Technical Note

Arthroscopic Rotator Cuff Repair and Subpectoral Biceps Tenodesis in the Lateral Decubitus Position

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Abstract: Arthroscopic rotator cuff repair can be performed with the patient in the beach-chair or lateral decubitus position. Patient positioning in shoulder arthroscopy is a critical step in surgical preparation and remains a debated topic. The lateral decubitus position is a reliable, safe, and effective position in which to perform nearly all types of shoulder arthroscopic procedures. The purpose of this Technical Note is to describe our preferred technique for performing arthroscopic rotator cuff repair with the patient in the lateral decubitus position, which portends several advantages, such as improved visualization of the glenohumeral space, ergonomic positioning, a low risk of cerebral hypoperfusion, and a shorter operating time.

Arthroscopic techniques are the gold standard for the treatment of rotator cuff tears, providing similar functional results to open and mini-open techniques with a significant decrease in postoperative complications.[1] Patient positioning in shoulder arthroscopy is a critical step in surgical preparation and remains a debated topic. Beach-chair (BC) positioning and lateral decubitus (LD) positioning remain the most commonly used positions for arthroscopic rotator cuff repair. Surgeons using the BC and LD positions often believe their positioning style is the easiest and fastest to use regarding the number of steps, amount of equipment, and assistance required to set up and perform arthroscopy; however, significant differences in clinical outcomes between the 2 styles have yet to be elucidated.[2]

Both BC positioning and LD positioning for shoulder arthroscopy have advantages and disadvantages, with surgeon preference typically based on experience and training. LD positioning was first introduced in the 1980s with the use of a static traction device to apply flexion and abduction of the shoulder and a vacuum beanbag to support the patient's torso.[3] Proponents of LD positioning believe there are distinct advantages regarding the ease of setup, intraoperative visualization and joint accessibility, and the complication profile.[4,5]

The purpose of this Technical Note and Video 1 is to describe our technique for performing arthroscopic rotator cuff repair with the patient in the LD position. This technique offers several advantages over BC positioning, such as improved visualization of the glenohumeral space, ergonomic positioning, a low risk of cerebral hypoperfusion, and a theoretically shorter operating time (Table 1).

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Table 1. Pearls and Pitfalls of Rotator Cuff Repair in Lateral Decubitus Positioning

Pearls
Improved visualization of the glenohumeral space and ability to perform labral work with ease
Ergonomic; the patient's head is not a mechanical block, limiting work space
Low risk of cerebral hypoperfusion
Theoretically shorter operating room time
Pitfalls
Careful padding of all bony prominences required to prevent skin injuries and peripheral neuropathies
Potential transient brachial plexopathy due to traction

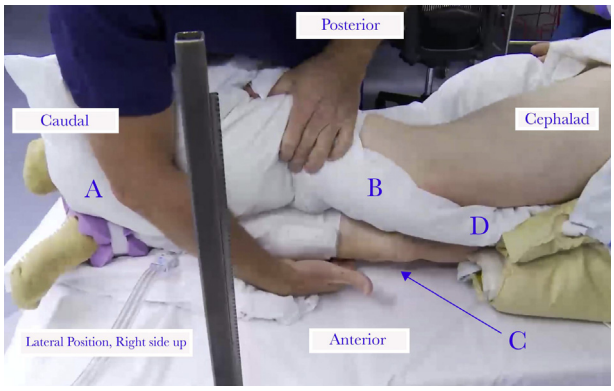

Fig 1. With the patient in the left lateral decubitus position, care should be taken to ensure that all bony prominences are well padded. (A) A foam pad is used to cushion the malleoli. (B) Multiple pillows are placed between the legs. (C) A free space should be created directly between the fibular head and operating table to prevent peroneal nerve compression. A hand should be able to be placed between the dependent knee and the operating room table. (D) The beanbag should be deflated and end at the mid thigh; ample padding should be placed between the beanbag edges and the patient.

