Complications in Shoulder Arthroscopy

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Shoulder arthroscopy is generally a safe and effective method for treating a wide variety of shoulder pathology. Fortunately, complications following shoulder arthroscopy are rare, with reported rates between 4.6% and 10.6%. These rates may be underestimated, as underreporting of complications and varying definitions of the term complication are likely. During shoulder arthroscopy, complications may occur at numerous points. The surgeon must be aware of potential problems and take necessary measures to prevent them.

This article describes common complications after arthroscopic shoulder surgery. Although failure of treatment and postoperative stiffness are undesirable outcomes, they are not described.

PATIENT POSITIONING AND ANESTHESIA

Shoulder arthroscopy is performed in either the sitting beach chair or the lateral decubitus position. Each of these positions has relative merits for the technical performance of procedures; however, each is also associated with a relatively different complication profile that must also factor into the surgeon’s preference for patient positioning.

In the lateral decubitus position, the patient’s operative extremity is suspended from a traction device (Figure 1). This potentially places the brachial plexus under tension. Paresthesias and nerve palsies have been reported in 10% to 30% of cases performed in this position. The optimal position for reducing strain on the brachial plexus while preserving arthroscopic visibility is approximately 45° of forward flexion and either 0° or 90° of abduction. Internal rotation of the humerus with forward flexion will also decrease brachial plexus strain. The surgeon should be careful to pad all bony prominences on the down leg, use an axillary roll to protect the down arm, and use no more than 15 to 20 lbs of traction.

In the beach chair position, the patient sits upright with the operative extremity supported by an assistant or mechanical arm-holder (Figure 2). Although this position provides the anesthesiologist greater access to the airway, anesthesia-related complications are more common in this position than in the lateral decubitus position, including spinal and cerebral ischemia and death.

Impaired venous return from the dependent lower extremities and vasodilation from anesthetic agents may contribute to impaired cerebral blood flow. Hypotensive anesthesia is commonly used during arthroscopic shoulder surgery to decrease bleeding and improve visualization. If such measures are used, careful monitoring of the patient’s blood pressure is essential to avoid extreme hypotension.

Blood pressure cuffs should be placed at the level of the heart, as using a dependent lower extremity will cause the readings to be falsely elevated. The head and neck should be placed in a neutral position to avoid alterations in cerebral blood flow and palsies of the hypoglossal and superficial nerves. Visual loss has also been reported in the beach chair position; however, it is unclear what role positioning may have played. There is also a theoretical risk of air embolus, which has been re-
ported following neurosurgical cases performed in the upright position.15

Interscalene nerve blocks are commonly used for arthroscopic shoulder surgery as they generally provide good muscle relaxation as well as intra- and postoperative analgesia. However, complication rates of 0.7% to 4%7,19-22 have been reported, and additional anesthetic methods are frequently necessary. Complications following interscalene nerve blocks include pneumothorax, pseudoaneurysm, respiratory distress from phrenic nerve palsy, seizure, hematoma, cardiovascular collapse, spinal or epidural anesthesia, peripheral neuropathy, and complex regional pain syndrome.7,19-25

**CHONDROLYSIS**

Postarthroscopic glenohumeral chondrolysis is an increasingly recognized entity. Although the cause is unknown, much attention has focused on the use of radiofrequency or thermal devices and intra-articular pain pumps during cases in which chondrolysis occurs.26-40 Young patient age, instability surgery, articular cartilage damage, bioabsorbable implants, type of anesthetic, type of irrigant fluid, and use of an intra-articular bolus of local anesthetic have also been implicated as risk factors.26,37,41,42 Patients undergoing arthroscopy for instability may have some degree of preexisting damage to the articular cartilage that predisposes them to postarthroscopic glenohumeral chondrolysis.37 Solomon et al37 proposed a multifactorial pathway in which articular cartilage damage combines with a secondary thermal, mechanical, or chemical insult to produce chondrolysis (Figure 3).

