Technical Note

Arthroscopy-Assisted Transosseous Lower Trapezius Transfer With Peroneus Longus Autograft Using a Reusable Transosseous Repair System for Massive Irreparable Cuff Tears

Senthilvelan Rajagopalan, F.R.C.S. Orth., Girinivasan Chellamuthu, M.S. Orth., and Robin G. Alex, D. Orth., D.N.B. Orth.

Abstract: Tendon transfers are preferred in patients with massive, irreparable posterosuperior rotator cuff tears without glenohumeral arthritis. Recently, a surge of lower trapezius transfer over latissimus dorsi transfer has been observed due to its biomechanical superiority. We present an arthroscopy-assisted lower trapezius transfer technique using a reusable transosseous system and a peroneus longus autograft. The reusable repair system and autograft make this technique both accessible and affordable. With its potential to improve patient outcomes and reduce health care costs, this lower trapezius transfer technique is a valuable addition to shoulder surgery. By sharing our experience, we hope to facilitate wider adoption of this approach.

Tendon transfers are preferred in patients with massive irreparable posterosuperior rotator cuff tears without glenohumeral arthritis.[1] The 2 commonly performed tendon transfers for this purpose are latissimus dorsi transfer and lower trapezius transfer (LTT). LTT has a line of pull similar to the posterosuperior cuff.[2] Hence, the LTT is preferred over the latissimus dorsi transfer. In LTT, a bridging graft is required to extend its attachment to the footprint of the rotator cuff. Achilles tendon allograft is commonly used.[3] Allograft availability is limited and expensive in developing countries. Autologous semitendinosus tendons, peroneus longus (PL) tendon, and fascia lata have been used as alternatives for extending the lower trapezius.[4-6] Arthroscopic rotator cuff repair can be performed by using anchors or transosseous systems. Reusable transosseous systems are cost-effective and, at the same time, provide outcomes comparable to those of anchor-based repairs.[7] Here, we describe an arthroscopic transosseous LTT technique using a reusable transosseous repair system called the Arthrocuff system (SPowerN). The instrumentation of this system and transosseous repair technique using this system have been previously published.[8]

Surgical Technique

Patient Positioning

A pictorial representation of the different steps of this surgical technique is shown in Figure 1. The patient is under general anesthesia with an interscalene brachial plexus block in a lateral decubitus position with the arm connected to a traction system. Adequate padding of bony prominences is performed. The patient's ipsilateral leg is exposed and prepped for a PL tendon harvest. Shoulder draping is performed so that there is access to the entire scapula for LLT harvest (Fig 2A).

Diagnostic Arthroscopy

A standard posterior portal is created, and the joint is inspected. The extent of the rotator cuff tear is assessed from the intra-articular side, and the scope is shifted to the subacromial space. A lateral working portal is created 4 cm below the acromion. This working portal

From the Shoulder and Upper Limb Unit, MIOT International Hospital, Chennai, India (S.R., G.C., R.G.A.) and Karpagam Academy of Higher Education, Coimbatore, India (G.C.).

Received September 12, 2024; accepted November 27, 2024.

Address correspondence to Girinivasan Chellamuthu, M.S. Orth., MIOT International Hospital, 4/112, Mount Poonamallee Rd, Sathya Nagar, Manapakkam, Chennai, Tamil Nadu 600089, India. E-mail: giri.c.nivasan@gmail.com

