Diagnostic Shoulder Arthroscopy and Arthroscopic Anatomy

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11.1 Overview and Brief History

Shoulder arthroscopy is an increasingly more common procedure in orthopedic surgery with broader indications. This is in part due to increased demand by patients, many of whom believe that less invasive surgery is inherently superior. By utilizing arthroscopy, a wide variety of pathology can now be treated in outpatient surgery centers, which facilitates the efficiency with which the surgeries are performed.

Shoulder arthroscopy was first described in 1931 as a means of anatomic evaluation in cadavers [1]. It was not until 1965 that the first clinical use of shoulder arthroscopy was described, as a means of capsular distension in rigid shoulders [2]. Since that time, shoulder arthroscopy has developed into a mainstay of orthopedics, with expanding indications for management of nearly all common shoulder pathologies. Recent data suggests that approximately 530,000 arthroscopic shoulder surgeries are performed in the United States alone each year, with rates steadily increasing [3].

There is still debate in the literature as to the differences in outcomes when comparing arthroscopic vs. mini-open and open shoulder surgery [4–8]. Broadly, the outcomes are favorable, and complication rates are low in all techniques. All-arthroscopy technique allows for less soft tissue disruption, specifically as related to the deltoid, as well as improved visualization of the intra-articular structures. Arthroscopy is associated with decreased shoulder stiffness, improved postoperative pain scores, and improved cosmesis limited to portal scars [8, 9]. However, this decreased dissection of native anatomy has traditionally come with steeper surgeon learning curves and limitations of the available fixation techniques. Additionally, careful portal placement is required to avoid neurologic injury, and meticulous arthroscopic technique is essential to prevent iatrogenic damage to important intra-articular structures.

In the half century since its clinical introduction, shoulder arthroscopy has rapidly advanced, becoming one of the most versatile tools in orthopedic surgery. As a new generation of surgeons trained with arthroscopy becomes increasingly more proficient, the use of arthroscopy can only be expected to continue to rise. This chapter will discuss basic preoperative planning considerations and intraoperative technique that lead to successful shoulder arthroscopy. Mastery of applied shoulder anatomy and access to these structures with arthroscopy will aid the orthopedic surgeon in the management of a wide variety of shoulder pathologies.

11.2 Anesthesia

General anesthesia and a variety of regional anesthetic options are available for use in shoulder arthroscopy. In isolation, these techniques have specific advantages and disadvantages. However, it is common that anesthetic methods are performed in conjunction, with the ultimate goal of providing safe patient care, optimal intraoperative conditions for the surgical and anesthesia teams, and intraoperative and postoperative comfort for the patient.

General anesthesia provides a reliable control of the patient and of the surgical field intraoperatively. Its effects can be easily prolonged or reversed, allowing for improved flexibility when dealing with perioperative complications. The presence of a secured airway is advantageous in the setting of unanticipated increase in the duration of a procedure or intraoperative complication. Finally, not all patients are comfortable with the utilization of regional anesthetic injections due to the reports of neurologic complications, as discussed below.

Patient comorbidities can lead to higher complication rates associated with general anesthesia, specifically patients

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with significant pulmonary or coronary conditions. The anesthetic agents used in general anesthesia have been implicated to increase cerebral desaturation events (CDEs) as compared to regional anesthesia techniques. For patients placed in the beach-chair position intraoperatively, this can lead to dramatic differences in the prevalence of cerebral desaturations [10, 11].

Regional anesthesia has increased in popularity and is now routinely used, often in addition to general anesthesia. The most common form of regional anesthesia is the interscalene block. The supraclavicular block is also well described. These methods have been shown to be a safe and effective tool for shoulder procedures and consistently improve patient perioperative pain scores and decrease opiate use [12]. Regional analgesia may also indirectly result in improved visualization intraoperatively. Due to the sensory nerve disconnect, there is no innate sympathetic response to painful stimuli. This results in decreased catecholamine response, allowing for more relative vasodilation and bradycardia that results in decreased blood pressures and therefore improved arthroscopic visibility [13].

The reported complications of regional anesthesia include brachial plexus injury, phrenic nerve palsy, Horner syndrome, and spinal/epidural infiltration [14]. The current literature demonstrates that the rate of these complications is exceedingly low with the use of imaging during the administration of regional anesthesia [12, 15].

Postoperative pain control is one of the most important factors in patient satisfaction. However, the drive for improved pain scores must be balanced with the detrimental effects that have been associated with opioid medications, commonly used as a pivotal component in postoperative pain control. With regard to postoperative analgesia, regional anesthesia has clear advantages over general anesthesia and can be extended well beyond the surgical procedure with the use of longer-acting analgesics as well as indwelling catheters [12].

There are many factors to consider when deciding the optimal anesthetic and analgesic plan for each patient. When carefully evaluated, the current available practices provide reliable outcomes for patient safety and satisfaction while undergoing arthroscopic shoulder procedures.

11.3 Setup and Positioning

The vast majority of arthroscopic shoulder procedures are completed in either the beach chair or lateral decubitus positioning. There is no literature to suggest superiority of one position over the other. Rather, the optimal position for each surgery will depend on surgeon comfort and specific patient characteristics [16, 17].

Setup and positioning must allow for proper visualization of the operative field and proper access of the anesthesia team to the patient. Positional complications are most often skin, soft tissue, or neurologic injuries due to pressure or traction. Less commonly but more severe are the spectrum of hypoperfusion injuries that can occur. The literature does not clearly indicate an effect of positioning on operative time, and both procedures may require the assistance of additional OR staff for preoperative and intraoperative adjustments.

Possibly the most important factor in ensuring patient safety is having a team of physicians, residents, and OR support staff that are informed, experienced, and vigilant. These providers must work in unison to ensure patient safety.

