

Shoulder Arthroscopy : Basics for The Beginner

Dr. Clement Joseph,

Dr. David V. Rajan

Consultant Arthroscopy Surgeons
Coimbatore, India.

Shoulder arthroscopy has become a widely practiced procedure with predictable results. Shoulder arthroscopy and open shoulder surgery by themselves have become a subspeciality of orthopaedics. But shoulder arthroscopy is a complex procedure which demands for specialized training and psychomotor skills. In this chapter, the fundamentals of performing shoulder arthroscopy will be discussed. The common indications for shoulder arthroscopy include shoulder instability, rotator cuff tears, impingement, SLAP lesions and adhesive capsulitis.

Pre-requisites for Shoulder Arthroscopy

As shoulder arthroscopy is a complex procedure, the surgeon should be well trained in performing the procedures. Practice in cadaver workshops and models is necessary. Proper knowledge about the use of instruments is a must. The surgeon should be able to handle arthroscope and instruments in either of his hands. The success of the surgery would be as good as the available instruments and the capability of the assisting staff. The assisting staff should be well trained in the procedures. Pre-operative drills of positioning the patient, knot tying techniques and usage of instruments in shoulder models should be conducted with the staff. Finally the surgeon should be capable of performing open shoulder surgery if arthroscopy cannot be continued for reasons of technical difficulty. The surgeon should constantly update his knowledge about advances in the management of shoulder pathology and also about the improvements in instrument and implant designs.

Anaesthesia for Shoulder Arthroscopy

We routinely use a brachial plexus block by the interscalene technique followed by general anaesthesia for shoulder arthroscopy. Though arthroscopy can be performed with block alone, the patient may not tolerate lying still in an awkward position for long. In addition, hypotensive anaesthesia is required to minimize bleeding and improve visualization. Brachial plexus block does not directly reduce the blood pressure, but blocks the painful sensory input and reduces the sympathetic response. Blood pressure can further be controlled by general anaesthesia. In addition, all the patients receive a dose of beta-blocker (if there is no contraindication) the night before surgery to reduce blood pressure.

Operating Room Set up

The surgeon should have full access to the shoulder joint. Hence the Boyles apparatus and the anaesthetist are near the foot end of the patient. A customized long connecting airway tube may be required for this arrangement. End tidal CO₂ monitors are connected to the anaesthesia tubings are must and will detect any disconnection of airway. Two video monitors are placed on either side of the table, to enable the surgeon to have visualization when he is operating from front or behind.

Patient Positioning

Shoulder arthroscopy can be performed in two positions, the beach chair position or in the lateral decubitus position. The choice depends on surgeon's training and familiarity. Both positions have their advantages and disadvantages.

Beach Chair Position

In this position, the patient is positioned 80 to 90 degrees sitting position and the shoulder and the upper limb are draped free. The vertical positioning allows us to have a familiar orientation. When arthroscopy is converted into open procedure, no change in positioning is necessary. An assistant is required to give traction and distraction. Obese patients in this position could develop hypotension due to superior vena caval compression.

Lateral Decubitus Position

This is the position we routinely use. In this position the patient is positioned on the unaffected side and the table is tilted 20 to 30 degrees posteriorly, so that the arm is positioned parallel to the floor. The shoulder is suspended in a traction system, which provides longitudinal traction to the forearm and also medial (distraction) traction to the proximal arm. Distraction more than 45 degrees and traction weights over 10 kg should be avoided. Compression of neurovascular structures in the axilla of the opposite side against the table is avoided by keeping a rolled towel or cushion under the upper lateral thorax. The neck is supported by side-supports, the lower limbs are flexed and secured to table with straps.

Examination Under Anaesthesia

This is a step, which should never be missed. The aim is to confirm diagnosis and also to quantify the amount and direction of instability and stiffness. Both the shoulders are examined for comparison. Range of movements are documented (Abduction, Internal rotation with arm by the side of body, External rotation in abduction and Internal Rotation in adduction). If abduction is restricted by stiffness, range measurements should be performed in maximum possible abduction. In a case of shoulder instability it is paramount to rule out multidirectional instability and to assess capsular laxity. This is done by performing sulcus test, load and shift test, and apprehension test. In an overhead athlete, any excess laxity in rotations should be noted.

