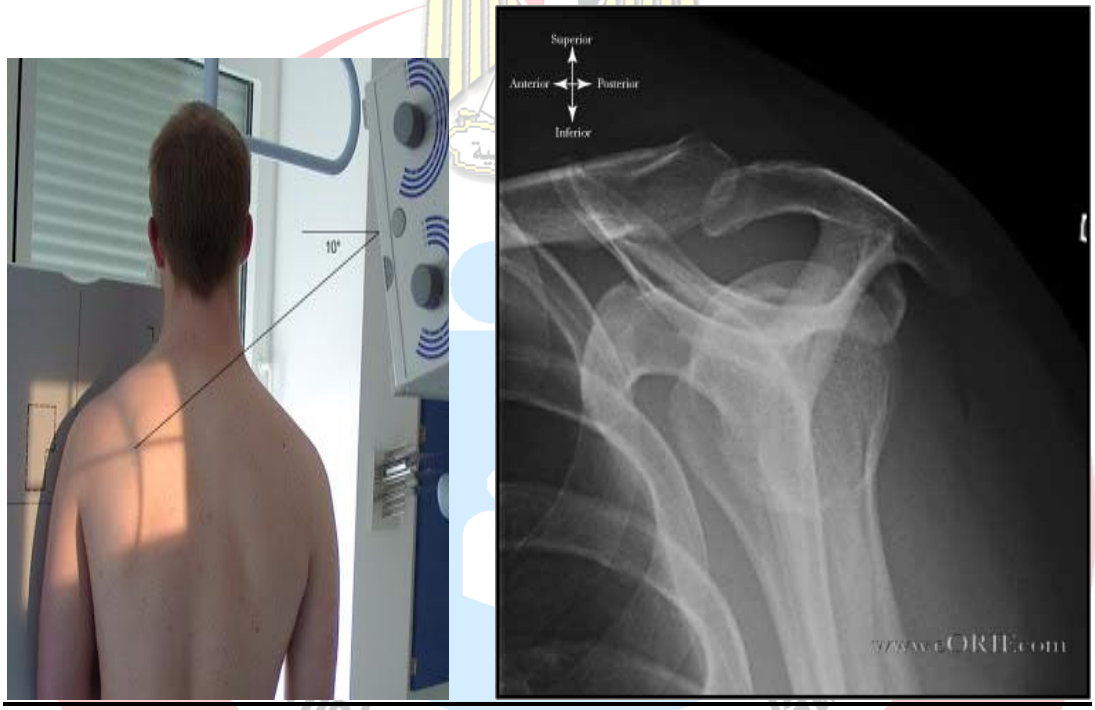


Fig.4 ; Outlet View Of The Shoulder

2. Y – view,(scapula lateral oblique) :- (fig; 5)

- **Patient position:**
- The patient stands in the PA view .
- The patient is rotated 45- 60 degrees with the lateral aspect of the affected shoulder in contact with the cassette., And adjusted so that the axilla is in center of the film.

- The arm is abducted and the elbow flexed to allow the back of the hand to rest on the hip.
- The cassette is positioned to include the superior border of scapula.
- The film should include the scapula, and upper end of the humerus and clear of the ribs
- **Central Ray:** to the medial border of the scapula.

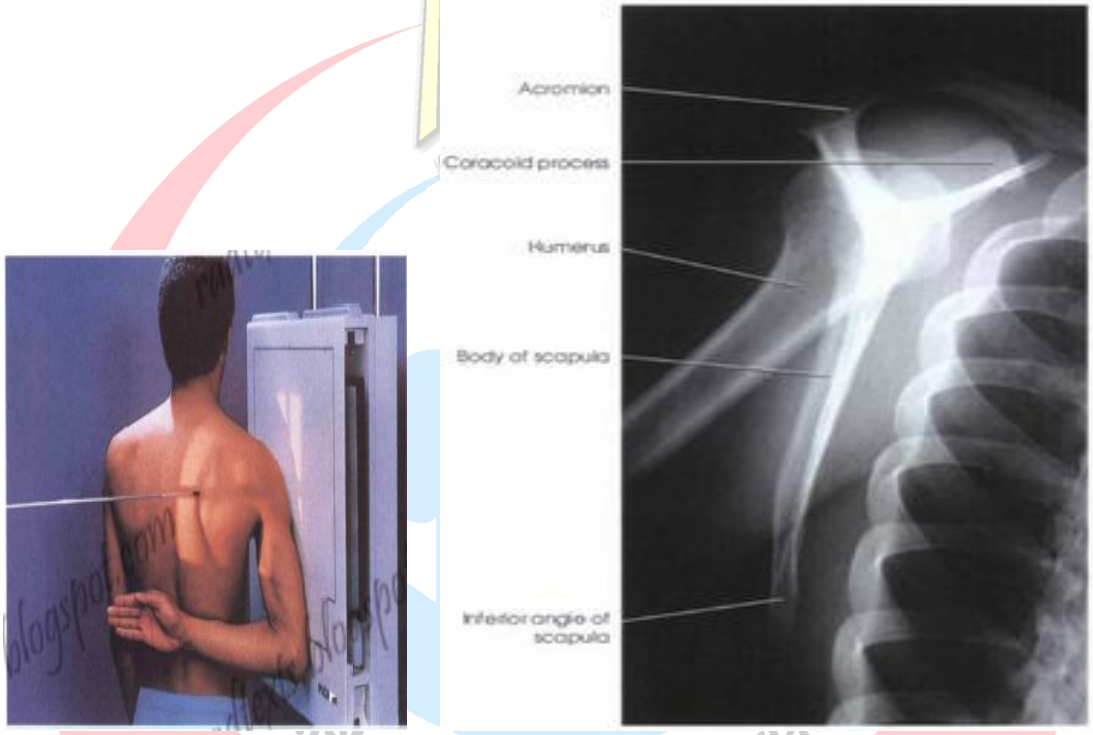


Fig. 5 ; Y Shaped View Of The Shoulder

3. **Shoulder AP With Internal And External Rotation;**
   AP with external rotation to show the greater tubersoity.
   AP with internal rotation to show the lesser tuberosity.

- **Patient position:-**
- While the patient in the straight AP
- The hand is rotated externally to have external rotation view.
- The hand is rotated internally to have internal rotation view.
- Other exposure parameters as in the AP view.

4 . Shoulder ; AP Oblique: (figure ; 6)

-Patient position:

- From the AP position, the shoulder is rotated 40 degrees towards the examined side. The glenohumeral space is well demonstrated .

The central ray is 5 cm medial and 5 cm inferior to the shoulder outer margin.

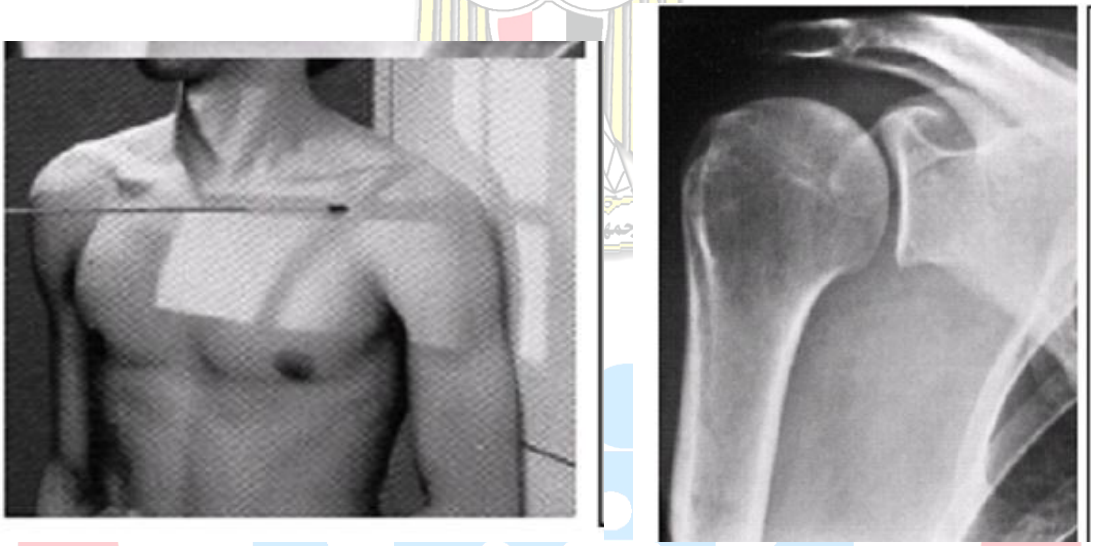


Fig. 6; AP Oblique View Of The Shoulder.

ACROMIOCLAVICULAR JOINT (AC joint):

AP view: as in the AP shoulder, however the central ray is above the humeral head.

This is done with weight bearing in each hand, in this case each side is done separately or both sides radiographed together at the same time and the central ray in the midline at the same level.

CLAVICLE

BASIC VIEWS:-

1. **ANTERO POSTERIOR (AP).**
2. **POSTERO ANTERIOR (PA)**

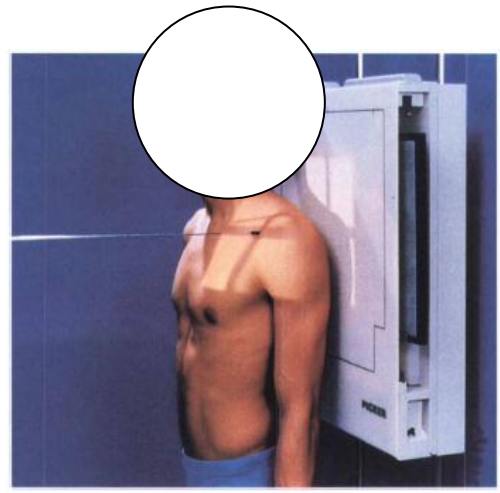
SPECIAL VIEW:

INFEROSUPERIOR AXIAL

1. Antero Posterior (AP):- (figure; 7):-

-Patient Position:-

- -The patient is supine on the table or standing with the posterior aspect of the shoulder in contact with the table or stand bucky.
- - In children both sides are done for comparison
- - In cases of fracture both AP and PA are done for comparison
- - **Central Ray :** perpendicular to the mid clavicle.
- **Collimation :-** collimate the beam to include the whole clavicle, acromioclavicular and sternoclviular joints.
- **Exposure Factors:-**
- KV : 60 MAS ; 70
- FFD ; 100 CM. BUCKY : used.
- FILM SIZE: 24 X 30 CM OR 10 X 12 INCH.



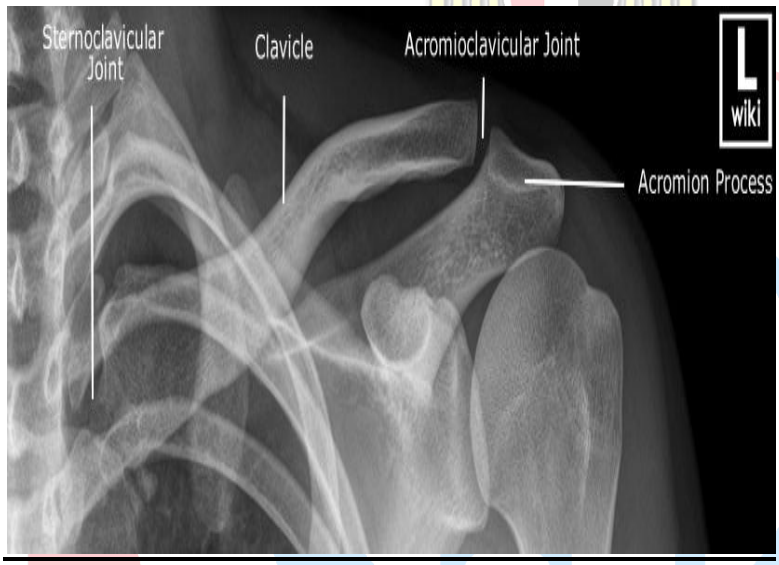


Fig. 7 : AP View Of The Clavicle.

2. **Postero Anterior Clavicle:**
   - **Patient Position:-**
   - The patient sits or stands in the PA position , in contact with the cassette anteriorly.
   - The patient is rotted slightly anteriorly so that the clavicle to be examined in contact with the cassette.
   - The position is adjusted so that the middle of clavicle is in center of the cassette.
   - The patient's head is turned to the other side,

Central Ray : to the mid clavicle.

3. **INFERO SUPERIOR VIEW :-**

   Patient in the sitting with the back of the shoulder in contact with the cassette.. central ray is angled 30 degree cephalic.

HUMERUS

VIEWS:-

1. **ANTERO POSTERIOR (AP).**
2. **LATERAL.**

1. HUMERUS , ANTEROPOSTERIOR VIEW: (figure; 8)

- **Patient Position;**
- The patient sits or stands with the back of the humerus in contact with the cassette. Or he could lie supine on table.
- The cassette is placed so that its upper border 3 cm above the head of humerus.
- The arm is mildly abducted and the humeral condyles parallel to the table.

Central Ray : perpendicular to the mid humeral shaft.

Collimation: use the diaphragm to collimate the beam to include from the humeral head , humeral shaft , epicondyles, and elbow joint.

Exposure Factors :-

KV : 65 & MAS ; 12 & FFD ; 100 CM
BUCKY Not used

FILM SIZE: 30 x 40 cm

Fig. 8 : AP View Of The Humerus.

2. **Lateral View Of The Humerus**
   - **Patient position:-**
   - The Patient stands against the stand bucky or lies supine on the table.
   - The cassette is placed so that its upper border 3 cm above the head of humerus.
   - The arm is internally rotated ,and the elbow is flexed to 90 degrees and place the hand on the lower abdomen.
   - **Central Ray ;** on the mid humeral shaft.

SUPRACONDYLAR FRACTURE views:-

There is fracture lower third of the humerus above the humeral epicondyles.

1. **Antero Posterior .**
2. **Lateral**

1. **Anteroposterior view : (figure 9)**

- Patient stands in the AP with the anterior surface of the arm towards the tube and the back of the arm in contact with the cassette.
- The central ray on the lower third humerus.
-

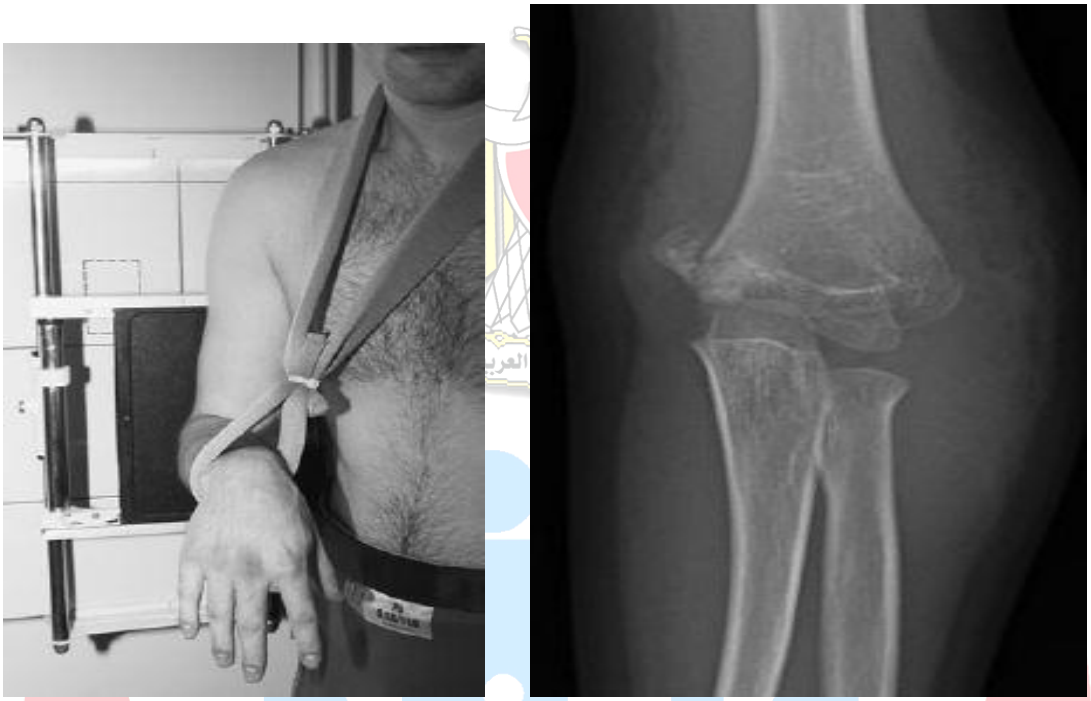


Fig. 9: AP View In A Case Of Supracondylar Fracture

2. **Lateral view : (figure 10)**
   - **Patient Position:-**
   - From the AP position in the previous case , patient is rotated oblique 45 degree , and the injured limb is put in the lateral direction in contact with the cassette, then the elbow is flexed and pushed back as in figure 10
   - **Central Ray ;** is directed to the humeral epicondyles

Fig.10: Lateral View Elbow In Supracondylar Fracture.

HUMERAL NECK FRACTURE:

1. **AP VIEW.** **2. LATERAL VIEW.**

3.TRANSTHORACIC LATERAL PROJECTION FOR THE PROXIMAL HUMERUS

1.Anteroposterior (AP View) For Fracture Humeral Neck:-

-Patient Position:-

-Patient stands or sit down facing the tube, and the patient rotated to put the arm in the straight AP position.

- Other exposure parameters as usual with the central ray at the humeral neck.

2. Lateral Oblique Position:- (figure; 11)

- **Patient Position:**

- The patient stands or sits with the lateral aspect of the diseased arm against the cassette .
-The patient is rotated forwards so that the scapula is at right angles to the cassette.
-The film include the head of the humerus and the whole scapula.

- **Central Ray** is horizontal directed to the medial border of the scapula and humeral neck.

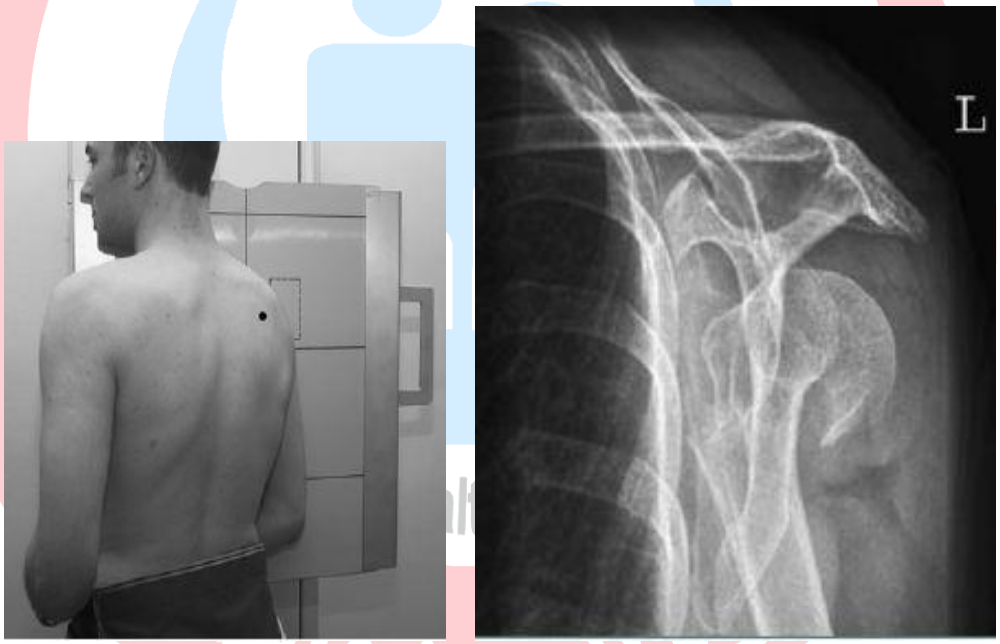


Fig. 11 ; Lateral Oblique View For Fracture Humeral Neck.

3. Transthoracic Lateral Projection Of The Humerus:- (figure ; 12)

- **Patient Position:-**
- Patient stands in the lateral projection against the stand bucky,
- The other arm is abducted raised above the head.

Central Ray : is directed through the axilla.