11.3.1 Lateral Decubitus

The lateral decubitus position was the original position for shoulder arthroscopy, where the patient is laid laterally on a well-padded operating room table with the operative arm facing the ceiling. A vacuum bean bag or well-padded table positioners are utilized in securing the patient's torso and abdomen for the procedure. An axillary roll is used to protect the brachial plexus and vascularity of the nonoperative extremity; take care not to place this in the true axilla, as this can compress the structures it is intended to protect. Rather, the roll should be placed slightly more inferior on the chest wall to allow for decompression of the axilla. The head must be placed in a neutral position, and the knees well-padded and slightly flexed to avoid injury to the common peroneal nerve.

This position was developed to allow for gravity-assisted distraction of the joint, achieved by placing the operative extremity in a sling and applying longitudinal traction through a pulley system until the desired joint distraction was accomplished. A traction weight of 10 pounds is usually sufficient and should not exceed 12 pounds. Additional slings placed on the arm can be used for translation in a plane orthogonal to the direction of traction to improve intraoperative visibility. Ensure all bony prominences are well padded on the operative extremity, including the hand and wrist (Figs. 11.1 and 11.2).

11.3.1.1 Considerations

Traction injuries can occur in the lateral decubitus due to stretch of the brachial plexus in certain positions. The arm is usually placed in 10 degrees of flexion and 60 degrees of abduction to maximize visualization. A cadaveric study showed that visualization is optimal and plexus strain is minimal when the arm is placed in 45 degrees of flexion and either 0 or 90 degrees of abduction [18]. The traction devices

Fig. 11.1 Demonstration of the lateral decubitus positioning with use of battery-powered mechanical arm for axial traction

Fig. 11.2 An additional mechanical arm with well-cushioned positioner is used for orthogonal manipulation of the arm. In all photos, left arm is the operative extremity

can often lead to internal rotation of the glenohumeral joint, which must be recognized during the procedure to avoid postoperative loss of external rotation.

11.3.2 The Beach Chair

Skyhar et al. first described the beach chair position in the 1980s. This position was developed to address brachial plexus traction injuries and the difficulty of repositioning the arm, both limitations of the lateral decubitus position [17, 19]. Additionally, beach chair allows for easier conversion to an open procedure if necessary, although this is rare. A variety of beach chair tables and standard OR table attachments are available that allow for proper positioning. Transition from supine to beach chair must be done with extreme care, especially in patients under general anesthesia. Support and positioning of the head and neck must be carefully observed. The most common positional injuries are ulnar nerve and common peroneal nerve pressure palsies. Ensure these regions are well padded throughout the procedure. At our institution, the supine patient is first repositioned using the reflex button on the table, which flexes through the back and the hips to approximately 45–60 degrees. The knees are then slightly flexed to 30 degrees to further protect the common peroneal nerve. Finally, the back is adjusted upright until the patient is seated at 70–90 degrees. The nonsurgical arm is placed on a well-padded arm board, and the surgical arm is carefully protected until it is prepped, draped, and placed into a mechanical articulating limb positioner for use throughout the case (Fig. 11.3).

11.3.2.1 Considerations

Patient positioning and controlled hypotension have been carefully investigated to delineate their influence on CDEs. Multiple studies have shown that the beach chair position leads to an increase in intraoperative CDEs, suggesting as high as 80% of all shoulder arthroscopy patients in beach chair experience CDEs. Despite the fear that CDEs may lead to ischemia and permanent neurologic injury, the clinical importance of these events is still under investigation. The current recommendations in the anesthesia literature are to maintain systolic blood pressure > 90, avoid mean arterial pressure decreases >20% from preoperative baseline, and use sequential compression devices (Table 11.1) [17, 20].

11.4 Examination Under Anesthesia

A critical step is the performance of an examination once the patient is under anesthesia, either asleep or with a regional nerve block. In the clinic, examinations are often patient-limited due to pain, guarding, and apprehension. An examination under anesthesia provides the examiner with a far more accurate representation of the true range of motion and instability. It is useful to have OR staff document the values from the examination. At our institution, this is easily done on the same dry-erase board that is used for the information contained in the time-out.

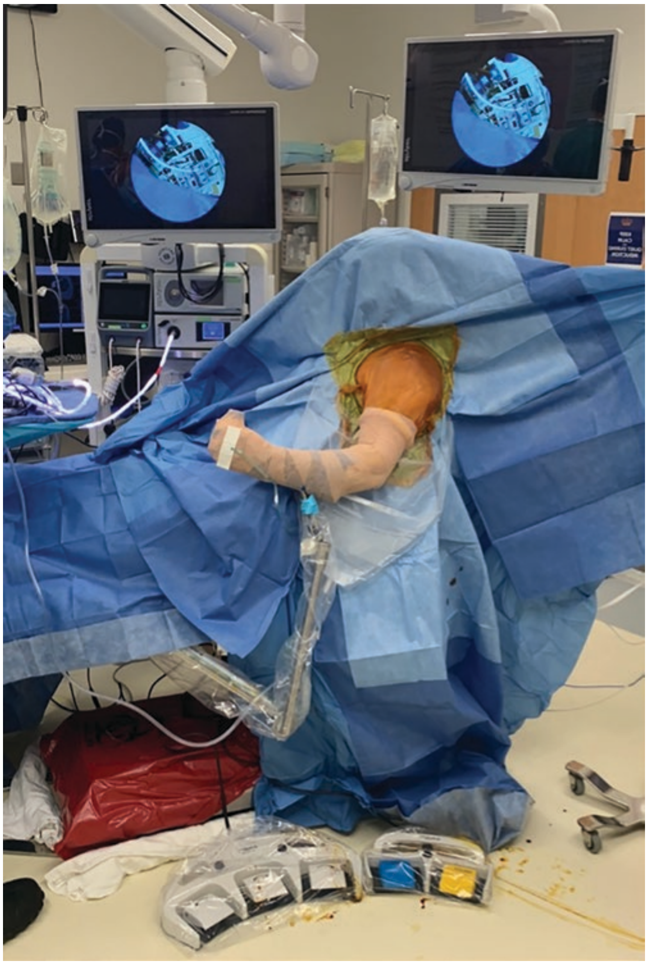

Fig. 11.3 Standard beach chair positioning with the use of battery-powered mechanical arm for positioning. Foot pedals are placed for surgeon control of arthroscopic instruments such as shavers and electrocautery. Monitors are placed on the patient's contralateral side, facing the surgeon for viewing intraoperatively

