Complications of Arthroscopic Shoulder Surgery

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Abstract: Shoulder arthroscopic procedures have become common in today's orthopedic practice. The safety of shoulder arthroscopy though well established, is not without complications both minor and significant. The true incidence of complications is difficult to identify in the current literature. However, as with all procedures, complications associated with shoulder arthroscopy do occur. General complications (ie, infection), those specific to shoulder arthroscopy (ie, positioning) and those associated with specific procedures (ie, failure) all have been recognized. The purpose of this article is to review the current literature regarding complications in shoulder arthroscopy, provide insight into the risk factors and types of complications and to provide guidelines on the prevention and management of complications if and when they occur.

Key Words: complication, complications, shoulder arthroscopy, beach chair, lateral decubitus, management, infection

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Arthroscopic shoulder surgery has become a common procedure over the last 2 decades. As our understanding of the complex anatomy and function of the shoulder unit has improved, so too have our outcomes and techniques in this field. With the increasing number of arthroscopic shoulder procedures being performed, complications, both common and rare, have been recognized. Despite this, it remains difficult to report true rates of complications accurately in part because of the lack of well-designed studies documenting complications, the practice of underreporting, and the historically low complication rates associated with the procedures.

The first large scale report of complication rates was by Small[1] in 1986, which included 14,329 shoulder arthroscopic procedures. He noted an overall complication rate of 5.3% with staple capsulorrhaphy but only 0.76% with subacromial surgery. This early study demonstrated the relative safety of shoulder arthroscopy but was limited to relatively simple procedures. Multiple other reviews have been reported since then but the numbers are difficult to compare for multiple reasons, including differing definitions of what actually constitutes a complication. Berjano et al[2] reported on 179 shoulder arthroscopic procedures noting an overall complication rate of 9.49%. They noted that in procedures that combined arthroscopy with an open procedure the complication rate was 5.26% versus 10.63% in arthroscopic procedures alone. Interestingly, they did not define shoulder stiffness as a postoperative complication and also noted that few of the complications were serious. Muller and Landsiedl[3] reported on 846 shoulder arthroscopic procedures with an overall complication rate of 5.8%. Forty-three percent of the complications in this series were due to infections.

In addition, little evidence exists to support "best practices" management of complications once they occur. Much of the literature that addresses management of complications due to shoulder arthroscopy are case series without controls or comparisons to current gold standards. Therefore, the physician has little guidance to choose the most effective management strategy once a complication occurs. It is clear that further prospective, controlled studies will be necessary to provide firm guidelines on management strategies in the future.

Currently, the Arthroscopy Association of North America, is conducting an ambitious study in an attempt to better identify the true incidence of complications in shoulder and knee arthroscopy.[4] They have created a database aimed to include at least 150,000 arthroscopic procedures. Data collected include both identification of complication events and patient factors that may influence the rates and types of complications seen during these procedures. The project is currently underway, with data collection ongoing through the end of 2012. Hopefully, the results of this study will help to characterize the rates and types of complications seen during routine shoulder arthroscopy and risk factors associated with the development of these complications.

When discussing complications of shoulder arthroscopy, they can be easily divided into one of 3 categories: those complications associated with surgical procedures in general, those specific to shoulder arthroscopy, and those unique to specific arthroscopic procedures.

GENERAL COMPLICATIONS

The incidence of infection after shoulder arthroscopy is quite low. This may result from the copious amount of irrigation that is constantly run through the shoulder during the procedure and the minimal exposure of deep tissues to the environment. D'Angelo and Ogilvie-Harris[5] reported on 9 cases of septic arthritis after arthroscopy with an incidence of 0.23%. On the basis of their examination of the cases they recommended routine antibiotic prophylaxis to prevent these potentially serious complications. Bigliani et al[6] reviewed the literature in 1991 and noted rates from 0.04% to 3.4%. Other reviews note similar infectious rates.[2,7] Brislin et al[8] published a recent study on 263 patients who had undergone arthroscopic rotator cuff repair. They noted only a single infection in this group with an incidence of 0.38%. Athwal et al[9] in 2007 reported on 39 cases of deep infection after rotator cuff repair.