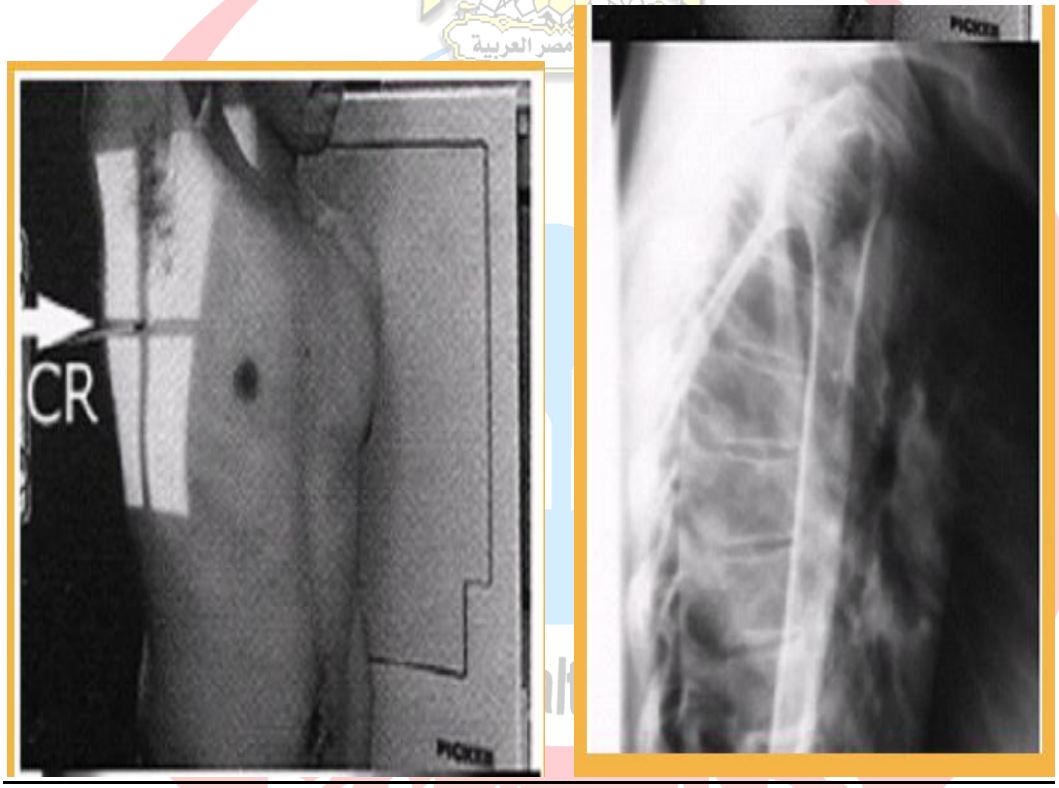


Fig . 12; Transthoracic Lateral View Of The Humerus

2.TECHNOLOGY AND POSITIONING OF THE ELBOW AND FOREARM

ELBOW

BASIC VIEW:-

1. ANTEROPOSTERIOR (AP).
2. LATERAL.

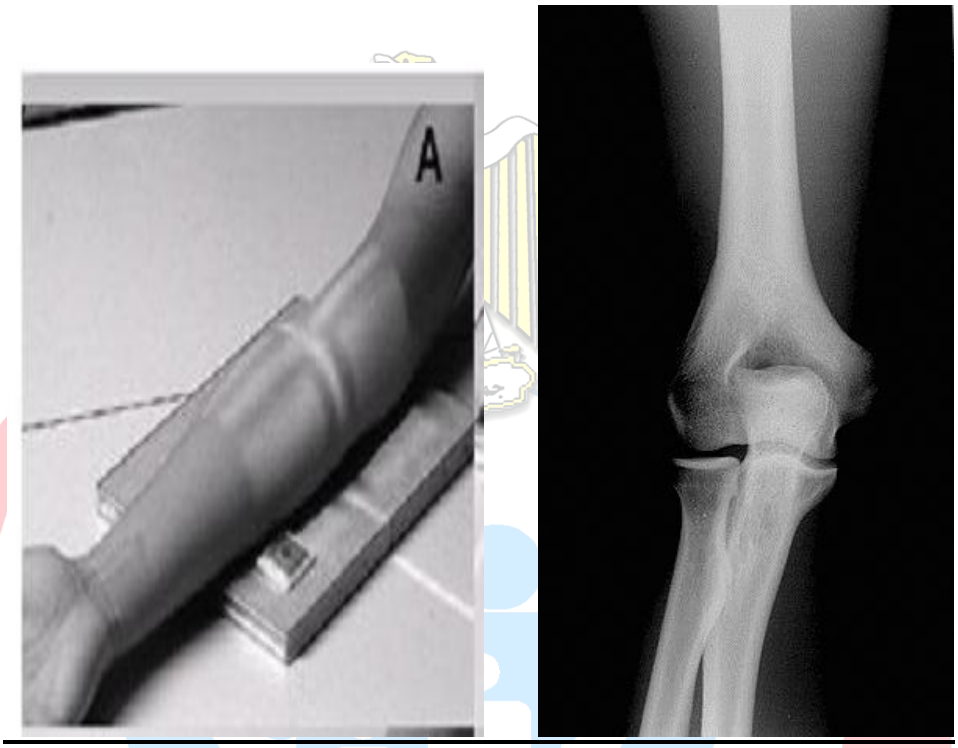
SPECIAL VIEWS:

1. ELBOW AXIAL.
2. ELBOW AP WITH FOREARM IN CONTACT WITH THE TABLE
3. ELBOW AP WITH HUMEUS IN CONTACT WITH THE TABLE
4. ELBOW AP IN PRONATION.
5. ELBOW AP IN SUPINATION.
6. ELBOW LATERAL VIEW WITH OBLIQUE BEAM.

BASIC VIEWS:-

1. **ELBOW ; AP VIEW:- (FIGURE ; 13)**
   - **Patient Position:-**
   - Patient is sitting on a low chair at the side or tip of the x ray table, the forearm , humerus , shoulder at the same level.
   - The hand is supinated.
   -
   - **Central Ray;** on the elbow 2 cm below the humeral epicondyles.

- **Exposure Factors:-**
- KV 65 MAS; 12
- FFD 100 CM BUCKY; not used
- Film used 24 x 30 cm or 10 x 12 inch.
-



-
- **Fig. 13 : AP View Of The Elbow**
-
-
-
- **2. ELBOW ; LATERAL VIEW:- (FIGURE ; 14)**
- **Patient Position:**
- Patient is sitting on a low chair at the side or tip of the table; the forearm ; shoulder and humerus at the same level.
- The elbow is flexed by 90 degrees
- The hand is perpendicular (i.e midway between pronation and supination) so that the little finger in contact with the cassette.
- **Exposure Factors:**
- KV 60 MAS 10
- FFD 100 CM GRID; not used.

- Film used ; 8x 10 inch , 24 x 30 cm or 10x 12 inch . Both AP and lateral views can be done on the same film.
-

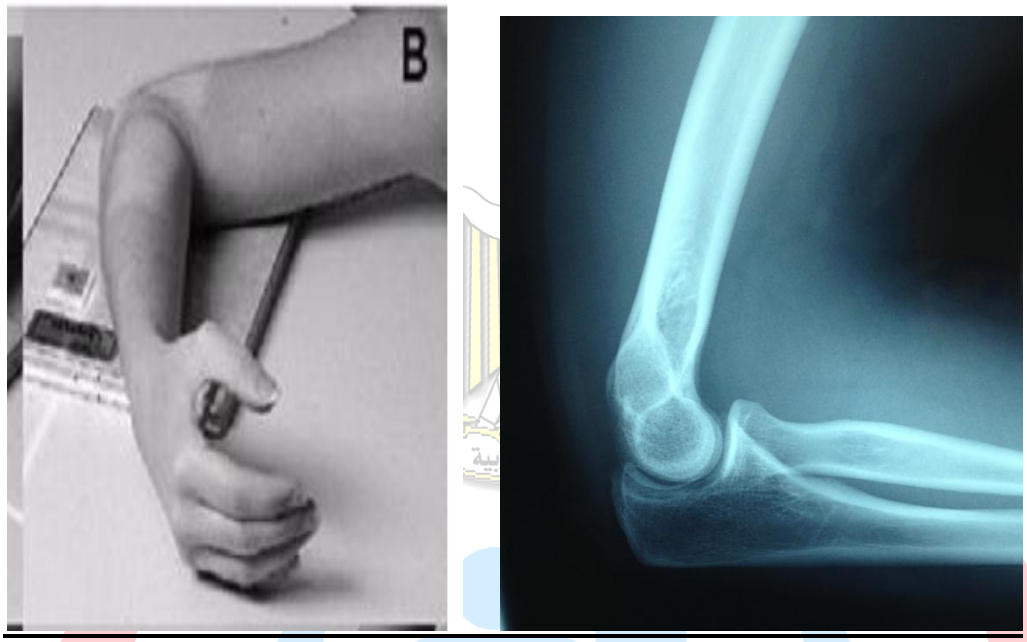


Fig.14: Lateral View Of The Elbow.

SPECIAL VIEWS:

1, ELBOW ; Axial View (Acute Flexion):- (Figure ; 15)

This is done in acute flexion

-Patient Position:-

- Patient sit down on a low chair with the arm in contact with the table, the shoulder and humerus are at the same level. And the hand over the head, **OR**

- Patient sit down on a low chair , with his back towards the table., put the elbow on the table, in this case the forearm side is in contact with the table.

- **Central Ray ;** perpendicular about 5 cm above the elbow .

Exposure Factors:

KV ; 75 MAS ; 12

FFD ; 100 BUCKY not used.

FILM USED : 24X 30 CM OR 10 X 12 INCH.

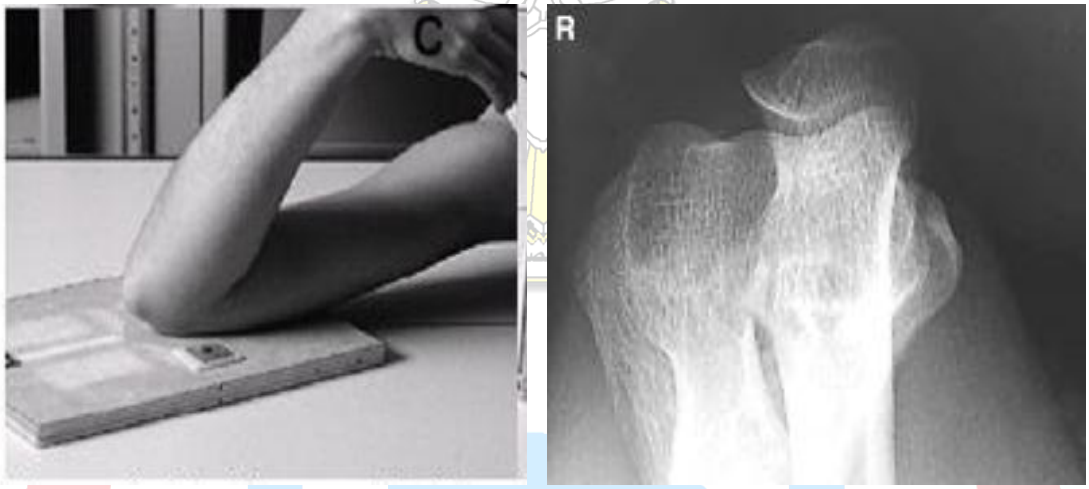


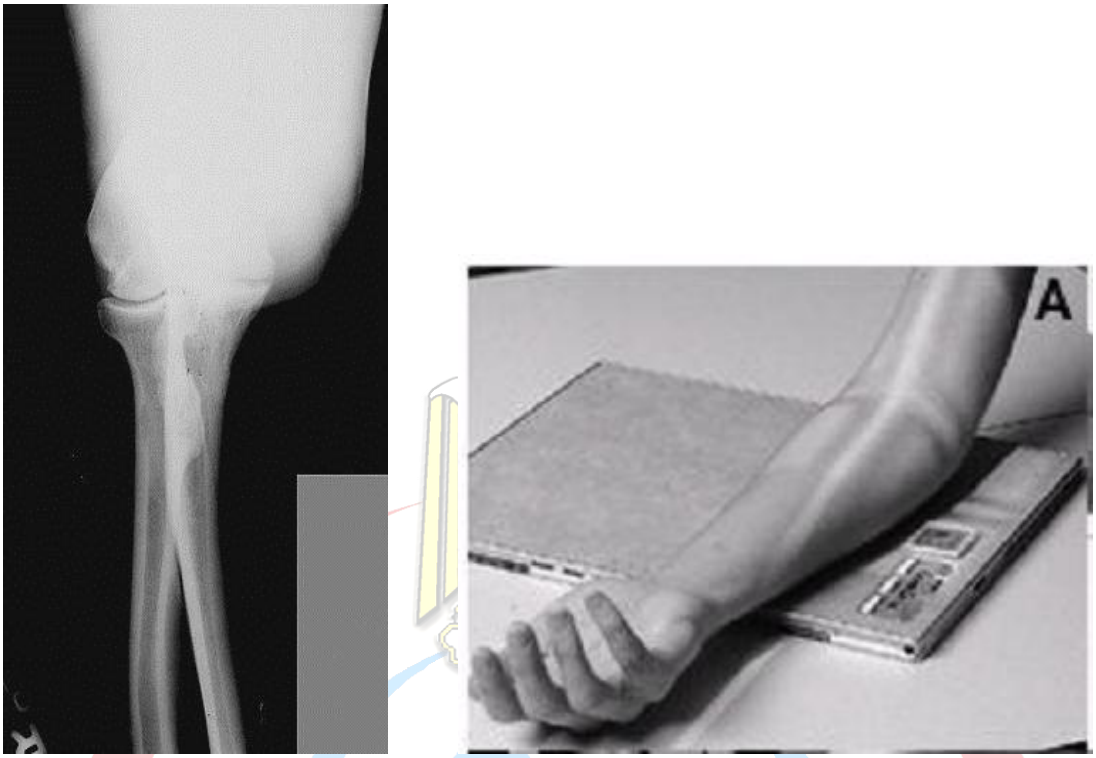
Fig. 15 ; Axial View Of The Elbow (with the Humerous in contact with the cassette)

2. **AP With Forearm In Contact With The Table (or cassette) (FIGURE 16):-**

   This is done when the elbow is partially flexed, with suspected fracture of the forearm.

   -Patient Position:-

   - Patient sit down on a low chair , with the back of the forearm in contact with cassette.
   - As the patient could not extend his arm, a soft pad is put under the humerus.
   - **Central Ray :** perpendicular on the elbow.



Fig,16 : Elbow AP , Partial Flexion With Forearm Parallel To The Film.

3. **ELBOW ; AP With Humerus In Contact With The Table; (figure ; 17)**

This is done when the elbow is partially flexed, with suspected fracture of the humerus .

-Patient Position:-

- Patient sit down on a low chair , with the back of the arm in contact with cassette.
- As the patient could not extend his arm, a soft pad is put under the forearm .
- **Central Ray :** perpendicular on the elbow.

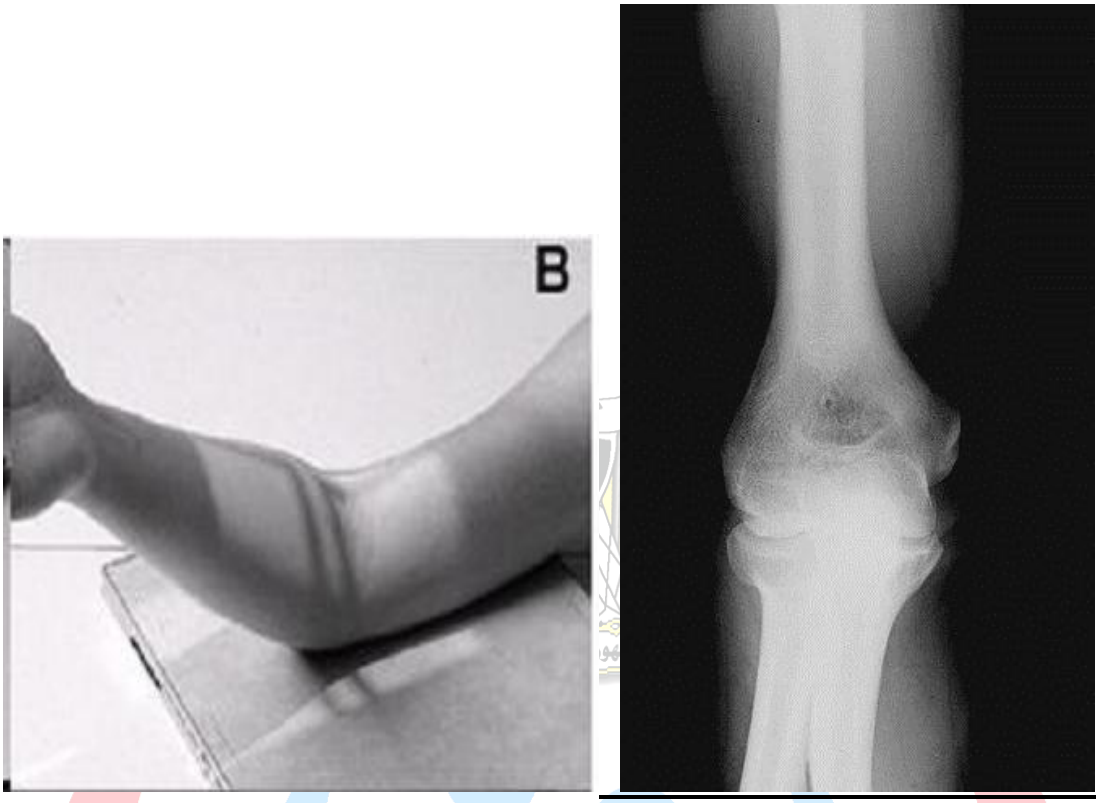


Fig. 17 : Elbow ; Partial Flexion With Humerus Parallel to the Cassette.

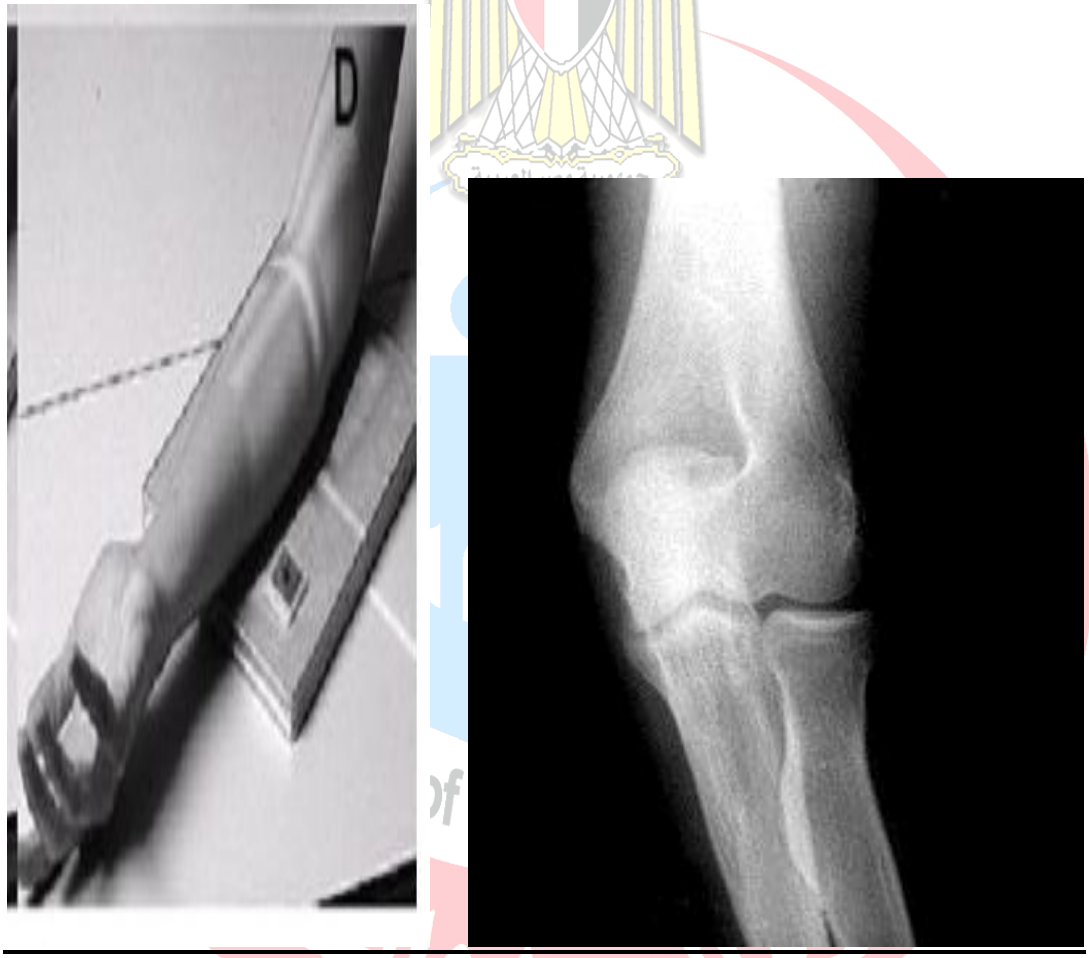
4, AP ELBOW IN PRONATION (figure ; 18)

- **Patient Position:-**
- Put the forearm on the table with the elbow in the AP position.
- The hand in pronation i.e. the palm in contact with the table.