Postarthroscopic glenohumeral chondrolysis often presents initially as a deep ache that progresses to severe pain and loss of motion.26 Patients typically present between 3 and 12 months after their index procedure.26,30,31,36 Radiographs demonstrate loss of the glenohumeral joint space without significant osteophytosis or subchondral sclerosis.26 Treatment of this problem is challenging, with many authors proposing nonsteroidal anti-inflammatory drugs, intra-articular corticosteroids, hyaluronic acid, and ultimately some form of arthroplasty with or without biologic resurfacing.26,28-30,32,36,43 Most authors now suggest avoiding thermal capsulorrhaphy and intra-articular pain pumps until more definitive studies are performed.31,38

**NEUROLOGIC COMPLICATIONS**

Nerve damage after shoulder arthroscopy is fortunately rare, with reported rates of ≤3%,44,45 with larger series reporting rates <0.2%.5,6,46 Paresthesias have been reported in 10% to 30% of cases.8-11,47 Injuries to the median,5,48 axillary,5 musculocutaneous,10,44,46 medial antebrachial cutaneous,49 radial,10, ulnar,44 medial pectoral,50 and anterior interosseous nerves,50 as well as cutaneous hypoesthesias51 have all been reported. These injuries are generally transient, although permanent damage requiring tendon transfers has been described.45 Positioning,8,11,47,52 traction,12 joint distention and fluid extravasation,10 and direct injury from portal placement45 have all been implicated in postoperative nerve injuries.

A thorough knowledge of shoulder anatomy is essential to avoid nerve injury while placing arthroscopic portals (Figure 4). Neurovascular structures are most at risk during placement of anterior portals. In particular, the dangers of the 5 o’clock (right shoulder) anteroinferior portal are
well described, with some authors cautioning against placement of anteroinferior portals altogether.53,54

Davidson and Tibone55 described an inside-out technique that established the portal at the leading edge of the inferior glenohumeral ligament and the glenoid rim. Resch et al56 described an outside-in technique in which they placed the 5 o’clock portal 2 cm below the palpable tip of the coracoid. In the beach chair position, the axillary nerve is an average of 12 to 33 mm away and the musculocutaneous nerve is an average of 18 to 28 mm from the glenoid rim.59 Increasing the musculocutaneous nerve maximally away from the glenoid rim. Resch et al56 described an inside-out technique that established the portal at the leading edge of the inferior glenohumeral ligament and the glenoid rim.59 Increasing the musculocutaneous nerve maximally away from the glenoid rim. Resch et al56 described an inside-out technique that established the portal at the leading edge of the inferior glenohumeral ligament and the glenoid rim.59

Placement of an anteroinferior portal also puts the cephalic vein and axillary artery at risk and may cause chondral injuries.53,54,57 Caution should be used when placing instrumentation inferiorly as the axillary nerve is 10 to 25 mm from the glenoid rim at the 5:30 to 6 o’clock position in the right shoulder. Abduction with neutral rotation moves the axillary nerve maximally away from the glenoid rim.59 Increasing abduction in the lateral decubitus position brings the lateral cord of the brachial plexus closer to the coracoid, so care should be taken when working around this structure.60

The placement of posterior, lateral, and Neviser supraclavicular portals imparts less risk to adjacent structures than anteriorly based portals, but care must still be taken.53,54 The standard posterior central or “soft point” portal is placed 2 cm medial and 2 cm inferior to the posterolateral corner of the acromion.51 Lateral portals are created 2 cm below the lateral edge of the acromion, between the anterior and posterior edges of the acromion.53 The Neviser portal is created in the soft spot bounded by the acromion, clavicle, and scapular spine. A skin incision is made 1 cm medial to the medial acromion and the cannula is advanced slightly posteriorly and 30° laterALLY.53 The axillary nerve is at least 30 mm away from standard posterior portals53,57 and standard lateral portals.53,57 The suprascapular nerve is at least 20 mm medial to the Neviser supraclavicular portal,53,61 making nerve injury unlikely. Care should be taken to avoid abducting or flexing the arm during portal placement to minimize musculotendinous damage.61 The posterolateral portal is created 2.5 cm inferior to the posterolateral corner of the acromion and places the axillary nerve, suprascapular nerve, and nerve branch to the teres minor at less risk than posteroinferior portals when accessing the inferior glenohumeral recess.62

