

Arthroscopic Knotless Repair of Complete Full-Thickness Tears of the Subscapularis Tendon Through a Single Portal



Eugene T. Ek, M.B.B.S, Ph.D., F.R.A.C.S., Michael C. Perret, M.B.B.S., F.R.A.C.S., and Paul Borbas, M.D.

Abstract: Arthroscopic repair of subscapularis tendon tears has shown to be a reliable and reproducible technique and is now considered the gold standard method over open repair. However, most arthroscopic techniques use several working portals and the procedure can be technically challenging and time-consuming, especially when knot-tying is required and when multiple anchors are used. Recently, single-portal knotless techniques have been popularized for upper-third lesions (e.g. Lafosse type 1 or 2 tears). Here, we describe a technique of repairing complete tears of the subscapularis tendon (Lafosse type 3 and 4) using knotless suture anchors through a single portal. This technique is quick and allows a safe anatomic footprint repair to the lesser tuberosity.

The subscapularis plays a very important role in the overall function of the shoulder joint, not only acting as the strongest tendon of the rotator cuff, but also as a very important anterior stabilizer of the glenohumeral joint.¹ However, it has been known as the forgotten rotator cuff tendon due to historically limited attention in the literature, despite its importance.² With advances in techniques, arthroscopic repair of the subscapularis tendon has become increasingly popular compared with the previous open repair.³

To date, there are a variety of techniques that have been described for arthroscopic subscapularis tendon repairs, and it is still not known which of the various repair techniques provide superior strength.⁴ However, most techniques routinely require several working

portals and the procedure often is technically challenging and time-consuming, due to suture management and when knot-tying is required. Recently, single-portal subscapularis tendon repair was introduced for upper-third lesions (Lafosse type 1 and 2).⁵ If a tear involves more than the superior 1.5 cm, it is more than only an upper third tear and therefore a second anchor or anchor row is recommended.⁶ Here, we describe a technique that uses a single-portal technique for knotless repair of complete subscapularis tendon tears, that is, Lafosse type 3 and minimally retracted type 4 tears.

Positioning and Diagnostic Arthroscopy

The patient is placed in a beach-chair position, with the operated arm placed into a hydraulic arm holder (Spider2; Smith & Nephew, Watford, United Kingdom). Preoperatively, range of motion of both shoulders is examined. Anatomic landmarks are marked, the operative site is draped after sterile preparation, and the arm is fixed in the arm holder.

A diagnostic glenohumeral arthroscopy is performed using a 30° arthroscope viewing from a standard posterior portal. Under direct visualization, a standard anterolateral working portal is established. In case of a subscapularis tear, we routinely perform a biceps tenotomy followed by a mini-open subpectoral biceps tenodesis with a unicortical button device.

The humeral head is translated posteriorly through direct pressure placed on the proximal humerus

From the Melbourne Orthopaedic Group, Windsor, Melbourne (E.T.E, M.P., P.B.); and Department of Surgery, Monash Medical Centre, Monash University, Clayton (E.T.E.), Victoria, Australia.

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Address correspondence to A/Prof. Eugene T. Ek, M.B.B.S., Ph.D., F.R.A.C.S., Melbourne Orthopaedic Group, 33 The Avenue, Windsor, Melbourne, 3181, VIC, Australia. E-mail: eugene.ek@mog.com.au

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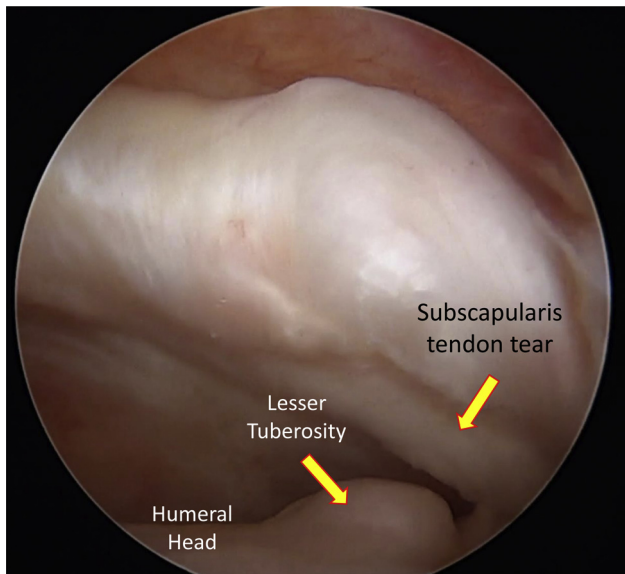


Fig 1. Lafosse type 3 subscapularis tendon tear viewed through a posterior viewing portal (right shoulder). With posterior translation of the humeral head, the subscapularis tendon tear and the lesser tuberosity footprint can be further visualized.