Table 11.1 The advantages and disadvantages of lateral decubitus and beach chair positioning for shoulder arthroscopy

	Lateral decubitus	Beach chair
Pros	Traction increases space in the glenohumeral and subacromial space Improved access to posterior and inferior glenoid Exaggeration of labral tears Cautery bubbles move laterally Less expensive setup Floor	Ease of setup Decreased pressure/traction nerve palsy Ease of examination under anesthesia Ease of intraoperative manipulation of arm Upright position of the shoulder allows for easier mental 3D concept of anatomy (glenoid perpendicular to floor) Ease of conversion to open procedure
Cons	Neurovascular traction and pressure injuries Nonanatomic arthroscopic orientation (glenoid parallel to the floor)	CDEs Cost of mechanical equipment Difficulty accessing posterior structures Cautery bubbles move superiorly

The shoulder range of motion is examined and measured for flexion, abduction, and internal and external rotation; the latter two measured with the arm adducted to the torso as well as abducted 90 degrees. Instability is assessed by abduction of the arm to 90 degrees, applying an axial load to the glenohumeral joint and attempting to translate the humeral head in each direction (anterior, posterior, superior, and inferior).

Finally, it is easy at this step to examine the nonoperative extremity to have a reference of the patient's baseline mobility, assuming there is no contraindication or pathology on the other extremity.

11.5 Pertinent Shoulder Anatomy and Portal Locations

Following prepping and draping, the bony landmarks are palpated and marked. First, mark the posterolateral edge of the acromion. This is the most reliably identified structure of the shoulder and can usually be identified even in the most obese patients. Use this starting point to then identify the scapular spine, acromion, clavicle, coracoid, and AC joint. Knowledge of the locations of these landmarks, followed by accurate identification and marking, is essential for establishing proper portal position and avoiding neurovascular structures.

There are three primary portals used for shoulder arthroscopy. Additional portals can be used for better visualization and access to certain areas depending on the pathology that must be addressed on a case-by-case basis.

11.5.1 Primary Portals

Posterior The posterior portal is the primary viewing portal and the first portal established in diagnostic shoulder arthroscopy (Fig. 11.4). To establish this portal, locate the "soft spot" 2 cm inferior and 1–2 cm medial to the posterolateral corner of the acromion. This subtle depression is the sulcus between the posterior aspects of the humeral head and the glenoid. The location and orientation of the glenoid can be appreciated by palpation of these structures while manipulating the arm. Based on surgeon preference, a spinal needle can be inserted into the shoulder to confirm location as well as insufflate the joint with saline, distending the capsule and allowing for easier entry into the joint. A skin incision is made, followed by the passage of a blunted arthroscopic obturator and its sheath directed toward the coracoid. The coracoid is a reliable marker for this trajectory and for this reason is referred to as "the lighthouse of the shoulder." Placement of the surgeon's off hand on the shoulder, palpating the coracoid with the index or long finger, can help the surgeon appreciate the necessary trajectory of the trocar by aiming at the digit. The trocar can either pass through the

Fig. 11.4 Standard 3 arthroscopy portals. (A) Anterior, (L) lateral, (P) posterior. The coracoid is denoted by the circular marking just medial to the anterior portal. The clavicle, acromion, and scapular spine are also clearly delineated

substance of the infraspinatus muscle or pass between the infraspinatus and teres minor. Proper portal placement is important to decrease injury risk to the axillary and suprascapular nerves (SSN). According to a study by Meyer et al., the posterior portal is located an average 49 mm from the axillary nerve and 29 mm from the SSN [21].

Special Considerations For procedures requiring best access to the subacromial space, a slightly more superior and lateral portal may be beneficial (1 cm inferior, 1 cm medial to posterolateral acromion).

Anterior The anterior portal is an essential working portal in most shoulder arthroscopy procedures. It is located slightly superior and lateral to the coracoid process and anterior to the AC joint. The portal passes between the pectoralis major and deltoid muscles. The portal is usually established with an outside-in technique, using the posterior portal and arthroscope to visualize the spinal needle passing through the rotator interval. Care must be taken to ensure that all anterior portals are lateral to the coracoid to minimize risk of neurovascular injury to the brachial plexus and axillary vessels. Meyer et al. noted that the cephalic vein was the most commonly injured structure when establishing the anterior portal [21].

Special Considerations A slightly more lateral portal will allow for easier access to the lesser tuberosity if subscapularis repair is necessary.

Lateral The lateral portal is primarily used for procedures in the subacromial space, to visualize the rotator cuff, and to address acromioclavicular pathology. It is located 2–3 cm inferior to the mid-lateral edge of the acromion and passes through the deltoid muscle. Care must be taken not to place this portal too far inferior to the edge of the acromion, as the anterior branch of the axillary nerve runs at a level 5 cm distal to the lateral acromion edge. This distance as measured on the skin is decreased with the arm in abduction. A study by Burkhead et al. found that the axillary nerve can be found as close as 31 mm [22].

11.5.2 Secondary Portals

Posterolateral The posterolateral portal is primarily utilized for subacromial decompression, rotator cuff, and labral repairs. It is located 2–3 cm lateral to the posterolateral edge of the acromion. Using an outside-in technique, the portal is made and the trocar is aimed medial to the subacromial bursa [21]. Inferior placement places the axillary nerve at risk (Figs. 11.5 and 11.6).