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They noted that long-term functional limitations in these patients are not uncommon. They emphasized recognizing Proprionobacterium acnes as the most likely causative organism and the need for at least 7 days of culture to identify this organism. Regardless of the true incidence, infection after shoulder arthroscopy requires a high index of suspicion with prompt management once deep infection is recognized.

Little data exist to guide management of a deep infection after arthroscopic shoulder surgery. In 2006, Jeon et al,[10] reported on 19 patients who presented with glenohumeral sepsis and were managed with arthroscopic lavage, debridement, and systemic antibiotic therapy. The infection was eradicated in 14 of the cases with a single procedure. They concluded that arthroscopic management was safe and effective. In 2010, Klinger et al,[11] reported on 21 patients with septic arthritis of the shoulder joint and concluded that in early infection (< 2 wk) arthroscopic management was effective but in more advanced infection, a combination of open and arthroscopic approach was more effective. It is important to keep in mind that neither of these studies were focused on postoperative surgical site infections and therefore it is difficult to extrapolate these findings to this subset of patients. However, in the setting of acute postarthroscopic joint infection, it is clear that aggressive management consisting of arthroscopic or open lavage, debridement, cultures, and intravenous antibiotic therapy is warranted.

General anesthetic complications germane to any surgical procedure also apply to shoulder arthroscopy. In addition, fatal air embolism[12] and pneumothorax,[13] possibly related to the use of CO_2, pulmonary edema,[14] and pneumomediastinum[15] have all been reported during shoulder arthroscopic procedures. It is important to educate patients of these risks for them to gain an understanding that minimally invasive procedures can still be associated with significant complications.

Of special relevance to shoulder arthroscopy is the increasing use of interscalene anesthesia for intraoperative management and postoperative pain control. Although purported to be a safe and effective means for pain control, reports of seizures, cardiovascular collapse and severe respiratory distress have been noted. In addition, neurologic complications in the form of transient and even permanent brachioplexopathies are a known risk of regional brachial plexus blockade.[16,17] Lenters et al[18] reviewed the experience of a single medical center over a 15-year period and supplemented these data with records from the national American Society of Anesthesiology Closed Claims Database. From the hospital experience, they reported a total of 41 major complications after interscalene block, with 14 of them still present, affecting comfort and function at the most recent follow-up. From the database, they noted 19 permanent complications and 4 deaths attributable to interscalene brachial plexus block. It does appear that fewer complications arise with anesthesiologists become more experienced with the techniques and newer technology including ultrasound-guided blocks. However, complications can and do still occur. It is important that the anesthesiologists performing these procedures have significant experience; understand the risks and that they communicate these to the patients. These procedures must be performed with the patient awake. Ultrasound guidance to direct needle placement is expected to decrease the risk of interscalene blocks.

Deep venous thrombosis of the lower extremity after shoulder arthroscopy has rarely been noted in the literature.[19,20] In 2011, Jameson et al,[21] reported on rates of symptomatic deep venous thrombosis and pulmonary embolism after shoulder arthroscopy by examining records from the English National Health Database. With over 65,000 patients, they found rates to be < 0.01%. Standard precautions, such as using mechanical compression devices on the lower extremities during the procedure and early mobilization may minimize the risk. Currently there are no guidelines in place that suggest the use of routine chemoprophylaxis is indicated after shoulder arthroscopy.

COMPLICATIONS SPECIFIC TO SHOULDER ARTHROSCOPY

Complications due to the 2 prevalent patient positions during arthroscopy do occur. The lateral decubitus position (Fig. 1) has the advantage of joint distraction, which allow easier access to the inferior aspect of the glenoid during joint arthroscopy. In this position, traction neuropraxia has been reported to occur up to 10% of the time.[22] Klein et al,[23] in 1987 placed strain gauges on the brachial plexus of cadavers and measured the strain on the plexus in the lateral decubitus position with varying amounts of flexion and abduction. They found that increasing flexion and abduction decreased strain on the brachial plexus. Stanish and Peterson[24] have reviewed the literature on neurological injuries after shoulder arthroscopy and suggested that careful patient positioning, minimal traction to distract the joint (no more than 7 kg); limiting the length of the procedure, and accurate portal positioning could minimize complications.

