SHOULDER JOINT

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Shoulder anatomy ..

The shoulder consists of three bony structures;
- the Humerus (upper arm)
- the Scapula (shoulder blade)
- the Clavicle (collarbone).

The shoulder joint includes
- the Glenohumeral (GH) joint
- the Acromioclavicular (AC) joint.
- The Glenoid cavity articulates with the head of the Humerus.
The primary reason to make a shoulder x-ray is to confirm or exclude the presence of:

- Fracture
- Position of the shoulder joint (dislocation)
- Any bone abnormalities (including bone tumors)
- Soft tissue disorders.
Projections …

Shoulder (Trauma) routine projections:

- AP
- Transthoracic lateral
- PA oblique (scapular Y lateral)
AP PROJECTION—NEUTRAL ROTATION: SHOULDER (TRAUMA)

Patient Position

- Performed with patient in erect or supine position.
- Rotate body slightly toward affected side to place shoulder in contact with IR.
- Position patient to center glenoohumeral joint to IR.
- Place patient’s arm at side in neutral rotation.
- Suspend respiration during exposure.
• AP supine

• AP Erect
• CR perpendicular to IR, directed to mid-GH joint which is (2 cm) inferior and slightly lateral to coracoid process
• IR size—24 × 30 cm
• Digital systems—80 ± 5 kV range
TRANSTHORACIC LATERAL PROJECTION: PROXIMAL HUMERUS (TRAUMA)

Patient Position

- Performed with patient in erect or supine position.
- Place patient in lateral position with side of interest against IR.
- Place affected arm at patient’s side in neutral rotation
- Raise opposite arm and place hand over top of head.
• CR perpendicular to IR, directed through thorax

• angle CR 10° to 15° cephalad
PA OBLIQUE PROJECTION (SCAPULARY LATERAL)

Patient Position
- Performed with patient in erect
- Patient facing IR.
- Rotate patient 45-60 degree
- Abduct arm slightly if possible
• CR perpendicular to IR, directed to GH-joint [5 cm] below AC joint
• IR size—24 × 30 cm
• Digital systems—80 ± 5 kV range
• Y image orientation

• The Y configuration is formed by
• The scapula (= stem of Y )
• scapular spine & neck (= posterior leg of Y )
• coracoid process (= anterior leg of Y )
• The central point in the Y shape is the glenoid.
• The humeral head should overlap the center of the Y shape
INFEROSUPERIOR AXIAL PROJECTION: SHOULDER (NON-TRAUMA)

Patient Position

- supine with shoulder raised (5 cm) from tabletop by placing support under arm and shoulder.
- Rotate head toward opposite side,
- place vertical cassette on table as close to neck as possible.
- Abduct arm 90° from body
- keep in external rotation palm up
• Direct CR centered to axilla and humeral head with angle medially 15° - 30° toward patient body
Clavicle

Routine
- AP
- AP AXIAL

Clinical Indications
- Fractures or dislocations of clavicle
**AP & AP Axial clavicle**

**Patient Position**

- Performed with patient in erect or supine
- Position with arms at sides, chin raised, and looking straight ahead.
- Posterior shoulder should be in contact with IR or tabletop, without rotation of body
- Suspend respiration (helps to elevate clavicles).
CR

AP

• CR perpendicular to midclavicle

AP Axial

• CR 15° to 30° cephalad to midclavicle
AP axial clavicle—CR 15° to 30° cephalad
- IR size—24 × 30 cm
- Digital systems—80 ± 5 kV range
SCAPULA

- Routine
- AP
- LATERAL
AP scapula

Patient Position

- Performed in erect or supine position.
- Posterior surface of shoulder is in direct contact with IR without rotation of thorax.
- Position patient so that midscapular area is centered to CR.
- Gently abduct arm 90°, and supinate hand.

(Adduction moves scapula laterally to clear more of the thoracic structures)
AP supine and erect
• CR perpendicular to midscapula, (5 cm) inferior to coracoid process and (5 cm) medial from lateral border of patient

• IR size—24 × 30 cm

• Digital systems—80 ± 5 kV range
LATERAL POSITION: SCAPULA

- Patient Position: Perform radiograph with patient in erect
- Face patient toward IR in anterior oblique position.
- Affected shoulder touching IR
- Forearm and elbow flexed 90 and behind back
- Rotate the other shoulder 45-60 degree away from IR
- CR to mid-vertebral border of scapula
• IR size—24 × 30 cm
• Digital systems—80 ± 5 kV range
Thank you
Forearm and Elbow

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Anatomy review ...
Projections ...