Anterosuperior The anterosuperior portal provides good access for procedures involving the anterior capsule and is often utilized to shuttle sutures during rotator cuff repair. It is created using an outside-in technique at a location halfway between the coracoid and acromion, usually directly above or anterior to the biceps tendon. Placing this portal more laterally can allow access to both the glenohumeral and subacromial spaces. Care should be taken to avoid the cephalic vein and axillary nerve.

Anteroinferior (5 O'clock) The anteroinferior portal's main function is to assist in placement of anterior labral/Bankart repair anchors. It is commonly used together with an anterosuperior portal. It is located slightly inferior to the coracoid and is commonly done through an inside-out technique. The cephalic vein, axillary vein, and axillary artery are all at risk with this portal, especially if placed too inferior. As a result, many surgeons have questioned the safety of this portal.

Posteroinferior (7 O'clock) The posteroinferior portal's main function is to assist in placement of posterior labral repair anchors or for loose body removal. This is commonly done through an inside-out technique at the 7 o'clock position of the glenoid. Structures at risk are the SSN and artery, axillary nerve, and posterior circumflex humeral artery.

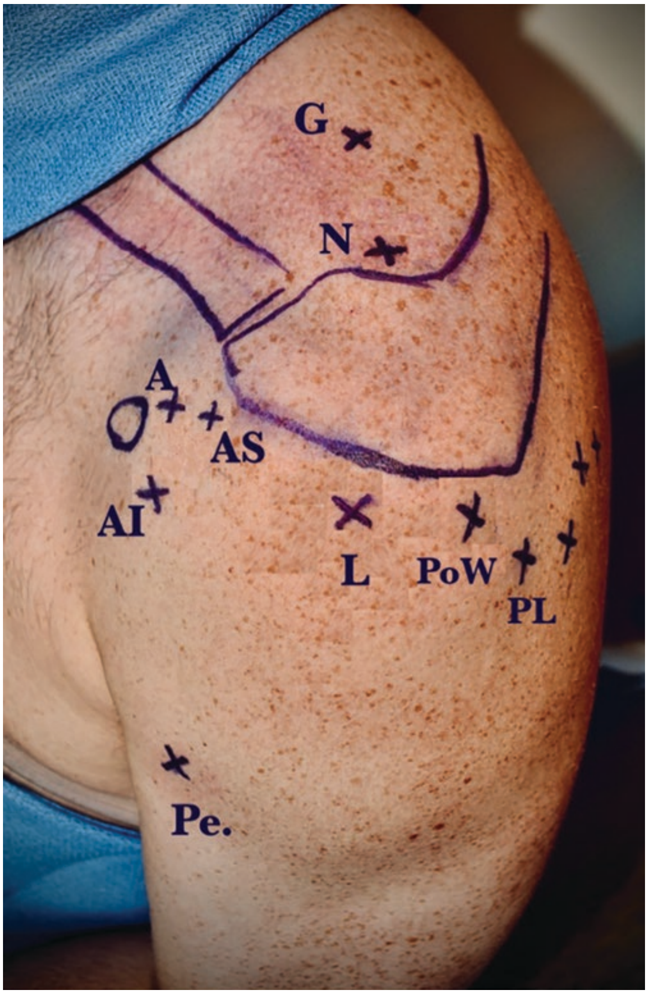

Fig. 11.5 Additional portals, anterior. Moving counterclockwise. A, anterior; AI, anteroinferior, or 5 o'clock; AS, anterosuperior; Pe, pec-portal; L, lateral; PoW, anterolateral or port of Wilmington; PL, posterolateral; G, G portal; N, Neviaser or supraspinatus

Anterolateral (Port of Wilmington) The anterolateral portal is used in the evaluation and repair of posterior SLAP and rotator cuff lesions. It is located 1 cm lateral and 1 cm anterior to the posterolateral corner of the acromion. It pierces the rotator cuff just medial to the musculotendinous junction and is aimed toward the coracoid at an angle 45° to the glenoid surface.

Neviaser (Supraspinatus) The Neviaser portal's main function is to provide the best visualization of the anterior glenoid primarily for SLAP repairs. It is created in the soft spot between the clavicle, acromion, and scapular spine. A needle is placed from this location anteriorly and laterally and goes through the supraspinatus muscle. The SSN and artery are at risk with this portal.

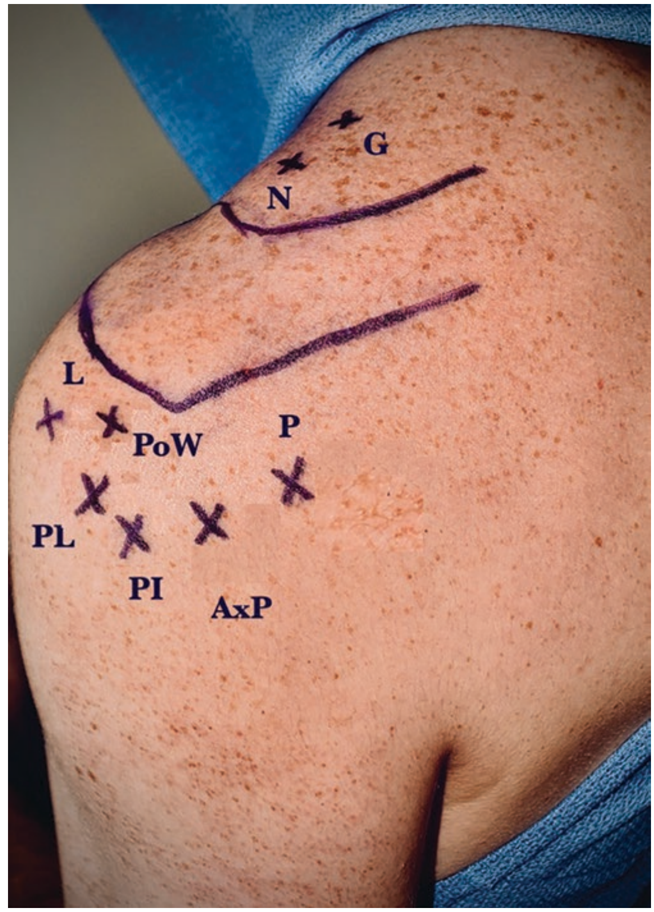

Fig. 11.6 Additional portals, posterior. Moving clockwise. G, G portal; N, Neviaser, or supraspinatus; P, posterior; AxP, axillary pouch; PI, posteroinferior or 7 o'clock; PL, posterolateral; PoW, port of Wilmington or anterolateral; L, lateral

Axillary Pouch This is the preferred portal for access to inferior glenohumeral recess and removal of loose bodies. It is developed by making an incision 2–3 cm inferior to the posterolateral acromion and 2 cm lateral to the posterior viewing portal.