Fig. 18 : Elbow ; AP In Pronation.

5. **AP ELBOW IN SUPINATION; (figure ; 19)**

- **Patient Position:-**
- Put the forearm on the table with the elbow in the AP position.
- The hand in supination i.e. the dorsum of the hand in contact with the table.



Fig, 19 : AP elbow With Hand In Supination.

6. **Lateral Elbow With Oblique X Ray (coyle view) (figure ; 20)**

This is done for demonstration of the radial head

-Patient Position:-

- Put the hand in the lateral view position as mentioned .

- Central Ray :- to the radial head , with the x- ray beam is directed 45 degree towards the body .

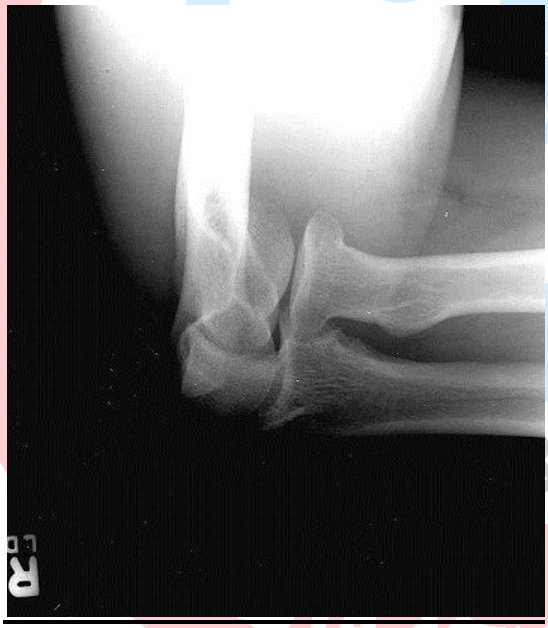


Fig ,20 : Lateral View Elbow With Oblique Beam

FOREARM

BASIC VIEWS:-

1. **ANTEROPOSTERIOR (AP)**
2. **LATERAL.**

1. FOREARM ANTERO POSTERIOR VIEW:-

- **Patient Position:**
- Put the forearm in the AP view (the same as the elbow).
- The hand Is supinated..(the plam facing anteriorly)
- Both elbow and wrist joints are displayed.
- **Central Ray :-** perpendicular on the middle of the forearm.
- **Exposure Factors:-**
- Kv 60 MAS 10
- FFD 100 CM BUCKY : not used.
- Film size : 24 x 30 cm & 10x 12 inch

2. FOREARM LATERAL VIEW:-

- **Patient Position:-**

Put the forearm in the lateral position (as in the lateral elbow).

- The central ray on the middle of the forearm.
- Exposure factors : as in the AP view

3. TECHNOLOGY AND POSITIONING OF THE WRIST AND HAND

WRIST

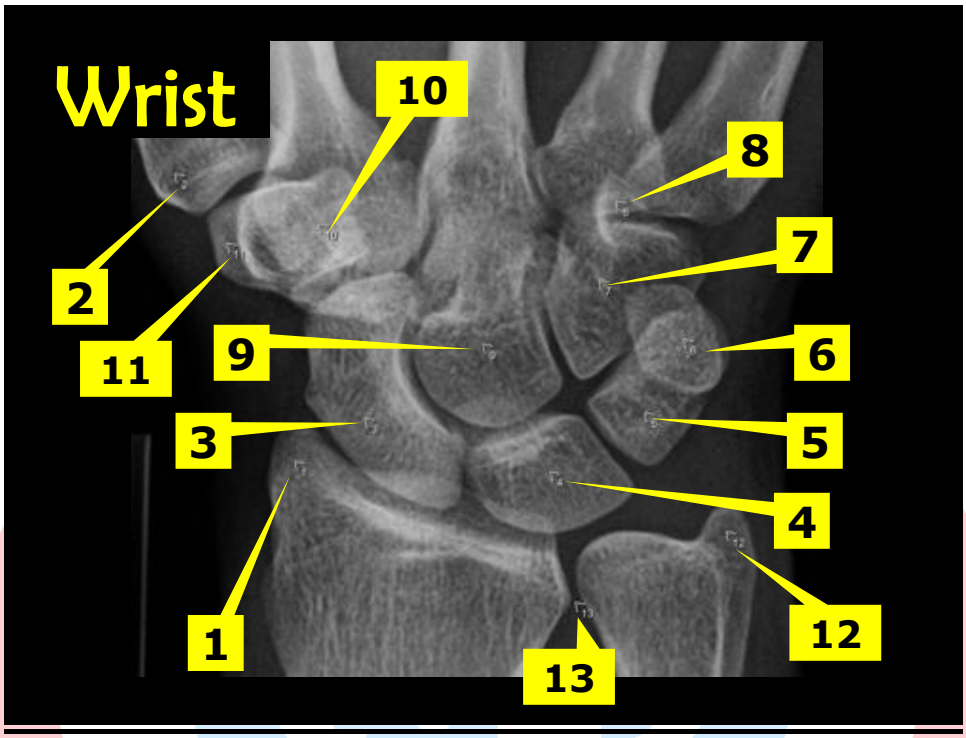


Fig. 21 : Radiograph Of The Wrist

1. Styloid process of the radius
2. Base of the 1st metacarpal bone
3. Scaphoid
4. Lunate
5. Triquetral
6. Pisiform
7. Hamate
8. Hook of hamate
9. Capitate
10. Trapezoid
11. Trapezium
12. Ulnar styloid process
13; Inferior Radio ulnar joint

BASIC VIEWS:

1. POSTEROANTERIOR VIEW (PA)
2. LATERAL.

SPECIAL VIEWS:

1. **Oblique View**
2. **PA With Ulnar Deviation.**
3. **PA With Radial Deviation**
4. **Antero Posterior (AP)**
5. **AP Wrist With Hand Angulation**
6. **PA With Hand Or Beam Angulation**
7. **Axial (Superior Inferior) .**

BASIC VIEWS:-

1. **WRIST POSTERO ANTERIOR VIEW: (figure; 22)**

- **Patient Position:-**
- Patient sit down on a chair at the side or edge of the table.
- Put the wrist on the cassette with the palmer (anterior) aspect in contact with the cassette (i.e the dorsal aspect towards the X ray tube).
- Forearm and hand are in contact with the cassette and table.
- **Collimation:-** use the diaphragm to colimate the beam to include the carpal bones , lower ends of both radius and ulna as well as the middle of the metacarpal bones.
- **Central Ray :-** perpendicular on the dorsum of the wrist between both radial and ulnar styloid processes.
- **Exposure Factors:**
- KV ; 60 MAS ; 6
- FFD; 100 CM BUCKY ; not used.
- Film size: 8 x 10 inch, two views can be done on the same film.

Fig; 22 : wrist PA

2. <u>WRIST LATERAL VIEW (figure ; 23)</u>

<u>-Patient Position:-</u>

- From the PA view we put the hand in the lateral view, with the lateral or ulnar aspect of the hand in contact with cassette.
-The forearm should be in contact with the table
- In this view the hand should be perpendicular on the cassette
-**<u>collimation :-</u>** use the diaphragm to collimate the beam to include the carpal bones , lower forearm and the middle of the carpal bones

<u>Central Ray :</u> on the radial styloid process..

Exposure Factors:-

KV ; 60 MAS ; 7

FFD ; 100 Bucky ; not used

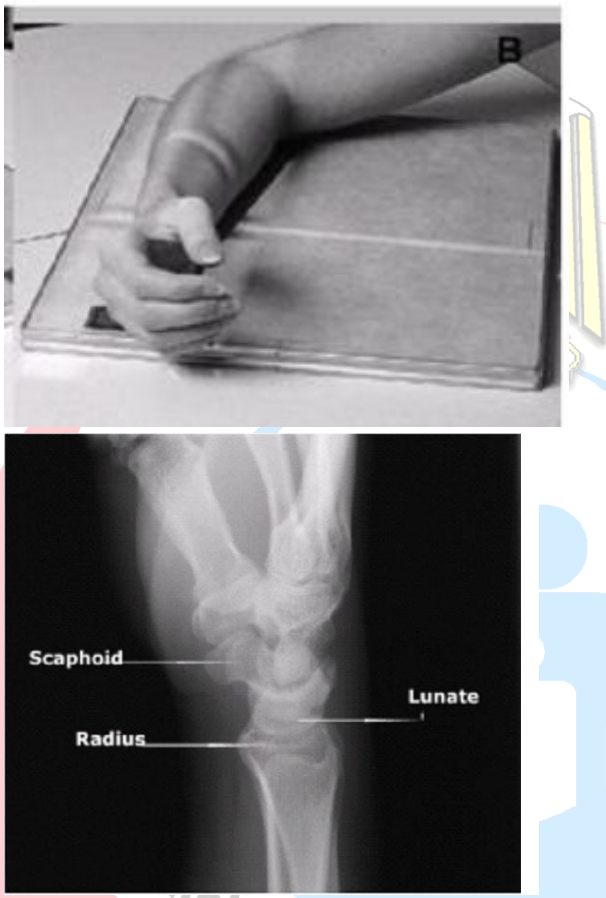


Fig. 23 : Wrist Lateral View.

3. **Wrist PA Oblique :-- (figure 24) :-**
   - From the PA Position , put the wrist in the oblique view 45 degree with the ulnar side , and 5th metacarpal bone in contact with the cassette
   - **Central Ray :** on the radial stylod process.

Fig .24 : Wrist PA Oblique

4. **Wrist PA With Ulnar Deviation (Figure ; 25) :-**

This is the best view for demonstration of fracture scaphoid

-Patient Position:-

-The wrist and hand in the PA position , then the wrist is gently deviated to the ulnar side .

-Central Ray :- perpendicular on the scaphoid.

This view can be done with beam angulation to the forearm by 20 or 30 degrees (stetcher view).

Fig .25 : Wrist PA With Ulnar Deviation

5. **Wrist PA With Radial Deviation:**

Wrist in the PA view, the hand is deviated to the radial side. And the examination is completed as in the PA. view

6. Wrist (AP) VIEW:-

-Patient Position:-

- The wrist in the AP view, the hand is supinated with the back of the wrist in contact with cassette.

7. Wrist (AP) With Hand Angulation:- (figure; 26)

- The wrist in the AP view, the hand is supinated with the back of the wrist in contact with cassette.
- The hand is flexed anteriorly about 20 degrees and supported by a sponge.

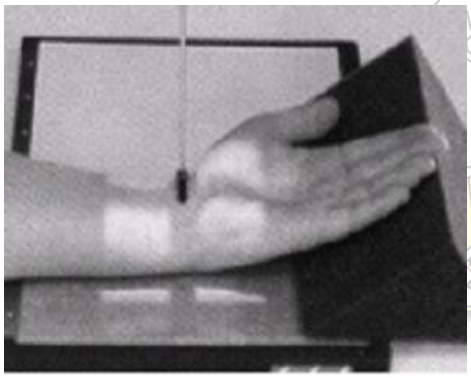


Fig. 26; AP Wrist With Hand Angulation

8. Wrist (PA) With Hand or Beam Angulation:-

This view better demonstrated the radio-carpal joint, and the scaphoid

- Patient Position :

- Wrist in the PA position with the palm in contact with cassette The hand is partially dorsiflexed and supported by a sponge about 20 degrees.
- OR the hand in the straight PA view , with the beam angled 20 degrees towards the forearm.

9. Wrist Axial View (Superior Inferior) (figure; 27) :-

To visualize the palmer (anterior) surface of the carpal bones.

- **Patient Position :-**
- The wrist in the PA position, the hand is hyperextend , aided by a band , pulling the hand back.
- The central ray falling on the wrist by an angle 25 degrees towards the forearm.

N.B : This position can be done with the patient back towards the table , then the palm of the hand rest on the table and the

forearm perpendicular, the central ray angulated 20 degrees to the hand.

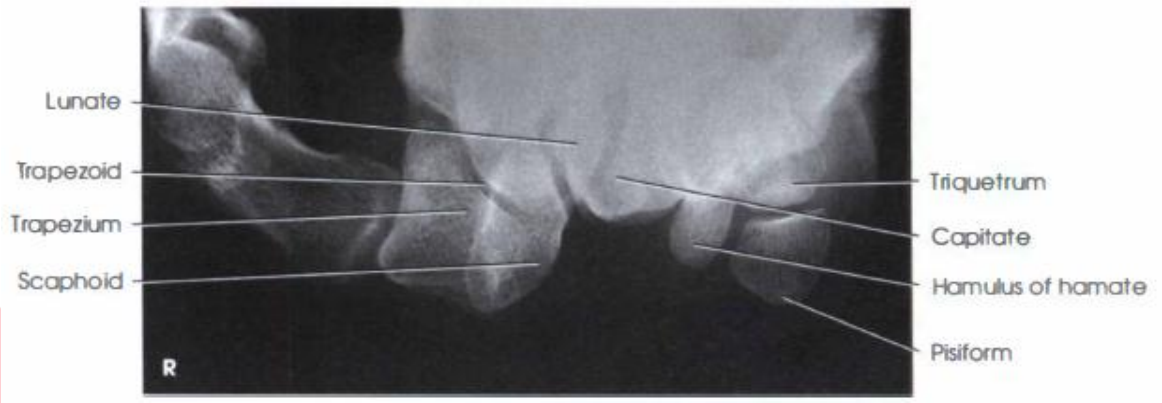


Fig. 27; Wrist Axial.

HANDS

BASIC VIEWS :-

1. **POSTERO ANTERIOR. (PA)**
2. **LATERAL.**

SPECIAL VIEWS :-

1. **PA OBLIQUE.**
2. **FAN LATERAL.**
3. **ANTERO POSTERIOR VIEW**

1. HAND (PA) : (Figure ; 28)

-Patient Position:-

-Put the hand in the PA position, with the fingers stretched.

- The palm of the hand is in contact with the cassette

- **Central Ray** :- on the 3rd metacarpal head.

-Exposure Factors:-

KV ; 55 MAS; 5

FFD ; 100 CM BUCKY ; not used

FILM SIZE : 8X 10 inch; two views are taken on the same film.

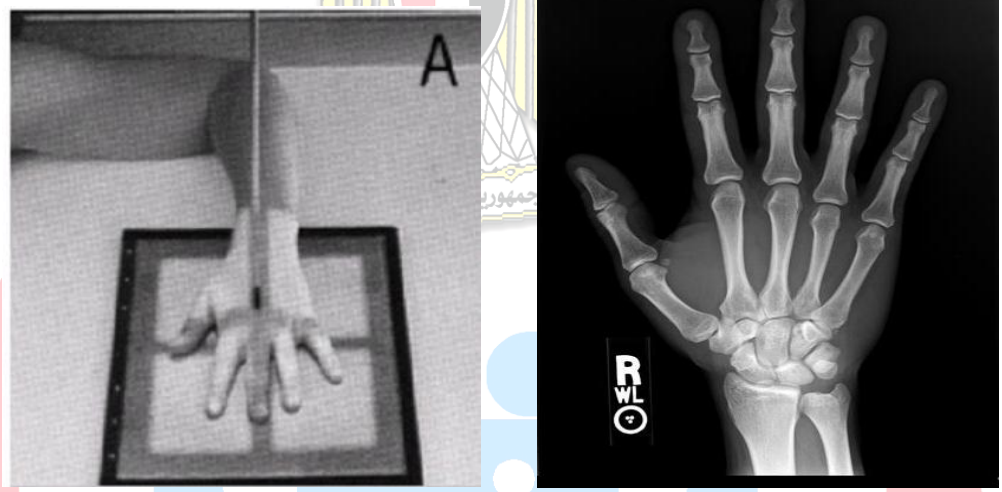


Fig. 28 : PA hand

2.LATERAL VIEW HAND :- (Figure ; 29)

- In this view the metacarpal bones and the fingers are overlapped. Its mainly used for Foreign body diagnosis.
- **Patient Position :**
- The hand in the lateral view , with the lateral side of the hand (ulnar side or 5th metacarpal bone in contact with the cassette).
- Elbow is flexed 90 degrees
- In the position the hand is perpendicular on the cassette.
- **Central Ray :** on the head of the 2nd metacarpal bone.

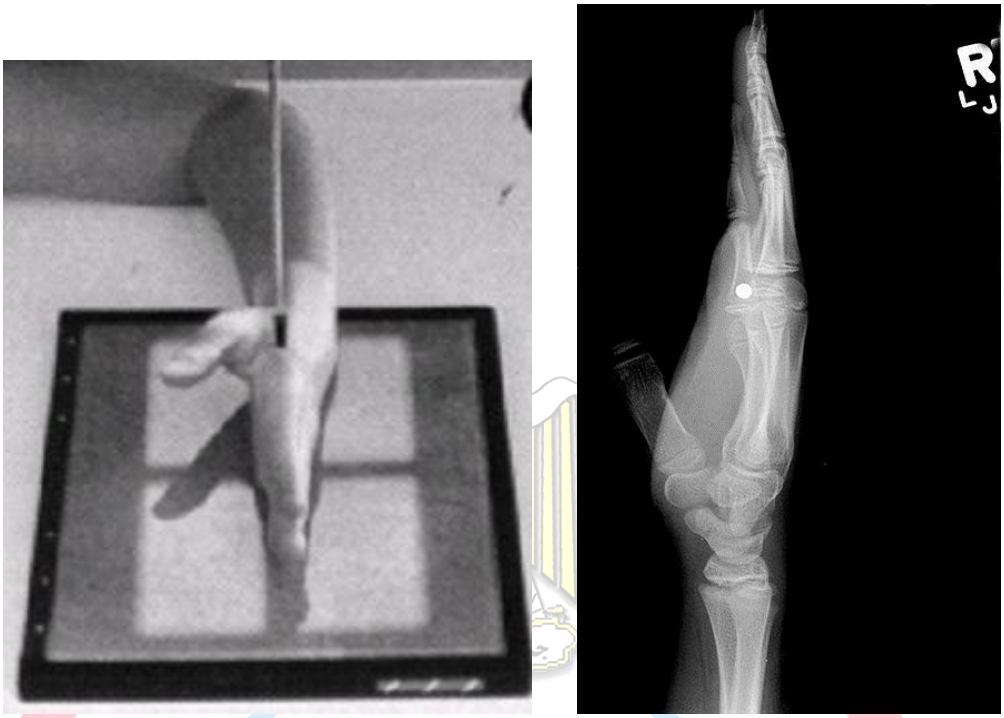


Fig . 29 ; Lateral View Of The Hand

3. HAND (PA OBLIQUE) : (Figure; 30)

This view is used open the metacarpo phalangeal joints.

-Patient Position:-

- from the PA view , the Hand is rotated 45 degrees, with the ulnar side and the 5th metacarpal bone in contact with the cassette.

Central Ray on the 3rd metacarpal heads

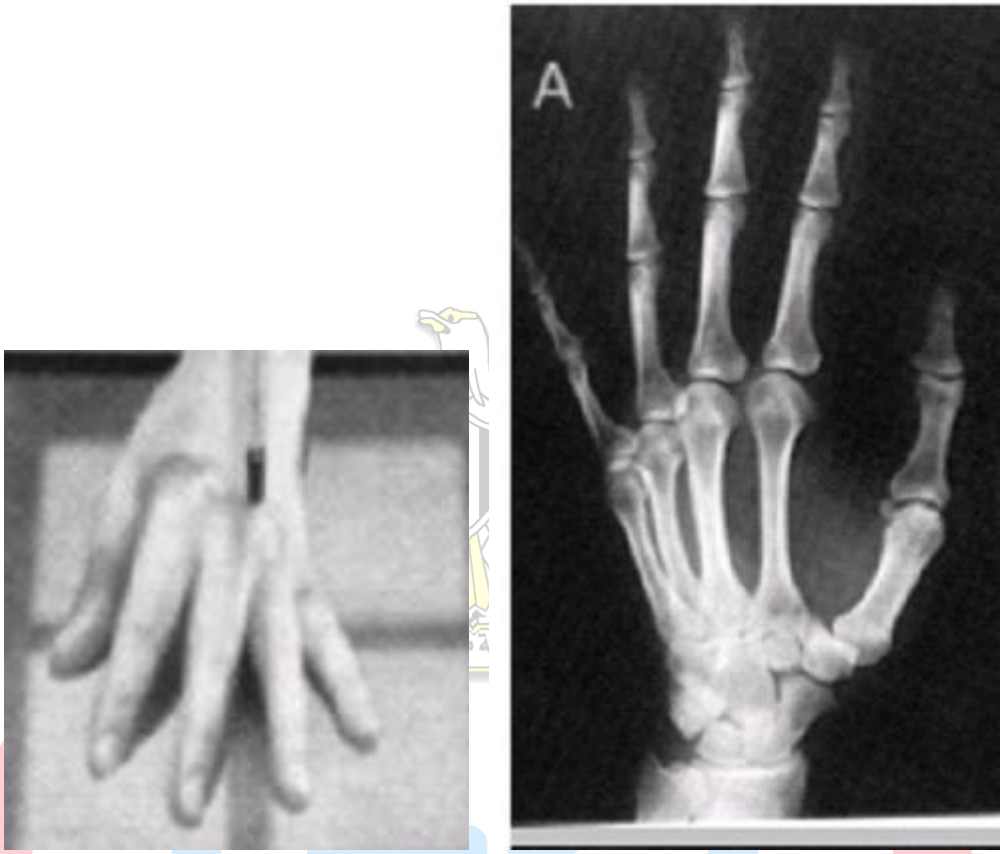


Fig. 30 ; PA Oblique View Of The Hand .

