

Robotic-Assisted Shoulder Replacement

Anatomy & Pathophysiology

BONY ANATOMY

- The proximal humerus comprises four main parts: the humeral head, greater tuberosity (GT), lesser tuberosity (LT), and humeral shaft [3].
- The articular head of the humerus is spherical with a diameter of 37 to 57 mm [3].
- The most superior portion of the articular surface of the humeral head averages 8 mm above the greater tuberosity [3].
- Humeral version averages 29.8 degrees, with a range of 10 to 55 degrees [3].
- The humeral head is inclined approximately 130 degrees with respect to the humeral shaft [3].
- The neck-shaft angle measures an average of 135 degrees [4].
- The humeral head is retroverted an average of 30 degrees [4].
- The humeral head averages 19° of retroversion and 41° of inclination (neck-shaft angle) [6].
- The articular surface of the humeral head is essentially spherical, with an arc of approximately 160 degrees covered by articular cartilage [15].
- The radius of curvature of the humeral head is approximately 25 mm and is slightly larger in men than in women [15].
- The average neck-shaft angle is 45 degrees (± 5 degrees), with a range of 30 to 50 degrees [15].
- Arthritic shoulders have a flatter neck-shaft angle close to 50 degrees [15].
- The superior margin of the humeral head articular surface is normally superior to the top of the greater tuberosity by 8 to 10 mm [15].
- The distance from the lateral base of the coracoid process to the lateral margin of the greater tuberosity is called the lateral humeral offset [15].
- A significant decrease in lateral humeral offset reduces the lever arms for the deltoid and supraspinatus muscles, weakening abduction and impairing function [15].
- A significant increase in lateral humeral offset causes excessive tension on the soft tissues (“overstuffing” of the joint), resulting in loss of motion and likely accelerating polyethylene wear [15].

- Humeral articular malposition of more than 4 mm leads to increased subacromial contact [15].
- An offset of 8 mm in any direction significantly decreases passive range of motion [15].
- Proximal humeral retroversion is highly variable, ranging from 0 to 55 degrees depending on the method used for measurement [15].
- The glenoid is a convex structure of shallow depth shaped like an inverted pear [3].
- The glenoid cavity is a shallow socket, approximately one third the size of the humeral head [4].
- The subchondral bone of the glenoid is relatively flat, and the articular concavity is augmented by cartilage and a circumferential labrum [6].
- The glenoid averages 5° of retroversion in relation to the axis of the scapular body [6].
- The normal position of the glenoid surface in relation to the axis of the scapular body ranges from 2 degrees of anteversion to 7 degrees of retroversion [15].
- The glenoid articular surface radius of curvature is 2 to 3 mm larger than that of the humeral head [15].
- The glenoid diameter ranges from 18-30 mm superior anteroposterior, 21-35 mm inferior anteroposterior, and 30-48 mm superoinferior [15].
- The glenoid inclination averages 4.2 degrees, with a range of -7 to 20 degrees [15].
- The glenoid version averages 1.5 degrees retroversion, with a range of 10.5-9.5 degrees anteversion [15].
- The glenoid surface area is 4-6 mm [15].
- The humeral head surface area is 11-19 mm [15].
- The glenoid cartilage thickness is 2.16 mm [15].
- The humeral head cartilage thickness is 1.44 mm [15].
- The glenoid radius of curvature is 22-28 mm [15].
- The humeral head radius of curvature is 23-28 mm, smaller in women than men [15].
- The medial (coronal) humeral offset is 4-14 mm [15].
- The posterior (transverse) humeral offset is -2 to 10 mm [15].
- The head-shaft angle is 30-55 degrees [15].
- The scapula is attached to the axial skeleton by the clavicle, specifically via the acromioclavicular (AC) and sternoclavicular (SC) joints [5].
- The scapula is separated from the chest wall by thin gliding fibro-fatty tissue, allowing smooth excursion over the chest wall [5].
- The basic part of the scapula is the body, which is triangular when viewed anteroposteriorly with its base situated superiorly and its apex inferiorly [5].
- The glenoid is connected with the flat body of the scapula by the scapular neck [5].
- The hook-shaped coracoid process curves forwards from the superior surface of the scapular neck [5].
- The scapular spine ends in a flattened bony process, the acromion, which curves forwards [5].