Surgical Technique

Patient Positioning, Anesthesia, and Intraoperative Assessment

Preoperatively, the patient undergoes supraclavicular interscalene catheter placement. The patient is initially positioned supine, and general anesthesia is induced. Next, the patient is carefully placed in the LD position with the operative side up (Fig 1). All bony prominences as well as neurovascular structures are carefully padded. An axillary roll is used to protect the brachial plexus, and an additional roll is used to protect the peroneal nerve. Figure 2 and Table 2 present additional LD positioning instructions. An examination under anesthesia is performed to document preoperative range of motion.

Initial Assessment

At case initiation, a standard posterior portal is made 2 cm inferior and medial to the posterolateral corner of the acromion (Fig 3). The scope is inserted into the glenohumeral joint, and a standard diagnostic arthroscopy is performed. Next, an anterior portal is created using the inside-out technique, approximately 1 cm lateral to the coracoid. The arthroscope is then directed into the subacromial space using the same posterior portal. A lateral portal is made, localized over the midportion of the tear. A cannula is inserted in the lateral portal. Next, the subacromial bursa is cleared using an arthroscopic shaver, and an acromioplasty is performed using a 5.5-mm stone-cutting burr.

Rotator Cuff Repair

An elevator is used to release any bursal-sided adhesions and mobilize the rotator cuff. An additional portal is made for suture anchor placement, allowing for the optimal angle of suture anchor insertion. The greater tuberosity is prepared by debridement and light decortication. Marrow stimulation of the greater tuberosity is performed to stimulate a healing response in a crimson-duvet fashion. An awl is used to create an initial socket for the suture anchor, and 2 double-loaded 4.75-mm SwiveLock suture anchors (Arthrex, Naples, FL) are placed medially, spaced out on the

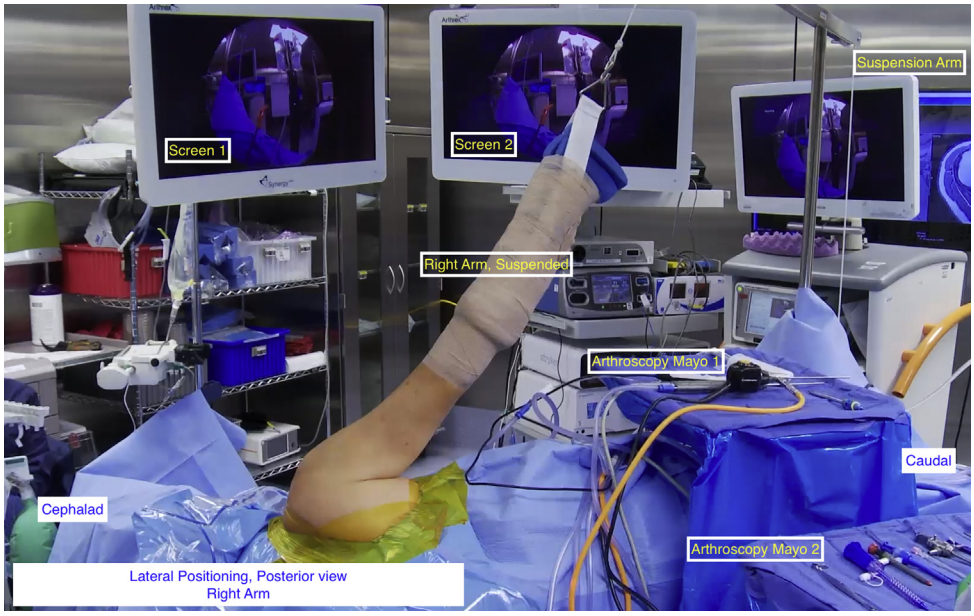

Fig 2. The operating room is viewed from the posterior aspect of the patient with the right arm suspended and the patient in the left lateral decubitus position. The arm suspension device should be at the foot of the operating room table and positioned to flex and abduct the operative arm. Screens should be positioned to be viewed with the surgeon standing directly posterior to the shoulder. The arthroscopic Mayo stands are placed distal to the operative shoulder. There should be a space anterior to the operative table for the open portion of the surgical procedure.