The beach chair position (Fig. 2) was described in 1988 by Skyhar et al.[25] Its advantages include easier airway access, placing the anatomy in the standard upright position, the ability to move the arm into different positions intraoperatively and decreased risk of traction-related

FIGURE 1. Lateral decubitus position for shoulder arthroscopy. The patient is positioned with a beanbag with the right arm in longitudinal suspension.

FIGURE 2. Beach chair position for shoulder arthroscopy. The arm is attached to a hydraulic positioning device that allows the arm to be manipulated during the arthroscopic procedure.

neuropraxia. However, several reports of catastrophic complications have been reported with the use of the beach chair position. Pohl and Cullen,[26] reported on 4 cases of shoulder surgery that resulted in death in 1 patient and severe brain damage in 3 others. Stroke, brain death, loss of vision, and ophthalmoplegia have also been described.[27,28] These complications are thought to be attributable to errors in blood pressure reference points leading to decreased cerebral perfusion. Contributing to this problem is the common use of deliberate hypotensive anesthesia during shoulder arthroscopy to facilitate visualization and decreasing blood loss. Studies indicate that a safe and clear operative field can be achieved by a pressure difference of 49 mm Hg or less between the systolic blood pressure and the pressure measured within the subacromial space.[29] In order to decrease the risk of fluid extravasation, deliberate hypotension is often used with only a modest increase in pump pressure. In the beach chair position, there is a significant hydrostatic pressure gradient between the brain and the site of blood pressure measurement that equates to 2 mm Hg per inch.[30] This can easily result in a difference of 25 mm Hg between the measured pressure at the brachium and the actual cerebral perfusion pressure. Because of this, it is recommended that the surgeon be judicious with use of deliberate hypotension and that blood pressure measurements be taken from the contralateral brachium and adjusted for the height difference in order to decrease the risk of significant cerebral hypoperfusion.

At the current time, it seems that choice of position should be left up to the surgeon's preference. Recognition of the potential complications of the preferred position and taking preventative measures can minimize the occurrence of a significant untoward event. Preference seems to develop secondary to tradition and training.

With the increasing complexity of arthroscopic procedures about the shoulder, the need to establish portals

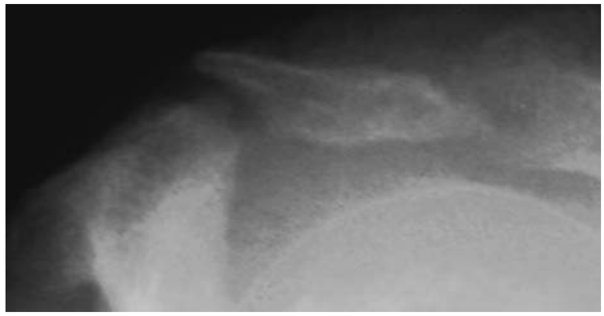

FIGURE 3. Outlet view radiograph depicting an acromial fracture postoperatively after shoulder arthroscopy and subacromial decompression.

that allow for optimal access and precision placement of implants has also increased. Although vascular complications associated with portal placement remains rare,[7,31] direct neurological injury remains a concern. Segmuller et al[32] noted direct cutaneous nerve injury in 7% of their 304 patients undergoing shoulder arthroscopy. Most of these injuries involved a cutaneous branch of the axillary nerve at the site of the established lateral portal. This concern over direct nerve injury underscores the importance of accurate portal placement.[33] Lo et al[34] in 2004 studied the neurovascular anatomy in proximity to the most commonly used arthroscopic portals established via an outside in approach. They noted that with the exception of the cephalic vein, all of the neurovascular structures were > 20 mm away from all of the portals evaluated; it was concluded that the standard and accessory arthroscopic portals are safe when established in an outside-in manner. Other considerations such as careful palpation of bony landmarks, accurate knowledge of shoulder anatomy, accounting for fluid extravasation, and the use of cannulas during portal placement may enhance safety during shoulder arthroscopy.