Routine for forearm are:
• AP forearm
• Lateral forearm
AP PROJECTION: FOREARM

Clinical Indications

• Fractures and dislocations of the radius or ulna
• Pathologic processes such as osteomyelitis or arthritis

Patient Position

• Seat patient at end of table, with hand and arm fully extended and palm up (supinated)
• Align and center forearm to long axis of IR, ensuring that both wrist and elbow joints are included
• Instruct patient to lean laterally as necessary to place entire wrist, forearm, and elbow in as near a true frontal position as possible
• Palpate the medial and lateral epicondyles to ensure they are the same distance from IR
• IR size—30 × 35 cm
• 70 ± 5 kV range

CR
• CR perpendicular to IR, directed to mid-forearm
• AP Forearm
• Both joints in view
Lateral projection forearm ...

Clinical Indications

- Fractures and dislocations of the radius or ulna
- Pathologic processes, such as osteomyelitis or arthritis

Patient Position

- Seat patient at end of table, with elbow flexed 90°
- Align and center forearm to long axis of IR; ensure that both wrist and elbow joints are included.
- Rotate hand and wrist into true lateral position, and support hand to prevent motion, if needed.
• **CR**

CR perpendicular to IR, directed to mid-forearm

• **IR size**—30 × 35 cm

• **70 ± 5 kV range**
• Lateral projection forearm
• Both joints in view
Elbow joint

Anatomy review
Elbow joint consists of 3 joints:

1. Humeroulnar joint:
   the proximal ulna consists of the olecranon (posterior side) and the coronoid process (anterior side) and articulates with the humerus through the trochlea.
   Its primary function is flexion and extension of the elbow.

2. Radiohumeral joint:
   the radial head articulates with the humerus through the capitellum.
   Its primary function is pronation and supination of the lower arm.

3. Proximal radioulnar joint:
   articulation between the radial head and the radial notch of the ulna.
   Its primary movement is rotation of the radial head.
The Elbow Joint

- Humerus
- Radius
- Joint cavity
- Joint capsule
- Ulna
- Articular cartilage
AP PROJECTION ELBOW

Clinical indications
• Fractures and dislocations of the elbow
• Pathologic processes, such as osteomyelitis and arthritis

Patient Position
• Seat patient at end of table, with elbow fully extended.
• Extend elbow, supinate hand, and align arm and forearm with long axis of IR
• Center elbow joint to center of IR
• Ask patient to lean laterally as necessary for true AP projection.
• Support hand as needed to prevent motion
CR

- CR perpendicular to IR, directed to mid-elbow joint, which is approximately 2 cm distal to midpoint of a line between epicondyles
- IR size—24 × 30 cm
- 70 ± 5 kV range
• AP elbow (extension)
**Patient Position**

- Seat patient at end of table, with elbow partially flexed
- **Obtain two AP projections**— one with forearm parallel to IR and one with humerus parallel to IR as showing below images:
- Place support under wrist and forearm or projection with humerus parallel to IR, if needed, to prevent motion
• CR

Perpendicular to IR, directed to mid-elbow joint, which is approximately 2 cm distal to midpoint of a line between epicondyles

• IR size—24 × 30 cm

• 70 ± 5 kV range
• Humerus parallel

forearm parallel
AP OBLIQUE PROJECTION—LATERAL (EXTERNAL) ROTATION: ELBOW

**Patient Position**

- Seat patient at end of table, with arm fully extended and shoulder and elbow on same horizontal plane (lowering shoulder as needed)
- Supinate hand and rotate laterally the entire arm so that the distal humerus and the anterior surface of the elbow joint are approximately 45° to IR. (Patient must lean laterally for sufficient lateral rotation.)
• CR perpendicular to IR, directed to mid-elbow joint (a point approximately 2 cm distal to midpoint of line between the epicondyles.

• IR size—24 × 30 cm
• 70 ± 5 kV range
• Lateral oblique of right elbow—external rotation
AP OBLIQUE PROJECTION—MEDIAL (INTERNAL) ROTATION: ELBOW

Patient Position

• Seat patient at end of table, with arm fully extended and shoulder and elbow on same horizontal plane

• Pronate hand into a natural palm-down position and rotate arm as needed until distal humerus and anterior surface of elbow are rotated 45°

• Align arm and forearm with long axis of IR. Center elbow joint to CR and to IR
• **CR**
  
  • Perpendicular to IR, directed to mid-elbow joint approximately 2cm distal to midpoint of line between epicondyles as viewed from x-ray tube

• IR size—24 × 30 cm

• 70 ± 5 kV range
• Medial (internal rotation) oblique.
Lateral projection Elbow

- **Patient Position** Seat patient at end of table, with elbow flexed 90°
- Align long axis of forearm with long axis of IR
- Center elbow joint to CR and to center of IR
- Rotate hand and wrist into true lateral position, thumb side up. Place inter-epicondylar plane perpendicular to the IR
• **CR**

• CR perpendicular to IR, directed to mid-elbow joint (a point approximately 4 cm medial to easily palpated posterior surface of olecranon process).