Arthroscopic Portals

Only basic portals will be discussed here. Portal placement is very crucial, as even few millimeters deviations could hamper the procedure. Portals are made in relation to bony landmarks. At the start of procedure bony landmarks of distal clavicle, acromion, spine of scapula and coracoid are marked with a permanent marker (sterilized by ETO). The inferior surfaces of bony landmarks are marked.

Posterior portal is the primary viewing portal for shoulder arthroscopy. The landmark of the portal is 2 cm inferior to the posterolateral angle of acromion. This portal goes in the interval between infraspinatus and teres minor muscles and this interval can be palpated as a "soft spot". In thin individuals the head of humerus and plane of the joint can easily be identified. The intended portal tract is infiltrated with local anaesthetic with adrenaline to reduce bleeding. The skin is incised and the arthroscopic trocar with sheath is introduced into the subcutaneous tissue and the joint is entered by penetrating the capsule. Arthroscope is introduced into the sheath, visualization of blood vessels in the synovial tissue once again confirms the intraarticular position and then fluid is let into the joint.

Anteriorly two portals are commonly used for reconstructive surgery for instability. They are anterior inferior portal (5 mm lateral to coracoid) and anterior-superior portal (1.5 cm lateral and 1 cm superior to the ant-inferior portal). For repair of SLAP lesions, an anterolateral portal (just below the anterolateral corner of acromion) is used. An outside in technique is used for establishing these additional portals. A spinal needle or a venflon needle is passed from the outside into the joint, to the desired intraarticular location. When establishing two anterior portals there should be enough space between them inside the joint, otherwise instrument handling and visualization will be a problem. For rotator cuff repairs and subacromian decompression, a lateral portal (3 - 5 cm distal to the midpoint of lateral border of acromion) is established.

Cannulae

Unlike knee arthroscopy, the scope and instruments have to traverse through lot of subcutaneous tissue and muscles. It is very easy to lose track and fluid can extravasate into surrounding soft tissues. Hence after establishing portals, cannulae are placed which allow easy passage of instruments into the joint and also to some extent seal the fluid extravasation. The cannulae in addition have a valve like membrane, which retains the fluid in the joint, and also have a side port to which fluid inflow or outflow can be connected.

Joint Distension and Fluid Management

Joint distension is fundamental to arthroscopy. In addition to traction, joint distension with adequate fluid pressure will distend the joint and also will prevent bleeding into the joint by hydrostatic pressure. Joint distension by gravity fluid system (saline containers hanging in a height) depends on the height from which the fluid is suspended and also the amount of fluid column available. But one cannot control fluid pressure and flow in this method. Though adequate for knee surgery, these are not sufficient for shoulder surgery.

Arthroscopic pump systems are invaluable for joint distension. Both fluid pressure and flow rate can be controlled. Prolonged high fluid pressures could result in extravasation of fluid into surrounding soft tissues and hence fluid pressures should be raised only as and when necessary.

Diagnostic Arthroscopy

The first step before any therapeutic procedure is a thorough and systematic diagnostic arthroscopy. All the structures in the joint are visualized and palpated. In selected cases with rotator cuff tears or impingement features, the subacromial space is also visualized. The structures which can be evaluated arthroscopically are as follows.

Biceps-superior Labrum Complex

The long head of biceps is called the "*policeman of shoulder*" as it is an important landmark. In addition to its insertion into the

supraglenoid tubercle, upto 50% of the tendon have insertion into the superior labrum and hence they are collectively grouped. The biceps tendon is visualized for any signs of inflammation (tendinitis) or partial tears. The biceps tendon is probed and can be pulled inside the joint and the part lying in the bicipital groove can be visualized. Subluxation of tendon is also assessed. Unlike the labrum in other areas, the free edge of the superior labrum overlaps the glenoid (meniscoid) and this is normal. Any detachment of superior labrum from the glenoid indicates a SLAP type II lesion. In addition fraying of superior labrum and bucket-handle tears of superior labrum can also be observed.