(posterior lever push) to confirm the diagnosis of a subscapularis tear and to visualize the footprint (Fig 1). The operation is performed with a 30° arthroscope, but a 70° arthroscope can be used to have a better direct visualization, if desired. Slight forward elevation and internal rotation of the shoulder can aid in improved visualization of the lesser tuberosity.

Soft-Tissue Releases and Footprint Preparation

The rotator interval tissue is carefully removed with electrocautery and a shaver to visualize and mobilize the subscapularis tendon. In case of a retracted subscapularis tear (Lafosse type 4), a separate traction stitch can be placed medial to the so called “comma-tissue” in a figure-of-eight fashion to pull on it and allow traction during the soft-tissue release and repair. As this is not necessary for Lafosse type 3 and non-retracted type 4 tears, we routinely do not use a traction stitch.

We do not perform a subcoracoid decompression or coracoplasty routinely, only in cases in which there is decreased coracohumeral distance on preoperative magnetic resonance imaging scan and/or intraoperatively the space is clearly reduced (i.e. less than 8 mm between the coracoid and the subscapularis tendon). The tendon mobility is tested with a tissue grasper to allow fixation to the footprint with tension. If the tendon is not sufficiently mobile, further release of adhesions in the rotator interval, subcoracoid space, and between the subscapularis and glenoid is performed to allow a tension-free repair. The tendon

stump, as well as the footprint, are debrided with a shaver. The lesser tuberosity is prepared with a burr to allow good tendon healing to the bone (Table 1).

Knotless Subscapularis Tendon Repair Technique (With Video Illustration)

We use 2 knotless suture anchors for the repair using one nonabsorbable suture tape (FiberTape; Arthrex, Naples, FL) for each anchor. The inferior portion of the subscapularis tendon is repaired first by inserting the suture tape in an inverted mattress fashion. We use an antegrade arthroscopic suture passer (Scorpion; Arthrex) which is loaded with a FiberTape external to the shoulder. The suture passer is introduced into the joint through the anterolateral working portal (Fig 2A). The FiberTape is then passed, from superficial to deep, through the tendon at the junction between the inferior and middle third, approximately 1 to 1.5 cm medial to the lateral tendon edge (Fig 2B). The FiberTape is pulled through that both limbs have about the same length (Fig 2C). Next, the superficial limb of the FiberTape is reloaded onto the suture passer and then passed through the lower part of the subscapularis tendon, approximately 1 cm superior, from superficial to deep, thus creating an inverted horizontal mattress suture configuration (Fig 2 D and E). The suture limbs are then loaded onto a 4.75-mm knotless suture anchor (SwiveLock, Arthrex) (Fig 2F). An awl is introduced into the joint to create a tunnel for insertion of the anchor. This is placed at the lower third of the subscapularis footprint on the lesser tuberosity. The anchor is then inserted with moderate tension placed onto the FiberTape suture limbs, to carefully reduce the tendon to the anatomic footprint (Fig 3). Further tensioning of the suture limbs allows to further compression of the tendon to the lesser tuberosity. The loose suture ends are then cut at level of the bone. If added fixation is desired, the retention sutures within the anchor can be