2212-6287/241504
https://doi.org/10.1016/j.eats.2024.103411

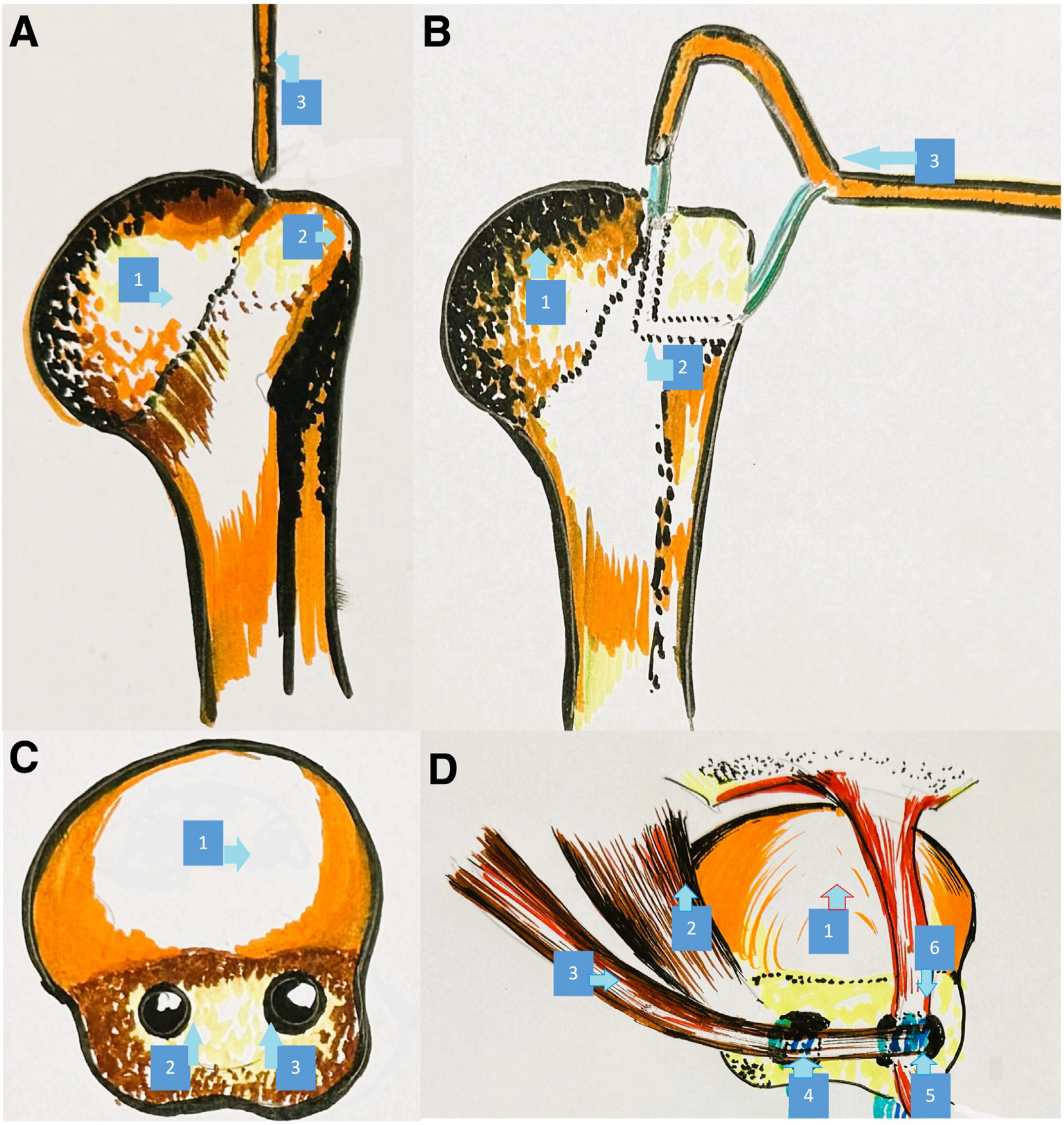

Fig 1. Pictorial representation of different steps in transosseous lower trapezius transfer (right shoulder). (A) Awl is on the rotator cuff footprint for the pilot hole of the transosseous tunnel (1, humeral head articular surface; 2, greater tuberosity rotator cuff footprint; 3, awl). (B) Arthrocuff jig with the shuttle sutures coming from the L-shaped transosseous tunnel and attached to the screw at the tip of the vertical limb of the jig (1, humeral head articular surface; 2, L-shaped transosseous tunnel; 3, Arthrocuff jig with locking screw at the tip of vertical limb holding shuttling sutures). (C) Superior view of the humeral head showing transosseous tunnels (1, humeral head articular surface; 2, superior end of the posterior transosseous tunnel; 3, superior end of the anterior transosseous tunnel). (D) Superior view of the humeral head after final fixation showing the peroneus longus bridging graft on the rotator cuff footprint (1, articular surface of the humeral head; 2, partial repair of the infraspinatus to the posterior transosseous tunnel; 3, peroneal graft traversing between the deltoid and infraspinatus is fixed on the rotator cuff footprint using transosseous sutures; 4, attachment point of the graft over the posterior transosseous tunnel; 5, attachment point of the graft over the anterior transosseous tunnel; 6, biceps superior capsule reconstruction).

is kept low to allow easy passage of the transosseous repair jig under the acromion. Rotator cuff repairability to the footprint is assessed after adequate soft tissue release around the rotator cuff tissue. Irreparability and poor tissue quality of the rotator cuff are established (Fig 2B).