Supraspinatus

The anterior edge of supraspinatus lies just behind the biceps tendon, when viewed from posteriorly. The articular side of the tendon can be visualized. The scope is swept along the tendon to its insertion into the greater tuberosity. Tears of supraspinatus involving articular side or detachment from its insertion can be identified. Infraspinatus tendon is partially seen from posterior portal and is better seen from anterior portal.

Head of Humerus

If the scope is moved further posteriorly and inferiorly, the posterolateral aspect of humeral head can be seen. A small area of irregularity, devoid of any cartilage near the insertion of posterior cuff tendons is normal and it is called bare areas. Hill-Sachs's lesion is a significant defect in the posterolateral aspect, associated with recurrent shoulder instability.

Labrum

The labrum is a fibrocartilaginous structure which depends the shallow glenoid and also provides attachments for Glenohumeral ligaments. In a classic traumatic anterior instability, the anterior and inferior portion of labrum is detached from the glenoid (Bankart lesion). Rarely the labral detachment can extend into superior labrum and also to the posterior labrum also. The detached labrum sometimes heals medially onto the neck of scapula

... of the glenoid rim. This is called an ALPSA lesion (anterior labruoligamentous periosteal sleeve avulsion). In this situation, the labrum will be found slipped down from the glenoid rim. The labrum should be elevated from this abnormal position and reattached to the rim.

The anterosuperior part of the labrum exhibits anatomical variations (Fig__). Knowledge of these variations is a must as inadvertent repair could result in severe stiffness of shoulder. Fraying of anterosuperior part of glenoid labrum may be found in overhead athletes due to internal impingement. Fraying and damage to the posteroinferior labrum can indicate the presence of posterior instability.

Glenohumeral Ligaments

Glenohumeral ligaments are condensations of the shoulder capsule in specific regions. They are superior, middle and inferior glenohumeral ligaments (SGHL, MGHL & IGHL). The inferior glenohumeral ligament has anterior and posterior limbs. The SGHL runs from the anterosuperior labrum towards the acromion and most often it is not conspicuous. The MGHL crosses the superior rolled border of the acromion obliquely. Its thickness varies in patients. The anterior limb of the IGHL is the most important ligament against anterior translation of humeral head in anatomical external rotated position. Any laxity should be addressed along with labral repair by arthroscopy. The posterior limb of IGHL is important in preventing posterior translation. The part of capsule between these limbs is the inferior capsular recess which is loose. If it is voluminous, capsular plication, capsulectomy or open may be required.

The cartilage of glenoid is inspected for any degenerative changes. The shape of normal glenoid is pear shaped, that is, the glenoid is broader inferiorly than superiorly. In recurrent anterior shoulder instability, the anterior-inferior quadrant of glenoid is worn, eroded and deficient. The shape of glenoid in recurrent instability becomes inverted pear shaped. This deficiency usually requires additional open procedure like a coracoid transfer.

Subscapularis

The subscapularis is visualized as a cord like structure in the anterior aspect when viewed from posterior portal. The insertion of subscapularis to the head of humerus can be visualized from anterior portals. Fraying and partial tears of the tendon could be visualized.

Rotator interval

Rotator interval refers to the part of the capsule lying between the anterior edge of supraspinatus and the proximal edge of subscapularis. In arthroscopy it is seen as a triangular space enclosed by subscapularis tendon and biceps tendon (as it lies over the anterior edge of supraspinatus). In cases of capsular laxity, the rotator interval appears wide and in cases of adhesive capsulitis, the rotator interval is contracted.