Table 1. Pearls and Pitfalls

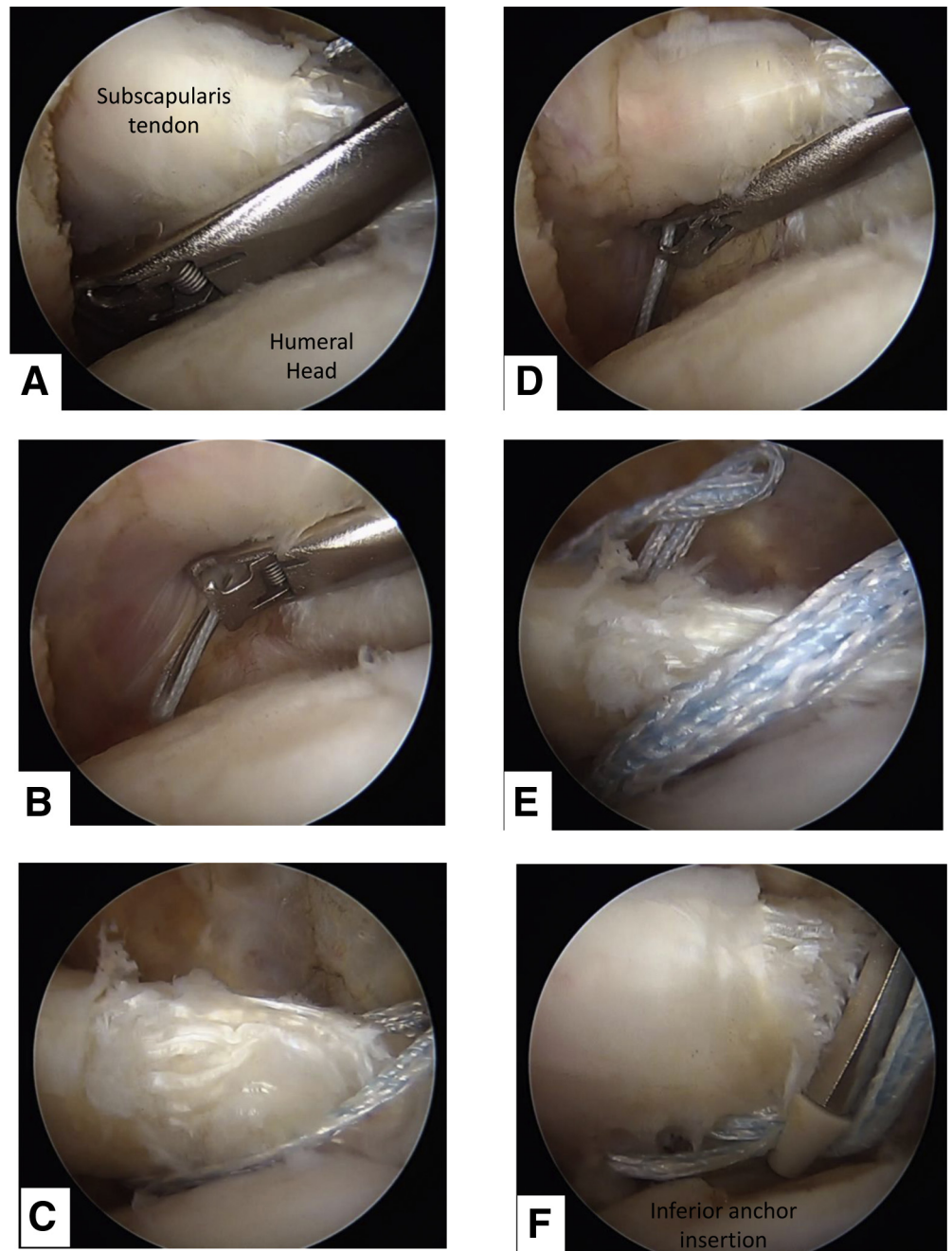
Pearls

- Perform a posterior lever push test to sufficiently visualize the entire subscapularis footprint.
- In case of a more retracted tear, an additional traction suture can be placed just medial to the “comma-tissue.”
- A meticulous 3-sided soft-tissue release is crucial to facilitate a tension-free tendon repair.
- Start with fixation of the lower/middle portion of the tendon, using an inverted mattress with an adequate tendon bridge of approximately 1 cm.
- Option of additional fixation with the retention suture from the anchor. These sutures can be passed through the tendon and arthroscopically tied as a horizontal mattress suture.

Pitfalls

- Surrounding neurovascular anatomy has to be respected with special care to avoid damage to the axillary nerve, especially when extensive soft-tissue release is required.