G Portal Also called the SSN portal, this portal is used in SSN decompression procedures. This portal is located 7 cm medial to the lateral border of the acromion or 2 cm medial to the Neviaser portal. The obvious structures at risk are the SSN within the suprascapular notch and the suprascapular artery above the transverse scapular ligament.

Pec-Portal Also called the inferolateral portal, this portal is primarily used in subdeltoid arthroscopy. It is established and is positioned at the inferolateral corner of the subdeltoid space, the junction of the superior margin of the pectoralis major tendon, and the long head of the biceps tendon.

11.6 Diagnostic Shoulder Arthroscopy

Diagnostic shoulder arthroscopy demands a comprehensive and systematic process to visualize all pertinent anatomic structures. The steps of the procedure may vary from surgeon to surgeon, but a reproducible routine will ensure that all pathology within the shoulder is identified and addressed. The "15-point system" is a well-described technique to ensure a comprehensive examination of the glenohumeral joint [23]. At our institution, a similar sequence is employed, with identification of major structures initially viewed from the posterior portal and then from the anterior portal.

Although not noted below, it is important to examine the anterior capsule and rotator interval prior to establishing your anterior portal, as the local anatomy will change significantly once this tissue is disrupted.

Finally, if clinically indicated, the subacromial and subdeltoid spaces are also investigated.

11.6.1 Viewing from the Posterior Portal [10]

Glenoid Articular Cartilage, Humeral Head Articular Cartilage Evaluation of these structures is completed to identify any chondromalacia or traumatic lesions to the articular surfaces. A hole in an area of thin articular cartilage in the center of the glenoid may appear to be a defect but is a normal anatomical finding. The bare area on the humeral head is visualized posteroinferiorly. This should be distinguished from a true Hill–Sachs lesion, which has articular cartilage superior and inferior to the area of exposed bone.

Biceps Tendon Located in the anterosuperior aspect of the joint, the biceps anchor and tendon are evaluated for tendinopathy and partial tearing. The biceps tendon can be probed and pulled into the joint to better visualize the extra-articular portion, assessing for tendonitis or subluxation.

Superior Labrum This region should be probed to examine for any tears. A superior labrum anterior posterior lesion ("SLAP tear") may be found and should be probed for stability (Figs. 11.7, 11.8, 11.9, 11.10, and 11.11).

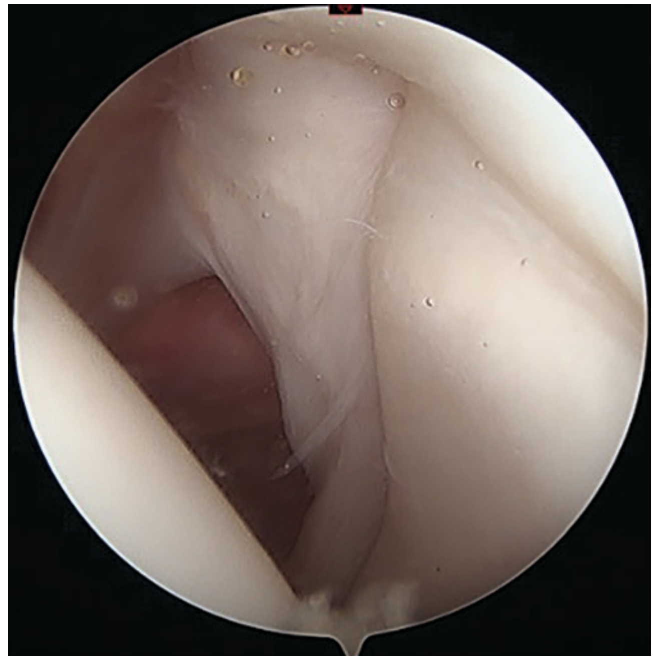

Fig. 11.7 Left shoulder, viewed from posterior portal. Normal appearance of the long head biceps tendon insertion onto the superior labrum. Humeral head visible on the left, glenoid on the right. Light handle facing down, therefore camera facing superiorly

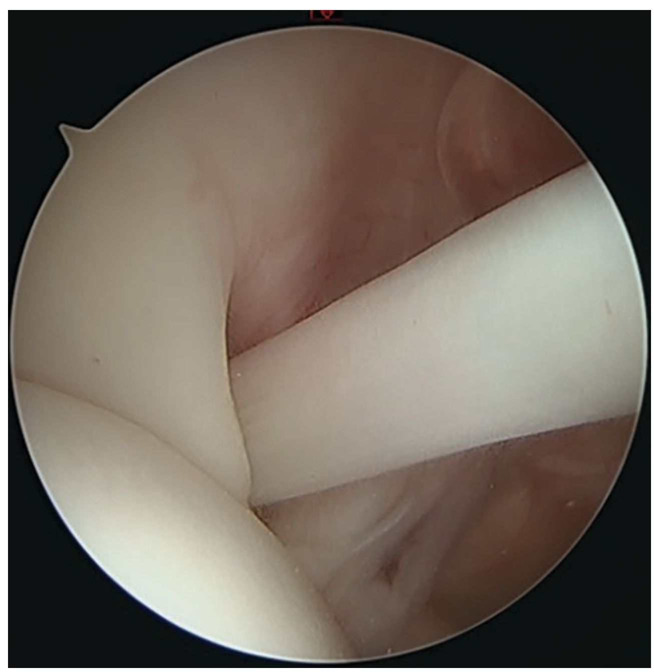

Fig. 11.8 Left shoulder, biceps tendon exiting the glenohumeral joint. Normal appearance, no fraying, no tendonitis. Humeral head visible lower left