Bursal scopy

In cases with subacromial pathology like impingement, rotator cuff tears or ACL joint pathology, bursal scopy is indicated. The same posterior portal is used. The trocar with sheath is withdrawn from the glenohumeral joint into the subcutaneous tissue and later directed superiorly to enter the subacromial space. Similarly the anterior portal can be redirected into the subacromial space. The subacromial space is a secondary articulation of the glenohumeral joint where movements between the coracoacromial arch and the humeral head covered with rotator cuff tendons take place. The subacromial bursa is an anteriorly located structure. Soon after entering the space, the areolar tissue and bursal tissue are cleared rapidly. Otherwise they distend after absorbing the fluid and make visualization difficult. The undersurface of acromion is inspected for osteophytes, irregularities. The coracoacromial ligament can be seen and can be traced upto coracoid if dissected properly. The bursal aspect of the rotator cuff tendons can be visualized. Medially the AC joint can be visualized. Osteophytes of AC joint or subluxation/instability of AC joint could be identified.

Complications

Intraoperative complications are mostly due to like damage to articular cartilage instrument breakage and knot entangling can occur due to technical inadequacy. Bleeding into the joint could hamper visualization especially in subacromian space. Extravasation of fluid into the surrounding tissue itself can prevent proper joint distension and also makes the subsequent open procedure difficult. Addition of adrenaline into the irrigation fluid to reduce intraarticular bleeding can result in generalized vasoconstriction and arrhythmias.

Excessive traction and abduction of arm could result in neuropraxia. Infection rate is very low after shoulder arthroscopy.

The anesthetist should be alert to deal with block related complications like hematoma formation, recurrent laryngeal nerve blockade, pneumothorax, vasovagal attack and Horner's syndrome.

Conclusion

Arthroscopy has greatly improved our understanding of shoulder pathology especially the sports related pathology. The results of shoulder arthroscopy are encouraging. The postoperative comfort to the patient is also much better than open procedures. One should remember that shoulder arthroscopy is a complex procedure and should be undertaken with adequate training and preparation. The entire team should be well versed in the techniques. When there is difficulty in performing an arthroscopic procedure, one should not hesitate to convert it into open procedure.

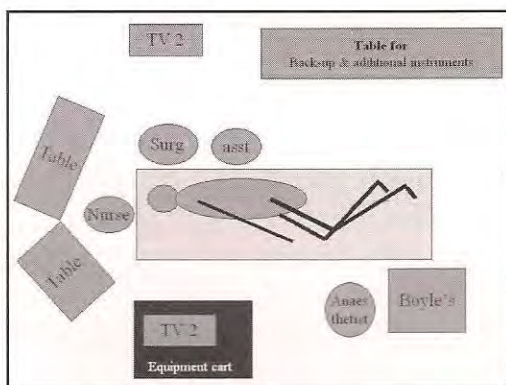


Fig. 1 : Operating room set-up.

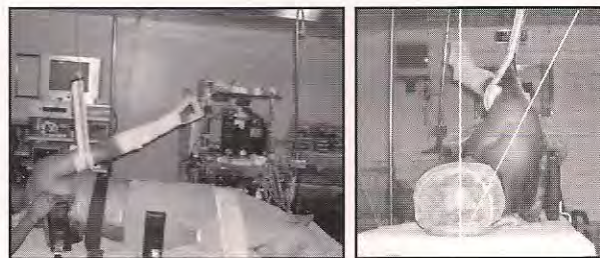


Fig. 2 : Positioning of the patient.(demonstration).

A. Patient's upper limb is suspended by longitudinal and vertical traction.

Note, the trunk is rotated posteriorly to make the glenoid horizontal.



Fig. 3 : Arthroscopy equipment cart.

