

# Double Row Knotted "Trident": 1 Suture Technique for Superior to Posterosuperior Small Cuff Tear



Paul Commeil, Edouard Harly, and Yves Bouju

**Abstract:** Many arthroscopy suture techniques have been described for small rotator cuff tears, but there is no consensus. The aim of this study is to describe a double-row knot technique, which we call a "trident point," for the superior and posterosuperior small cuff tear that is easily reproducible and has a fast learning curve. This knot takes into account the excess of tendon tissue on the foot print after a cuff suture, called a "dog-ear deformity." However clinical, ultrasound, and biomechanical evaluation with follow-up remains necessary to validate the sustainability of this arthroscopy technique.

Cuff tear surgery has evolved in recent decades from a classical open approach to arthroscopy. The quality of a rotator cuff repair depends on both the strength of the anchorage and the tendon-bone contact, which ensures good healing.<sup>1</sup>

The aim of repairing rotator cuff tear (RCT) is to restore the normal anatomy of the footprint. Even though many suture techniques have been described, none has shown clinical superiority so far.<sup>2</sup>

The evolution of these surgical techniques, the new imaging technologies, and the aging of the population lead surgeons of the shoulder to operate on more and more small ruptures.

For superior posterosuperior small (<1.5 cm) cuff tears, the double-row knotted "trident" technique is reliable and easily reproducible and requires the establishment of only two anchors.

*From the Service de Chirurgie Orthopédique et Traumatologique (P.C.), Raba Léon, Clinique de l'Atlantique (E.H.), Puilboreau, and the Institut Main Atlantique (Y.B.), Saint Herblain, France.*

*The authors report the following potential conflicts of interest or sources of funding: Y.B. received personal fees from ConMed, during the conduct of the study. Full ICMJE author disclosure forms are available for this article online, as supplementary material.*

*Received June 11, 2020; accepted October 26, 2020.*

*Address correspondence to Paul Commeil, Service de Chirurgie Orthopédique et Traumatologique, 3 Rue de Hourtins 33000 Bordeaux, France. E-mail: [commeilp@hotmail.fr](mailto:commeilp@hotmail.fr)*

© 2020 by the Arthroscopy Association of North America. Published by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/201025

<https://doi.org/10.1016/j.eats.2020.10.062>

## Surgical Technique

### Preoperative Evaluation

A medical-surgical history, a complete clinical examination with an evaluation of the range of motion, a testing of the cuff are performed.

A classic imaging assessment including plain radiographs (face 3 rotations and Lamy's profile). Magnetic resonance imaging or injected computed tomography scanning is performed to analyze more precisely the cuff tear and to evaluate muscular atrophy and fatty infiltration using the Goutallier classification. A fatty infiltration >2 of the Goutallier classification, tear >1.5 cm in length or width are contraindications for the "trident" suture.

### Anesthesia and Patient Positioning

An interscalene block is performed. After induction of general anesthesia, the patient is placed in the beach chair position. The affected arm is flexed 30° to 40° and placed in neutral rotation. Longitudinal traction (3-4 kg) is used (Fig 1).

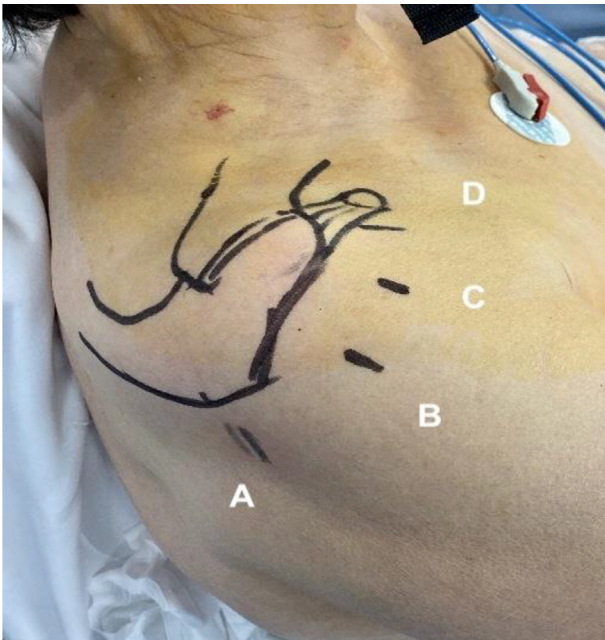
### Standard Portal Placement

The acromion, coracoid, acromioclavicular joint, coracoacromial ligament, and the different portals are marked (Fig 2). First, an entry mark by the soft point allows an intra-articular look to evaluate the different lesions. An anterior pathway in the rotator interval is created using the "outside-in technique" (the locating of the interval by a 14-gauge needle), and, if necessary, tenotomy or tenodesis of the long biceps is performed. The arthroscope is removed from the glenohumeral joint to the subacromial space by the soft point to perform an enlarged bursectomy and visualize the