Establishment of the Transosseous Tunnels, Partial Cuff Repair, and Biceps Superior Capsular Reconstruction

The greater tuberosity footprint is freshened (Fig 2C). A superior portal is established in line with the footprint of the rotator cuff on the greater tuberosity. Two pilot

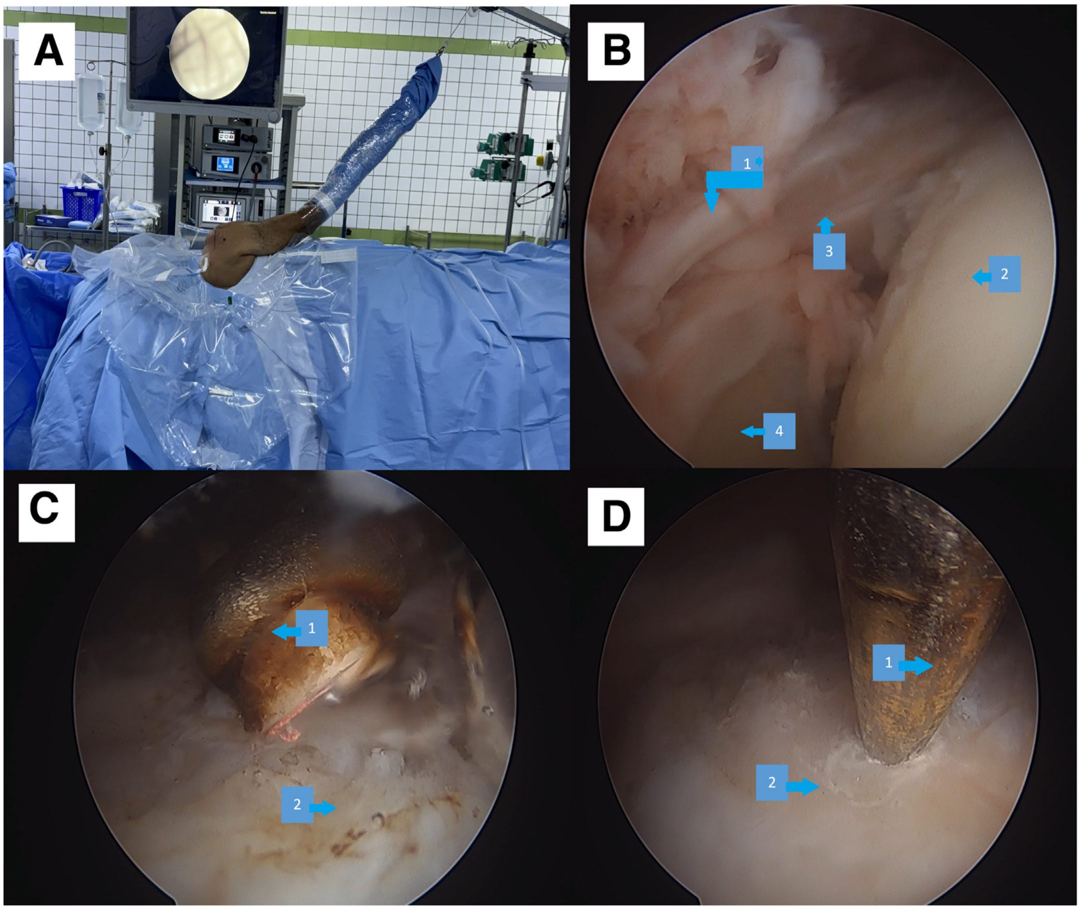

Fig 2. Patient position and arthroscopic pictures (right shoulder). (A) The patient is placed in a lateral position with the arm suspended using a traction of 4 kg. The patient is draped such that the entire scapula is exposed along with the shoulder and upper one-third of the arm. (B) Diagnostic subacromial bursal scopy, through the posterior viewing portal, shows a massive retracted rotator cuff (1, retracted and delaminated rotator cuff tissue; 2, humeral head articular surface; 3, long head of the biceps tendon; 4, glenoid articular surface). (C) Viewing through the posterior portal and working through the lateral portal, the bursa is cleared to expose the footprint of the rotator cuff (1, radiofrequency ablator used to clear the rotator cuff footprint; 2, rotator cuff footprint). (D) Viewing through the posterior portal and working through the superior portal, the entry awl (SpowerN) is used to mark the pilot hole for the vertical limb of the Arthrocuff jig on the rotator cuff footprint. First, the posterior transosseous pilot hole is created (1, awl; 2, area of rotator cuff footprint).