Fractures of the acromion, clavicle, and humerus can occur during shoulder arthroscopy. Fracture of the acromion has been extensively described in the literature.[7,35] This is usually a result of overzealous and inaccurate resection of the acromial spur, often in the setting of a patient with a thin acromion preoperatively (Fig. 3). Simple precautions can be taken to prevent this complication. Measurement of the thickness of the acromion on preoperative radiographs and attention to the depth of resection using the known diameters of the arthroscopic tools as a reference are helpful. In addition, adequate visualization and exposure of the anterior acromion to prevent beginning the resection too far posteriorly, and working from anterior-inferior to superior will further minimize the chance of excessive resection. Fractures can be treated with screw fixation, tension band fixation, or excision of the remaining bone and repair of the deltoid attachment. Clavicle fractures can occur as a result of the surgeon becoming disoriented during subacromial surgery. At this point, the surgeon may mistakenly resect through the shaft of the clavicle instead of the acromioclavicular (AC) joint because of straying too medial during the procedure. Humeral-sided fractures are also a concern during shoulder arthroscopy. They can occur as a result of excessive manipulation of a stiff shoulder (Fig. 4), improper instrument penetration, or implant placement. Paying attention to the amount of force

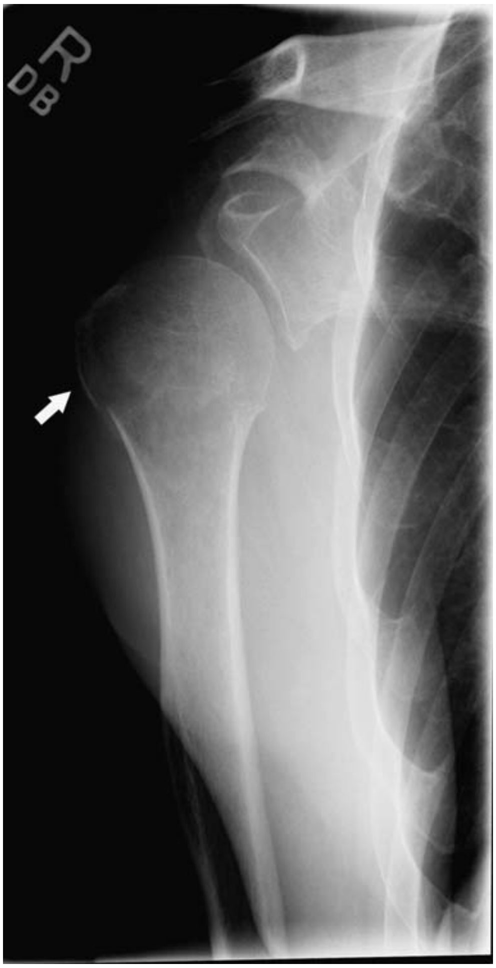

FIGURE 4. Anteroposterior radiograph demonstrating a greater tuberosity fracture (white arrow) as a result of overly aggressive manipulation of a stiff right shoulder under anesthesia.

imparted during manipulation and careful attention to instrument placement and topography of the tuberosity can minimize the risk of these complications. When such a fracture occurs, it can be treated conservatively or by reduction and internal fixation depending on the stability of the fracture.

Stiffness is probably the most common complication of any surgery about the shoulder. It can be a significant cause of morbidity, loss of function, and continued disability. Significant restriction of motion has been proposed to occur, ranging from 2.8%[36] to 15%[3] after shoulder arthroscopy. Stiffness is manifested clinically by decreased active and passive range of motion, often with a very profound loss of external rotation. This is often accompanied by a period of worsening pain after the postsurgical pain has abated. The physical exam demonstrates restricted glenohumeral motion, with a disproportionate amount of motion coming from scapulothoracic rotation. It is important to differentiate postoperative stiffness from restricted motion secondary to complex regional pain syndrome. In the latter, physical examination findings of hyperesthesia, profound edema, excessive warmth, and neurological dysfunction often accompany the lack of motion. If complex regional pain syndrome is suspected, a full workup, usually with the aid of a pain specialist, is required to manage the condition. Postoperative stiffness can be minimized with early range of motion and emphasis on scapular stabilization to encourage smooth glenohumeral motion.

