

Arthroscopic Techniques

Salvage of intra-operative loosening of suture anchor in arthroscopic repair of large rotator cuff tears: A novel technique

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ABSTRACT

Arthroscopic repair of large rotator cuff tears in elderly female patients is a technically challenging procedure. Poor bone density can cause loosening of the anchor, and the anchor can get pulled out just after insertion, during knot tying, after knot tying, even postoperatively. We describe the salvage of intraoperative anchor loosening using an interference screw in such a patient with a successful outcome.

Keywords: Arthroscopic repair, Interference screw, Loosening, Rotator cuff tear, Suture anchor

INTRODUCTION

Rotator cuff tear is a frequent source of shoulder pain and dysfunction in elderly patients. Massive rotator cuff tears encompass roughly 20% of all cuff tears and 80% of recurrent tears.^[1] Different classification systems have been proposed to guide the management of rotator cuff tears but the lack of consensus makes it important to interpret the tear pattern information considering the patient's clinical situation. Arthroscopic repair of symptomatic rotator cuff tears is the standard treatment to enhance shoulder function and to avert advancement into cuff tear arthropathy. The use of suture anchors is popular owing to their simplicity, limited morbidity, and excellent clinical outcomes. Cadaveric studies have demonstrated a significant decrease in the bone mineral density (BMD) below the articular surfaces of specimens with full-thickness rotator cuff tears.^[2] It is relatively common to experience a feeling of inferior pull-out resistance of suture anchors in patients with poor BMD. The loosening of the anchor could often be appreciated with a gentle tug. Various management options such as Buddy anchoring,^[3] switching the implant site of anchors, increasing the suture limbs,^[4] Steinmann pin anchoring,^[5] and cement augmentation of suture anchors^[6] have been suggested for the same. We try to present a simple salvage technique for intra-operative loosening of an anchor using bio-screws.

CLINICAL PRESENTATION

A 60-year-old female patient had a slip and fall onto her right shoulder 3 months ago. Since her radiographs revealed no bony

injury, she was put on an arm sling pouch for the initial 4 weeks, followed by rehabilitation. However, she did not improve in her function over time, hence was referred to us. At presentation, she had pain in the left shoulder and restricted active range of motion (ROM). On examination, there was visible wasting of the deltoid muscle. There was restriction in active forward flexion and abduction, but a full range of painless passive movements was possible. Jobe's test, External rotation lag, and Yergason test were positive. Clinical tests for the subscapularis were negative. Neurovascular examination revealed no deficits.

The plain radiograph of the right shoulder was unremarkable. Magnetic resonance imaging scan of the injured shoulder revealed a large full-thickness rotator cuff tear involving the supraspinatus and infraspinatus muscles, with tendon retracting to the humeral head (Patte grade 2) and no fatty infiltration (Goutallier stage 0) with bicipital tendinosis. The patient was planned for arthroscopic cuff repair after a detailed discussion about the risks and benefits of the proposed surgery, and informed consent was taken.

Surgical steps

The patient was positioned in the lateral decubitus under general anesthesia. Parts were cleaned and draped. The standard posterior portal was established 2 cm distal and medial to the posterolateral tip of the acromion. Glenohumeral arthroscopy confirmed the large cuff tear and biceps tendonitis at the genu with disruption of the lateral anchor of the biceps hiatus. Subscapularis was intact. Next, a posterolateral

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Received: 19 March 2025 Accepted: 22 July 2025 Epub Ahead of Print: 03 September 2025 Published: 09 January 2026 DOI: 10.25259/JASSM_15_2025

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subacromial viewing portal was created, and the arthroscope was switched to this portal. An anterior subacromial portal was created, and the subacromial space was cleaned using a radio-frequency (RF) device (SERFAS, Stryker). The torn cuff margins were released from subacromial burial adhesions and from the glenoid. The greater tuberosity was prepared by cleaning the soft tissue with RF and abraded using a shaver. Trial reduction of the cuff to its footprint was achieved without tension. The lateral portal was created.