Rotator Interval with Superior and Middle Glenohumeral Ligaments and Subscapularis Tendon These structures can be more clearly visualized by placing the shoulder in various positions to tighten the ligaments or tendons. The superior glenohumeral ligament often accompanies the long head of the biceps. The middle glenohumeral ligament has significant variations and can be altogether absent. A Buford complex is a well-described variant composed of a cord-like MGHL that inserts directly onto the long head of the biceps, causing an absent anterosuperior labrum in the 1–3 o'clock position. It is important to recognize this normal anatomic variant and not to "repair" it, which will lead to stiffness.

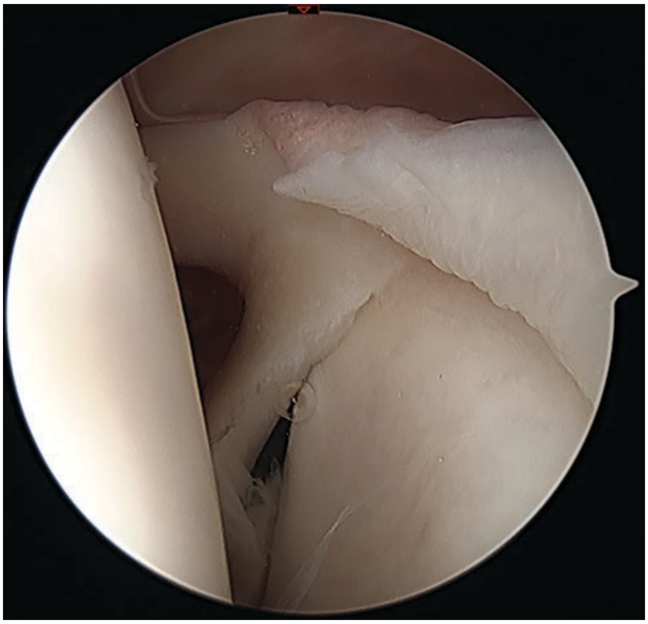

Fig. 11.9 Left shoulder demonstrating superior labral anterior posterior tearing (“SLAP lesion”), a common cause of deep shoulder pain in overhead athletes or because of fall/traumatic injury to the arm

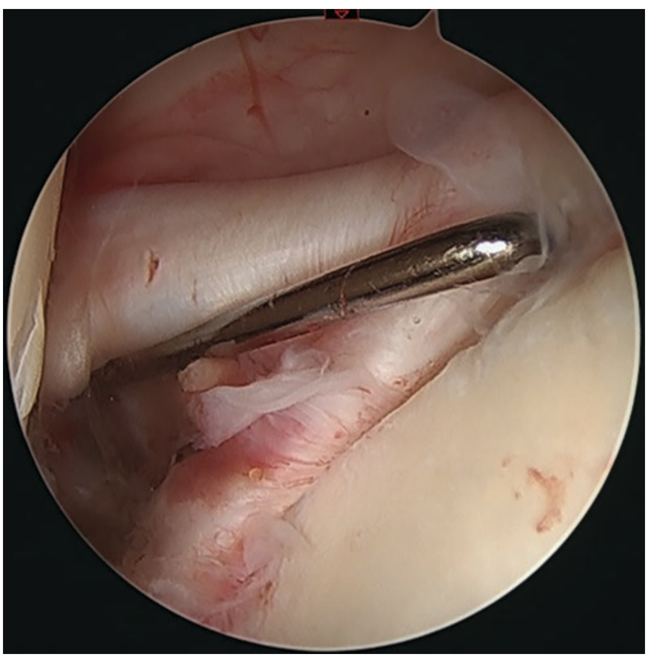

Fig. 11.10 Left shoulder demonstrating SLAP lesion with biceps tendonitis. Arthroscopic probe has been inserted via the anterior portal to inspect the tear

Subscapularis The superior tendinous edge (“rolled border”) of the subscapularis is examined as is its attachment to the lesser tuberosity of the humerus. Humeral rotation and translation can help to identify the attachment of the subscapularis to the lesser tuberosity.

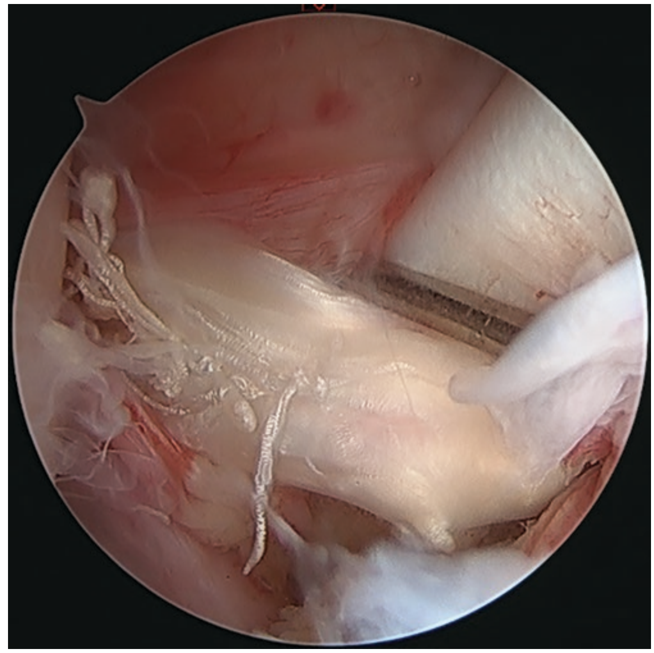

Fig. 11.11 Left shoulder, demonstrating marked biceps tendonitis with longitudinal fraying. Probe has been inserted via the anterior portal to pull the more distal aspect of the tendon intra-articularly for inspection

Anterior Inferior Labrum The anterior labrum is examined for fraying or detachment that can lead to glenohumeral instability. A Bankart lesion is a tear in the insertion point of the anterior inferior glenohumeral ligament. Another tool for assessment of shoulder instability is the “drive-through sign,” which is the ability to maneuver the arthroscope in between the humeral head and the glenoid fossa (Figs. 11.12, 11.13, and 11.14).