Table 2. Key Steps to Lateral Decubitus Positioning

Step	Notes
Placement of pillow or head positioner under patient's head or ear	Ensure head is in neutral positioning without lateral bending; maintain physiological spine-neck alignment
Support of patient's arms on parallel arm boards, abducted 90°	Careful padding of elbow prominences
Placement of axillary roll under patient's thorax, distal to axillary fold	
Flexing of dependent leg at hip and knee and placement of pillow between upper leg and dependent leg	Padding of all bony prominences and neurovascular structures
Use of beanbag positioner recommended—patient must be snug	Use of surgical assistance to contour beanbag to patient's habitus
Use of safety straps across hips to secure patient and beanbag	
Use of kidney posts to reinforce positioning	

lateral portion of the articular margin (Video 1). Sutures from the medial-row SwiveLock anchors are passed through the tendon and tied down in an anterior-to-posterior fashion, and the tendon is appropriately tensioned and reduced. The sutures associated with the suture anchor can be used to fix any "dog ears" that may arise during repair.

Next, alternating sutures from the medial-row anchors are retrieved from the lateral portal and passed through the eyelets of 2 additional 4.75-mm SwiveLock anchors, which are designated to the lateral row (Fig 4). An awl is used to create the sockets for the anchors, which are positioned lateral to the footprint in the greater tuberosity.

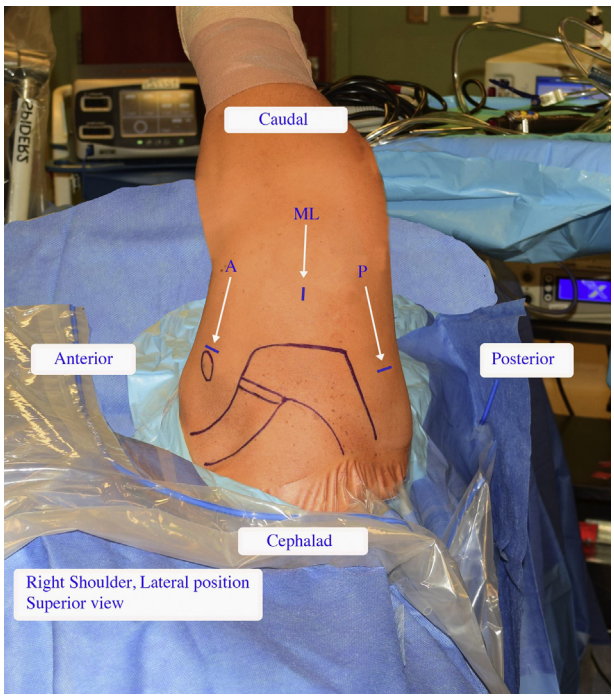

Fig 3. The anterior portal (A), lateral mid-acromion mark (ML), and posterior portal (P) in the right shoulder are viewed from a superior viewing point with the patient in the lateral decubitus position. The clavicle and acromion are outlined. The anterior portal is made just lateral to the coracoid, which is circled. The scope is inserted into the glenohumeral joint, and the anterior portal is created using the inside-out technique.

Open Biceps Tenodesis

After completion of the arthroscopic portion of the procedure, the surgeon repositions himself or herself to the anterior portion of the patient (Fig 5). An axillary incision is created, and the pectoralis major tendon is identified and retracted superiorly. The biceps tendon is identified within the groove and delivered through the incision. This is whipstitched, and a 6-mm drill is used to create an anterior hole through the near cortex of the proximal humerus at the base of the bicipital groove. A posterior hole is made through the proximal humerus using a 3-mm spade-tip drill. Tendon stitches are loaded onto a Biceps Button (Arthrex), which is deployed across the humerus and flipped onto the far side of the far cortex. The sutures are tensioned, and 5 half-hitches are tied using an arthroscopic knot pusher. Backup fixation is obtained with the use of a 6-mm Bio-Composite screw (Arthrex) engaging the near cortex and tendon.

Discussion

This Technical Note details our surgical technique for performing arthroscopic rotator cuff repair with the patient in the LD position. This technique offers several advantages over BC positioning, such as improved visualization of the glenohumeral space, ergonomic positioning, a low risk of cerebral hypoperfusion, and a theoretically shorter operating time.