5 mm double-loaded titanium suture anchors (Titanium Wedge anchor, Stryker, Kalamazoo, MI) were used for cuff repair. The first anchor was placed just posterior to the bicipital groove, and biceps tenodesis was performed using the triple lasso loop technique, and the supraspinatus anterior margin was secured over it to recreate the anterior cable. The second anchor was inserted near the articular margin of the greater tuberosity on its posterior part. The sutures were passed through the infraspinatus in a mattress pattern using a Fast pass device (Smith Nephew, Andover, MA). The third anchor was placed from the posterior portal on the posterior surface of the greater tuberosity, and sutures were traversed through the posterior cuff using a bird beak device. The bone appeared osteopathic at the time of anchor insertion.

While securing the knot over the infraspinatus muscle on the middle anchor, loosening was noticed as the anchor started coming out [Figure 1]. The anchor was pushed into the pilot hole using an anchor punch for a 5 mm anchor. Further tugging of the sutures again resulted in the gradual pull-out of the anchor. At this point, we decided to secure the anchor with a larger screw.

The anchor punch was used again to push the suture anchor deep into the pilot hole [Figure 2]. The depth of the pilot hole was measured using an anterior cruciate ligament femoral depth gauze [Figure 3]. A 7 mm bioscrew (Biosteon, Stryker, Kalamazoo, MI) was inserted into the hole over a nitinol guide wire to create an interference fit [Figures 4 and 5]. Upon tugging, the construct was found to be stable, and arthroscopic non-sliding knots were secured to reduce and compress the cuff tendons to the bone interface [Figure 6].

Postoperatively, the shoulder was placed in a neutral rotation brace. Wrist/Elbow ROM, hand grip strengthening, and pendulum exercises with a sling were started in the immediate post-operative period. The patient was also given one injection of vitamin D3 6 lac units, along with oral calcium supplements and an injection of teriparatide 20 mcg subcutaneously daily for 6 months. Passive ROM was initiated four weeks onward, followed by active assisted and active ROM from eight weeks. Check X-rays were taken at intervals, and no further change in anchor position was noted [Figure 7].

At 6 months of follow-up, the patient had painless active full ROM with near-normal function. Quick disabilities of the arm, shoulder, and hand questionnaire improved significantly ($P < 0.001$) from 46.1 preoperatively to 15.5, and

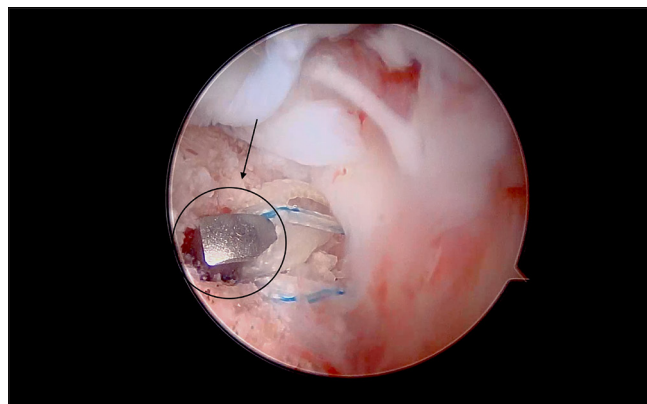


Figure 1: Visualization of intra-operative loosening and anchor pull-out (Black circle and arrow).

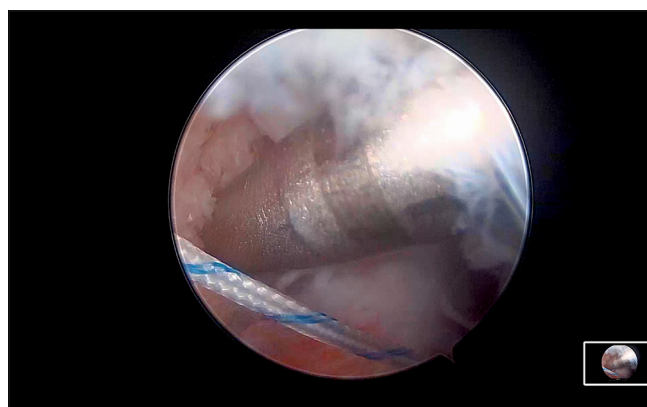


Figure 2: Pushing the anchor down using an anchor punch.