holes (posterior and anterior) are made 1 cm apart in the rotator cuff footprint area using an entry awl (SpowerN) through the superior portal (Fig 2D). The pilot holes are 3.9 mm in diameter and serve as vertical limbs of transosseous tunnels. The transosseous jig (Arthrocuff system; SpowerN) is inserted through the direct lateral portal. This jig is made to engage the anterior pilot hole. Using the cannulated handle of the jig, a horizontal tunnel is created using a 2.9-mm drill bit. This coalesces with the vertical limb to form an "L"-shaped transosseous tunnel posteriorly. A locking screw mechanism (Arthrocuff system; SpowerN) with shuttling sutures is then passed through the horizontal tunnel. The jig is removed, allowing for shuttling of the sutures from the horizontal tunnel to the vertical tunnel. Three 2.0 FiberWire sutures (Arthrex) are shuttled through the tunnel (Fig 3). These steps are repeated in the anterior transosseous tunnel. One of the 3 FiberWire sutures exiting from the posterior tunnel is loaded into the Scorpion device (Arthrex), and partial infraspinatus repair is performed on the posterior aspect of the subacromial space (Fig 4A). One of the 3 FiberWire sutures from the anterior transosseous tunnel is loaded onto the Scorpion device. FiberWire is passed through and over the long head of the biceps tendon. The tendon is pulled close to the anterior transosseous tunnel and fixed to perform biceps superior capsular reconstruction. The distal end of the tendon is left intact (Fig 4 B and C).

PL Graft Harvest and Preparation

A 2-cm vertical skin incision is made just above and posterior to the lateral malleolus. The PL and brevis tendons are exposed. The distal part of the PL is sutured