4. Hand Fan lateral ; (figure; 31)

- **Patient Position :-**
- The hand in the lateral position with the fingers separated
- **Central Ray :-** perpendicular on the 2nd metacarpal head.

Fig. 31 ; Fan Lateral View Of The Hand And Fingers

FINGERS VIEWS:-

1. **POSTEROANTERIOR VIEW :**
2. **LATERAL VIEW**
3. **OBLIQUE VIEW;**

These views can be done for any single finger alone

1. **Finger Posteroanterior View : (figure; 32)**

- **Patient Position :-**
- Hand pronated., with the palmer (frontal) aspect of the desired finger in contact with the cassette,
- **Central Ray** over the proximal interphalangeal joint.
- Exposure factor;
- KV 55 MAS: 5
- FFD 100 CM BUCKY ; not used
- Film used ; 8x10 inch ,

Fig. 32; PA View Of The Index Finger .

2. **Finger Lateral view:- (figure; 33)**

- **Patient Position:-**
- The desired finger in the true lateral position
- **Central Ray ;** perpendicular over the proximal interphlangeal joint.

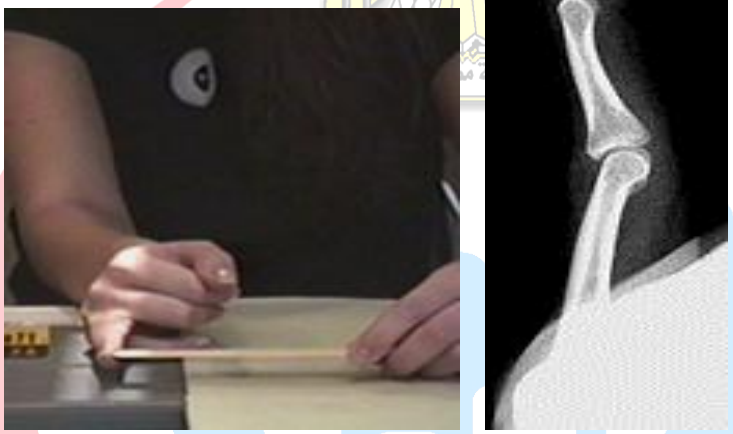


Fig. 33 Lateral View Of The Little Finger

3. **Finger oblique view : (figure ; 34):**

Patient Position :

- Put the finger in the oblique view (between the PA and the lateral position) .
- **Central Ray** and exposure factors as in the PA view.

Fig. 34 ; Oblique View Of The Ring Finger

THUMB

The thumb has special views, since it,s perpendicular on other fingers

Thumb Views :-

1. **Antero Posterior**
2. **Postero Anterior.**
3. **Lateral. View**

1, THUMB (AP) :- (Figure; 35)

-Put the thumb in the AP view, with the dorsal aspect in contact with the cassette.

Central ray ; over the proximal interphalangeal joint.

2.Thumb PA VIEW:

-With the hand in the lateral view, support the thumb on a soft cotton pad or sponge with the dorsal aspect of the thumb facing the X- ray tube , and the plamer aspect toward the cassette. in this case the thumb will be the Postero anterior view.

Fig. 35; AP view of the thumb.

3. Thumb Lateral View (figure; 36)

- put the hand in the PA position and then adjust the thumb to be in the lateral view.

Central Ray on the proximal interphalangeal joint.

Fig. 36 Lateral View Of The Thumb

CHAPTER FOUR

TECHNOLOGY AND POSITIONING OF THE PELVIS AND LOWER LIMB

TECHNOLOGY AND POSITIONING OF THE PELVIS , HIP AND FEMUR

PELVIS AND BOTH HIPS

BASIC VIEWS:-

1. ***ANTROPOSTRIOR VIEW FOR ONE OR BOTH HIPS.***
2. ***LATERAL OBLIQUE.***

SPECIAL VIEWS:

1. ***TRUE LATERAL.***
2. ***FROG POSITION FOR ONE OR BOTH HIPS.***
3. ***VON ROSEN POSITION.***

BASIC VIEWS

1. ***Antero Posterior view of both hips (AP) (figure; 1)***

Patient Position:-

1.Patient is supine , arms away from the pelvis (placed on chest or at both sides).

2. Head support , and flex the knees to relieve back strain in the supine position.

3. Mid sagittal (midline) plane should be aligned to the midline of the table.

4. No rotation (both iliac bones , both hips and greater trochanters should be symmetrical and equidistance from the table).

5. Internal rotation of both feet (15-20 degrees) (To overcome femoral neck anteversion).

6.. Distance between both heels 20-25 Cm apart.

7. The upper border of the cassette 3-4 cm above the iliac crest

8. Suspend breath in expiration .

Central X - Ray :-

- 5 cm above the symphysis pubis.
- The central x- ray, at a point in the midline line , and a horizontal line (lying between two horizontal lines 1st line at the iliac crest level, 2nd line 5 cm below the greater trochanter).

Exposure Factors :-

KV: 70-80 MAS: 80-90

FFD: 100 CM . BUCKY : used.

Film size : 14 x 14 or 14 x 17 inch

Collimation :- collimate the beam from above the iliac crest and below the greater trochanter and both lateral sides of the body .

Shielding :- Shield gonads (male or female particularly in childhood and child bearing age if not obscuring interested areas).

Assessment Criteria For A Good Radiograph:

Both iliac crests , both iliac bones, both hip joints , both greater trochanters , proximal femora should be demonstrated , and symmetrical.

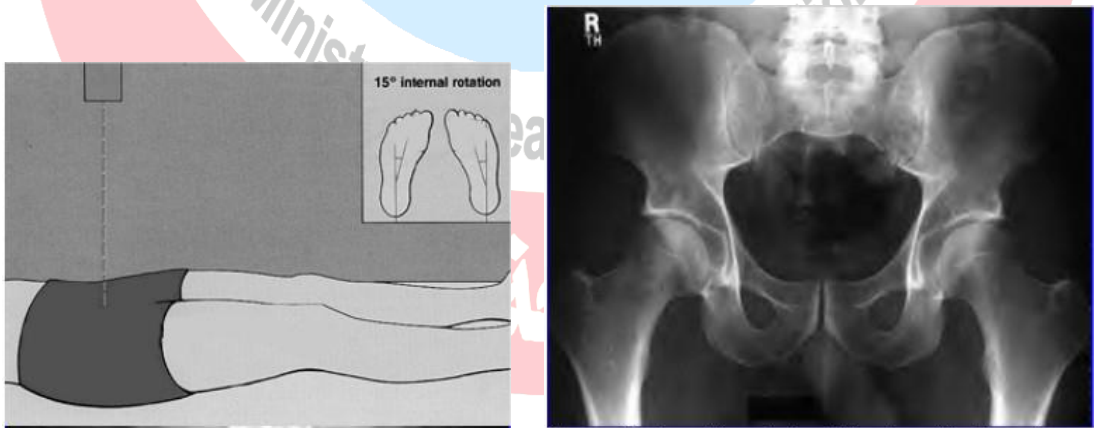


Fig. 1 : AP. View Of The Pelvis

2. AP FOR A SINGLE HIP:

Patient position :-

- As for both hips.

CENTRAL X - RAY :-

About 6 cm below the mid point of a line between anterior superior iliac spine and the symphysis pubis

Collimation : beam collimation to demonstrate the femoral head and neck, trochanters, the proximal femur , ilium, pubic bones and the pubic symphysis.

3. Lateral Oblique:- For a single Hip Joint; (Figure ; .2)

Patient Position:-

-Patient lie supine in the middle of the table. Patient is turned onto the affected side at least 45 degrees. The hip is flexed for 90 degrees

-Central Ray: at the skin crease in the inguinal region of the examined side.

-Collimation: collimate the X- ray beam to include the iliac bone of the examined side, hip joint, greater trochanhter and proximal femur

-Exposure Factors:-

KV: 80 MAS; 90

FFD; 100 BUCKY used

FILM SIZE: 24 x30 cm o r 10 x 12 inch.

Fig. 2 : Lateral Oblique For A Single Hip

SPECIAL VIEWS:

1. **True Lateral (cross table lateral view, translateral , axio lateral or infero superior):- (Figure; 3)**

- **Patient Position :-**
- Patient lie supine in the middle of the table.
- The cassette is placed vertical against the greater trochanter of the affected side, to extend from the iliac crest down to below the greater trochanter.
- The other limb is elevated , abducted and supported.

- **Central Ray I**s horizontal, angled 20 degree cephalic to the center of the film, directed from medio lateral.
-

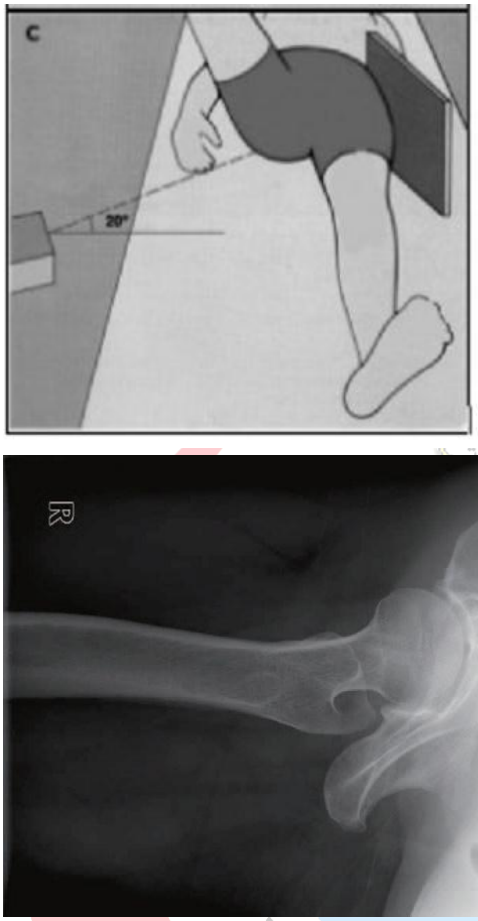


Fig. 3; Translateral (Axiolateral , Infero Superior)

Exposure Factors:

KV 75	MAS 65
FFD 100 CM	BUCKY , NOT USED

2. Frog leg lateral view of both hips (figure; 4)

Patient Position :-

Both hips and knees are flexed, (about 30-40 degrees) , abduct both hips (external rotation) for 45 degrees. The soles of both feet touch each others.

Central X- Ray:-

About 2.5 cm above the symphysis pubis .

Exposure Factors:

Kv : 75 MAS ; 110 FFD ; 100 CM
BUCKY : used Film size : 14 x 14 or 14 x 17 inch.

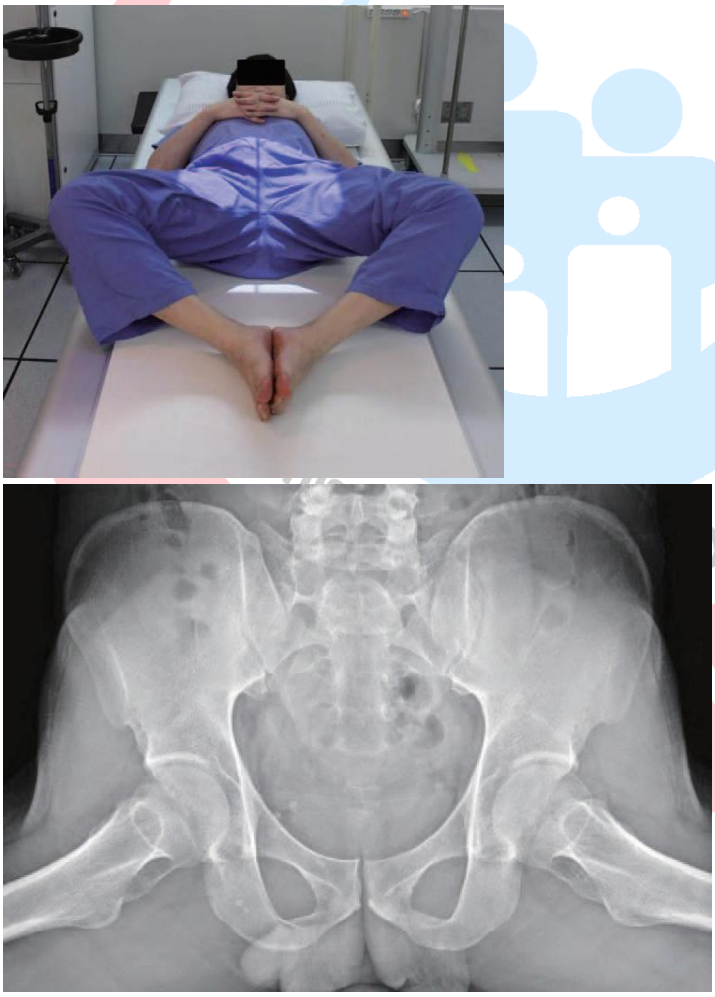


Fig.4 : Frog leg lateral View Of Both Hips.

3. **Von Rosen position:- (figure ; 5)**

- This is done in cases of hip dysplasia.
- The child lie supine in the middle of the table
- Both lower limbs are internally rotated and abducted (separated) by 90 degree i.e each one is abducted by 45 degrees.
-

Figure ; 5 : Von Rosen View

SACRO ILIAC JOINTS

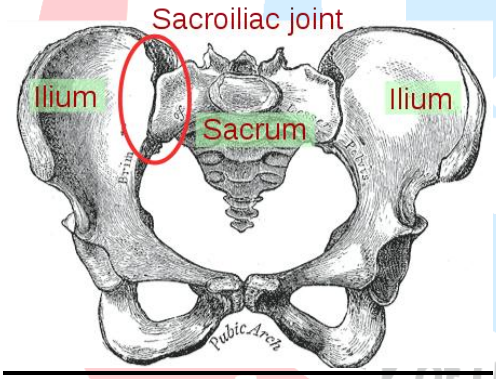


fig. 6 ; Sacro- iliac Joint

1. **POSTRO ANTERIOR (PA).**
2. **ANTERO POSTERIOR WITH CEPHALIC ANGULATION.**
3. **OBLIQUE VIEW.**

1. Postero Anterior View:-

-Patient Position:-

-Patient lie prone in the middle of the X- ray table.

Central Ray: between both sacro iliac joints, 10 degrees caudal

Exposure Factors:-

KV: 80 MAS ; 120

FFD 100 cm BUCKY: used.

FILM SIZE: 14 x 14 or 14 x 17 inch.

2. Antero Posterior View With Cephalic Angulation:- (figure ; 7)

-Patient Position:-

- patient lie supine in the middle of the examination table.

- Head support , and flex the knees to relieve back strain , and straightened the back.

Central Ray: 5 cm above the symphysis pubis, with cephalic angulation 25 degrees.

The cassette is moved 10 cm above the iliac crest

Fig. 7 ; AP Sacroiliac Joint With Cephalic Angulation

3. Oblique View Sacro Iliac Joint :- (figure ; 8)

-Patient Position :

- Patient lie supine in the midline.

-The side to be examined is elevated by an angle 20-25 degrees, supporting the elevated side by soft pad.

-Central Ray:- on the raised side 5 cm medial to the anterior superior iliac spine .

Exposure Factors:

KV : 80 MAS; 120

FFD 100 CM Bucky ; not used.

FILM USED : 24 X 30 CM OR 10 X 12 INCH

Fig. 8 ; Oblique View Of The Right Saco Iliac Joint .(N.B. the examined side is elevated).

SACRUM AND COCCYX

1, Sacrum Antero Posterior View:- (figure ; 9)

- Patient in the AP . position ; Hips and legs flexed.
- Central ray 5cm above the symphysis pubis with angle 15 degree cephalic
- Exposure factors : KV; 75 MAS; 120.

Figure ; 9 : AP Sacrum

2. Coccyx Antero Posterior View:- (figure ; 10):

-Patient in the AP position; hips and legs flexed

- Central ray 5 CM above the symphysis pubis ; 10 degrees caudally.

Exposure factors ;

Kv : 70 MAS: 80

Figure 10 ; AP Coccyx .

3. Sacrum Lateral View: (figure ; 11)

Patient in the lateral position, legs flexed , avoid sagging of the lumbar spine .

Central ray 10 cm posterior o the anterior superior iliac spine .

EXPOSURE FACTORS :

KV : 85 MAS : 150

2. COCCYX LATERAL VIEW :-

-patient In the lateral position. Center over the coccyx.

Exposure factors;

KV : 75 MAS : 120

Fig. 11 : Sacrum And Coccyx Lateral View

FEMUR

BASIC VIEWS:

1. **ANTERO POSTERIOR (AP).**
2. **LATERAL**

As the femur is a long one , its difficult to be radiographed in one film , therefore one or both joints should be radiographed with the femoral shaft (the hip or knee or both).

In young , average patient both hip and knee joints can be radiographed in the same time.

If it is difficult to get the two joints, only one joint is X rayed , which is the one close to the lesion.

In proximal femoral shaft lesions the hip joint is X- rayed with it.

It mid or distal half lesions the knee joint is X- rayed with it.

In this section we will explain how to do x ray for the mid and distal femoral lesions , the same principle can be applied to get the femur and the two joints if possible.

Fig. 12 ; AP View Of The Femur, including the femoral shaft, hip and knee joints (in a young adult before fusion of the epiphysis).

1. ANTERO POSTERIOR VIEW (AP): (figure ; 12)

-Patient Position:-

- Patient lie on table (supine or sitting) with the knee extended

- The femur and knee are in contact with cassette

- Internal rotation of the leg 15 degrees.

Central Ray: in the middle of the cassette

Collimation: collimate the beam to include from the mid femur to below the knee

Exposure Factors:-

KV:70 MAS ; 45

FFD100cm BUCKY: used.

FILM SIZE: 30 x 40 cm or 14 x 17 inch

2. LATERAL VIEW:- (FIGURE ; 13)

-Patient Position:-

-Patient lie supine , turned on the side to be examined, on the lateral or outer aspect, with flexion of the knee 45 degrees.

- The knee , femur and proximal tibia are in contact with the cassette, if the thigh is thick a soft pad can be put under the leg.

-Central Ray: on the middle of the cassette

Collimation: collimate the beam to include the mid , lower femur and the knee.

Exposure Factors:-

KV: 70 MAS ; 40

FFD ; 100 cm BUCKY; used

FILM SIZE: 30x 40 cm or 14 x 17 inch.

Fig. 13 ; Lateral View Femur (a young adult, note; non fusion of the epiphysis).