- The highest concentration of bony mass in the scapula is found in the glenoid, the scapular neck (including the base of the coracoid process), and the lateral border of the scapular body [5].
- Two bony pillars transmit compressive forces from the glenoid fossa: the lateral pillar and the spinal pillar [5].
- The lateral pillar connects the inferior border of the glenoid with the inferior angle [5].
- The spinal pillar arises from the central part of the glenoid and continues medially to become part of the base of the scapular spine [5].
- The triangle formed by the two pillars and the medial border constitutes the biomechanical body of the scapula [5].
- The weakest bone in the scapula is located primarily in the central part of the biomechanical body, i.e., in the infraspinous fossa [5].
- The weakest area of the circumference of the biomechanical body of the scapula is the spinomedial angle, where the scapular spine connects to the medial border [5].
- The clavicle is the first bone to ossify at the fifth week of gestation and is the only long bone to ossify by intramembranous ossification [6].
- The medial (sternal) epiphysis of the clavicle is the last ossification center to fuse, at age 20 to 25 years [6].
- The primary blood supply to the clavicle is periosteal, and no nutrient artery is present [6].
- The scapula has only one true diarthrodial articulation, the acromioclavicular (AC) joint [6].
- Normal shoulder motion is approximately two-thirds glenohumeral and one third scapulothoracic [6].
- Ossification of the scapular body begins at the eighth week of gestation [6].
- The acromion has three ossification centers: the metacromion (base), the mesoacromion (middle), and the preacromion (tip) [6].
- Failure of fusion of the acromial ossification centers results in os acromiale [6].
- The coracobrachialis muscle and the short head of the biceps tendon originate from the coracoid process [6].
- The pectoralis minor muscle inserts onto the medial coracoid process [6].
- The proximal humerus has three centers of ossification: the humeral head (4 to 6 months), the greater tuberosity (1 to 3 years), and the lesser tuberosity (3 to 5 years) [6].
- The proximal humeral ossification centers fuse to the shaft at age 17 to 20 years [6].
- The humeral head is retroverted 30 degrees relative to the transepicondylar axis of the humerus [17].
- Head height is approximately 5.6 cm above the superior border of the pectoralis major tendon [17].
- The anatomic neck is located directly below the humeral head and serves as an attachment for the shoulder capsule [17].
- The surgical neck is more distal than the anatomic neck and is more often involved in fractures [17].
- The scapula spans second through seventh ribs and serves as an attachment for 17 muscles [17].
- The scapula is anteverted on the chest wall approximately 30 degrees relative to the body [17].

- The glenoid is retroverted approximately 5 degrees relative to the scapular body [17].
- Os acromiale is incomplete fusion of secondary ossification centers, most commonly between the mesoacromion and meta-acromion [17].
- The coracoacromial ligament contributes to anterosuperior stability in rotator cuff deficiency and should be preserved with irreparable cuff tears to prevent anterosuperior escape [17].
- The acromial branch of the thoracoacromial artery runs on the medial aspect of the coracoacromial ligament [17].
- The coracoacromial ligament is the arthroscopic landmark for a complete release of the rotator interval for adhesive capsulitis [17].
- The clavicle is the first bone in the body to ossify at 5 weeks gestation and last to fuse with the medial epiphysis at 25 years of age [17].
- Fracture of the clavicle is the most common musculoskeletal birth injury [17].

VASCULAR SUPPLY

- The proximal humerus receives its blood supply from the anterior and posterior humeral circumflex branches from the third division of the axillary artery [3].
- The posterior humeral circumflex artery travels with the axillary nerve, enters the quadrilateral space posteriorly, and anastomoses with a branch of the anterior circumflex to supply the posterior cuff [3].
- The anterior humeral circumflex artery (AHCA) arises from the axillary artery at the inferior border of the subscapularis [3].
- The AHCA provides vascular inflow to the humeral head by way of its terminal anterolateral branch known as the artery of Laing (also known as the arcuate artery) [3].
- The ascending branch of the AHCA courses parallel to the lateral aspect of the long head biceps tendon and enters the humeral head at the interface of the bicipital groove and greater tuberosity [3].
- Injury to the arcuate artery may result in osteonecrosis of the humeral head [3].
- Additional extraosseous collateral branches can permit humeral head perfusion despite complete ligation of the arcuate artery [3].
- The major blood supply to the humeral head is through the ascending branch of the anterior humeral circumflex artery, which penetrates the head at the bicipital groove and becomes the arcuate artery [4].
- The anterolateral ascending branch of the anterior humeral circumflex artery provides the primary blood supply to the humeral head [6].
- The terminal intraosseous portion of the anterior humeral circumflex artery enters at the proximal aspect of the intertubercular groove as the arcuate artery [6].
- The anterior and posterior humeral circumflex arteries provide a rich blood supply to the proximal humerus [10].
- Quantitative assessment has shown that 64% of the humeral head blood supply arises from the posterior humeral circumflex artery [10].
- The primary blood supply to the clavicle is periosteal, and there is no nutrient blood supply [12].