With respect to stiffness, rotator cuff, and instability surgery represent challenges for the surgeon. Too early and aggressive motion may predispose the repair to fail, whereas too conservative a rehabilitation program could increase the likelihood that arthrofibrosis may occur. In my experience, this is best prevented with extensive patient education, very detailed physical therapy protocols, and frequent follow-up appointments to identify those patients who are prone to developing stiffness. Understanding the difference between passive, active-assisted and active range of motion, as well as the limits of a safe range of motion are essential for adequate compliance. In addition, frequent communication between the surgeon and the physical therapist to formulate a unified rehabilitation plan is invaluable.

Correctly identifying those patients who are stiff preoperatively is as equally important as identifying postoperative patients who may develop stiffness. Often, pain restricts a patient's range of motion in the clinic setting, however, if the clinician fails to diagnose early adhesive capsulitis in this setting or if it is, for example, mistakenly attributed to impingement syndrome, the wrong course of treatment may be prescribed. Erroneous diagnosis in this setting may lead to unnecessary surgery and poor postoperative outcomes. Diagnostic subacromial injections with lidocaine can effectively aid in separating a truly stiff shoulder from a shoulder that seems stiff because of guarding secondary to pain.

Despite the best efforts on the part of surgeon and patient, a small subset of postoperative shoulders will become stiff and fail to respond to conservative management. In this group, closed manipulation and/or arthroscopic release is highly effective to restore motion and relieve pain.[37,38] At present, there is no consensus on the timing of manipulation or release in this population, with proponents of early (3 mo) and late (> 6 mo) being highly prevalent.

Chondrolysis is a rare but devastating process that has been identified to occur after shoulder arthroscopy (Fig. 5). Although no specific cause has been elicited, several potential contributing factors have been explored. Reports of chondrolysis have been made after the use of an intra-articular pain pump.[39,40] In addition, pain pumps often infuse bupivacaine, a substance that has been implicated as chondrotoxic in various animal and in vitro models.[39–41] In 2010, a review of the 100 cases of postarthroscopic glenohumeral chondrolysis in the English literature was reported.[42] Fifty-nine percent of the cases had continuous infusion of local anesthetics. However, a 2008 study by Dragoo et al[43] reported that exposure of cultured chondrocytes to bupivacaine up to a maximum of 48 hours was not significantly chondrotoxic, whereas more prolonged exposure led to increased chondrocyte death. In addition, bupivacaine injections into the glenohumeral and knee joints are commonly performed in the clinical and operating room settings without significant observed rates of chondrolysis, lending more evidence that significant cartilage damage may not occur after a single exposure to intra-articular bupivacaine.

Several reports have associated chondrolysis with use of a thermal probe in capsulorrhaphy or capsular

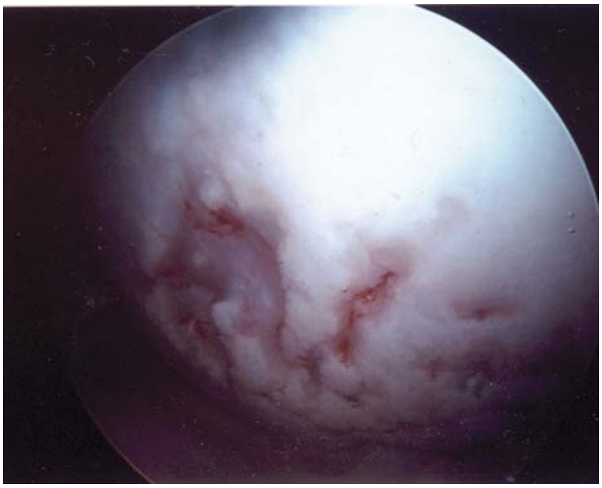

FIGURE 5. Arthroscopic photograph of a right shoulder viewed from the posterior portal. Significant chondrolysis of the humeral articular surface developed after an index arthroscopic shoulder procedure. This patient continued to have pronounced pain and disability after the index procedure prompting reexploration.