**Fig 1.** The patient is placed in the beach chair position. The right arm is flexed at 30° with longitudinal traction.

rupture with an extra articular view. An anterolateral portal is performed at the anterior border of the acromion, 2 fingertips away from the anterior portal, after locating the RCP with a needle. A third lateral portal is done, to obtain a good triangulation. A bursectomy is performed with an electrocautery system ± associated with debridement, using a 4-mm shaver cuff. The section of the coracoacromial ligament is practiced with an electrocautery system. A complete debridement of any tissues preventing the good visualization and the good



**Fig 2.** The acromion, coracoid, acromioclavicular joint, coracoacromial ligament, and portals are drawn on this right shoulder before the beginning of the surgery. (A, soft point; B, lateral; C, anterior lateral; D, rotator interval).

mobilization of the rupture must be performed, as well as a total excision of the subacromial bursa.

### Suture Technique

Pearls and pitfalls of the trident technique are summarized in [Table 1](#). The procedure is performed with a 30 ° arthroscope, after intra- and extra-articular analysis of the RCT. The preparation of the footprint is done with the arthroscope in lateral portal. The electrocautery system and the shaver are positioned in the anterolateral portal ([Fig 3](#)).

Debridement and abrasion with the shaver of the footprint at the cartilage-bone junction allow the setting in place of an anchor in the center the rupture in the axis of the anatomic neck (Y-knot RC all-suture anchor; ConMed, Largo, FL; [Fig 4](#)). The size of the anchor (max 15 × 15 mm) and the reparability are previously evaluated using a clamp. Of note is that most rotator cuff suture anchors can be used for this technique.

Two different sutures are passed on each side of the tear using a Spectrum™ type wire hook ([Video 1](#)). This ensures a “soft tissue friendly” technique for the rotator cuff, because it preserves the blood supply for healing ([Fig 5](#)).

We tie the U-shaped center point with a Nicky’s knot. The four strands are retrieved by the anterolateral path. A punched hole with a mallet 2 cm away from the upper edge of the trochiter and in the vertical axis of the first anchor is made to set up a BioComposite SwiveLockC anchor, closed eyelet 4.75 (Arthrex), to obtain a double row ([Fig 6](#)).

The central knot provides a good fixation of the RCT on the footprint, and the lateral suture fixes the dog-ear deformity and increases tendon-bone contact ([Fig 7](#)).

### Postoperative Rehabilitation

The patient is immobilized in an analgic sling for about 10 days. The protocol of 5 times/5 minutes a day

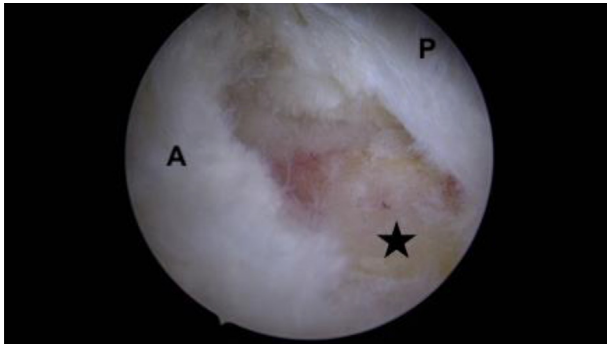
**Table 1.** Pearls and Pitfalls

#### Pearls

- For best visualization, use the midlateral portal as the primary viewing portal.
- Use the anterolateral portal as the primary working portal, and anterior and posterior (i.e., soft point), for suture management. If it possible, use a blue suture as anterior and posterior suture, easier to fine in the bursa.
- Perform an acromioplasty to improve the space needed for repair.
- Perform a large bursectomy to clearly see and understand the rupture.

#### Pitfalls

- Failure to remove all the soft tissue and the bursa will impede visualization and increase surgical time.
- This technique must be used only for small rupture. In case of medium to large rupture, a 2-anchor technique is better for apply the rotator cuff on the footprint.
- There may be a learning curve if prior practice has been limited to viewing the rotator cuff from posterior portal.