**Infection**

Deep infection after arthroscopic or mini-open shoulder surgery is rare, with rates reported between 0.16% and 1.9%.46,63-65 Preoperative antibiotics should be used to reduce the incidence of postoperative infection.63,66 Surgical site preparation with 2% chlorhexidine gluconate and 70% isopropyl alcohol (Chloraprep; Enturia, El Paso, Texas) is more efficacious than 0.7% iodophor and 74% isopropyl alcohol (Duralprep; 3M, Minneapolis, Minnesota) or providone-iodine scrub and paint (0.75% iodine scrub and 1.0% iodine paint; Tyco Healthcare Group, Springfield, Massachusetts) in eliminating bacteria from the shoulder region prior to surgery.67

Patients with postoperative shoulder infection typically present with erythema and wound drainage.63,64 The erythrocyte sedimentation rate is typically elevated,63,64 but fever and malaise are relatively uncommon.64 It is important to distinguish between superficial and deep infections. Although the incidence of superficial infections is not known, these infections do not extend deep to the deltoid, and they can generally be treated with oral antibiotics alone.63,64 However, patients with deep infections will typically require multiple debridements and intravenous antibiotics.63,64 Consultation with an infectious disease specialist may be helpful when selecting an antibiotic regimen.

**Propionibacterium acnes** is a frequent cause of postoperative shoulder infections.63,64,68,69 Because this organism can be difficult to isolate, cultures should be monitored for at least 1 week and up to 3 weeks. Shoulder function after infection is generally decreased compared to patients who do not experience infection.64 The amount of intact cuff at final debridement may be an important factor in determining outcome.63

**Thromboembolic Complications**

Deep venous thrombosis (DVT) and pulmonary embolus are rare events after shoulder arthroscopy, with reported rates between 0.06% and 0.42%.63,70,71 The literature consists primarily of case reports with only a few case series. The lateral decubitus position increases the risk of thromboembolic complications,70,72-75 as traction causes decreased limb perfusion.9,76 However, thromboembolic complications have been reported after use of the beach chair position as well.71,77,78 Other potential risk factors include prolonged surgical time, use of an interscalene block, and presence of a hypercoagulable state.71,72 In most reported cases, an underlying hypercoagulable state was identified as a contributing factor.70,71,73,75,77,79 Interestingly, one large series reported several ipsilateral lower extremity DVTs after shoulder arthroscopy.71,72 In another recent series, there was no association between a thromboembolic event and whether the patient had received antithrombotic prophylaxis.65

**Conclusion**

Despite myriad potential problems, shoulder arthroscopy is generally a safe and effective method for treating a variety of conditions. Whether the beach chair or lateral decubitus position is used, careful patient positioning and vigilant anesthesia monitoring are
essential. Thermal devices and intra-articular pump pains have been implicated in the pathogenesis of postarthroscopic glenohumeral chondrolysis and should be avoided or used with caution. The musculocutaneous and axillary nerves are most at risk during arthroscopic portal placement. The anteroinferior or 5 o’clock portal warrants special caution.

Preoperative antibiotics and proper antisepsis are important to reduce the risk of infection. Thorough debridement and targeted antibiotics are effective treatment measures. Thromboembolic events are rare and usually attributable to a hypercoagulable state. Patients should be informed of these potential complications prior to surgery, and treating surgeons must exercise care to minimize the risk of these potentially debilitating problems.

REFERENCES