release.[44–46] In 2009, Good et al[47] studied temperatures in the glenohumeral joints of cadavers when using a thermal device in different flow states. They noted that the temperature in the joint rose to above 45°C in all flow states but that higher flow states led to quicker dispersion of the heat than lower flow states. Irrigant temperatures above 45°C have been shown to result in chondrocyte death. They concluded that use of a thermal probe might lead to temperatures high enough to cause chondrocyte death and that maintaining adequate fluid-pump flow rates may help to minimize exposure to high temperatures and protect the articular cartilage.

Many other factors have also been implicated in the development of chondrolysis including infection, bioabsorbable implants, mechanical imbalance, and repetitive and single traumatic events. At present, there is insufficient evidence to suggest that there is any one predisposing cause for the development of chondrolysis, although care should be taken when considering pain pump usage and continuous anesthetic infusion given the current medico legal environment. Research to identify these complex interactions and their contributions to this disease process is ongoing.

Increasing numbers and types of implants used to stabilize and repair structures about the shoulder are becoming available. The surgeon has the choice to use metal, bioabsorbable, bioinert, or even recently biocompatible implants. Metal implants have the advantage of being able to be followed on routine radiography in order to confirm placement. Disadvantages include artifact creation on subsequent magnetic resonance evaluation, loosening, and migration.[48] To address these concerns, bioabsorbable implants have been developed and extensively used in place of metal implants. These implants have been scrutinized for complications including loose body creation as a result of partial anchor resorption and osteolysis stemming from the biological response as the anchor resorbs.[49,50] Osteolysis of anchors in the anterior glenoid may create a stress area for further anterior glenoid bone loss. Reported complications with the use of bioabsorbable implants are very rare, especially with newer generation implants with more reliable degradation profiles and sturdier suture-eyelet constructs.[51] Bioinert and biocompatible implants have also been developed to address concerns surrounding the degradation and osteolysis profile of bioabsorbable implants. When these radiolucent implants are used, if they are inserted in a proud manner or become loose, they may cause significant articular cartilage injury as loose bodies before they are recognized (Figs. 6A, B). One should harbor a high index of suspicion for this complication in the setting of a patient with mechanical symptoms and pain after implantation of radiolucent anchors. In this setting, early advanced imaging and reexploration is warranted in a timely manner.