• IR size—24 × 30 cm

• 70 ± 5 kV range
• Lateral projection of right elbow
Humerus

Anatomy review
AP PROJECTION: HUMERUS

Patient Position

- Erect or supine, adjust the height of the cassette so that shoulder and elbow joints are equidistant from ends of IR

- Rotate body toward a affected side as needed to bring shoulder and proximal humerus in contact with cassette

- Align humerus with long axis of IR,

- Extend hand and forearm as far as patient can tolerate

- Abduct arm slightly and gently supinate hand so that epicondyles of elbow are parallel and equidistant from IR
• **CR**
  
  • CR perpendicular to IR, directed to mid point of humerus
  
  • IR size—30 × 35 cm
  
  • 80 ± 5 kV range
• AP humerus projection.
Lateral projection of humerus

- **Position patient**  Erect or Supine
- **If Erect** >>>> erect with back to IR and elbow partially flexed, with body rotated toward affected side as needed to bring humerus and shoulder in contact with cassette.
- Internally rotate arm as needed
- epicondyles are perpendicular to IR
• If supine >>> hand internal rotation till the thumb is directed outward laterally touching the table, forearm and shoulder must touch the table also
CR

- CR perpendicular to IR, centered to mid point of humerus

- IR size 35 × 43 cm
- 80 ± 5 kV range
Thank you
POSITIONING TERMINOLOGY

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INTRODUCTION...

Radiographic positioning :-

 refers to the study of patient positioning performed for radiographic visualization of specific body parts on image receptor ...

we will describes the commonly used terms consistent with the positioning and projection terminology as approved and published by the American Registry of Radiologic Technologists (ARRT)...
GENERAL TERMS...

**Radiograph :-** An image of a patient’s anatomic part(s), as produced by the action of x-rays on an image receptor...

*If the radiograph* is produced with the use of traditional film-screen (analog technology) the image is captured and displayed on film..

*If the radiograph* is produced via (digital technology), the image is viewed and stored on display monitors.
ANALOG (CONVENTIONAL IMAGING TECHNOLOGY)...

This is the traditional method that is often referred to as film-based radiography.

The need for processing chemicals, the use of a dark room, the need for human resources, as well as the difficulty to maintain high quality images are all factors that limit the wide-scale use of this method.
ANALOG TECHNOLOGY ...

Chemical Processing

X-Ray

Exposure

Invisible Latent Image

Developer

Fixer

Wash

Dry

Sprawls
DIGITAL (COMPUTED) IMAGING TECHNOLOGY...

This technology eliminates the need for dark-room and chemical processing of the film, since **reusable phosphor plates** are used as **image receptors** and are scanned by **CR reader** (digitizer with laser scanner)..

Laser scanner (CR-reader) convert the stored information into digital images., the image receptor then erased prior to the next use.
DIGITAL TECHNOLOGY...

Digital Radiography System

- Receptor
- Image Processor
- Image Management System
- Display
- Display Control
- Patient Information System
- Storage
- Communications Network
- Sprawls
RADIOGRAPHY DEVELOPMENT...

**Film**
Expose an image on X-ray film and develop it in a darkroom.

**CR (Computed Radiography)**
Store X-ray images on imaging plates (that can be used again, but are a consumable) and digitize them. CR developed by Fujifilm are called FCR.

**DR (Digital Radiography)**
When the sensor detects X-rays, an electrical signal is emitted by a flat panel detector and creates an image. The flat panel detector is built into the device, and no consumables are needed.

* Amount of X-ray exposure: Film > CR > DR
**Radiography** :- The process and procedures of producing a radiograph.

**Image receptor (IR) :-** a device that changes the x-ray beam that pass through patient's body into a visible image. An image receptor may be a radiographic film and cassette or a special detector placed in a table...
IMAGE RECEPTOR...
LOOK TO THE DETECTOR...

Projectional radiography

X-ray generator

Object

X-ray detector

Radiograph
LOOK TO THE CASSETTE & FILM...

X-rays passing through hard tissue like bone (more dense) meet more resistance and leave a lighter image on the film.