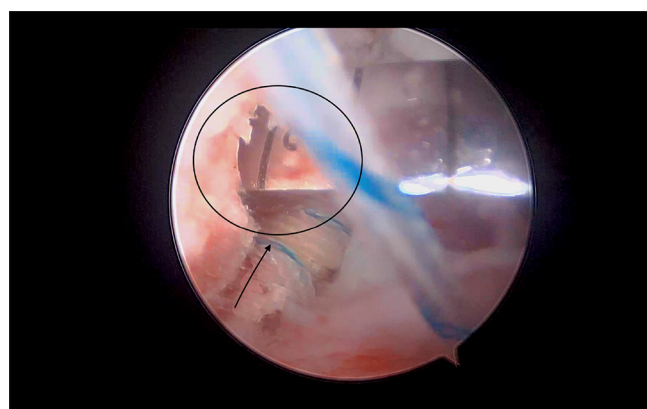


Figure 3: Depth measurement using anterior cruciate ligament femoral depth gauze (Black circle and arrow).

Oxford Shoulder Score improved significantly ($P < 0.001$) from 26.8 preoperatively to 41.4 at six months.

We encountered a similar anchor pull-out in two more cases and were able to salvage the anchor and bail out using this technique successfully.

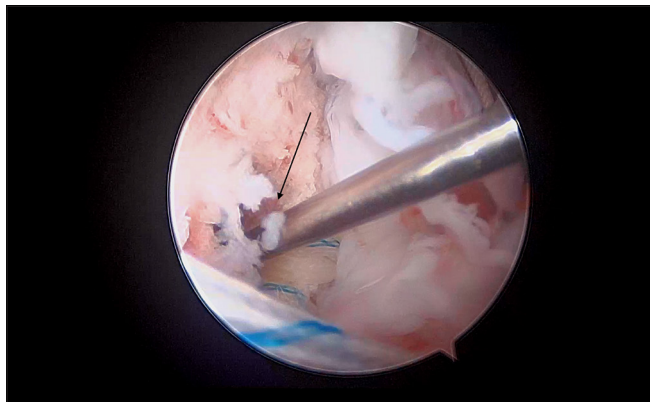


Figure 4: Nitinol guide wire placement (Black arrow).



Figure 5: Placement of 7 mm diameter and 25 mm long biocomposite screw over the guide wire.

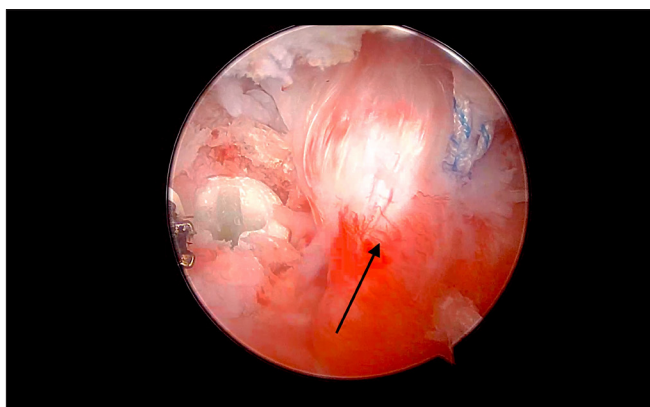


Figure 6: Final sitting of the screw and repaired cuff with non-sliding knots (Black arrow).

DISCUSSION

The management of patients with massive rotator tears remains challenging. Rotator cuff repair has a high re-tear rate, and the risk of failure increases with patients' advancing age and larger tear size. The incidence of early anchor pull-out after arthroscopic rotator cuff repair is approximately

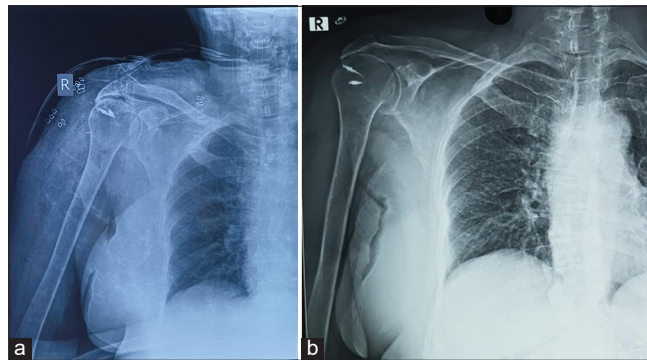


Figure 7: (a) Postoperative X-ray (2 weeks), (b) Postoperative X-ray after 6 months showing no loosening or anchor migration.