MUSCLES AND TENDONS

- The greater tuberosity serves as the attachment site for the supraspinatus, infraspinatus, and teres minor tendons of the rotator cuff [3].
- The lesser tuberosity serves as the attachment site for the subscapularis tendon [3].
- The bicipital groove lies between the greater and lesser tuberosities and serves as a pathway for the long head of the biceps [3].
- The distal aspect of the bicipital groove is internally rotated with respect to the proximal portion [3].
- The rotator cuff consists of four muscles: the subscapularis, supraspinatus, infraspinatus, and teres minor [4].
- The teres major is not a rotator cuff muscle [4].
- The cuff muscles serve as depressors of the humeral head to allow the deltoid to efficiently abduct the humerus [4].
- The infraspinatus and teres minor are external rotators, while the subscapularis is an internal rotator of the humerus [4].
- The deltoid and pectoralis major muscles, along with the rotator cuff, cause predictable displacement of fractures around the proximal humerus [4].
- The rotator cuff is a sheet of conjoined tendons closely applied over the shoulder capsule and inserting mainly into the greater tuberosity of the humerus, with the subscapularis inserted into the lesser tuberosity [11].
- The rotator cuff has an important function in stabilizing the head of the humerus by pulling it firmly into the glenoid whenever the deltoid lifts the arm forwards or sideways [11].
- The rotator cuff must act simultaneously and synergistically with the deltoid muscle for normal function [15].
- The extrinsic muscles primarily control movement of the scapula and include the rhomboids, levator scapulae, trapezius, and serratus anterior [16].
- The intrinsic muscles control the glenohumeral joint and include the rotator cuff muscles, deltoid, pectoralis major, teres major, latissimus dorsi, and biceps brachii [16].
- The tendinous insertions of the rotator cuff muscles, the articular capsule, the coracohumeral ligament, and the glenohumeral ligament complex blend into a confluent sheet before insertion into the humeral tuberosities [16].
- The tendons of the infraspinatus and supraspinatus muscles join approximately 15 mm proximal to their insertion and cannot be readily separated by blunt dissection [16].
- The infraspinatus and teres minor fuse near their musculotendinous junctions [16].
- The supraspinatus and subscapularis tendons join as a sheath that surrounds the biceps tendon at the entrance of the bicipital groove [16].
- The roof of the biceps sheath consists of a portion of the supraspinatus tendon, and a sheet of the subscapularis tendon forms the floor [16].

- The coracohumeral ligament is a thick band of fibrous tissue extending from the coracoid process along the surface of the capsule to the tuberosities between the supraspinatus and subscapularis tendons [16].
- The coracohumeral ligament is deep to the tendinous insertion of the cuff and blends with the capsule and supraspinatus tendon to form part of the roof of the biceps sheath [16].
- The deltoid has anatomic subdivisions including acromial, clavicular, and scapular portions [8].
- The deltoid is a well-defined muscle that is easily resected but extremely difficult to reconstruct functionally after proximal humeral resections for bone tumors [8].
- The subscapularis originates from the anterior scapula and inserts anteriorly onto the lesser tuberosity [10].
- The greater tuberosity provides attachment superiorly and posteriorly for the supraspinatus, infraspinatus, and teres minor, all of which originate from the posterior scapula [10].
- The deltoid forward flexes and abducts the shoulder and courses from the clavicle and acromion superiorly, coalescing into a common tendinous insertion onto the lateral upper third of the humeral shaft [10].
- The pectoralis major powers adduction and internal rotation due to its tendinous insertion anteriorly onto the lateral wall of the bicipital groove [10].
- The pectoralis major forms the roof of the distal continuation of the bicipital tunnel, which is a closed space that extends proximally to the glenohumeral joint [10].
- The infraspinatus and teres minor muscles are more effective in their roles as depressors and external rotators of the humeral head due to evolutionary changes in the vector of muscle pull from the axillary border of the scapula to the glenoid fossa [13].
- The acromion has enlarged over time to reflect the increasing role of the deltoid muscle in shoulder function [13].
- The broader attachment of the deltoid on the acromion and its more distal insertion on the humerus have increased its mechanical advantage in shoulder motion [13].