X-rays passing through soft tissue like skin and muscle meet little resistance (less dense) and leave a darker image on the film.
**Central ray (CR) :-** refers to the centermost portion of the x-ray beam emitted from the x-ray tube (the portion of the x-ray beam that has the least divergence).
RADIOGRAPHIC EXAMINATION ...

A radiologic technologist is shown positioning a patient for a routine chest examination as shown in the figure below.
A radiographic examination involves 5 general functions:-

1. Positioning of body part and alignment with the IR and CR
2. Application of radiation protection measures and devices
3. Selection of exposure factors.
4. Instructions to the patient related to breathing and initiation of the x-ray exposure
5. Processing of the IR
   - film-based >>> chemical processing (analog technology)
   - Computer based >>> digital processing (digital technology)
ANATOMIC POSITION...

The anatomic position :-

is a reference position that defines specific surfaces and planes of the body..

The anatomic position is an upright position with arms abducted slightly (down), hands by side with palms forward, head and feet together and directed straight ahead ...
Anatomic position
BODY PLANES , SECTIONS , AND LINES...

Positioning terms that describe Central ray angles or relationships between body parts often are related to imaginary planes that pass through the body in the anatomic position.

The study of CT, MRI and sonography emphasizes sectional anatomy, which also involves the primary body planes and sections as described subsequently.
It is straight line connecting two points

Four common planes as used in medical imaging are :-

1. Sagittal >>> green color
2. Coronal >>> purple color
3. Axial (horizontal) >>> light blue color
4. Oblique >>> orange color
PLANES...

A sagittal plane is any longitudinal plane that divides the body into right and left parts..

Coronal Plane is any longitudinal plane that divides the body into anterior and posterior parts ...

Horizontal (Axial) Plane is any transverse plane that passes through the body at right angles (90 degree) to longitudinal plane, dividing the body into superior and inferior portions..

Oblique Plane is a longitudinal or transverse plane that is at an angle not parallel to the sagittal, coronal, or horizontal plane.
Body sections are divided by planes

- Sagittal plane (median plane)
- Transverse plane (horizontal plane)
- Coronal plane (frontal plane)
SECTIONS ...

Longitudinal Sections :-

These sections or images run in the direction of the long axis of the body or any of its parts, regardless of the position of the body (erect or recumbent).

Transverse or Axial Sections (Cross-Sections):-

Sectional images are at right angles along any point of the longitudinal axis of the body or its parts (Fig. 1.40)
Terms of the back and front of the body:

**Posterior or Dorsal:**

refers to the back half of the patient, or the part of the body seen when the person is viewed from the back as demonstrated in the anatomic position. (colored purple)

**Anterior or Ventral:**

refers to front half of the patient, or the part seen when viewed from the front in the anatomic position. (colored tan)
Terms of surfaces of the feet :-

**Plantar surface:-** refers to the sole or posterior surface of the foot.

**Dorsal surface:-** refers to the dorsum or anterior surface of the foot.
Terms of surfaces of the hand:-

**Dorsal surface** :- refers to the back or posterior aspect of the hand..

**Palmar surface** :- refers to the palm of the hand in the anatomic Position..
RADIOGRAPHIC PROJECTIONS...

Projection: is a positioning term that describes the path of the cr of the x-ray beam as it passes through the patient, projecting an image onto the IR.

Although the term *position* is used in the clinical setting, the term *projection* is considered to be the **most accurate term** for describing how the procedure is performed.
Posteroanterior Projection (PA) :

(PA) projection refers to a projection of the CR from posterior to anterior..

Combines these two terms, posterior and anterior, into one word, abbreviated as PA.

The CR enters at the posterior surface and exits at the anterior surface (PA-projection) ..
Anteroposterior Projection (AP) :-

(AP) projection refers to a projection of CR from anterior to posterior,
Combines these two terms, anterior and posterior, into one word.
Describes the direction of travel of the CR, which enters at an anterior surface and exits at a posterior surface (AP-PROJECTION)…
AP Oblique Projection:-

An AP projection of the upper or lower limb that is rotated is called “oblique.” This is not a true AP projection and must include a qualifying term that indicates which way it is rotated, such as medial or lateral rotation.

With an AP oblique projection, the CR enters the anterior surface and exits the posterior surface of the body or body part.

# AP-oblique projection with medial rotation
PA Oblique Projection:-

PA projection with rotation, also it must include a qualifying term that indicates which way it is rotated.

With a PA oblique projection, the CR enters the posterior surface and exits the anterior surface of the body or body part.

PA oblique projection with lateral rotation.
Mediolateral and Lateromedial Projections:-
Described according to the path of the CR
In the case of the **mediolateral ankle projection**, the CR enters the *medial aspect and exits the lateral aspect of the ankle*..