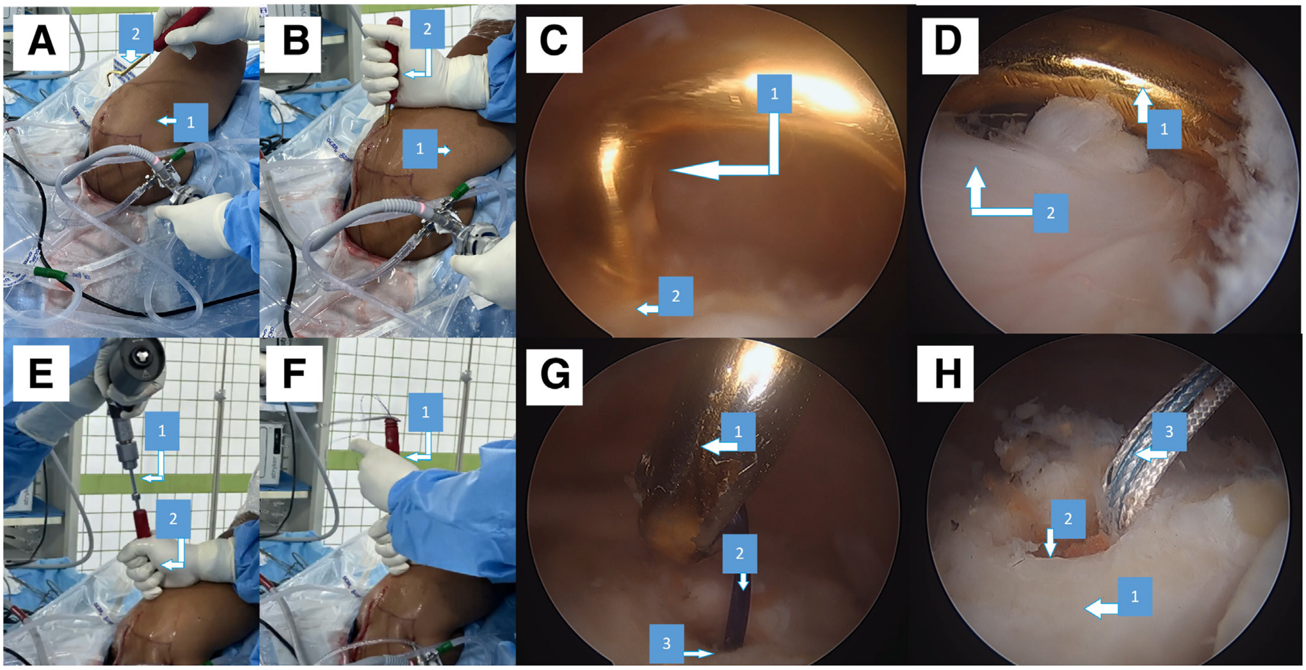

Fig 3. External and arthroscopic images of transosseous tunnel creation (right shoulder). (A) An external image showing the Arthrocuff jig (SpowerN) is introduced through the direct lateral portal into the subacromial space (1, shoulder of the patient in lateral position; 2, Arthrocuff jig). (B) An external image showing the vertical limb of the Arthrocuff jig inserted through the lower lateral portal into the posterior pilot hole on the rotator cuff footprint and positioning of the jig to drill the horizontal limb of the transosseous tunnel (1, shoulder of the patient in the lateral position; 2, Arthrocuff jig held in position to drill the horizontal limb of the transosseous tunnel). (C) Arthroscopic view through the posterior portal—the vertical limb of the Arthrocuff jig goes into the posterior pilot hole (1, vertical limb of the Arthrocuff jig; 2, posterior pilot hole on the rotator cuff footprint). (D) Arthroscopic view through the posterior portal—the jig is made to sit in such a way that the vertical limb goes flush into the pilot hole and the curved component comes over the lateral aspect of the greater tuberosity (1, Arthrocuff jig; 2, rotator cuff footprint). (E) A 2.9-mm drill bit passes through the jig to drill the horizontal limb of the transosseous tunnel in the greater tuberosity, which will coalesce with the vertical pilot hole to create an L-shaped transosseous tunnel (1, 2.9-mm drill bit is passed through the jig; 2, Arthrocuff jig is held perpendicular to the floor to drill the horizontal limb of the transosseous tunnel). (F) The drill is removed, and the locking screw mechanism (SpowerN) with the shuttling sutures is inserted through the jig so that it screws into the tip of the vertical limb of the Arthrocuff jig (1, locking screw mechanism with shuttling sutures passed through the jig). (G) Viewing from the posterior portal, the locking screw with the shuttling sutures is retrieved as the jig is removed (1, vertical limb of the Arthrocuff jig with a locking screw holding the shuttling sutures at the tip; 2, shuttling sutures; 3, rotator cuff footprint). (H) Viewing from the posterior portal, three 2.0 FiberWires are passed through the L-shaped transosseous tunnel using the shuttling suture (1, rotator cuff footprint; 2, posterior transosseous tunnel; 3, three 2.0 FiberWires through the posterior transosseous tunnels).

to the peroneus brevis. The PL is harvested after tenotomy. The graft is prepared using 2.0 FiberWire sutures at each end. FiberWire is also added at 1 cm from the distal end of the graft (Fig 4D-F).

Lower Trapezius Tendon Preparation

A 4-cm-long horizontal incision is made 1 cm below the superomedial aspect of the scapula. The lower trapezius tendon is identified and released from the scapular spine at the insertion site. Care is taken not to dissect the medial to the scapula medial border to avoid the risk of injury to the spinal accessory nerve.