0.1–3.1%, and the incidence of intraoperative pull-out is even higher, at approximately 3.3–5.4%.^[7] Intra-operative anchor pull-out is much more likely to happen in patients with larger rotator cuff tears, women, older individuals, or those who had pre-existing shoulder stiffness before surgery. Djurasovic *et al.*^[8] reviewed 80 cases of failed rotator cuff repair and showed 10% of them had anchor migration and loosening, which they attributed to deteriorating bone mineralization of the proximal humerus in patients with rotator cuff tears. A complex situation arises for the surgeon contemplating arthroscopic repair in patients with proximal humerus osteopenia, which can increase the risk of suture anchor loosening and suture cut-out, thereby negatively impacting the cuff repair.

Frequently, the situation arises where a suture anchor has poor hold in the greater tuberosity. It is utmost necessary to address this potential loosening of the anchor to ensure optimum clinical results. Few choices are feasible when an unstable anchor is detected intra-operatively. Probably, this is an opportunity to replace or secure the loose anchor safely. Replacing with a larger anchor can be a good alternative but it does squander a perfectly good anchor and time. The other alternative is to change the implantation site of the anchor for better purchase, which may or may not be successful. To secure the loose anchor, a second anchor can be placed adjacent to it to create an interference fit of one anchor against another. Burkhart^[3] advocated a “rescue anchor technique” for a loose anchor in which a new laterally placed anchor shares the load of the medial anchor, which gets loosened under tension in poor-quality bone. Buddy screwing technique was implemented by Jung *et al.*^[5] to salvage repair in 16 patients who had intra-operative pull-out and reported early operative failure in three patients. Following the availability of soft anchors in the market, the buddy screwing technique fell out of practice, in favor of placing a second anchor at a different location in good quality bone. Although all-suture anchors are known to be biomechanically inferior to screw and hard anchors, they save humeral bone stock and allow additional space for tendons to heal. Inserting a soft anchor at a separate

location is a practical solution, because fixation points are small and cause reduced bone damage when they fail than screw-in type anchors.

Brady *et al.*^[3] found that the strongest suture anchor construct in an osteoporotic bone model was a dual-anchor interference fit system, followed by a single 5.5 mm bio-corkscrew fully threaded. However, placing the two anchors to overlap would reduce the anchor bone contact area and the pull-out strength. Disaster ensues if the hole enlarges and the anchor pulls out following that.

Other possible techniques can be cement augmentation or conversion to trans-osseous repair. Insertion of cement into the wide tunnel mouth arthroscopically is a real difficult task. Transosseous repair requires a special device that may not be available intra-operatively.

In our technique, we were able to salvage the original suture anchor and create an interference fit for the same. Bio-composite screws or Polyether ether ketone (PEEK) screws are easily available implants in the Operating room (OR) and do not require much instrumentation. A 7 mm screw provides a reasonable interference fit in a hole created by a 5 mm anchor. The pull-out strength is satisfactory without compromising the repair.

However, a major limitation of this technique is that it cannot be used to salvage a loosened anchor after the knot has been secured. Loosening of the suture anchor after securing the knot would require sacrificing the anchor and replacing it.

CONCLUSION

Our technique offers the arthroscopic surgeon an easy bailout upon encountering intra-operative loosening of suture anchors without sacrificing it. The pull-out strength of the construct is satisfactory without compromising the repair and clinical results.

Author contributions: VN : Concepts, design, definition of intellectual content, literature search, data acquisition, manuscript preparation, manuscript editing; DS : Concepts, design, definition of intellectual content, data acquisition, manuscript preparation, manuscript editing and review; VAK: Concepts, definition of intellectual content, design, data acquisition, data analysis,

manuscript preparation, manuscript editing, and review; AA: Concepts, design, definition of intellectual content, literature search, and data acquisition.

Ethical approval: Institutional Review Board approval is not required.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation: The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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How to cite this article: Nagendra V, Sabat D, Kamath VA, Aggarwal A. Salvage of intra-operative loosening of suture anchor in arthroscopic repair of large rotator cuff tears: A novel technique. *J Arthrosc Surg Sports Med.* 2026;7:106-9. doi: 10.25259/JASSM_15_2025