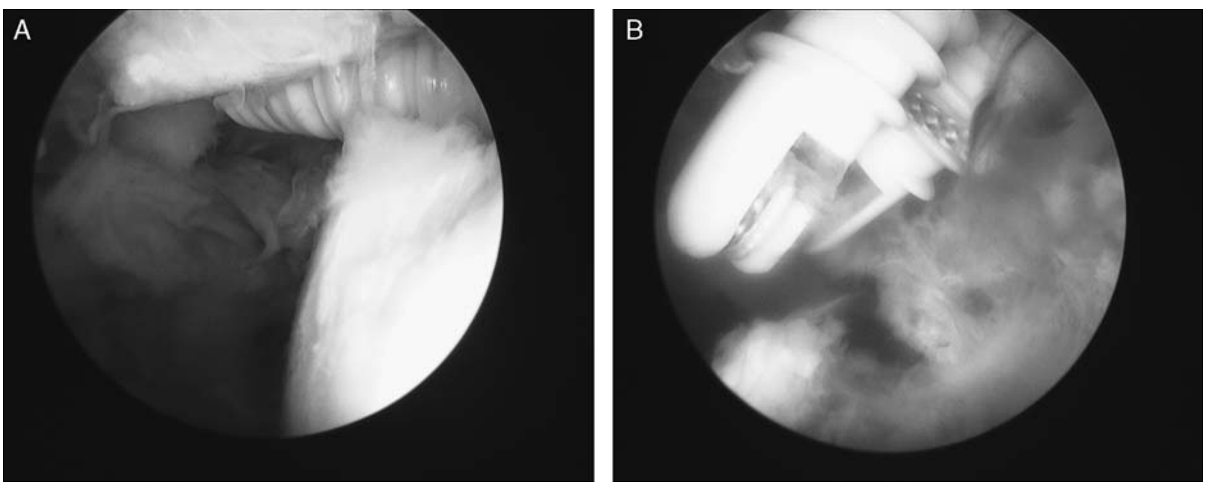

FIGURE 6. Arthroscopic photographs of a right shoulder in the lateral decubitus position viewed from the posterior portal. A, Glenohumeral joint with the humeral articular surface on the right, with anchor pullout as a result of rotator cuff failure. B, Subacromial space with additional anchor failure. The implants in these images are bioabsorbable. The patient complained of mechanical symptoms and increasing pain after surgery.

COMPLICATIONS ASSOCIATED WITH SPECIFIC PROCEDURES

Subacromial Surgery

Overall, subacromial surgery has the lowest rate of complications of all procedures in the shoulder with rates between 0.76% and 6.5%.[1,36] The most common reported cause of failure of arthroscopic acromioplasty is inadequate resection.[52] Difficult visualization is a significant factor in most inadequate resections. Visualization can be maximized with extensive bursectomy, meticulous hemostasis, relative hypotensive anesthesia, and adequate hydrostatic pressure. As discussed above, keeping the difference between the measured blood pressure and subacromial space pressure to 49 mm Hg or below facilitates clear visualization.[29] Excessive resection of the acromion should also be avoided (Fig. 7). As previously mentioned, preoperative planning with careful attention paid to acromial thickness and morphology can minimize its occurrence.

Finally, postoperative AC symptoms can occur when the AC joint is violated during acromioplasty.[45] Whether to leave the AC joint undisturbed, coplaning the AC joint, or completely resecting the AC joint when violation and inferior osteophytes are encountered remains controversial.[52,53] Biomechanical studies have demonstrated increased superior and anterior translation in coplaned specimens[54] and AC joint instability symptoms have been reported clinically after coplaning. In contrast, studies have noted no increased incidence of AC joint symptoms, compromised clinical results, or additional surgery at an average follow-up of up to 6 years.[55]

Rotator Cuff Repair

Arthroscopic rotator cuff repair has gained in popularity recently with subjective and objective results similar to miniopen rotator cuff repair.[56] Failure of rotator cuff surgery resulting in continued disability remains a concern regardless of the technique used. One major cause of failure is due to rotator cuff retearing. In 2007, Cole et al[57] evaluated cuff repair integrity in 49 shoulders at a minimum of 2 years follow-up using magnetic resonance and noted that 22% of repairs had a recurrent tear. Brislin et al[8] reviewed 263 repairs in 2007 and noted only 1 reoperation for repair failure. No follow-up imaging was used to identify a retear so diagnosis was based on symptomatology and evidence at second look arthroscopy. Although cuff integrity is not universal after rotator cuff repair resulting in an asymptomatic shoulder, it is clearly associated with a better outcome.[58] Several recent studies have demonstrated that the tear size at the time of repair and age are critical factors in assessing the risk of failure.[57,59] Significant interest has arisen with the advent of newer double row repair techniques and enhanced rotator cuff footprint coverage. Current evidence suggests that double row repairs may have lower radiographic retear rates but have not been shown to provide superior functional outcomes.[60] Other causes for failure after rotator cuff surgery can prove to be due to concomitant pathology not addressed or identified including glenohumeral arthritis, impingement, AC joint pain, biceps problems, and even cervical-based pain origins.

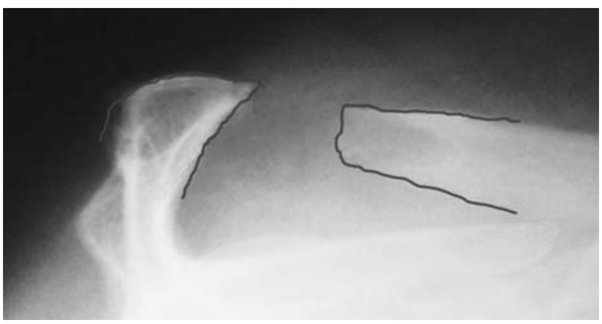

FIGURE 7. Outlet radiograph of a right shoulder showing excessive acromial resection. The red line outlines the edges of the resected acromion and the distal clavicle.