Anterior Capsule and Anterior Band of the Inferior Glenohumeral Ligament Synovitis or fraying on the anterior capsule indicates repeated trauma or inflammation. The anterior band of the inferior glenohumeral ligament attaches to the glenoid neck between the 2 o’clock and 4 o’clock positions. The inferior glenohumeral ligament will tighten as the shoulder abducts.

Inferior Capsule and Recess This area is assessed for laxity, redundancy, or tearing. In addition, a humeral avulsion (HAGL lesion) may be seen. Finally, this is a common location for loose bodies.

Posterior Labrum and Capsule The posterior labrum and capsule are visualized by retracting the arthroscope and pointing it inferiorly.

Rotator Cuff Supraspinatus Attachment This is viewed by rotating the arthroscope superiorly. Visualization of this

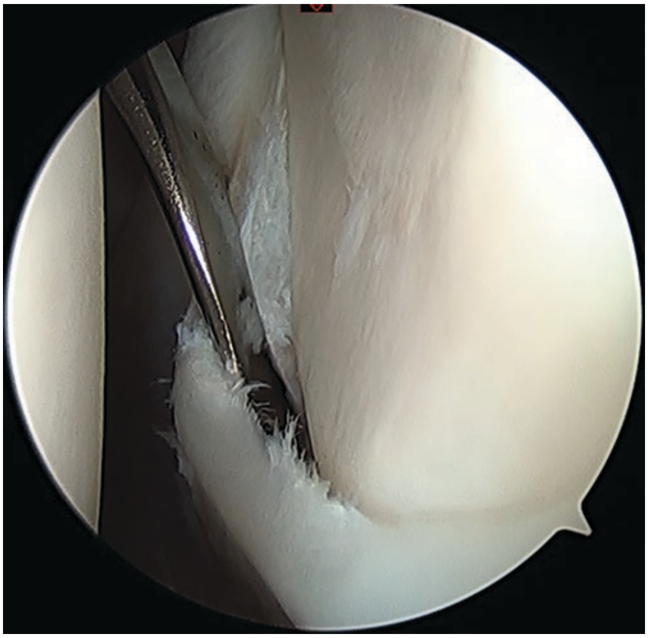

Fig. 11.12 Left shoulder, viewing from posterior portal. An elevator has been introduced through anterior portal and is probing to exaggerate Bankart lesion (anteroinferior labral tear)

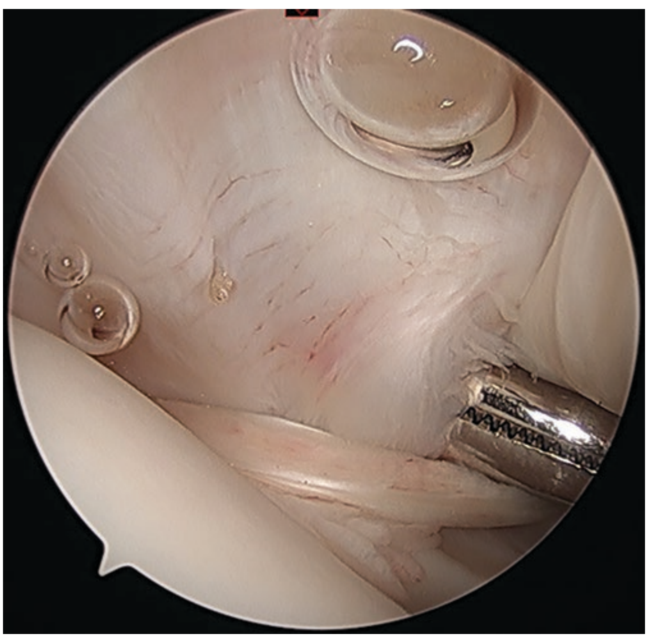

Fig. 11.13 Left shoulder, placement of anterior portal. Entry of the portal is low and lateral in the rotator interval to improve instrument position for Bankart repair

region is aided by positioning the arm in slight abduction and 45° of flexion and applying gentle traction to place the rotator cuff under tension and open the viewing space. The rotator cuff insertion onto the tuberosity is carefully evaluated for fraying, partial tear, or complete tear of the rotator cuff. Fraying or partial tears of the rotator cuff should be evaluated by examining the thickness with a probe.