Fig 2. (A) The suture passer is introduced into the joint and the subscapularis tendon is grasped at the inferior portion of the tendon. (B) The suture passer is oriented such that the loaded FiberTape suture is passed from superficial to deep through the lower part of the subscapularis tendon. (C) The suture is pulled through, and the 2 limbs are equalized. (D) The superficial limb is then passed through the subscapularis tendon again, creating an approximately 1-cm tissue bridge. (E) An inverted mattress suture configuration is created. (F) The suture limbs are then loaded onto a 4.75-mm knotless suture anchor and inserted into the lower part of the lesser tuberosity under tension.



used and passed through the tendon more superiorly, and arthroscopically tied down as a horizontal mattress suture (Video 1).

The remaining upper-third tear is repaired using a second FiberTape suture, which is loaded into the suture passer and is passed through the tendon about 1 cm inferior to the superior tendon edge and about 1 to 1.5 cm medial the lateral edge (Fig 4A). The suture is passed from deep to superficial and then anterior FiberTape limb is then reloaded onto the suture passer and it is passed a second time through the tendon, approximately 1 cm medial to the previous suture limb.

Both FiberTape limbs are then pulled, creating a “figure-of-eight” suture configuration around the superior edge of the tendon (Fig 4B). A tunnel is then created at the upper part of the lesser tuberosity, adjacent to the lateral edge of the bicipital groove. Both FiberTape limbs are then pulled through a second 4.75-mm knotless suture anchor and the anchor is then inserted with appropriate tension. The loose suture ends are again cut at the level of the bone. Finally, the repair is tested with a probe and mobilization of the shoulder. This repair technique of the upper third of the subscapularis in a “figure-of-eight” fashion recreates

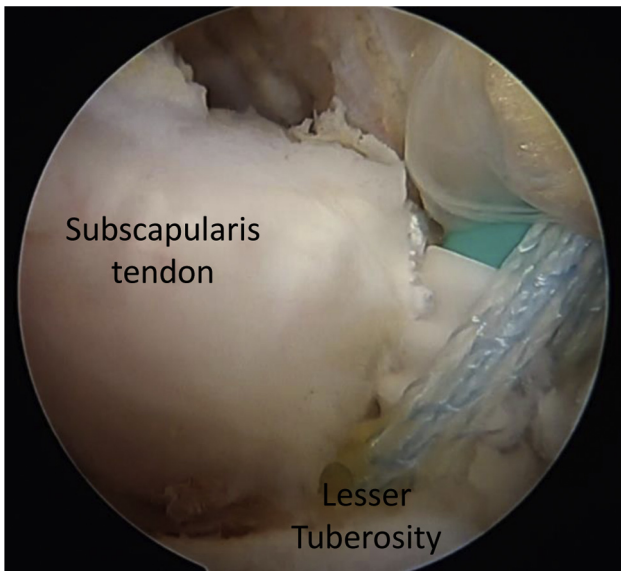


Fig 3. The inferior anchor is then inserted with moderate tension placed onto the FiberTape suture limbs, reducing the tendon to the anatomic footprint.

the anatomic rolled edge of the upper subscapularis tendon (Fig 4C). The 2 portals are closed in a standard fashion and sterile dressings are applied.

Postoperative Protocol

The arm is placed in a sling, and postoperative passive mobilization of the shoulder is started on day 1 after surgery. The sling will be used for 6 weeks. During this time, passive and active-assisted mobilization is allowed to 90° forward elevation and 0° external rotation. After 6 weeks, active mobilization is started without range of motion restrictions. Strengthening can be started after 3 months.

Discussion

Since Gerber et al.⁷ introduced open repair of isolated subscapularis tendon tears, good-to-excellent clinical outcomes have been reported throughout the literature.⁸ With modern advanced arthroscopic techniques and implants, subscapularis tendon repair has become the gold standard technique compared with open repair. However, it is the authors' opinion that the present arthroscopic techniques can be time-consuming, technically challenging, and often requiring several working portals. Recently, single-portal techniques have been introduced for upper-third subscapularis tears (e.g. Lafosse type 2).⁹ In this article, we present a simple and quick technique for knotless anatomic repair of Lafosse type 3 and minimally retracted type 4 tears with use of only a single anterolateral portal. Furthermore, with the use of an additional traction suture placed medial to the "comma tissue," we feel that even retracted but mobile