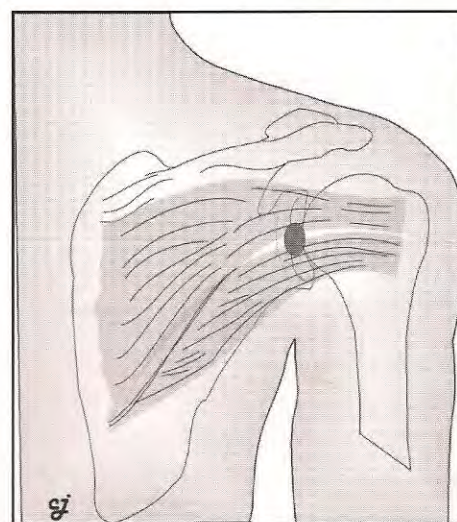


Fig. 3 : Posterior portal : Posterior portal is made in the soft spot in the interval between infraspinatus and teres minor.

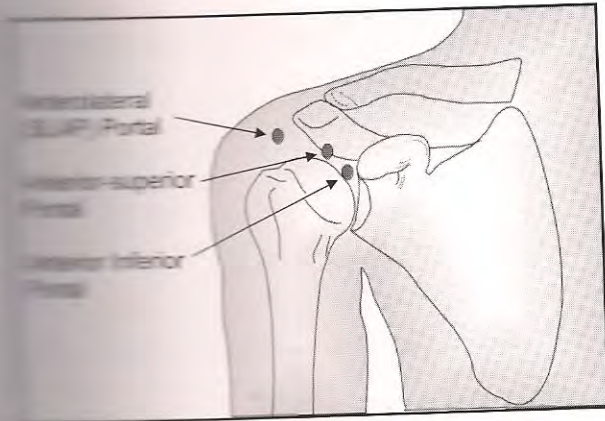


Fig. 4 : Anterior Portals.

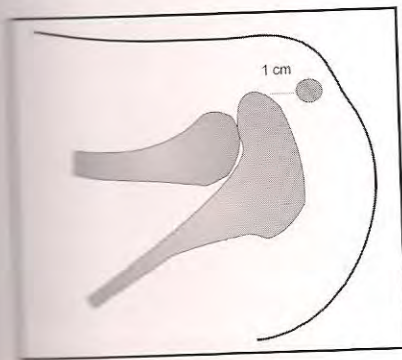


Fig. 5: Superior view showing anterolateral portal.

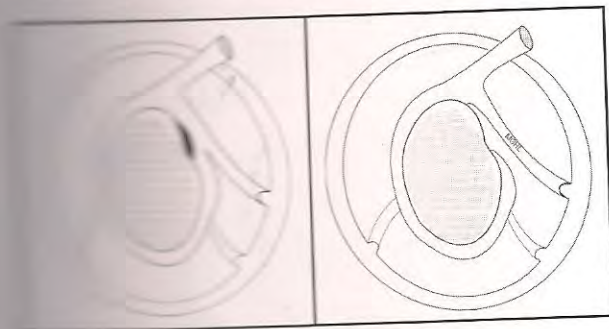
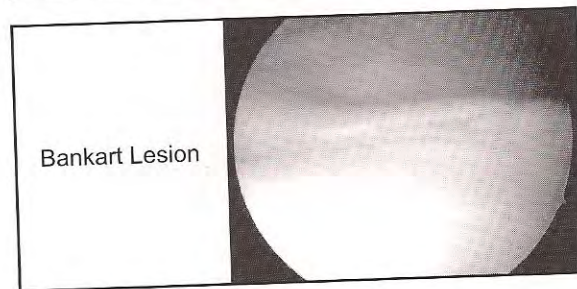
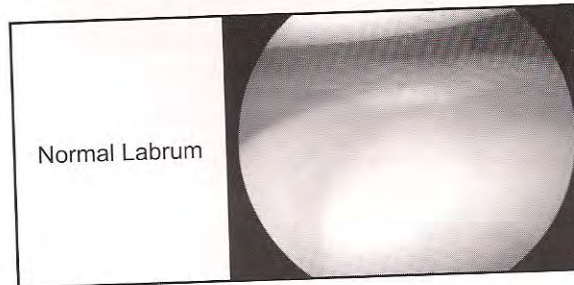
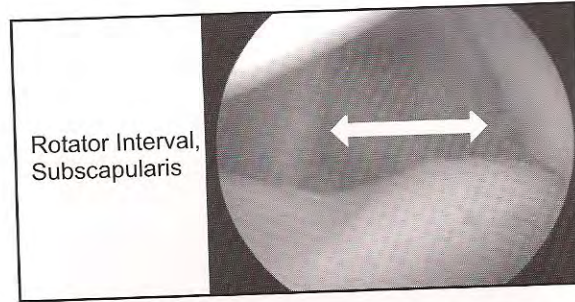
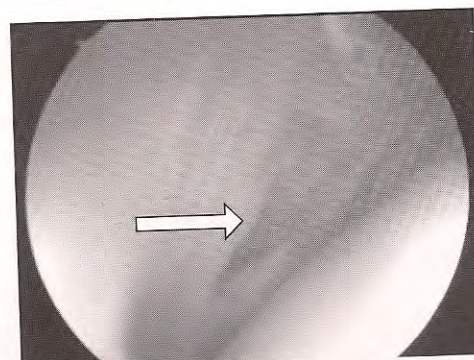