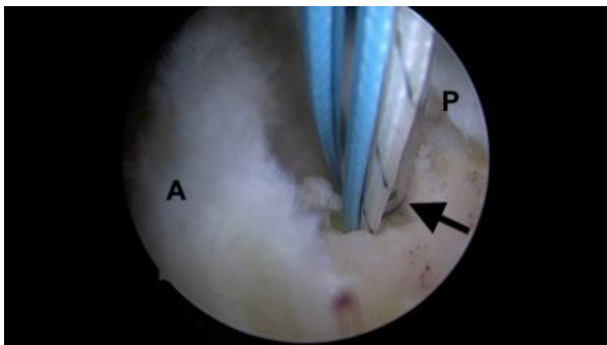
**Fig 3.** Intraoperative arthroscopic image of the left shoulder in beach chair position in lateral view portal in the sub acromial space after the bursectomy. Abrasion of the footprint (star) with the shaver after having spotted the tear. (A, anterior; P, posterior).

self-re-education begins at day 3 to 5 after surgery, in association with physiotherapy. The mobilization of the shoulder is possible for the gestures of daily living without pain. The focus is based on relaxation, with the goal of a free range of motion of the shoulder at 3 months and activities in force at 6 months.

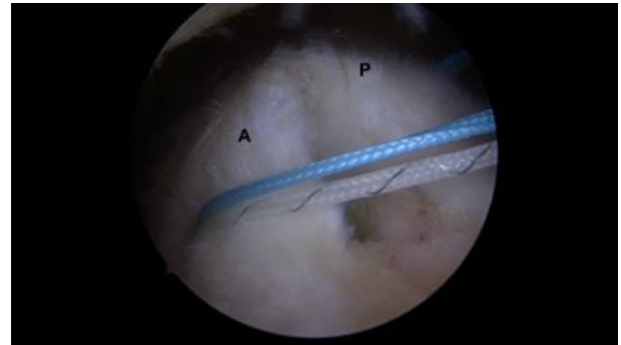
### Discussion

Several biomechanical studies have shown that the double row allows better coverage of the footprint after rotator cuff surgery.<sup>3,4</sup> Clinical studies and review show no significant difference between single and double row.<sup>5,6</sup>

As far as the double row is concerned, several techniques have been described, including the “suture bridge” technique, which crosses the suture limb of the second row, allowing a more anatomical reapplication of the cuff on the footprint. From an anatomic point of view, the vascularization of the tendon is medial to lateral, making this technique risky in terms of possible vascular complications.<sup>7</sup>



**Fig 4.** Intraoperative arthroscopic image of the left shoulder in beach chair position in lateral view portal in the sub acromial space showing the placement of the first anchor (4 strands) at the cartilage-bone junction (arrow). (A, anterior; P, posterior).



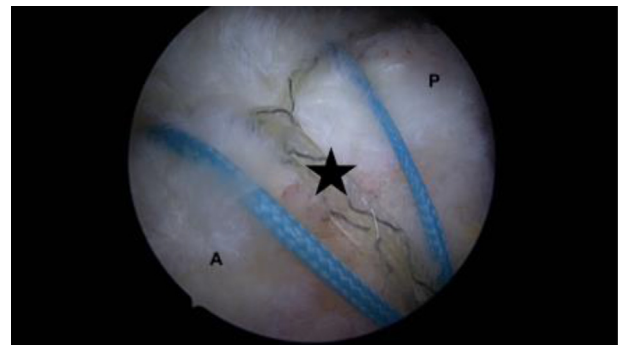
**Fig 5.** Intraoperative arthroscopic image of the left shoulder in beach chair position in lateral view portal in the sub acromial space showing the passage of two strands over the anterior part of the tear. (A, anterior; P, posterior).

The Trident double row technique, detailed in this article, provides many advantages, especially on the healing potential of the cuff (Table 2).

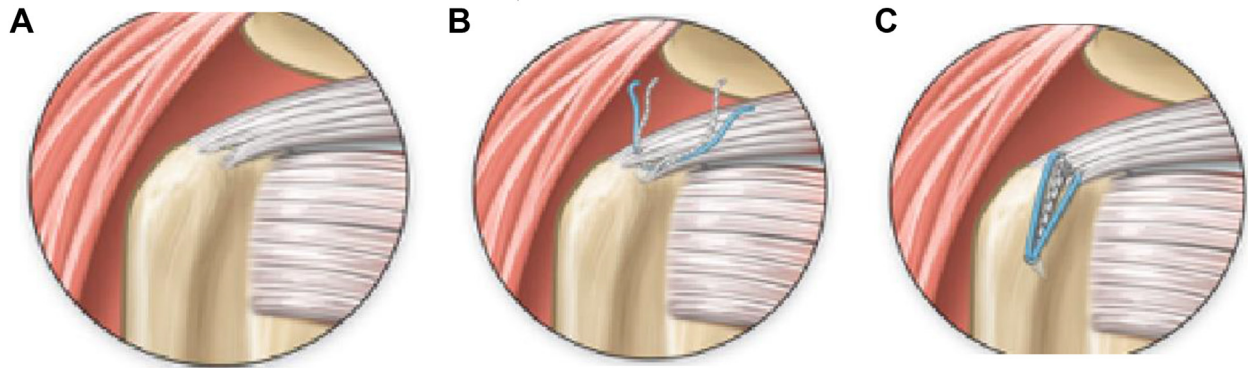
Managing the excess of tendon tissue after a cuff suture, called the “dog-ear deformity,” has been a real challenge for years.