PL Graft Fixation and Completion of LTT

The arthroscope is reinserted into the subacromial space. Through the lateral portal, a suture retriever is passed in the interval between the infraspinatus and deltoid from the subacromial space exiting at the level of the lower trapezius. The prepared PL is shuttled in this space and brought to the footprint. Two 2.0 FiberWire sutures from the anterior tunnel are used to tie down the distal end of the PL graft. The same procedure is repeated to tie down the graft to the posterior transosseous tunnel using 2 FiberWire sutures (Fig 5A-C). Multiple cycles of internal and external rotation of the shoulder are performed to increase the tension of the interpositional graft. The arm is placed in a 60° abduction and maximal external rotation position, and the peroneus graft is weaved in a Pulvertaft fashion and sutured under maximal tension to the lower trapezius tendon (Fig 5D). Once suturing is performed, the sliding of the tendon graft is checked, and the

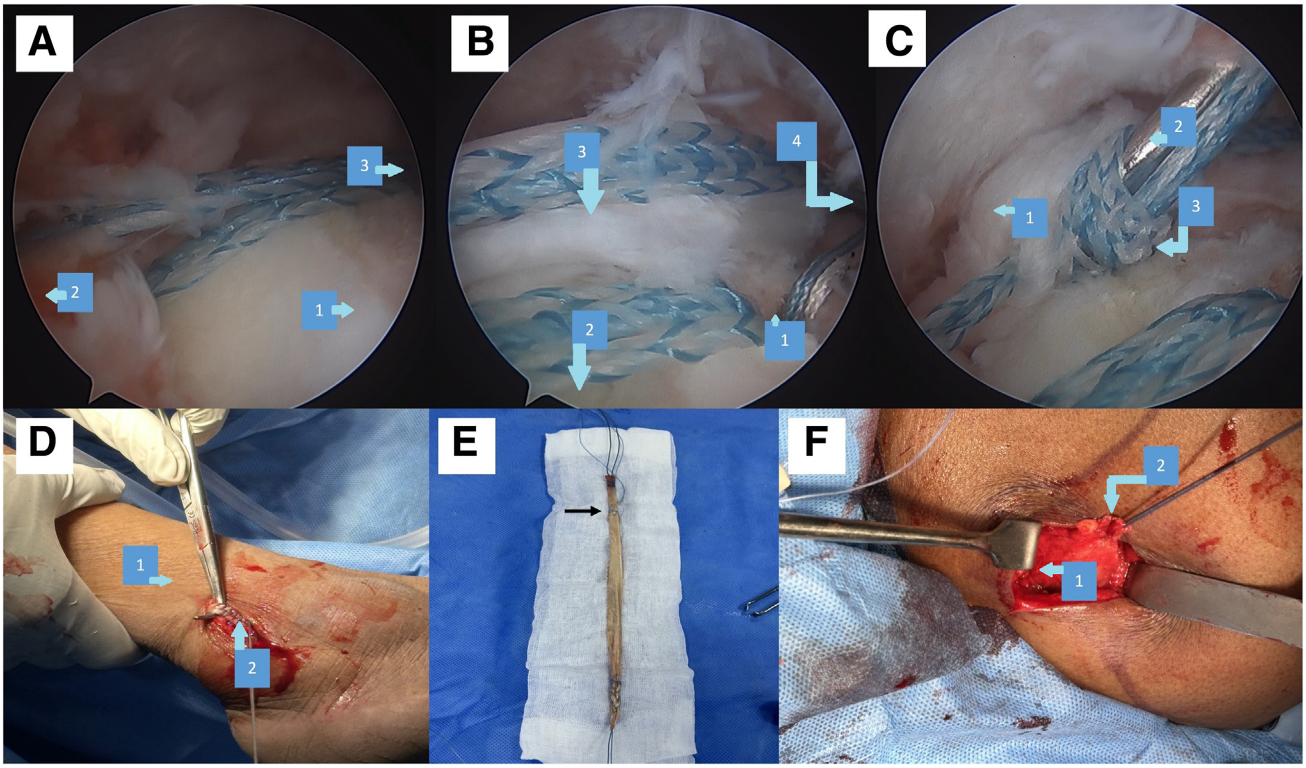

Fig 4. Arthroscopic pictures showing partial cuff repair and biceps superior capsular reconstruction and external images showing peroneus longus and lower trapezius grafts (right shoulder and right leg). (A) Viewing through the posterior portal and working through the lateral portal, partial repair of the retracted rotator cuff (infraspinatus) is achieved using a 2.0 FiberWire through the posterior transosseous tunnel (1, articular surface of the humerus; 2, infraspinatus pulled to its footprint for partial cuff repair using 2.0 FiberWire; 3, location of the posterior transosseous tunnel). (B) Viewing through the posterior portal and working through the lateral portal, a 2.0 FiberWire shuttled through the anterior transosseous tunnel is passed over and through the long head of the biceps tendon to achieve superior capsular reconstruction (1, a posterior transosseous tunnel with 2, partially repaired infraspinatus; 3, biceps pulled to the 4 anterior transosseous tunnel using 2.0 FiberWire). (C) Viewing through the posterior portal and working through the lateral portal showing the completion of the biceps superior capsular reconstruction over the anterior transosseous tunnel (1, long head of the biceps tendon; 2, knot