TECHNOLOGY AND POSITIONING OF THE KNEE AND LEG

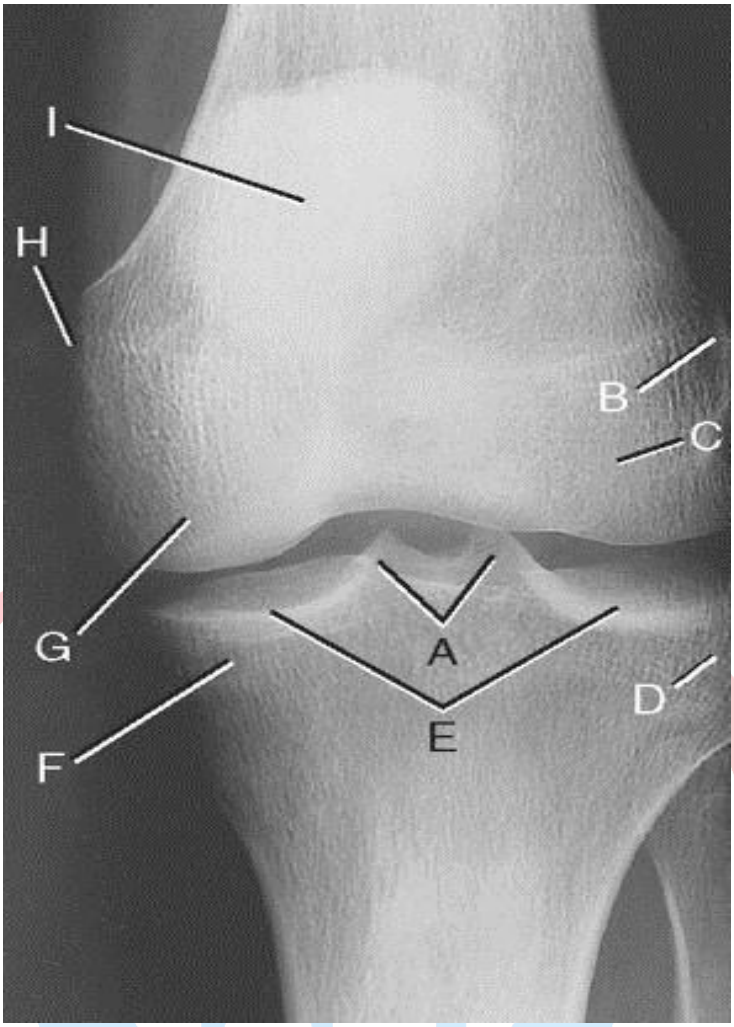


Figure ; 14 : Antero-posterior view of the knee

A. Medial and lateral intercondylar tubercles; extensions of intercondylar eminence (tibial spine)

B. Lateral epicondyle of femur

C. Lateral condyle of femur

D. Lateral condyle of tibia

E. Articular facets of tibia (tibial plateau)

F. Medial condyle of tibia

G. Medial condyle of femur

H. Medial epicondyle of femur

I. Patella (seen through femur)

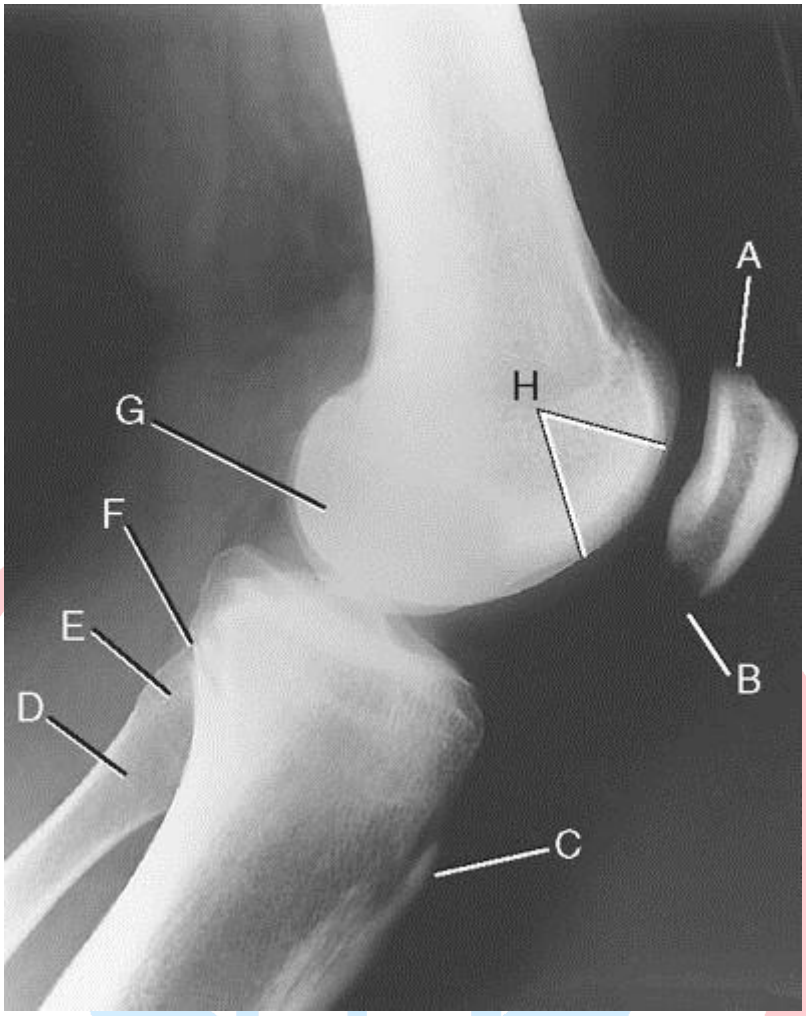


Figure ; 15 ; lateral view of the knee.

A. Base of patella

B. Apex of patella

C. Tibial tuberosity

D. Neck of fibula

E. Head of fibula

F. Apex (styloid process) of head of fibula

G. Superimposed medial and lateral condyles

H. Femoral condyle Patellar surface

KNEE

BASIC VIEWS:

1. **ANTERO POSTERIOR VIEW; (AP VIEW)**
2. **LATERAL VIEW.**

SPECIAL VIEWS:

1. **POSTERO ANTERIOR VIEW (PA).**
2. **AXIAL, TANGENTIAL, SKYLINE OR SUNRISE VIEW:**
3. **OBLIQUE VIEWS**
4. **LATERAL VIEW WITH THE PATIENT SUPINE.**
5. **TUNNEL VIEW.**

BASIC VIEWS

1. ANTREO POSTERIOR VIEW ☹ (AP): (figure ; 16)

-Patient Position:-

- Patient lie on the table supine or sitting with extended knee .
- The cassette is put under the knee. So that the knee , leg, femur in contact with cassette.

Central Ray: 1 cm below the lower pole of the patella.
In average patient the x - ray beam is perpendicular
In thin patient the x- ray beam is 5 degree caudal
In obese patient the x- ray beam is 5 degree cephalic.
Collimation: use the diaphragm to collimate the x ray beam to include the lower femur, the proximal tibia
Exposure factors:-
KV: 65 MAS ; 25 FFD ; 100
BUCKY: principally not used but can be used in obese leg to remove scatter radiation

FILM SIZE: 24 x 30 cm & 10 x 12 inch for one or two views according to the size of the knee. 14 x 14 inch film size can be used in obese patients.

FIG,16; AP View Of The Knee.

2. **Lateral View:- (figure ; 17)**

-Patient Position:-

- Patient lie on the side to be examined.
- The outer aspect of the knee, leg and lower femur are in contact with the cassette.
- The knee is flexed 30 degrees

Central Ray: to the anterior part of the femoral condyle

Collimation: use the diaphragm to collimate the x ray beam to include the lower femur, the proximal tibia

Exposure factors:-

KV: 65 MAS ; 20

FFD ; 100 cm

BUCKY; not used , it may be used in obese knees.

FILM SIZE: 24 x 30 cm & 10 x 12 inch for one or two views according to the size of the knee. 14 x 14 inch film size can be used in obese knees.

Fig. 17 ; Lateral View Of The Knee.

SPECIAL VIEWS:

1. **POSTERO ANTERIOR VIEW (PA).**
2. **AXIAL , TANGENTIAL, SKYLINE AND SUNRISE VIEW:**
3. **OBLIQUE VIEWS**
4. **LATERAL VIEW WITH THE PATIENT SUPINE.**
5. **TUNNEL VIEW.**

1. **Postero Anterior View:**

-Patient Position:-

- Used when the patient could not extend his knee.

- Patient lie prone. If painful or fractured knee is suspected, a soft pad is placed below the femur and leg

Central Ray: on the knee joint posteriorly

Collimation: use the diaphragm to collimate the x ray beam to include the lower femur, knee and the proximal tibia and fibula .

Exposure Factors:-

KV: 65 MAS ; 25

FFD: 100 cm BUCKY; not used, can be used in obese knee to remove scatter radiation

FILM SIZE: 24 x 30 cm or 10x 12 inch.

2. **AXIAL, TANGENTIAL, SKYLINE OR SUNRISE VIEW:-**

Done to show the patella , and patello femoral joint in axial view.

A. With Patient Supine:- (figure ; 18)

-Patient Position:-

- Patient lie supine on the X- ray table , knee is flexed 90 degrees

- X- ray cassette is hold by the patient vertical against the femur.

Central Ray: - X -ray beam is horizontal , passing through the patello femoral articulation.

Collimation: collimate the beam to include the patella, proximal femur and tibia

Exposure Factors:-

KV: 65 MAS; 30

FFD: 100 cm BUCKY; not used

FILM SIZE: 24 x 30 cm or 10 x 12 inch

B. With Patient Prone: (figure ; 16)

-Patient Position:-

- Patient lie prone , with the knee flexed 90 degrees, the patient hold the knee in this position by a piece of gauze.

- The cassette is put below the knee, in contact with the table.

Central Ray: the central X ray beam is directed towards the knee 15-20 degrees

Collimation: collimate the beam to include the patella, proximal femur and tibia

Exposure Factors:-

KV: 65 MAS 30

FFD ; 100 cm BUCKY; not used

FILM SIZE: 24 x 30 cm or 10 x 12 inch.

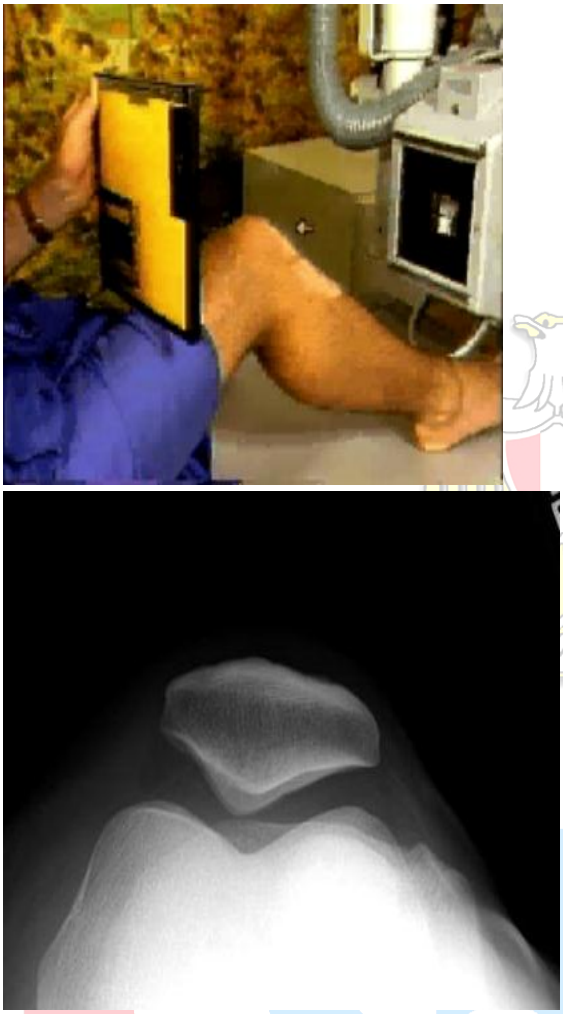
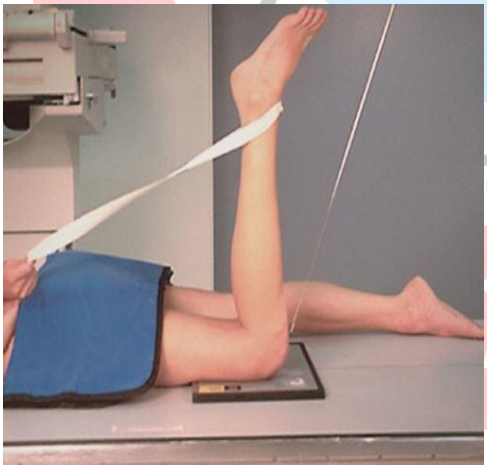
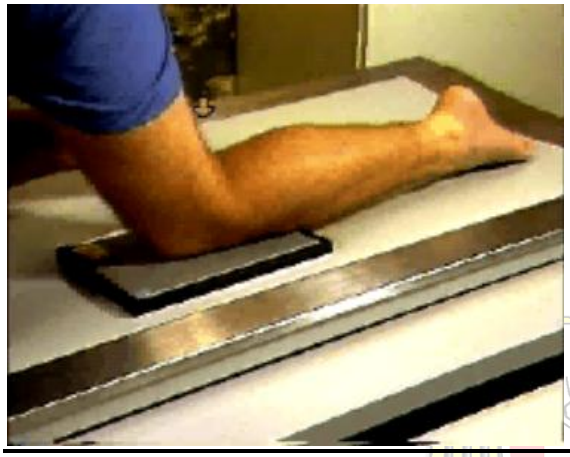


Fig. 18; , Skyline View Of The Knee (Patient Sitting).



Fig; 19; , skyline view of the knee with patient prone .

3. **Oblique Views:-**
   - From the AP view, rotate the knee medial or lateral (about 45 degrees) to do medial or lateral oblique.
   - Other parameters are the same as in the AP view.
   -
4. **Lateral view with patient supine :**
   - This is done to see fluid level, or when the patient could not lie in the lateral position.
   - Patient lie supine on the X ray table with knee extended
   - The knee , lower femur , proximal tibia is contact with cassette.
   - The cassette is placed vertical at the outer side of the knee.
   - X – ray beam is horizontal.
5. **Tunnel view; (figure ; 20)**
   - This is done to see the femoral condyles and intercondylar fossa.
   - Patient lie prone , put the cassette below the knee.
   - The leg is flexed 40-50 degree and rest on a pillow
   - X ray is directed to the knee 40-50 degree caudal.



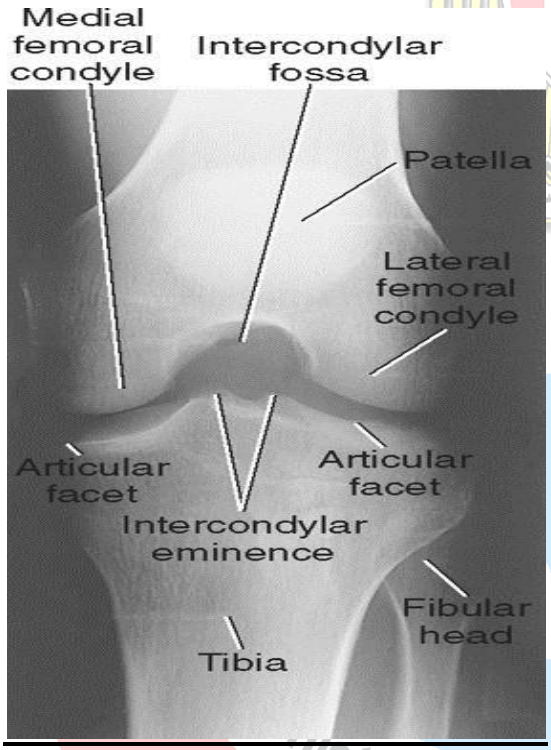


Figure ; 20 ; Tunnel View Of The Knee.

LEG (TIBIA AND FIBULA)

BASIC VIEWS: (figure; 21)

1. **ANTERO POSTERIOR (AP).**
2. **LATERAL.**

1. ANTERO POSTERIOR VIEW OF THE LEG:

-Patient Position:-

- Patient lie supine or sitting on the x – ray table with the leg extended .
- Leg slightly rotated medially so that both malleoli are equidistance from the table.
- Both knee and ankle joints are demonstrated , or at least one joint which is close to the lesion is demonstrated.

Central Ray: in the middle of the leg.

Collimation: use the diaphragm to collimate the beam to both bones and the joints.

Exposure Factors:-

KV: 60 MAS"; 15

FFD : 100 cm BUCKY : not used

FILM SIZE: 30 x 40 cm or 14 x 17 inch. Both AP and lateral views can be done on the same film.

2. LATERAL VIEW:- (figure , 21):

-Patient Position:-

- Patient lie on the side to be examined, with the lateral side of the leg in contact with the cassette.
- The leg, ankle , knee and lower thigh should be in contact with the table and cassette.
- The cassette Is put along its long axis, including or both joints

-Central Ray: perpendicular on the mid portion of the leg.

Collimation: use the diaphragm to collimate the beam to both bones and the joints.

Exposure Factors:-

KV: 60 MAS' 13

FFD : 100 BUCKY; not used

FILM SIZE: 30 x 40 cm or 14 x 17 inch. Both AP and lateral views can be done on the same film.