Redler et al.<sup>8</sup> showed that reducing these ears creates a favorable biodynamic and organic environment, by preventing the escaping of synovial fluid from inhibiting the healing of the tendon. In this Technical Note, the authors consider that these deformities were frequent and more important for small tears and that the passage of a single point is the first step necessary to reduce these ears to restore a more anatomic footprint.

The knotted double-row technique is a technique that is easy with a fast learning curve and high reproducibility. Its cost is low, and it only requires two anchors with no additional instrumentation. In this technique, only one knot is knotted, leading to a shortening of the surgical time.



**Fig 6.** Intraoperative arthroscopic image of the left shoulder in beach chair position in lateral view portal in the sub acromial space showing final assembly, after placing the second row, with a U-shaped center point (star) and the two strands knotless making a trident shape. (A, anterior; P, posterior).



**Fig 7.** Drawing summarize the stages of the trident point. A, Schema of a posterosuperior rotator cuff tear. B, Schema showing the positioning of the anchor and the passage of the strands each side of the cuff. C, Layout of the trident point with the second row.

**Table 2.** Advantages and Risks or Limitations

**Advantages**

- Linearly oriented suture limbs do not cross radial blood supply of rotator cuff
- Allows a good correction of dogear deformities
- Trident technique using in the same time a knot-tying and knotless structure
- Failure of the lateral-row anchor will not cause failure of entire construct

**Risks or Limitations**

- No biomechanical data are available for this particular technique
- Available only for small tear of superior and posterosuperior rotator cuff tear

**Conclusion**

The double-row "trident" technique has several advantages in the management of superior-to-posterosuperior small ruptures with an optimal reduction, while limiting the cost and the duration of the procedure.

**References**

1. Rothrauff BB, Pauyo T, Debski RE, Rodosky MW, Tuan RS, Musahl V. The rotator cuff organ: integrating developmental biology, tissue engineering, and surgical considerations to treat chronic massive rotator cuff tears. *Tissue Eng Part B Rev* 2017;23:318-335.
2. Dang A, Davies M. Rotator cuff disease: treatment options and considerations. *Sports Med Arthrosc Rev* 2018;26:129-133.
3. Aydin N, Karaismailoglu B, Gurcan M, Ozsahin MK. Arthroscopic double-row rotator cuff repair: a comprehensive review of the literature. *SICOT-J* 2018;4:57.
4. Sobhy MH, Khater AH, Hassan MR, El Shazly O. Do functional outcomes and cuff integrity correlate after single- versus double-row rotator cuff repair? A systematic review and meta-analysis study. *Eur J Orthop Surg Traumatol Orthop Traumatol* 2018;28:593-605.
5. Brown MJ, Pula DA, Kluczynski MA, Mashtare T, Bisson LJ. Does suture technique affect re-rupture in arthroscopic rotator cuff repair? A meta-analysis. *Arthrosc J Arthrosc Relat Surg* 2015;31:1576-1582.
6. Kakoi H, Izumi T, Fujii Y, Nagano S, Setoguchi T, Ishidou Y, et al. Clinical outcomes of arthroscopic rotator cuff repair: a retrospective comparison of double-layer, double-row and suture bridge methods. *BMC Musculoskelet Disord* 2018;19:324.
7. Gasbarro G, Neyton L. The arthroscopic "Montgolfier double-row knotless" rotator cuff repair technique. *Arthrosc Tech* 2019;8:e669-e674.
8. Redler LH, Byram IR, Luchetti TJ, et al. Influence of rotator cuff tear size and repair technique on the creation and management of dog ear deformities in a transosseous-equivalent rotator cuff repair model. *Orthop J Sports Med* 2014;2:2325967114529257.