pusher used to complete knot over the biceps tendon; 3, anterior transosseous tunnel). (D) External image showing harvest of the peroneus longus tendon from the ankle using a vertical skin incision. Whipstitches are made on the tendon using 2.0 FiberWire before the harvest of the tendon (1, right leg with the patient in the left lateral position; 2, peroneus longus tendon with whipstitch). (E) The harvested peroneus longus tendon is prepared with 2.0 FiberWire stitches at both ends of the graft and 1 cm from the distal end of the graft (black arrow). (F) View of the posterior aspect of the shoulder and scapular region with the patient in the lateral position: near the junction of the spine and medial border of the scapula, a 4-cm-long skin incision is made, and layered dissection is performed to visualize the lower trapezius tendon. The distal end of the tendon is separated (black arrow) and stitched using 2.0 FiberWire (1, lower trapezius tendon; 2, whipstitches from the tendon).

procedure is completed. Pearls and pitfalls of this technique are presented in Table 1. The advantages and disadvantages are listed in Table 2. A demonstration of this surgical technique is shown in Video 1.

Postoperative Rehabilitation

The arm is placed in an abduction/external rotation splint at 30° of abduction and 40° of external rotation for 6 weeks to allow graft healing. Elbow and wrist mobilization exercises are performed. After 4 weeks, pendulum shoulder exercises, passive shoulder flexion-extension, and abduction are initiated. Rotation until a neutral position is allowed. After 6 weeks, active range-of-motion exercises and a gradual increase in internal rotation are started, and the splint is discontinued.

Discussion

We have described an arthroscopy-assisted transosseous technique for LTT using the peroneus longus autograft as the bridging graft with the patient in a lateral decubitus position. The original description of LTT was in the beach-chair position. There are some advantages to the lateral decubitus position, as outlined by Baek et al.[4] Classical open transosseous rotator cuff repair remains the gold-standard technique for rotator cuff repair.[9,10] With the advent of arthroscopic surgery, anchor-based repair has become popular. Transosseous