LIGAMENTS AND STABILITY

- The glenohumeral joint depends on static and dynamic stabilizers for movement and stability, especially the rotator cuff [15].
- The rotator cuff stabilizes the glenohumeral joint while allowing greater freedom of motion and fixes the fulcrum of the upper extremity against which the deltoid can contract and elevate the humerus [15].
- The shoulder joint is composed of four articulations: the sternoclavicular, acromioclavicular, glenohumeral, and scapulothoracic [16].
- The bony anatomy contributes little to stability and has been compared with

Investigations

PLAIN RADIOGRAPHY

- The purpose of shoulder imaging is to establish diagnosis, determine pathoanatomy severity, assist in surgical planning, and illustrate the condition to the patient [2].
- Standardized plain films are almost always sufficient to garner the information needed for care [2].
- CT scans may offer increased precision in measuring glenoid version, but this precision does not necessarily improve the quality of surgery or clinical outcome [2].
- The first key radiographic view is the anteroposterior (AP) view in the plane of the scapula, taken so the x-ray beam passes through the glenohumeral joint [2].
- The AP view in the plane of the scapula shows the superoinferior position of the humeral head relative to the glenoid, presence of osteophytes, joint space narrowing, degree of medial humeral displacement, bone quality, loose bodies, and humeral head collapse or deformity [2].
- The second key radiographic view is the axillary view taken with the arm in the functional position of elevation in the plane of the scapula [2].
- The axillary view is oriented so that both the spinoglenoid notch and the scapular neck are visible [2].
- The axillary view demonstrates glenohumeral relationships in the functional position of elevation, referred to as the “truth view” [2].
- CT scans have the disadvantage of being taken with the arm in the adducted position, unlike the axillary truth view [2].
- The standardized axillary view shows the thickness of the cartilage space, relative positions of the humeral head and glenoid, presence of osteophytes, degree of osteopenia, and extent of bony deformity and erosion [2].
- Joint space narrowing is most evident on the axillary truth view because arthritis usually involves the central aspect of the humeral head [2].
- The axillary truth view can show posterior subluxation or “functional decentering” that is not evident in images taken with the arm at the side [2].
- The degree of posterior subluxation can be measured by the position of the center of the humeral head in relation to the plane of the scapula [2].
- The degree of posterior subluxation can be measured by the position of the center of the humeral head in relation to the glenoid face [2].
- The degree of posterior subluxation can be measured by the point of contact of the humeral articular surface on the glenoid articular surface [2].
- The point of contact measurement reflects the degree of centering of the net humeral joint reaction force on the glenoid [2].
- Malcentering of the joint reaction force leads to posterior instability, posterior glenoid wear, and “rocking horse” loosening of prosthetic glenoid components [2].

- At least two X-ray views should be obtained: an anteroposterior in the plane of the glenoid and an axillary projection with the arm in abduction [20].
- The standard shoulder series should include a true AP view in the scapular plane, an AP view, an axillary view, and a scapular Y view [28].
- The true AP view in the scapular plane visualizes the anterior greater tuberosity in profile and can reveal proximal humeral migration [28].
- The AP view with the arm in internal rotation visualizes the posterior aspect of the greater tuberosity and the lesser tuberosity in profile [28].
- The axillary view is necessary for evaluating glenohumeral joint instability and determining humeral head position in the glenoid fossa [28].
- The axillary view may detect occult, locked posterior shoulder dislocation in a patient who exhibits a lack of passive external rotation [28].
- The scapular Y view provides visualization of the coracoacromial arch and can reveal coracoacromial spurs associated with rotator cuff pathology [28].
- The scapular Y view is a reliable alternative for evaluating glenohumeral subluxation and dislocation [28].
- The acromiohumeral distance is normally 7 to 14 mm [28].
- The width of the glenohumeral joint space should be symmetric superiorly and inferiorly [28].
- The coracoclavicular distance is normally 1.1 to 1.3 cm [28].
- Neer classified acromial morphology as type I (flat), type II (curved), and type III (hooked) [28].
- Type III acromial morphology has a correlation with the presence of rotator cuff disease, but no direct causal relationship has been demonstrated [28].
- The Neer trauma series consists of an AP view, a lateral view in the scapular plane, and a Velpeau modified axillary view [22].
- The lateral radiograph in the scapular plane is the tangential Y-view of the scapula [22].
- The combination of the three views in the Neer trauma series allows evaluation of the shoulder joint in three separate perpendicular planes [22].
- The axillary view is important for evaluating the glenoid articular surface and the relationship of the humeral head anteriorly and posteriorly [22].
- Conventional radiographs are appropriate for patients presenting with shoulder pain with any history of trauma, dislocation, night pain, or chronic shoulder pain [28].
- Arthritis, calcific tendinitis, and osteolysis of the distal clavicle can be observed on plain radiograph [27].