Differences in orientation, visualization, and accessibility have been cited as major differences between BC and LD positioning. Surgeons who favor BC positioning believe that the upright, anatomic position makes orientation and teaching easier.[5] However, proponents of LD positioning have argued that positioning of the glenoid parallel to the floor creates a standard reference point.[2] Ultimately, intraoperative orientation and conceptualization of the anatomy are more a function of surgeon preference and experience rather than the actual position of the patient. Surgeons who favor the BC position have argued that BC positioning allows

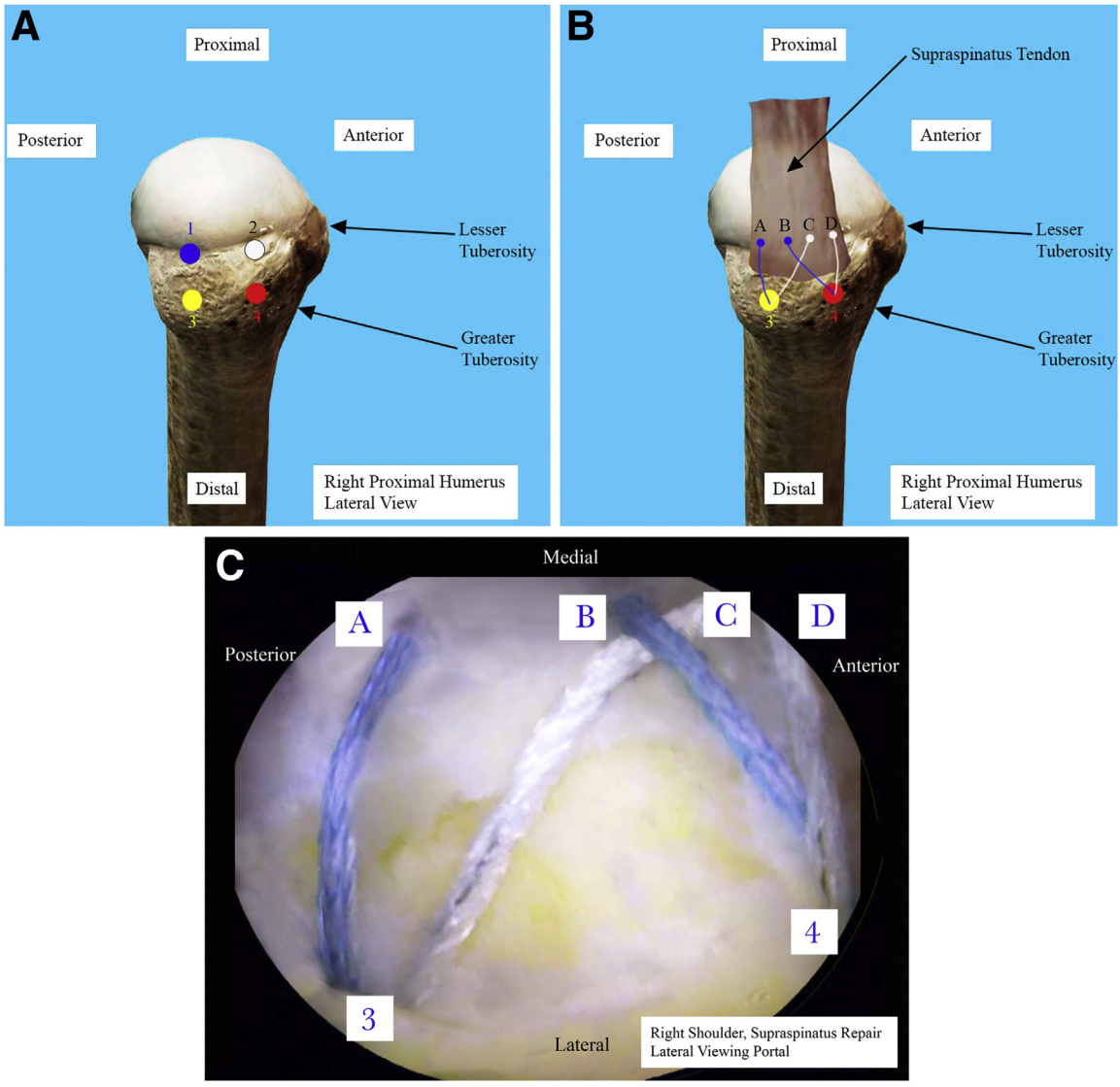

Fig 4. A standard 4-anchor repair technique for a supraspinatus tendon tear is represented. The proximal humerus is visualized from a superior-lateral viewpoint. The greater tuberosity and lesser tuberosity are labeled. When preparing the tendon for repair, we prefer to use 2 medial-row anchors that are double loaded with suture tape and 2 lateral-row anchors. (A) The anterior-medial anchor (2) and the posterior-medial anchor (1) are placed 1 to 1.5 cm apart at the articular margin. The placement of the anterior-lateral anchor (4) and posterior-lateral anchor (3) is also labeled. (B) The supraspinatus tendon is reduced by individually passing both suture tapes from the anterior-medial anchor (C, D) and posterior-medial anchor (A, B). The sutures are passed at an equal distance from each other through the tendon from deep to superficial. The most anterior suture from the anterior-medial anchor (D) and posterior-medial anchor (B) is then inserted into the anterior-lateral anchor (4). This is repeated with the posterior suture of the anterior-medial anchor (C) and posterior-medial anchor (A), with insertion into the posterior-lateral anchor (3). (C) Arthroscopic image of a right supraspinatus rotator cuff repair viewed through a lateral viewing portal.