**Mediolateral projection (ankle)**..
In the case of the **lateromedial projection**, the CR enters the *lateral* aspect and exits the *medial* aspect of the wrist..

**Lateromedial projection (wrist)**..
BODY POSITIONS ...

General body positions

1. Supine
2. Prone
3. Erect
4. Recumbent
5. Trendelburg
6. Fowler
7. Sims
8. Lithotomy
SUPINE POSITION...

Lying on back facing upward…
PRONE POSITION...

lying on abdomen facing downward (head may be turned to one side)…
ERECT POSITION...

An upright position to stand or sit erect…
RECUMBENT POSITION...

Lying down in any position (prone, supine, or on side).

- dorsal recumbent >>>>> Lying on back (supine).
- Ventral recumbent >>>>> Lying face down (prone).
- lateral recumbent >>>>> Lying on side (right or left lateral).
TRENDELENBURG POSITION...

A recumbent position with body tilt *(head lower than feet)*...
FOWLER POSITION...

A recumbent position with body tilt *(head higher than feet)*...
SIMS POSITION ...

A recumbent oblique position with the patient lying on the left Anterior side, with the right knee and thigh flexed and the left arm extended down behind the back.

A modified Sims position used for insertion of the rectal tube for barium enema as shown
LITHOTOMY POSITION...

A recumbent (supine) position with knees and hip flexed and thighs abducted and rotated externally, supported by ankle supports.

This position is seen frequently in the surgical suite for certain urinary studies.
BODY POSITIONS ...

Specific body positions

In addition to a general body position, the second way the term position is used in radiography is to refer to a specific body position described by the body part closest to the IR (oblique and lateral) or by the surface on which the patient is lying (decubitus).
LATERAL POSITION...

Lateral Position:- refers to the side view. A true lateral position is always 90° to a true AP or PA projection. If it is not a true lateral so, it is an oblique position.

Specific lateral positions:- described by the part closest to the image receptor (IR)...

A right lateral position is shown with the right side of the body closest to the image receptor (IR) in the erect position.
OBLIQUE POSITIONS...

**Oblique Positions:** refers to an angled position in which neither the sagittal nor the coronal body plane is perpendicular to the IR.

Oblique body positions of the thorax, abdomen, or pelvis are described by the part closest to the IR..

**Posterior oblique:** is an oblique position describing the posterior aspect of the body close to the IR (either right or left, erect or recumbent)..
Erect LPO position

Recumbent LPO position
**Anterior oblique**: is an oblique position describing the anterior aspect of the body close to the IR (either right or left, erect or recumbent).

**Erect RAO position**

**Recumbent RAO position**
DECUBITUS POSITION...

The word decubitus (de-ku′bi-tus) literally means to “lie down”… This term describes a patient who is lying on one of the following body surfaces: back (dorsal), front (ventral), side (right or left lateral)…

In radiographic positioning, decubitus is always performed with the central ray horizontal..

*(don't forget the CR is horizontal)*
Dorsal decubitus position
LATERAL DECUBITUS...

In this position, the patient lies on the side (Right or Left), and the x-ray beam is directed horizontally from anterior to posterior (AP) or from posterior to anterior (PA).

Left Lateral decubitus position (AP projection).
DESCRIBE THE POSITION?

PROJECTION?

???????????
ANSWER IS ...

Position >>> right lateral decubitus

Projection >>> PA – projection
The position is named according to the surface on which the patient is lying (dorsal or ventral) and by the side closest to the IR (right or left).

The projection is named according to the pathway of the CR.
TANGENTIAL PROJECTION...

**Tangential** (ta¨-jen¨-shal)

means touching a curve or surface at only one point.

This is a special use of the term projection to describe the central ray that skims a body part to project the anatomy into profile and free of superimposition of surrounding body structures.
EXAMPLES

Following are two examples or applications of the term tangential projection:

• Tangential projection of zygomatic arch >> CR

• Tangential projection of patella
AXIAL PROJECTION ...

refers to the long axis of a structure or part
the term axial is used to describe any angle of the CR of 10° or more on the long axis of the body or body part.
AP AXIAL PROJECTION – LORDOTIC POSITION

This is a specific AP axial chest projection to visualize the apices of the lungs. It also is called the AP-Lordotic view. In this case, the long axis of the body is angled not the CR.

The term Lordotic comes from Lordosis, a term that denotes curvature of the cervical and lumbar spine.
AP LORDOTIC CHEST POSITION
WISH YOU THE BEST...

Thank you

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