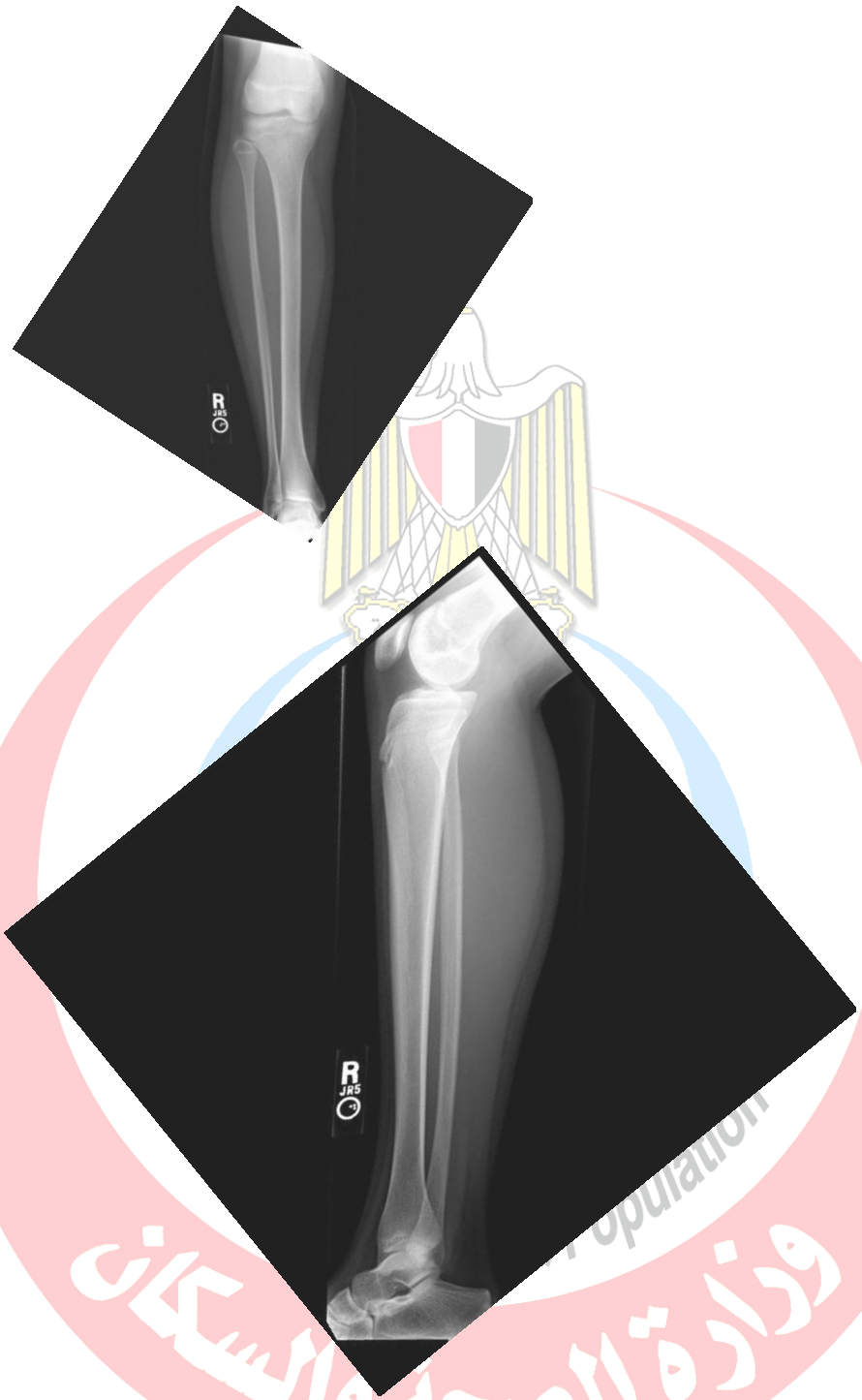


Figure ; 21 : AP and lateral views of the leg

TECHNOLOGY AND POSITIONING OF THE ANKLE AND FOOT

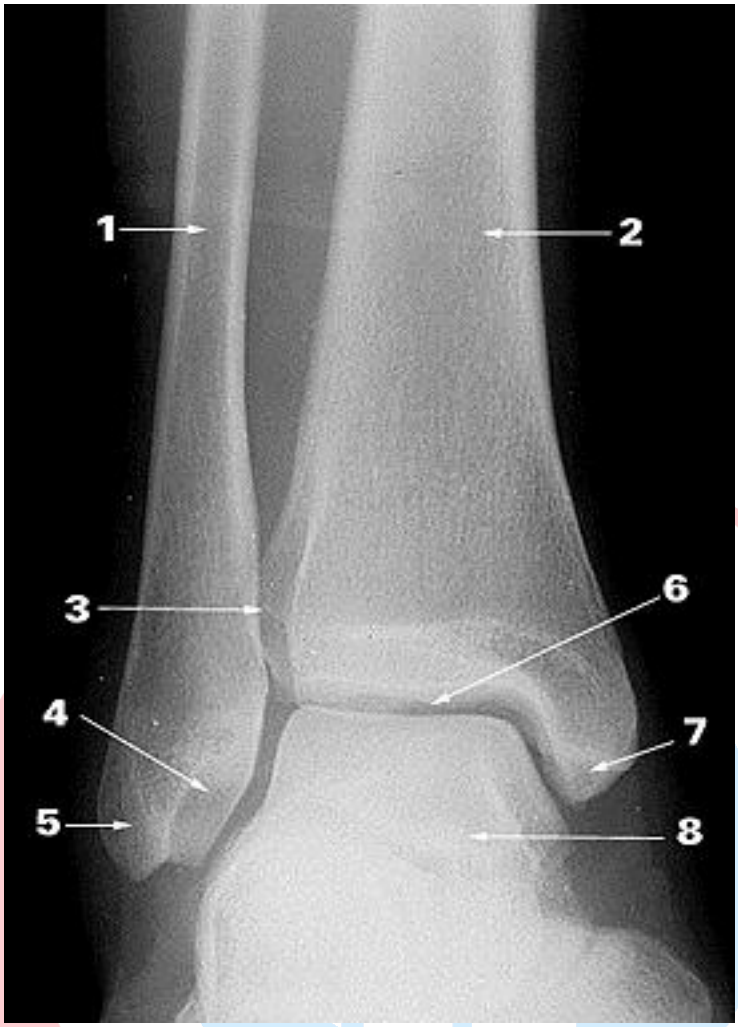
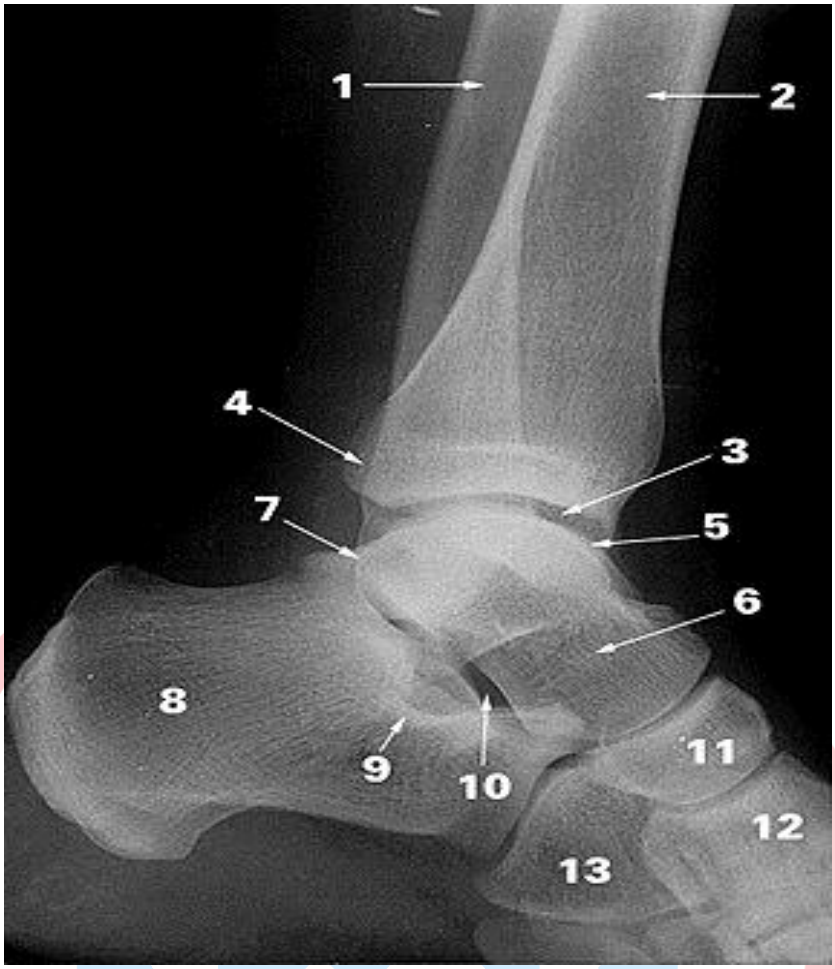


Figure **; 22 :** Ankle (AP)

1. **Fibula**
2. **Tibia**
3. **Tibio fibular joint**
4. **Talo fibular**
5. **Lateral malleolus**
6. **Tibio talar articulation**
7. **Medial malleolus**
8. **talus**



Figure; 23 : lateral view ankle .

1. **Fibula**
2. **Tibial**
3. **Tibio talar articulation**

6. Talus

8. calcaneus.

11. navicular.

13. Cuboid

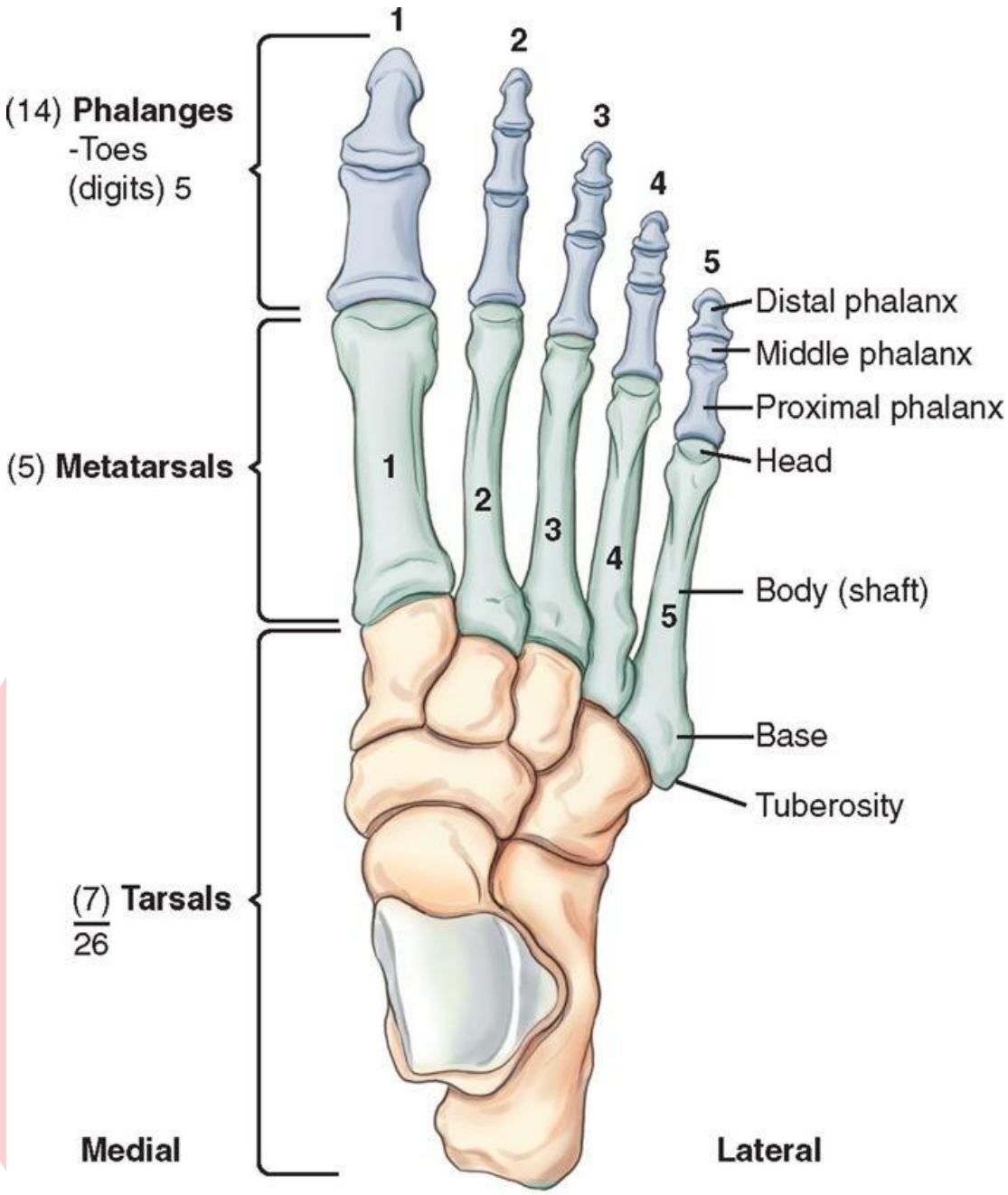


Figure ; 24 : Diagram AP , Foot.

ANKLE

BASIC VIEWS:-

1. **ANTERO POSTERIOR (AP)**
2. **LATERAL.**

SPECIAL VIEWS:-

1. **OBLIQUE VIEW**
2. **MORTISE VIEW.**
3. **FORCED INVERSION VIEW.**

BASIC VIEWS:

1. **ANTERO POSTERIOR VIEW (AP):- (figure ; 25).**

Patient Position:-

- Patient lie on the x ray table (supine or sitting)
- Knee extended.
- Foot perpendicular on the table, both malleoli on the same distance from the cassette.

Central Ray mid distance between both malleoli.

Collimation : use the diaphragm to collimate the x ray to include the ankle , lower fourth of both tibia and fibula and the foot .

Exposure Factors :-

KV : 60 MAS : 15

FFD 100 CM BUCKY ;not used

FILM SIZE: 24 x30 cm or 10x 12 inch to include both AP, lateral views on the same film.

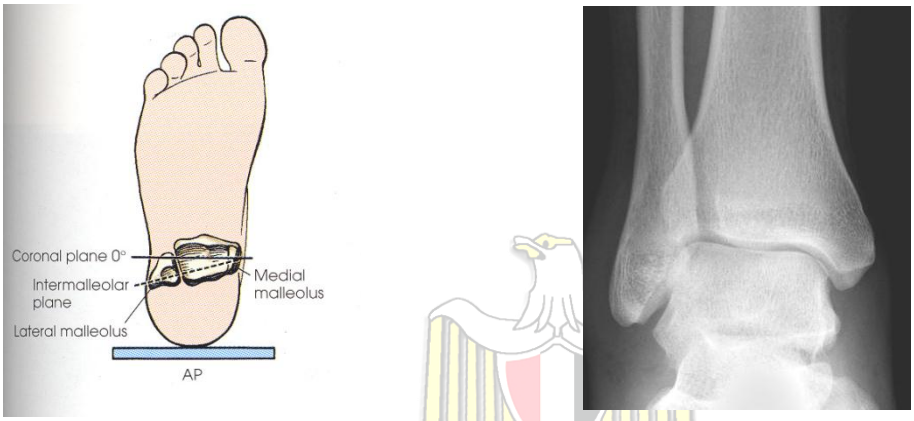


Fig 25; ; AP view of the Ankle

2. Lateral view:

-Patient Position:-

- Patient sitting on the X- ray table with the knee extended.

- The ankle is rotated so that the lateral aspect in contact with the cassette.

- Dorsiflex the foot so that the foot make an angle 90 degree with the leg.

Central Ray: on the medial malleolus

Collimation: collimate the beam to include half the foot, the ankle and lower parts of both tibia and fibula

Exposure Factors:-

KV: 60 MAS ; 12 FFD ; 100 cm

BUCKY: not used

FILM SIZE: FILM SIZE: 24 x30 cm or 10x 12 inch to include both AP, lateral views on the same film

SPECIAL VIEWS:-

1. **OBLIQUE VIEW:- (figure ; 26)**

-Patient Position:- From the AP view the ankle is rotated medially 45 degrees, ankle support can be used,
Central Ray: on the ankle joint
Collimation: as in ankle AP view
Exposure Factors:-
KV: 60 MAS ; 15
FFD 100 cm BUCKY; not used
FILM SIZE: One view : 8 x 10 Inch, two views 24 x 30 cm or 10x 12 inch.

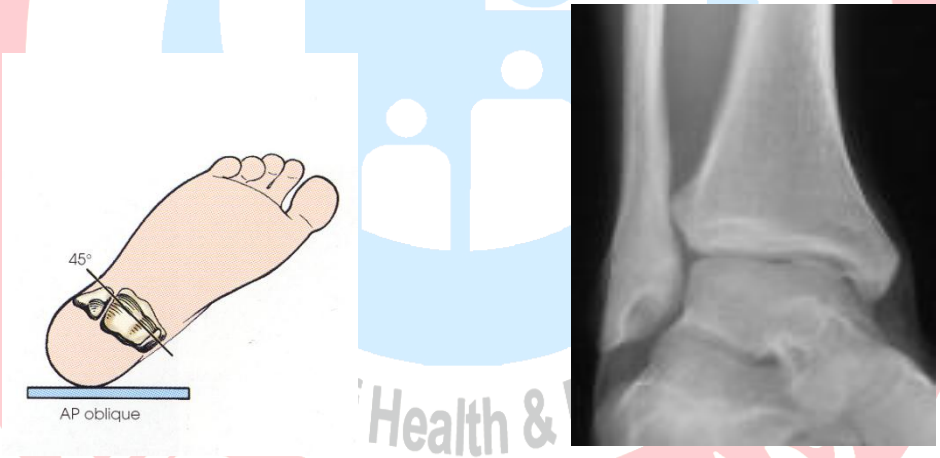


Figure ; 26; Ankle Oblique 45 Degrees

2. **MORTISE VIEW :-** figure ; 27

-Patient Position:- A s in AP view, ankle rotated 15-20 degrees medially
Central Ray: on the ankle
Collimation: as in AP VIEW

Exposure Factors:- AS in AP VIEW

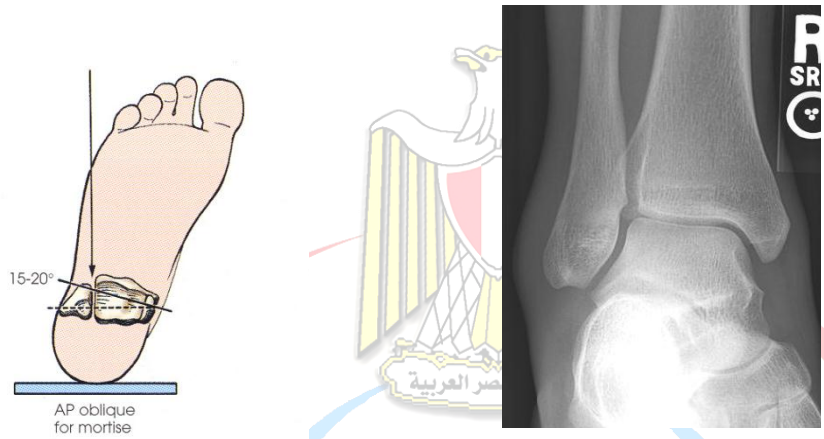


Figure ; 27; ankle Mortise view ,.

3. FORCED INVERSION VIEW:

- Done in suspected tear of the lateral ligaments.
- **Patient Position :** Put the ankle in the AP view, then push the foot by the examiner hand medially.
- Take exposure in this position
- Exposure factors as in AP view.

X RAY VIEWS OF THE HEEL:

1. LATERAL VIEW OF THE HEEL: (Figure ; 28)

Patient Position:-

- Patient lie down on the x -ray table , with the ankle in the lateral view and the lateral aspect of the foot in contact with the table.
- The planter surface perpendicular on the table.

- Dorsiflex the foot so that the foot make an angle 90 degree with the leg.
- Central ray is perpendicular on upper part of the calcaneus

EXPOSURE FACTORS;-

- KV ; 65 KV MAS: 10
- FFD : 100 CM BUCKY : not used

Film size : 8x 10 inch.

Figure ; 28 Lateral View Ankle And Calcaneus.

2. **AXIAL VIEW OF THE HEEL (CALCANEUS): (figure ; 29)**

Patient Position:

- Patient lie down on the table (sitting or recumbent) , with the knee straight
  (extended) , as in AP ankle .
- The foot is perpendicular on the table.
- The toes are pulled back towards the body by a piece of gauze
- The central ray is towards the calcaneus, i.e towards the body or cephalic by an angle 30 degree.

- **Exposure Factors:-**

KV : 65 MAS : 15

FFD : 100 CM BUCKY : NOT USED.

Film size : 8x 10 inch

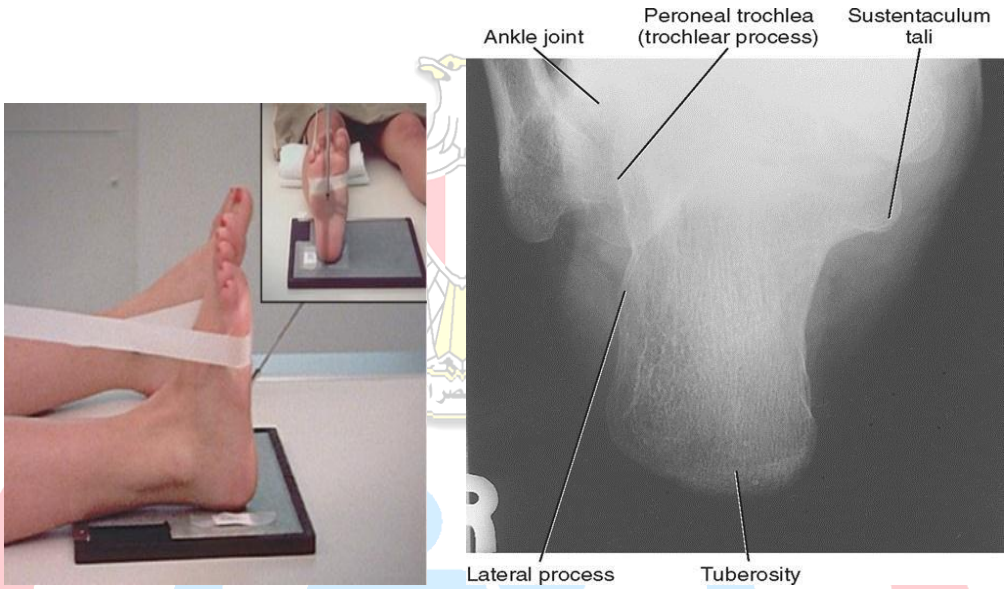


Fig . 29 ; Axial view of the calcaneus.(planto dorsal axial calcaneus)

OTHER OPTIONAL VIEWS OF THE CALCANEUS:-

A; With the patient prone, and the foot perpendicular on the table , with central ray oblique on the calcaneus. And the beam angled 30 caudal .

B. Patient standing on the cassette ,and the central ray oblique 30 degree towards the foot.

FOOT

X - RAY VIEWS OF THE FOOT :-

1. AP view.
2. AP oblique view.
3. Lateral view.
4. Lateral view for the flat foot.

X- RAY VIEWS OF THE FOREFOOT (TOES);

1. AP Views of the toes.
2. Lateral.
3. Oblique view.
4. AP view of the big toe.
5. Lateral view of the big toe.

X- RAY VIEWS OF THE HEEL:

1. Lateral view.
2. Axial views.

X – RAY VIEWS OF THE FOOT

1. **AP VIEW (ANTRO POSTERIOR OR DORSI PLANTER):- (figure ; 30)**

PATIENT POSITION:-

-Patient is sitting on the table, with the knee flexed, and the planter surface of the foot in contact with the table.

Fig.30 : AP View Of The Foot

- Central ray perpendicular to the tarsal bones
-
- **Exposure Factors:-**
- KV : 60 MAS : 6
- FFD : 100 CM BUCKY; not used.
- Film size : 24x 30 cm or 10 x 12 inch

2. AP OBLIQUE :- (figure ; 31)

Patient position :-

- From the AP position the foot is rotated to the medial aspect.
- Central ray 10-15 degree towards the ankle joint.
- The intertarsal joints are well seen in this view.

Figure ; 31;Foot oblique view

3. LATERAL VIEW OF THE FOOT:- (fig. 32)

Patient Position:-

- Patient lie down on the x -ray table , with the lateral aspect of the foot in contact with the table.
- The planter surface perpendicular on the table.
- Central ray is perpendicular on the tarsal bone

Exposure Factors;-

- KV ; 65 KV MAS: 10
- FFD : 100 CM BUCKY : not used
- Film size : 24 x 30n cm . 10 x 12 inch

Fig; 32 ; Lateral View Of The Foot

4. LATERAL VIEW OF FLAT FOOT: (WEIGHT BEARING):- (fig. 33)

Patient Position :-

- Patient stands with the vertical cassette stands between both feet.
- The side to examined is the one towards the X- ray tube
- Central ray is horizontal perpendicular to the metatarsal base.