increased access to the anterior, posterior, and superior glenohumeral joint, as well as the subacromial space.[5] BC positioning is also suggested to have easier access to the anterior portal because the arm is not in the way.[4] In addition, the ease of stabilizing the scapula is thought to make an examination under anesthesia easier with the patient in the BC position.[6] It has also been suggested that the shoulder capsular anatomy is less stretched in the BC position, which may impact capsular reattachment, assessment of ligamentous laxity, and proper tensioning of soft-tissue repairs.[2] On the contrary, proponents of the LD position have argued not only that it allows for excellent visualization of the articular side of the rotator cuff and subacromial space but also that, compared with BC positioning, traction in the LD position accentuates labral tears and provides for improved visualization and work space, particularly in the posteroinferior glenoid, labrum, and

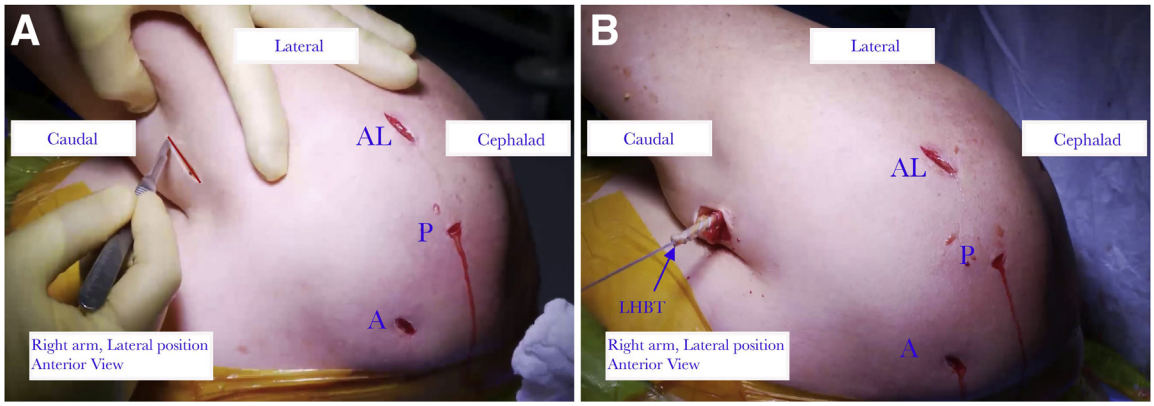

Fig 5. Anterior view of the right arm with the patient in the left lateral decubitus position. (A) The anterior portal (A), anterior-lateral portal (AL), and percutaneous portal (P) for anchor placement are marked. The inferior aspect of the pectoralis major tendon is marked. The incision is made longitudinally to allow splitting of the fascia between the pectoralis major tendon and the conjoined tendon. (B) With the long head of the biceps tendon (LHBT) exposed, a high-tensile permanent looped suture is whipstitched and excess proximal tendon is removed. A 6-mm drill is used to create an anterior hole through the near cortex of the proximal humerus, after which a 3-mm spade-tip drill is used to make a posterior hole. Tendon stitches are loaded onto a Biceps Button that is deployed across the humerus and flipped onto the far side of the far cortex. Sutures are tensioned, 5 half-hitches are tied, and backup fixation is obtained with the use of a 6-mm BioComposite screw engaging the near cortex and tendon.