COMPUTED TOMOGRAPHY (CT)

- CT is helpful for planning fracture surgery and shoulder joint replacement [20].
- CT imaging is frequently used to evaluate fractures of the shoulder, assess bony lesions in recurrent instability cases, or for preoperative templating for shoulder arthritis [27].

- CT with three-dimensional reconstructions is the advanced imaging study of choice for determining the extent of glenoid bone loss in the setting of shoulder instability [28].
- Three-dimensional sagittal CT scans allow for optimal evaluation of displaced glenoid fractures [28].
- Three-dimensional reconstructions can reveal fine details of shoulder anatomy, but this additional information rarely changes the planning or conduct of the arthroplasty [2].

MAGNETIC RESONANCE IMAGING (MRI)

- MRI is useful to identify osteonecrosis of the humeral head, or a bone tumour [20].
- MRI can identify labral tears and rotator cuff tears, although accuracy for these is enhanced by combining the scan with arthrography [20].
- MRI is the modality of choice for evaluating the rotator cuff, biceps, and subacromial/subdeltoid bursa [27].
- T1-weighted MRI can reveal Hill-Sachs lesions [27].
- T2-weighted MRI provides better visualization of full thickness rotator cuff tears [27].
- Traditional MRI is utilized for evaluation of soft tissues with high contrast and spatial resolution [25].
- MR accuracy in identifying labral and rotator cuff tears in the literature ranges from 70% to 100% [25].
- Acquired multi-planar imaging allows for the detailed evaluation of the glenoid, labrum, joint capsule, and rotator cuff in different planes [25].
- With standard MRI or MRA, the shoulder is routinely positioned in neutral or partial external rotation [25].
- Abduction and external rotation (ABER) of the arm is an alternative position utilized to increase the sensitivity and specificity for detecting anteroinferior labroligamentous injury [25].
- Limited range of motion or pain may prohibit patients from performing the ABER provocative maneuver [25].
- Full routine MRI or MRA examination had similar accuracy as the ABER sequence in evaluating the anteroinferior labral–ligamentous complex [25].
- The sensitivity of MRA with the ABER position for detecting anteroinferior labral lesions was significantly higher than that of MRA in neutral position [25].
- MRA with the ABER position is more effective in identifying Perthes lesions than MRA in neutral position [25].
- MRAs can demonstrate a patulous capsule on coronal, sagittal, and axial imaging in patients with multidirectional instability [25].
- MRAs can be helpful in evaluating lesions of the rotator interval and other associated findings that may affect the surgical plan [25].
- Glenoid dysplasia, increased capsular cross-sectional area, and increased glenoid retroversion have been found to be associated with increased posterior labral tears and symptomatic instability [25].
- Glenoid retroversion was significantly increased in patients with symptomatic posterior labral tears [25].

- There was no significant association between instability and increased humeral head subluxation in patients with multidirectional instability [25].
- The diagnosis of multidirectional instability is a clinical one, and the need for expensive or invasive imaging should be weighed against the information gained [25].