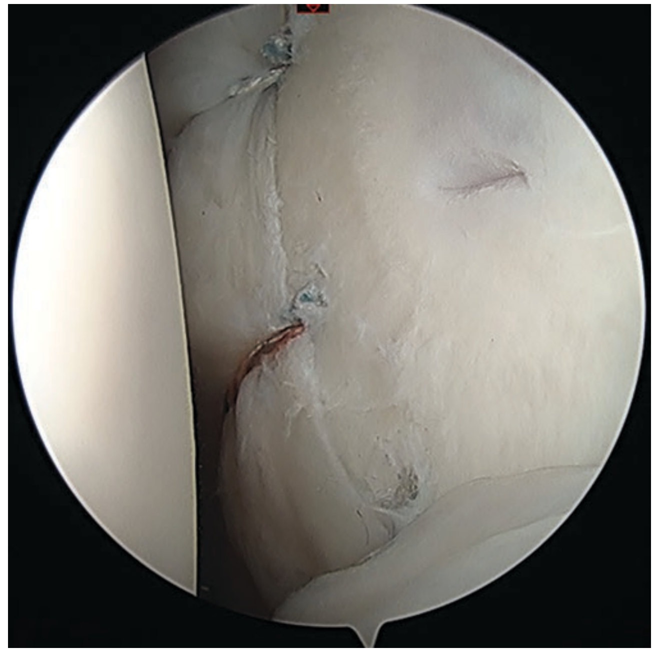

Fig. 11.14 Left shoulder, viewing from posterior portal. Humeral head visible on left, glenoid on the right, with knotless suture repair of the previously demonstrated Bankart lesion (anteroinferior labral tear)

11.6.2 Viewing from the Anterior Portal [5]

Posterior Labrum When viewed from the anterior portal, the posterior labrum should be smooth with a tight attachment to the glenoid. Fraying in this region can be indicative of a Kim lesion, which represents shear injury to the posterior labrum secondary to recurrent posterior subluxations or laxity.

Posterior Capsule and Rotator Cuff This should be evaluated for redundancy, synovitis, inflammation, or any fraying that may indicate instability.

Anterior Inferior Labrum and the Anterior Inferior Glenohumeral Ligament Careful observation for the ligamentous insertion to the humerus is indicated to rule out humeral avulsion of the glenohumeral ligament (HAGL).

Middle Glenohumeral Ligament and Medial Subscapularis Tendon and Recess The MGHL will attach on the labrum or glenoid neck and can be viewed from this anterior position. The subscapularis tendon can also be traced back to the subscapularis recess. This is another common location for loose bodies.

Lateral Subscapularis Tendon and Anterior Humeral Head and Biceps Identify the insertion of the subscapularis tendon onto the lesser tuberosity.

11.7 Subacromial Space

The diagnostic shoulder arthroscopy may or may not include evaluation of the subacromial space. The subacromial space is accessed through the posterior portal by redirecting the obturator tip just beneath the posterior acromion and advancing it anteriorly to the region just behind the coracoacromial ligament. After confirming entry into the space, a lateral portal is established. The subacromial space should be examined thoroughly, which may require partial or subtotal bursectomy to effectively visualize the bursal surface of the rotator cuff and the undersurface of the acromion clearly.

The inferior aspect of the acromion is evaluated. The coracoacromial ligament is then identified. The anterior, lateral, and medial aspects of the acromion are then cleared of the bursal tissue and evaluated for spurring. The acromioclavicular joint is then evaluated, and the distal clavicle is brought into view by placing a downward force on the distal clavicle. Afterward, the arthroscope is pointed downward, and the rotator cuff insertion is carefully evaluated for any tears using a probe. The rotator cuff should be palpated for roughness, fraying, or calcifications. Rotation of the shoulder can aid in visualization of the entire footprint.

Subacromial decompression is one of the most common arthroscopic shoulder procedures and treats a variety of subacromial pathology. Currently, the clinical importance of subacromial decompression for isolated subacromial shoulder pain is hotly debated. Proponents point to years of studies demonstrating positive outcomes, while detractors have produced data suggesting that subacromial decompression was not statistically superior to simple diagnostic shoulder arthroscopy or clinically superior to no surgery [24, 25].

11.8 Subdeltoid Space

Subdeltoid space arthroscopy provides adequate exposure for procedures such as biceps tenodesis or transfer, extracompartmental anterior shoulder arthroscopy, and arthroscopic-assisted CC ligament repair or reconstruction. Its popularity has increased in recent years, and the technique is best described by O'Brien et al. [26]. The subdeltoid space is extra-articular and defined by the acromion and CA ligament superiorly, the coracoid and conjoined tendon medially, the pec major insertion inferiorly, and the humerus laterally. After the pec-portal is established and the subdeltoid space is insufflated, these structures are all readily identifiable.

This technique is traditionally done in the beach chair with the operative shoulder flexed 90°, the elbow flexed 90°, and the arm abducted 15°. This position allows the humeral head to fall posteriorly, which facilitates exposure of the subdeltoid space anteriorly. An anterolateral working portal is established that is 1–2 cm distal to and 1–2 cm posterior to the anterolateral edge of the acromion.

Biceps tenotomy and tenodesis both provide excellent results. However, biceps tenotomy can result in Popeye deformity and may lead to cramping with repetitive use, leading many surgeons to perform tenodesis. The subdeltoid approach is becoming increasingly popular manner of performing biceps tenodesis. However, Werner et al. demonstrated that arthroscopic tenodesis may lead to improper over tensioning as compared to open tenodesis, a finding that can result in decreased failure load, as well as residual anterior shoulder/bicipital groove pain [27]. Neviaser et al. conducted cadaveric studies and identified a reliable traversing branch of the anterior humeral circumflex 1.5 cm proximal to the superior edge of the pec tendon that can be used to estimate the length of the proximal biceps tending. The authors concluded this may serve as a reliable landmark for determining the appropriate tension of the biceps tendon when performing an all-arthroscopic biceps tenodesis [28].

11.9 Summary

Shoulder arthroscopy is an essential orthopedic surgery procedure, with the ability to treat a comprehensive variety of shoulder conditions. However, this flexibility warrants careful preoperative consideration to determine the optimal surgical plan for each patient. General and regional anesthesia both have advantages and disadvantages and are often used in conjunction. Both beach chair and lateral decubitus offer excellent visualization in the shoulder, and therefore positioning is typically dependent on surgeon preference on a case-by-case basis. An understanding of the clinical anatomy, the described portal positions, and working areas within the shoulder will allow the operative team to access all relevant pathology and protect against iatrogenic injury. Only after mastery of these basic skills will the orthopedic surgeon be able to complete thorough, reproducible shoulder arthroscopy.

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