Fig. 6: Anatomical variants of anterosuperior labrum.

(A) sublabral hole is a foramen found in the attachment of anterosuperior labrum and is a normal variant.
 (B) Buford complex. In this variant, MGHL arises as a thickened like structure from the superior labrum near the acromioclavicular joint and anterosuperior labrum is absent.

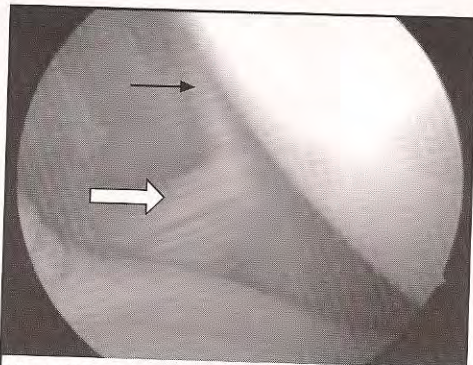


ALPSA lesion (seen from the anterosuperior portal). In this lesion, the detached labrum heals to the medial neck of the scapula. It has to be elevated and attached to the rim of glenoid.



The articular side of rotator cuff is visualized. In this case a partial tear is also present (arrow)

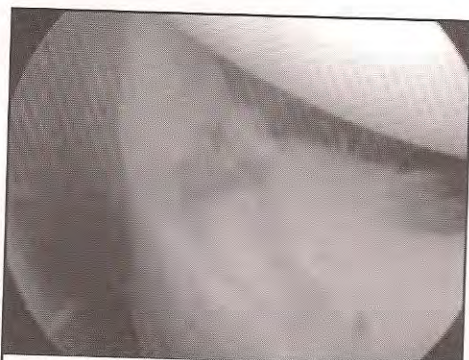
Contd. on Next Page.....



The middle Glenohumeral ligament (block arrow) crosses the subscapularis (thin arrow) obliquely.



Bony deficit of antero inferior glenoid due to recurrent anterior dislocations.



SLAP. Bucket handle tear of superior labrum extending into the biceps anchor (Type IV)



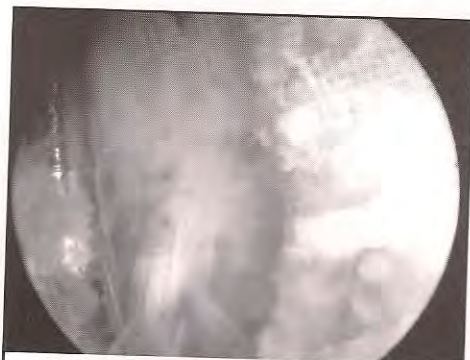
Calcific tendonitis yellowish discoloration of the supraspinatus tendon.



Rotator cuff tear. The irregular torn edge of the rotator cuff is found to be lying on the humeral head.



Osteoarthritis Grade II to III osteoarthritic changes in the humeral head.



CA ligament visualized in subacromial bursal scopy after clearing of the bursal tissue.

□ □ □