inferior capsule.[2,7] Other advantages include not having the operating room table or patient's head as a mechanical block limiting work space in the posterior and superior shoulder, as well as increased comfort and decreased fatigue for the surgeon.[2]

Complications after surgery with the patient in the BC or LD position are rare but may be potentially devastating. In the BC position, cerebrovascular events are the major feared complication. A survey of American shoulder surgeons, who had performed over 200,000 shoulder procedures with patients in the BC position, found 8 incidences of cerebrovascular desaturation events, for an overall incidence of 0.003%.[8] Although this incidence is very low, the neurologic sequelae can be severe. Moreover, stroke, hemiparesis, visual loss, and ophthalmoplegia have all been reported after surgery with patients in the BC position.[9-11] It should be noted that patients with abdominal obesity are known to be at greater risk of hypotension and cerebrovascular desaturation events in the upright position because compression of the vena cava decreases venous return.[12] Complications after shoulder surgery in the LD position are similarly infrequent and of a different variety. The most commonly reported complication in patients in the LD position is neurologic injury from excessive strain on the brachial plexus due to intraoperative traction. The incidence of transient paresthesia or nerve palsies after arthroscopic surgery in the LD position has been reported to be 0.2% to 10%.[6] Fortunately, almost all cases of these reported nerve injuries were cases of transient neurapraxia, which went on to achieve recovery.[6,13] However, clinically important neurapraxia to the musculocutaneous, ulnar, and axillary nerves has been reported.[6] In addition, pressure-related skin injuries and peripheral nerve compression injuries have been reported for both the BC and LD positions, most often related to patient positioning and inadequate padding, although these are also rare.[6]

There are overall few studies directly comparing BC and LD positioning with patient outcomes after shoulder surgery. A systematic review of 64 studies reviewing clinical outcomes and recurrence rates after arthroscopic anterior shoulder stabilization in the BC and LD positions found that although excellent clinical outcomes with low recurrence rates were obtained with either position, statistically lower recurrence rates were noted in patients in the LD position.[14] A recent cross-sectional study compared BC and LD positioning for arthroscopic anterior shoulder stabilization and found that surgeons using the LD position more frequently placed anchors in the inferior glenoid and at the 6-o'clock position and reported longer labral tears, suggesting that LD positioning improved access to and visualization of the inferior glenoid.[15] A systematic review of 15 studies of clinical outcomes and recurrence rates after arthroscopic posterior shoulder stabilization in the BC and LD positions found no significant difference in outcome scores, overall mean recurrent instability rates, or return-to-sport rates between the 2 positions. To our knowledge, there has only been 1 study directly comparing BC and LD positioning in arthroscopic rotator cuff repair: Zhang et al.[16] compared 216 patients with greater than 3 years' follow-up and found that patient-reported outcomes were statistically improved in the LD cohort. Furthermore, patients in

the LD group showed improved flexion, abduction, and external rotation angles at latest follow-up. Operative durations were also found to be significantly shorter in patients undergoing surgery in the LD position.[16] A retrospective study evaluating factors impacting arthroscopic rotator cuff repair operational throughput time at an ambulatory care center in 318 patients similarly found that patients set up in the BC position had a significantly longer operating room time than those in the LD position (115.8 minutes vs 89.6 minutes, $P < .0001$), as well as a significantly longer recovery room time.[17]

In conclusion, the LD position for performing rotator cuff repair and open biceps tenodesis is a reliable, safe, and effective position and affords the benefits of improved visualization of the glenohumeral space, ergonomic positioning, a low risk of cerebral hypoperfusion, and a shorter operating time.

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