During rotator cuff repair, visualization and arm positioning are key to avoid placing anchors too medially into the articular margin. Visualization is improved with careful hemostasis, attention to intraoperative blood pressure and extensive bursectomy. When placing suture anchors into the medial aspect of the greater tuberosity, the arm should be adducted as much as possible to avoid a shallow approach to the tuberosity and potential penetration of the humeral head. An incision just off the lateral acromion will also improve the trajectory of the anchor and decrease the risk of articular injury.

Instability Repair

Suture anchor capsulorrhaphy has become the gold standard in arthroscopic stabilization, yet recurrence after arthroscopic instability surgery remains a relatively common complication. Several studies claim that with newer techniques and improved anchors, outcomes of arthroscopic stabilization are approaching those of open technique with the potential benefit of less morbidity and improved range of motion.[61–63] This view is not without some controversy. A meta-analysis performed by Lenters et al[64] in 2007 noted that arthroscopic suture anchor techniques are associated with significantly higher risks of recurrent instability and dislocation than open methods. However, the arthroscopic repairs were associated with higher Rowe scores than the open methods providing evidence that function and motion may be better preserved using arthroscopic approaches.

In 2012, a systematic review reporting on the risk factors of recurrence after arthroscopic bankart repair demonstrated a rate of 3.4% to 35%.[65] Factors leading to a greater risk of recurrence included, age younger than 22 years old, male sex, increasing number of preoperative dislocations and participation in competitive sports, substantial associated glenoid or humeral head bone loss, and the presence of anterior labroligamentous periosteal sleeve avulsion. Recent interest has centered on the role of these bone deficiencies and their contributions to recurrent instability rates. In 2000, Burkhart and De Beer[66] reported a higher rate of recurrence in patients with significant bone defects. Recognition of these potential risk factors has led to a shift in management of high-risk patients. Consideration should be given to additional arthroscopic techniques (ie, remplissage) or even conversion to open techniques (ie, Laterjet or other bone block procedures) to minimize recurrence rates.

Injury to the axillary nerve deserves special consideration during instability surgery. The nerve branches off of the brachial plexus and crosses the inferior border of the subscapularis just medial to the musculotendinous junction where it continues posteriorly along the inferior capsule until it wraps around the humerus and runs along the undersurface of the deltoid musculature. Although uncommon, there are 2 main maneuvers that place it at risk during instability surgery. Namely, when placing an anchor through a "5 o'clock" portal and during suture passage for capsular shift in the same "5 o'clock" position. Using a single pass technique with a blunt percutaneous trochar system or avoiding penetration of the subscapularis tendon when placing the low anterior anchor can help to minimize risk during anchor placement. By limiting depth of penetration of the inferior capsule during suture passage, one can also limit risk of nerve injury as it courses along the inferior capsule.

Suture anchor placement during arthroscopic capsulorrhaphy requires a working 3-dimensional knowledge of glenoid anatomy in order to prevent anchor malposition. Understanding the slope of the glenoid neck, glenoid version, and the angle of approach during anchor placement is critical. Similar to rotator cuff repair, choosing to use metal or radiolucent implants will determine whether implant position can be followed postoperatively with standard radiographs.

SUMMARY

Shoulder arthroscopy seems to be a safe and effective technique based on a review of the literature. Despite the increasing complexity of procedures being done, complication rates have remained steady. It is important to recognize that serious and even life-threatening complications, though rare, can and do occur. It is imperative that the surgeon recognizes that decisions made before (such as choice of position, type of anesthesia, etc.), during (choice of implant, use of thermal devices, portal placement, etc.), and after surgery (rehabilitation, use of pain catheters, etc.) can affect the complication profile and rate in an individual's practice. A thorough understanding of shoulder anatomy, implant design, and patient risk factors can help to minimize these complications. Finally, when complications do occur, early recognition and management can minimize the morbidity of these procedures.

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