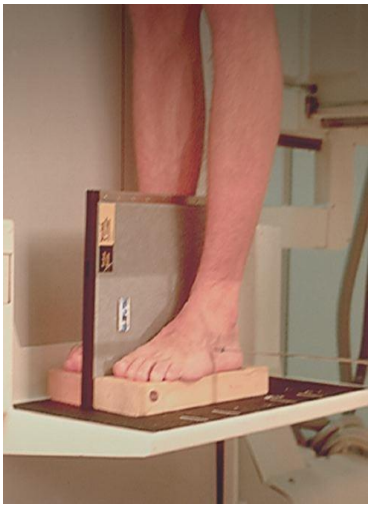


Fig. 33 : Lateral View Of The Foot Standing

X- RAY VIEWS OF THE FOREFOOT AND TOES

1. A.P . VIEW (OR DORSIPLANTER):

Patient Position:-

-Patient is sitting on the table, with the knee flexed, and the planter surface of the foot in contact with the table.

- Central X – Ray : perpendicular to the mid metatarsal bone .

- If the purpose is specifically for the toes the center will be at the head of the third metatarsal bone .

- If the purpose is a specific toe , the center at the head of the metatarsal bone of that toe.

- **Exposure Factors:-**
- KV : 55 MAS : 5
- FFD : 100 CM BUCKY; not used.
- Film size : 8 X 10 inch

Figure ; 33 : AP and oblique views of the toes

2 ,Lateral View Of The Foot:-

Patient Position:-

- Patient lie down on the X -ray table , with the lateral aspect of the foot in contact with the table.
- The planter surface perpendicular on the table.

- **Central Ray** is perpendicular on the mid metatarsal bone

Exposure Factors;-

- KV ; 65 KV MAS: 10
- FFD : 100 CM BUCKY : not used
- Film size : 8x10 inch .

3.AP OBLIQUE :-

Patient Position :-

- From the AP position the foot is rotated to the medial aspect.
- Central ray on the 3rd metatarsal bone.
-

4.AP OF THE BIG TOE:-

Patient Position:-

-Patient is sitting on the table, with the knee flexed, and the planter surface of the foot in contact with the table.

- Central ray on the head of the 1st metatarsal head:

- **Exposure Factors:-**
- KV : 55 MAS : 4
- FFD : 100 CM BUCKY; not used.
- Film size : 8X 10 inch

N.B. Both sides can be done for comparison.

5. Oblique View Of The Big Toe: (figure ; 33)

Patient Position:

- Rotate the foot to the oblique position so that the medial aspect in contact with the cassette. A soft radiolucent pad is put under the raised lateral aspect.
- The central ray on the first metatarsal head.

CHAPTER FIVE

TECHNOLOGY AND POSITIONING OF THE SPINE

TECHNOLOGY AND POSITIONING OF THE CERVICAL SPINE

CERVICAL SPINE

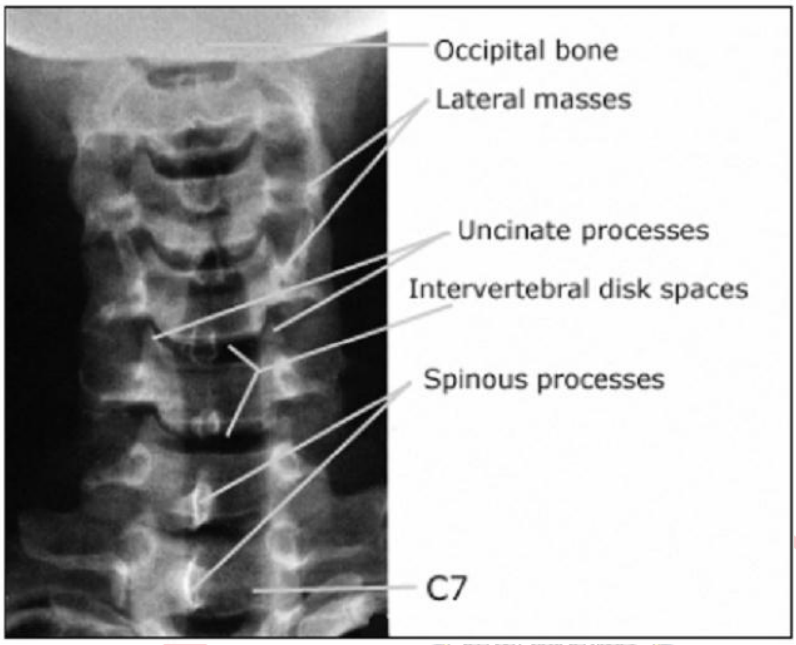


Fig. 1 Cervical Spine (Ap View)

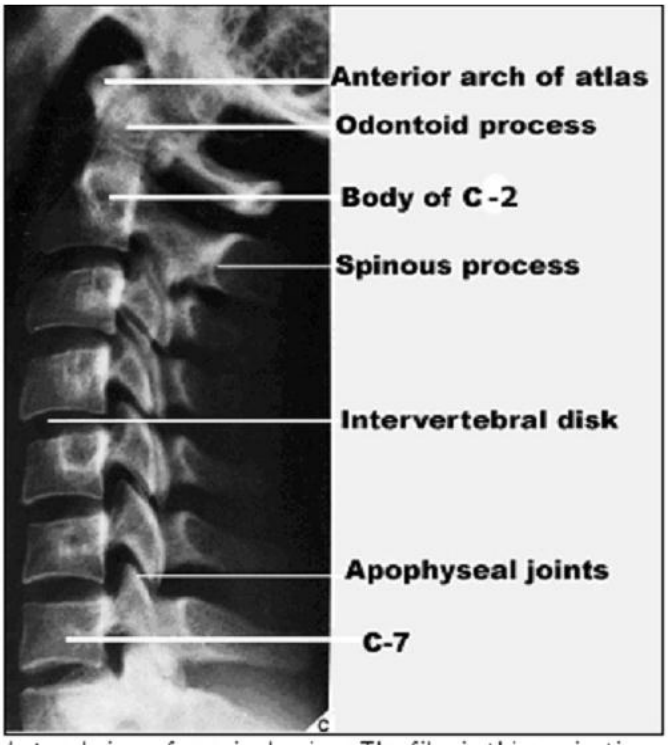


Fig. 2. Cervical Spine (Lateral View).

Fig 3: Cervical Spine (Oblique View).

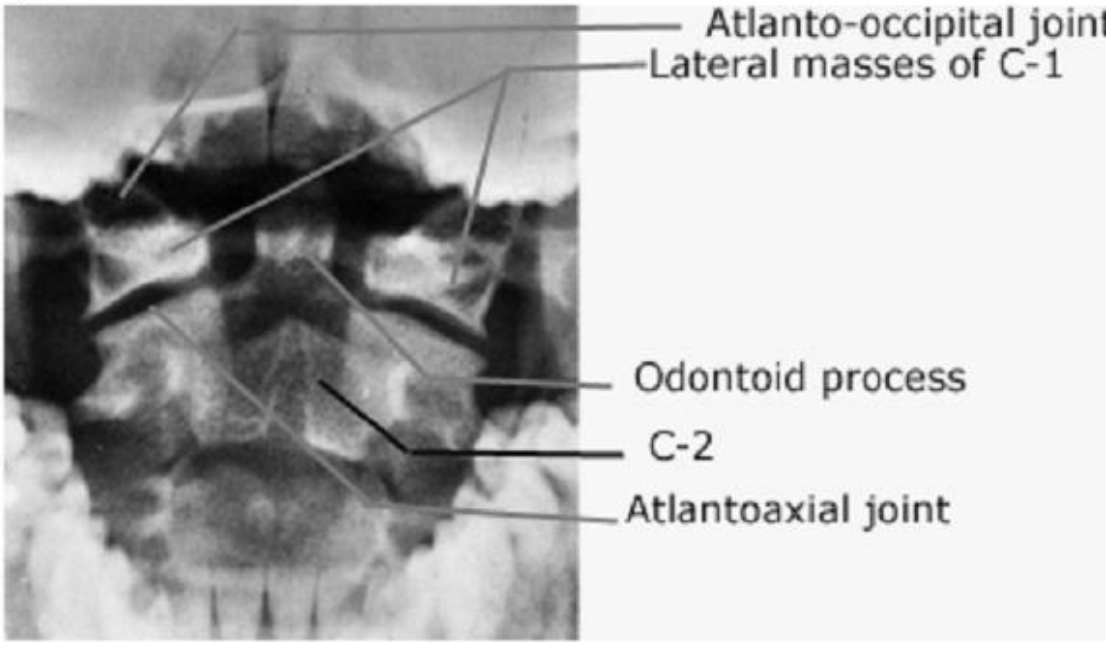


Fig. 4 Open Mouth View (For C1 & C2)

BASIC VIEWS :-

1. **ANTERO POSTERIOR (AP).**
2. **LATERAL.**

SPECIAL VIEWS :-

3. **OBLIQUE VIEW (RT. OR LT.).**
4. **DYNAMIC VIEWS (FLEXION AND EXTENSION).**
5. **OPEN MOUTH VIEW.(FOR C1 & C2).**

1. **Anteropostrior view :- (figure ,1 ; figure ; 5)**

-Patient Position:-

- Patient in the AP position , standing , sitting or supine facing the x ray tube .

- Push the chin forward and upward so that the base of the mandible perpendicular to the film, and the skull basal line have an angle 45 degree with the horizontal or vertical plane .

N.B. the basal line is the line between the outer angle of the eye and the external ear opening .

- **Central Ray :-** to C4 at the epiglottis level, or 10 cm above the suprasternal notch, 15-20 degree cephalic angle .
- Base of the skull, tip of the mandible parallel to the X-ray beam.
- **Exposure Factors :-**
- KV: 70 MAS; 60
- FFD ; 100 CM BUCKY ;used
- Film used : 8 x 10 inch.

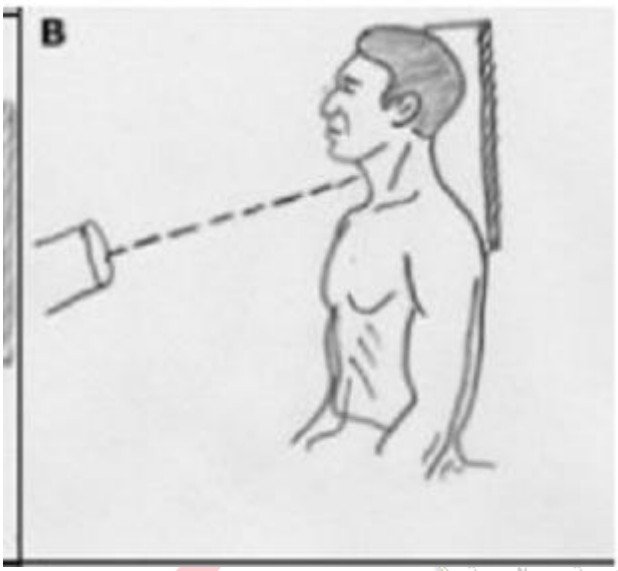


Fig. 5 ; Cervical Spine ; AP View.

2; LATERAL VIEW :- (figure ;2; & figure ; 6)

- **Patient Position:-**
- Patient in the lateral position , with the shoulder in contact with the lower edge of the cassette, and the sagittal plane parallel to the film
- The neck is straight, drop the shoulders , to visualize C7 vertebra.
- The chin is moved forward , to get the mandibular rami away from the anterior ach of C1.
- If C1, C2 , C7 not included coned views are needed.

CENTRAL RAY : horizontal, 3 cm below the angle of the mandible at C3 - C4 level.

Exposure factors :

KV 65 MAS ; 30

FFD; 150 CM (to compensate for the distance between the spine and the film). BUCKY ; USED . FILM USED : 8 x 10inch .

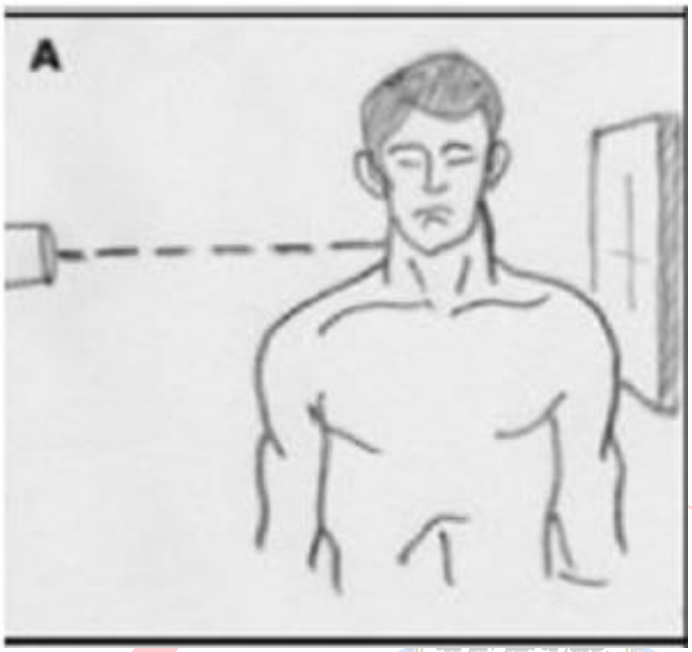


Fig. 6 ; Lateral View Of The Cervical Spine

3. Open mouth view:- (figure 4, figure 7)

For visualization of the odontoid process, and arch of C1. , atlano- axial articulation, and atlanto occipital articulation.

-Patient Position:-

- Patient lie supine in the AP position with open mouth.

- Open the mouth to ensure that upper incisors parallel to the base of the skull.

- The skull should be centralized with no rotation.

- Central Ray : through the open mouth, vertical and parallel to the palate

- Exposure Factors:

KV ; 70 MAS 50

FFD 100 CM BUCKY USED

FILM USED : 8 X 10 INCH

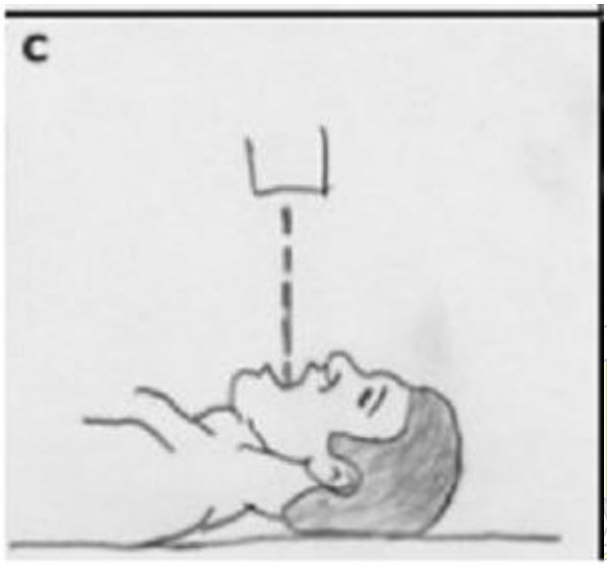


Fig. 7 : Open Mouth View For C1 & C2

4. Oblique view :- (figure ; 3,)

This view is done to visualize the intervertebral foraminae..

- **Patient Position :- there are four types : 1; anterio oblique right or left . 2, posterior oblique right or left).**
- Posterior oblique views :
- From the AP position the patient is rotated 45 degrees .
- right posterior oblique : the back of the right side in contact with the cassette
- left posterior oblique. the back of the left side in contact with the cassette .
- Anterior oblique views:
- From the PA position , the patient is rotated 45 degree ;
- right anterior oblique ; the anterior side (of right shoulder) in contact with the cassette
- left anterior oblique ; the anterior side (of the left shoulder) in contact with the cassette (figure 8) .
-

- **In all these views:**
- The chin is pushed slightly down, then rotate the skull to be parallel to the cassette.
- Move the chin forward,
- **Central Ray :-** to C4 , 15 cephalic angulation . (at the level of the epiglottis).
- **Exposure Factors :-**
- KV 70 MAS ;40 & FFD ; 150 CM , to avoid magnification BUCKY ; USED
- FILM USED ; 8 X 10 INCH.

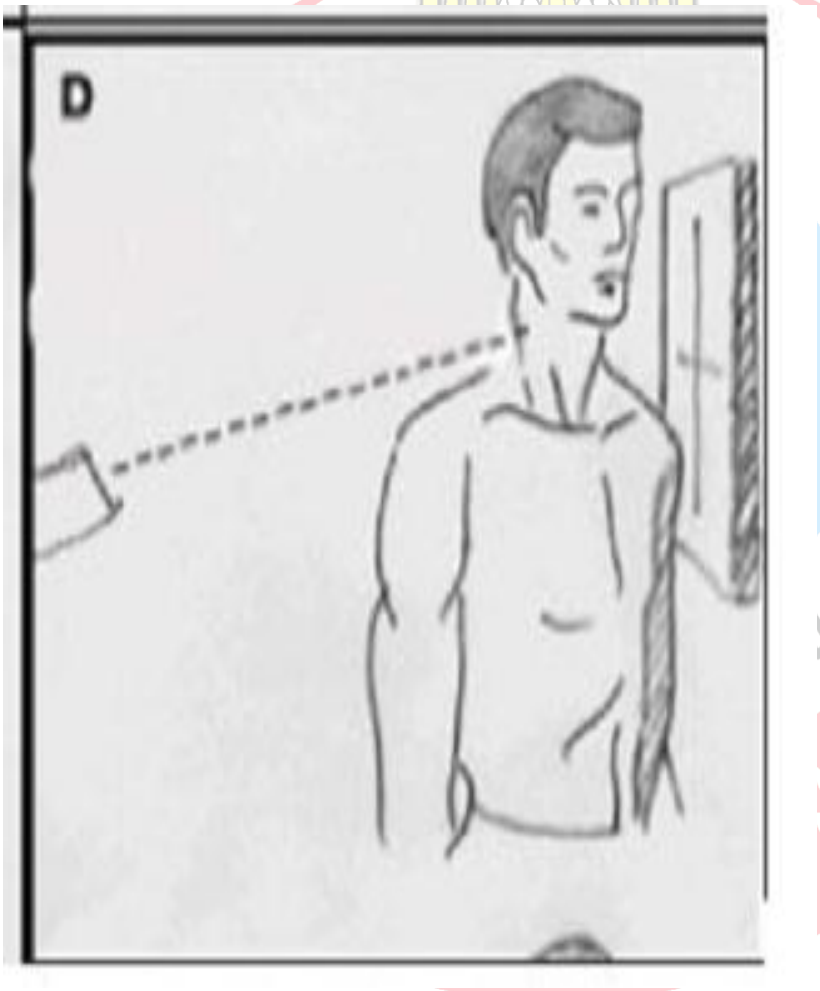


Figure ; 8 ; left anterior oblique cervical spine (patient is rotated 45 degree ,to the left , to see the left intrevertebral foramina. The anterior part of the left shoulder in contact; CR ; 15-20 degrees cephalic

5. **Dynamic View: (Figure ; 9).**

This is done to detect vertebral subluxation. (one vertebra moves over the other) .

Its done in the lateral view

Flexion view done with flexion of the cervical spine and the chin close to the chest as possible.

Extension view ; with the neck hyperextended.

A B

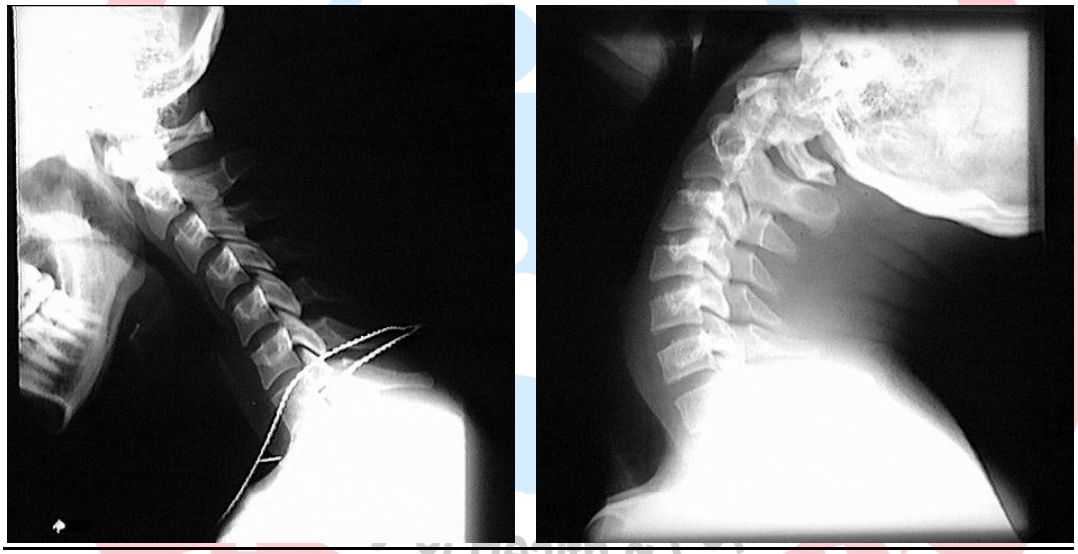


Fig.; 9 ; Dynamic Views, Of The Cervical Spine , (A) ;Flexion And (B); Extension.