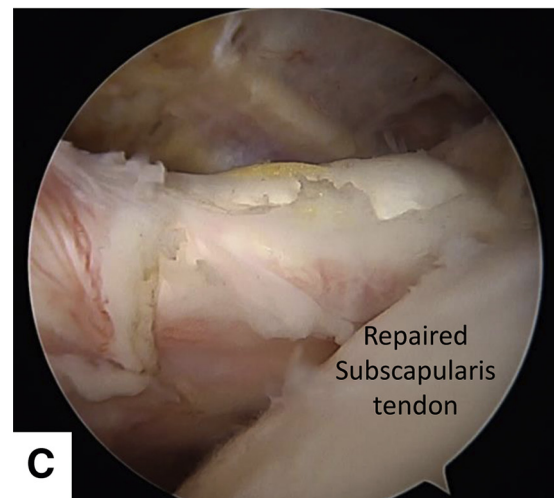
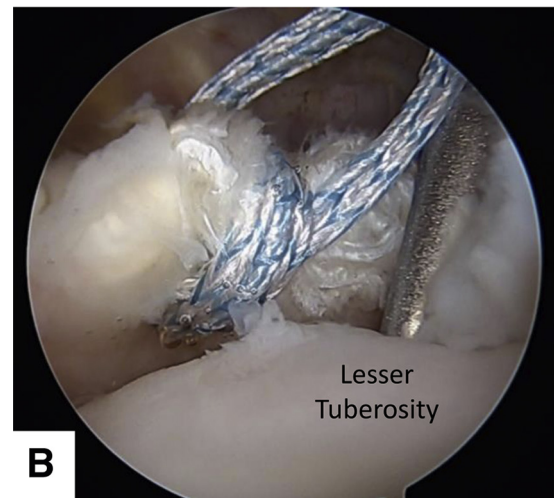
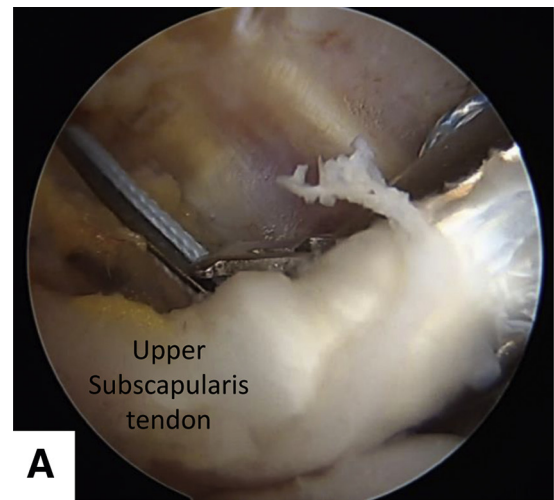


Fig 4. (A) The remaining upper-third tear is repaired by passing a second FiberTape suture, which is passed through the superior tendon edge creating a (B) "figure of eight" configuration. (C) Both suture limbs are inserted into the upper lesser tuberosity with a second 4.75-mm knotless suture anchor. The anatomic rolled edge of the upper subscapularis tendon is recreated.

Table 2. Strengths and Limitations**Strengths**

- Quick and straightforward procedure.
- Single-portal technique, with necessity of only one anterolateral working portal.
- Less swelling and better fluid management with this quick, single-portal technique.
- Easy technique with knotless anchor fixation that allows better tensioning.
- Opportunity to add additional sutures to the repair as the knotless anchors are preloaded with a suture.

Limitations

- Challenging in retracted tears and poor tendon quality.
- Additional traction stitch would not be in line with tendon.
- Incomplete soft-tissue release, so that repair is under tension.
- Inadequate suture-tension and too-thin suture bridge.

subscapularis tears can be reliably repaired with the present technique (Table 2).

Re-tear rates after arthroscopic repair of subscapularis tendon tears range from 5% to 30% in the current literature.¹⁰ However, it is still unclear whether single- or double-row repair is superior and whether concomitant treatment of the long head of the biceps tendon with a biceps tenotomy or tenodesis should be performed in every case.

It is widely accepted, after initially reporting by Denard and Burkhart,⁶ that a second suture anchor or anchor row is necessary for subscapularis tears involving more than the upper 1.5 cm, indicating more extensive lesions (i.e. Lafosse type 3, 4, and 5). With our presented technique, we feel that such tears can be easily and safely repaired with anatomic footprint restoration, using only a single anterolateral working portal.

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