ARTHROGRAPHY

- Arthrography involves injection of contrast agent in conjunction with either an MRI or CT scan to enhance imaging of the joint [27].
- MR arthrography (MRA) refers to MRI of a joint that has been injected with an intra-articular contrast agent such as diluted gadolinium or saline solution [25].
- The contrast material is injected prior to MRI by fluoroscopic or ultrasound guidance under strict aseptic technique [25].
- By distending the joint capsule, the cartilage, ligaments, and labrum are outlined with contrast, increasing the sensitivity for detecting tears and other lesions [25].
- In the acute dislocation setting, a joint effusion with distension of the joint may outline structures similarly, making the arthrogram unnecessary [25].
- MRA has proven utility by increasing both sensitivity and specificity in detecting injuries to the capsulolabral–ligamentous complex compared to traditional MRI [25].
- A meta-analysis of 6 studies including 4,667 shoulders found greater diagnostic test accuracy for MRA over MRI in the detection of glenoid labral lesions [25].
- MRA sensitivity for detecting glenoid labral lesions was 88% and specificity was 93% [25].
- MRI sensitivity for detecting glenoid labral lesions was 76% and specificity was 87% [25].
- MR arthrography is considered the benchmark for evaluation of labral tears [27].
- MR arthrography is rarely indicated for evaluation of rotator cuff pathology [27].
- When MRI or MR arthrography is contraindicated, such as in patients with pacemakers or vascular clips, CT arthrography is indicated [27].

ULTRASONOGRAPHY

- Ultrasonography is a simple and accurate test for identifying rotator cuff tears and calcific tendinitis [20].
- Ultrasonography can be useful in guiding injections or barbotage, such as aspirating calcific deposits in the rotator cuff [20].
- Ultrasonography is a low-cost alternative to MRI and arthrography for evaluating both skeletal and soft-tissue structures of the shoulder [27].
- Ultrasonography can provide immediate, real-time visualization of the rotator cuff, biceps tendon, and calcific deposits [27].
- Ultrasonography can be used to measure the subacromial space [27].
- Ultrasonography can detect atrophy of rotator cuff muscles [27].

- As a result of providing images in real-time, ultrasonography can evaluate impingement in various positions and motions [27].
- Ultrasonography is highly operator dependent [27].
- Ultrasonography is not as useful for evaluating labral tears or rotator cuff tears that are very small or larger than 3 cm [27].
- The most commonly performed joint examination using ultrasonography is the shoulder examination [18].
- Accuracy of rotator cuff ultrasonography depends on the skill of the scanner operator and an awareness of pitfalls encountered [18].
- Ultrasonography can pick up on partial tears that may need treatment but have normal physical examination findings due to the ability to move the tendon with direct visualization [18].
- In a study of 147 patients with rotator cuff calcific tendinitis treated with ultrasonography-guided lavage, 70% of shoulders resulted in significant reduction of symptoms [18].
- Calcifications that were softer and middle-sized (12 to 17 mm) had more significant improvement after ultrasonography-guided lavage [18].
- Better results after ultrasonography-guided lavage occurred in patients aged 30 to 40 years [18].
- The sensitivity of ultrasonography for the detection of full-thickness rotator cuff tears is 98% [28].
- The specificity of ultrasonography for the detection of full-thickness rotator cuff tears is 80% [28].
- The positive predictive value of ultrasonography for the detection of full-thickness rotator cuff tears is 90% [28].
- The negative predictive value of ultrasonography for the detection of full-thickness rotator cuff tears is 95% [28].
- The accuracy of ultrasonography for the detection of full-thickness rotator cuff tears is 94% [28].
- The sensitivity of MRI for the detection of full-thickness rotator cuff tears is 100% [28].
- The specificity of MRI for the detection of full-thickness rotator cuff tears is 68% [28].
- The positive predictive value of MRI for the detection of full-thickness rotator cuff tears is 85% [28].
- The negative predictive value of MRI for the detection of full-thickness rotator cuff tears is 100% [28].
- The accuracy of MRI for the detection of full-thickness rotator cuff tears is 89% [28].

GENERAL IMAGING PRINCIPLES

- The shoulder is a three-dimensional structure that cannot be represented by a single planar view [23].
- Critical relationships, such as the degree of centering of the humeral head, change with the position of the arm [23].
- Shoulder pathology may be found in a large number of different bones and soft tissues [23].
- Overlying and superimposed structures as well as metallic implants may complicate imaging the structures of interest [23].

- Surgeons need to develop a judicious approach to imaging that yields necessary information while avoiding the tendency to “over-image” [23].
- Proper radiographic technique is as important as proper surgical technique to achieve the desired outcome [2].
- Radiograph technologists must know what is being sought in the images to ensure proper technique [2].
- Many “axillary views” sent for consultation are taken without standardization, making it impossible to determine important features of the glenohumeral joint [2].

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