TECHNOLOGY AND POSITIONING OF THE DORSAL SPINE

DORSAL SPINE

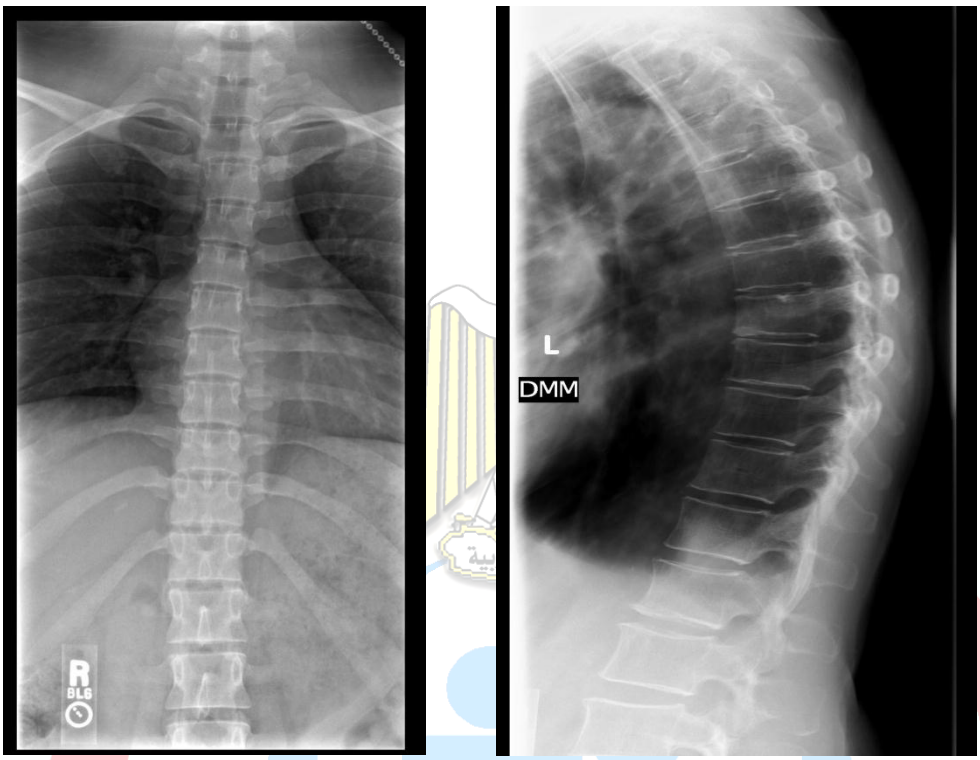


Fig. 10 : Dorsal Spine (AP & LATRAL VIEWS)

VIEWS :-

1. **ANTERO POSTERIOR VIEW.**
2. **LATERAL VIEW.**
3. **OBLIQUE VIEWS (RT. & LT.)**

1. **Dorsal spine (AP view):- (figure; 10)**

- **Patient Position:-**
- Patient lie supine on the table , with the patient facing the X- ray tube , midline of the patient align with midline of the table .
- Legs are flexed (in the supine position) so that the spine in contact with the cassette.
- Put the upper border of the cassette above the shoulder to include C 7 vertebra.

- Beam Collimation ; use the diaphragm to collimate the beam to get better contrast, and to include the desired vertebrae..

Central Ray : to the center of the cassette, at D7 level (in the middle of the sternum i.e . between the sternal angle and the xiphoid process).

Film exposed after deep inspiration

Exposure Factors:-

KV ; 80 MAS; 90

FFD ; 100 CM BUCKY ; USED

FILM USED : 30X 40 CM 0R 14 X 17 INCH.

2. **Dorsal spine (lateral view) (figure ; 10):**
   - **Patient Position :-**
   - Patient lie on the table , in the lateral position, with both arms above the head.
   - Put a pillow below the head , also, a soft pad is put below the lumbar spine so that the cervical , the dorsal and the lumbar spine at the same level and parallel to the table
   - Both hips and knees are flexed.

Central Ray :- through the axilla (at D 6 level).

Exposure Factors :-

KV 80 MAS ; 110

FFD 100 CM BUCKY USED

FILM USED ; 30 X 40 CM OR 14 X 17 INCH.

Note that the upper dorsal vertebra does not appear clear , due to the shadow of the shoulder.

3. Oblique View:-

- From the supine position , the patient is rotated to the right or left side by an angle 45 degreed.

- Soft pad is put under the raised side to keep the patient stable in position.

- Both arms are elevated away above the head.

- **Central Ray ;** in the mid clavicular line on the elevated side at D7 (Apprixately middle of sternum) .

Exposure Factors :-

KV ; 80 MAS: 90

FFD : 100 CM BUCKY : USED

CERVICO DORSAL JUNCTION

This region extends from the cervical spine C4, C5 to the dorsal spine D4-5 level .This region is not well seen in the lateral view as, as it s covered by the shadow of the shoulder .

Views :-

1. **ANTERO POSTERIOR (AP):-**
2. **LATERAL VIEW.**

1. ANTERO POSTEIOR VIEW:-

- **Patient Position:**
- - patient supine on the table or standing . both arms at the side**.**
- **Central Ray '** : at the suprasternal notch.
- Exposure Factors :-
- KV ; 65 MAS; 70
- FFD ; 100 CM BUCKY USED

2. Lateral View: swimmers view, (Figure; 11)

A. Patient Standing :-

- Patient in the standing lateral view, with the shoulder against the cassette.
- Separate the shoulders, so that the arm at the cassette side is raised above the head, and the other side is depressed, and moved slightly anteriorly,
- **Central Ray :** through the axilla , close from the film.

B. <u>Patient Prone :</u>

- Patient lie prone , the side against the film is depressed, while the other side is abducted and elevated. (this is the reverse to what mentioned in the standing position).
- **<u>Central Ray ;</u>** on the axilla remote from the film.

<u>Exposure Factors :-</u>

KV ; 80 MAS ; 110

FFD : 100 CM BUCKY USED.

Fig. 11 : Swimmers View (Prone & Erect) (lateral view), For The Cervico Dorsal Region.

DORSO-LUMBAR JUNCTION

VIEWS:

1. **ANTEROPOSTERIOR (AP).**
2. **LATERAL .**

1. **Antero Posterior View Of The Dorso Lumbar Junction:**

-Patient Position :

- Patient lie supine on the table , with the central line of the body aligned with the central line of the table.

- Hips and knees are flexed.

-**Central Ray :** over the xiphoid process.

Exposure Factors:-

KV '; 70 MAS ; 110

FFD ; 100 CM BUCKY USED.

2. **Lateral View For The Dorsolumbar Region:**

-Patient Position:- patient lie on the X- ray table in the lateral position.
Both arms are raised , hips and knee are flexed
Central Ray :- on the spine at D12 level.
-**Exposure Factors:-**
KV ; 80 MAS ; 110
FFD ; 120 CM BUCKY USED
- IN Both views Exposure preferred to be at the end of expiration.

RADIOGRAPHY FOR SCOLIOSIS

X- ray spine for diagnosis of scoliosis include :-

1 . AP (or PA) Spine ERECT AND SUPINE : for diagnosis of scoliotic curve and to detect any abnormality in the vertebrae. (Figure, 12) .

- No rotation of the thorax or pelvis .
- Lower margin of the cassette or IR 5 cm below the iliac crest .

Three AP views are taken :-

- **AP VIEW for the dorsal and lumbar spine** :
  Patient stands in the AP view , facing the X- ray tube, ensure that the patient stands in straight standing AP.
- **AP with bending to the right side.**
- **AP with bending to the left side.**
- **Collimation :** wide collimation of the beam to include the scoliotic curve, or no collimation if the curve is large .

2, Lateral View. : as in lateral view of the dorsal and lumbar spine .

- To detect lordosis or kyphosis.
- Place the convex side of the curve against the cassette or image receptor (IR).
- Lower margin of the cassette or IR 5 cm below the iliac crest

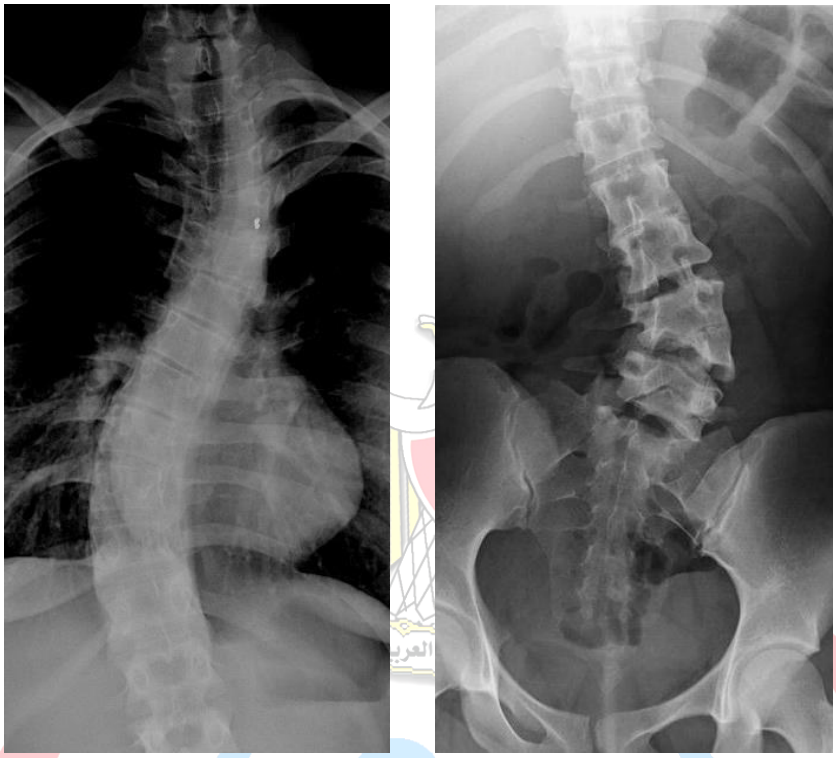


Fig.12 ; Scoliosis AP View

TECHNOLOGY AND POSITIONING OF THE LUMBAR SPINE

LUMBOSACRAL SPINE

view

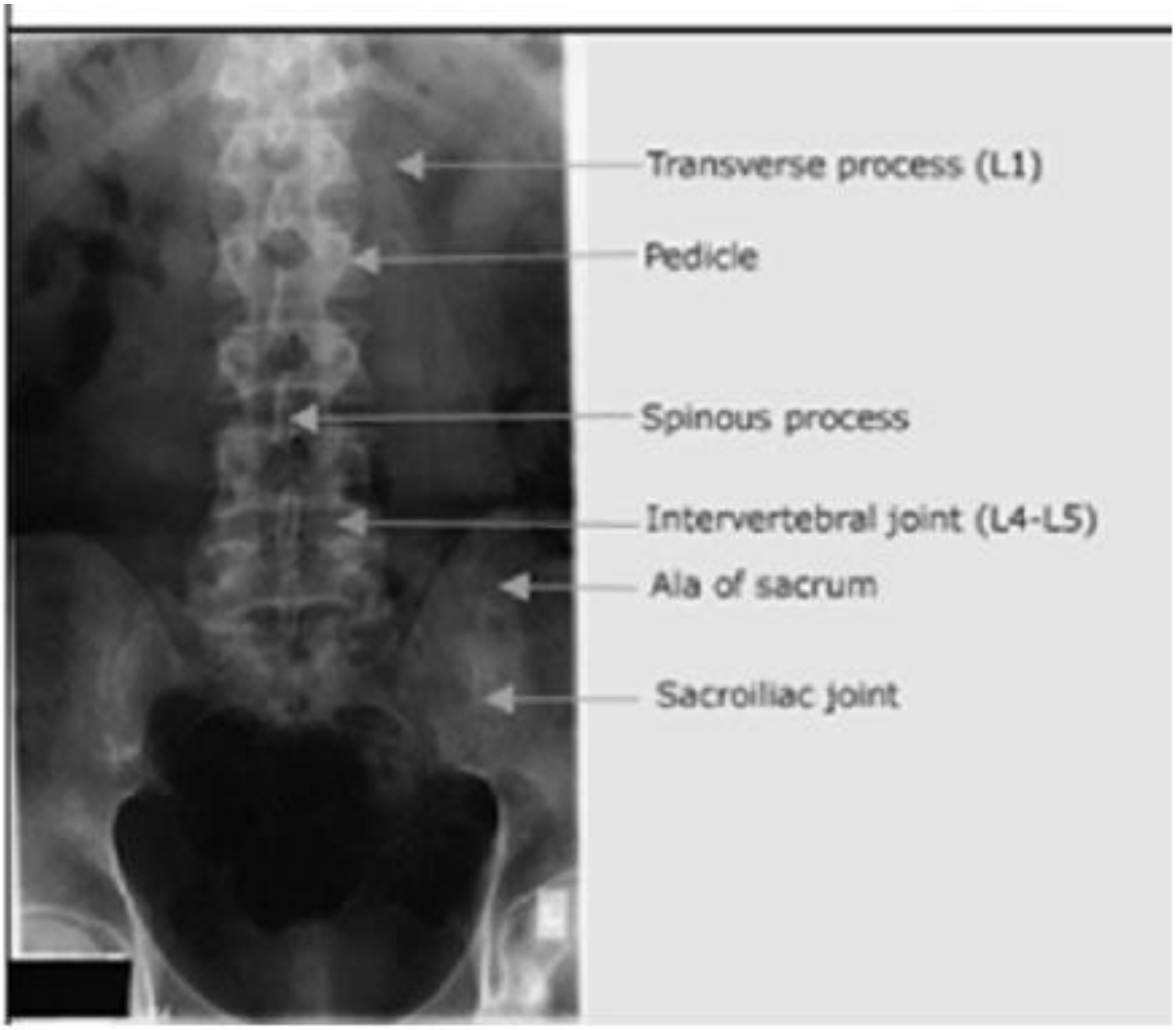


Fig. 13; AP View Lumbosacral Spine .

BASIC VIEWS :-

1. **ANTEROPOSTERIOR VIEW.**
2. **LATERAL VIEW.**

SPECIAL VIEWS :-

1. **OBLIQUE VIEWS (RT. & LT.)..**
2. **LATERAL VIEW STANDING .**
3. **DYNAMIC VIEWS (FLEXION & EXTENSION)**

1, Antero Posterior View:- (figure ; 13)

- **Patient Position :-**
- Patient lie supine on table, with the midsagittal plane aligned with the midline of the table .
- Flex the hip and knee joints, also a small pillow put under the neck aiming to straighten the lumbar spine and to be close to the table.
- **Collimate** the beam from the xiphoid process down to the symphysis pubis.
- **Central Ray** in the midline at a level 3 cm above the iliac crest (which is at L4-5 Disc level).
- **Exposure Factors :-**
- KV ; 80 MAS ; 100
- FFD ; 100 cm BUCKY used
- Film used : 30x 40 cm & 14 x 17 inch.
- Film exposed during expiration.
- Gondal shield .

2 . LATERAL VIEW:- (figure ; 14)

- **Patient Position:**
- Patient lie on the X- ray table in the lateral position , with mid axillary line aligned with the midline of the table .
- Align the lumbar spine to be parallel to the table , and prevent sagging of the spine , by; -
- 1.Pputting a soft pad under the waist ,
- 2.Flex the hips and knees , with a pillow between both knees
- 3.Put a pillow under the neck.

- 4. Caudal angle 5-8 degrees may be used especially in obese females
  - In females with broad pelvis you may need to put another pillow under the dorsal spine , in order to make it parallel to the table .
  - Ensure , no rotation , and no motion .
- **Collimate** the beam to include the lumbar and the sacral spine .
- **Central Ray** : in the mid axillary line 3 cm above the iliac crest.
- **Exposure Factors :-**
- KV ; 90 MAS ; 150
- FFD ; 120 cm (to compensate for the distance between the spine and the table . BUCKY, used
- Film used 30x 40 cm 0r 14 x 17 inch.
- Exposure after end of expiration.

IF L5-S1 not clearly seen Coned view for L5- S1 may be done , in this case central ray will be 4 cm inferior to the iliac crest and 5 cm posteriorly .

- **Fig 14; Lateral View Of The Lumbosacral Spine**

- **3. OBLIQUE VIEWS :- (figure ; 15)**
- Its done to see the intervertebral foraminae , intervertebral joints (facet joints) and the neural arch and lamina to detect fracture pars interaticularis.
- Both sides are done for comparison.
- **- Patient Position :- We select any two right & left views of the following , which is the same principle as applied in the cervical spine**
- Right posterior oblique view : from the AP view the left side is raised by 45 degrees.
- Left posterior oblique view from the AP view the right side is raised by 45 degrees.
- Right anterior oblique view : from the PA view the left side is raised by 45 degrees.
- Left anterior oblique view from the PA view the right side is raised by 45 degrees.
- Support the raised shoulder and pelvis with a radiolucent sponge to maintain position .
- **Central Ray** 3 cm above the raised iliac crest in the mid clavicular line of the raised side.
- Exposure after deep expiration.
- **Exposure Factors:**
- KV ; 80 MAS ; 160
- FFD ; 120 cm. bucky ; used

Fig.15; Right And Left Oblique Views.

4. **LATERAL STANDING :**

Patient stands in the lateral position against the stand bucky. Central ray in the mid axillary line 3 cm above the iliac crest.

5. **DYNAMIC VIEWS : (figure ; 16)**

- Done to detect vertebral subluxation (movement of one vertebra over the other)
- Patient stands in the lateral view against the stand bucky.
- In flexion view the patient bends forward as far as he can, and the cassette is placed transverse in the stand bucky.
- In the extension view the patient extends his back as far as he can posteriorly , and the cassette is placed vertical in the stand bucky ,

A B

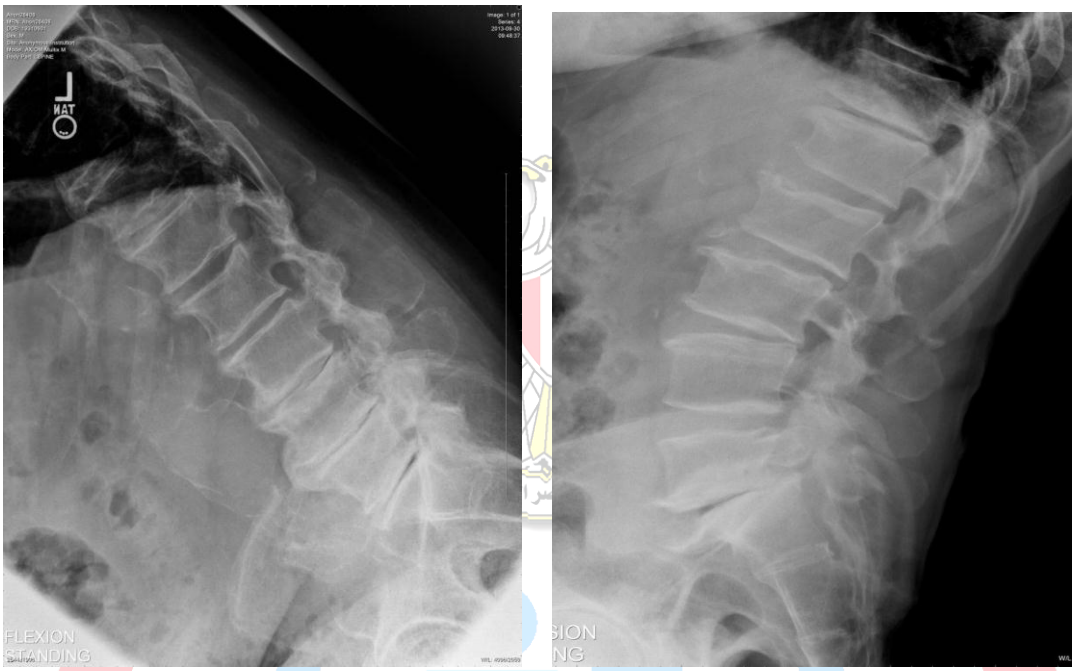


Fig 16 : Dynamic Lateral View Lumbar Spine ☹(A) Flexion & (B) Extension Views.

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