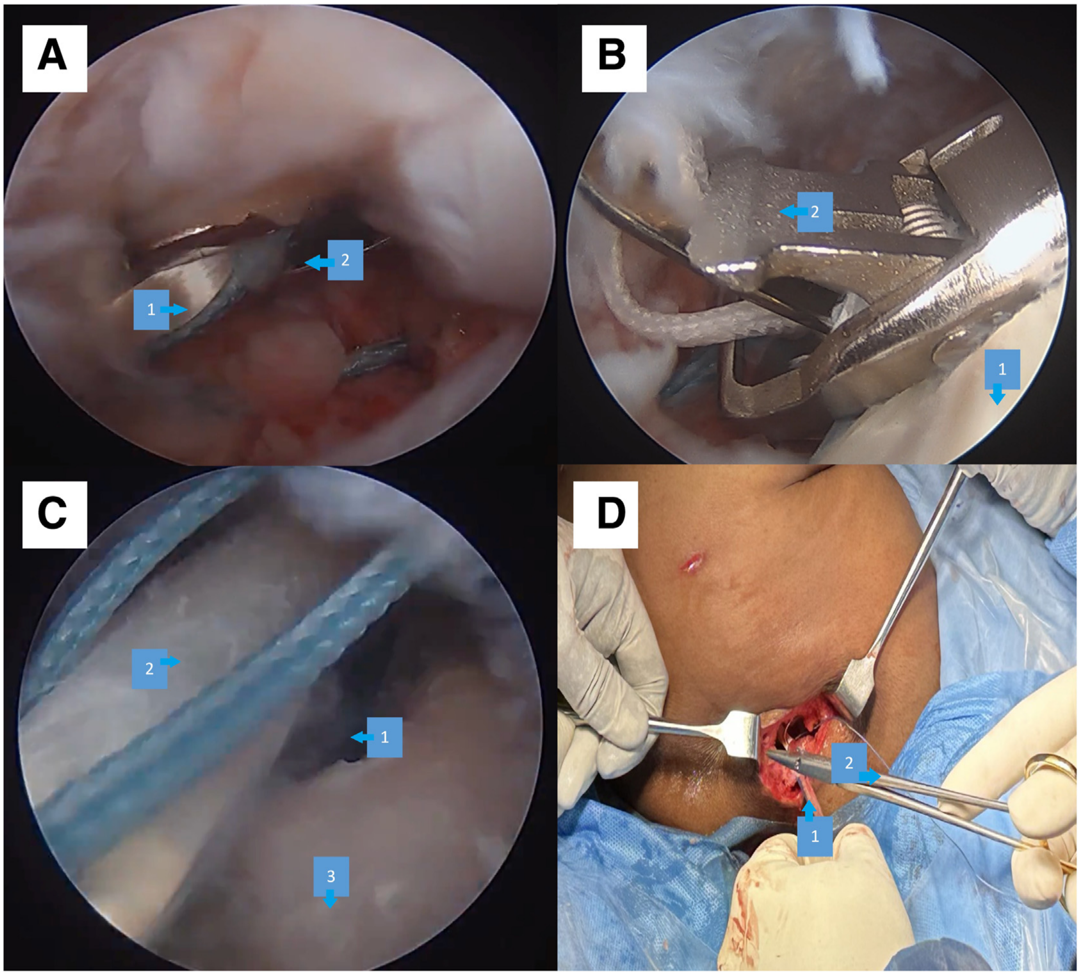

Fig 5. Arthroscopic and external images showing passage of the peroneus longus graft and Pulvertaft weaving of the graft (right shoulder). (A) Arthroscopic view from the posterior portal The prepared peroneal tendon is passed between the infraspinatus and deltoid using a suture retriever, from the incision near the medial border of the scapula into the subacromial space (1, peroneus longus graft pulled into the subacromial space using 2, a suture retriever). (B) Arthroscopic view from the posterior portal and working from the direct lateral portal, the distal end of the graft is fixed to the anterior interosseous tunnel using FiberWire stitches (1, lower trapezius tendon; 2, FiberWire passed into the tendon using antegrade suture passer). (C) Arthroscopic view from the posterior portal and working from the direct lateral portal—the distal of the graft is attached to the posterior interosseous tunnel (1, posterior transosseous tunnel; 2, peroneus longus graft; 3, rotator cuff footprint area). (D) An external image of the posterior aspect of the shoulder and scapular region with the patient in a lateral position—Pulvertaft weaving of the scapular end of the graft to the end of the lower trapezius tendon is done (1, Pulvertaft weaving and suturing of the peroneus longus is done with the tendon in held in tension; 2, needle holder is used for suturing).

equivalent double-row anchor configurations have been used to mimic open transosseous repair, providing a greater approximation of the cuff in the footprint area.[11] Anchors have associated limitations such as anchor pull-out, cyst formation, suture cut-through, and high financial burden.[7,12] Over the years, several arthroscopic transosseous techniques have been described using different jigs.[9,13,14] These techniques have been shown to produce equivalent results with better healing responses, avoiding the limitations of anchor-based repair.[7,9,10,15,16]

LTT has been shown to reverse the external rotation lag with healing of the tendon at the rotator cuff footprint by 6 months.[17] Elhassan et al.[18] showed that 90% of the patients had good functional outcomes after LTT at an average follow-up of 14 months. Achilles tendon allograft has been frequently used as interposition grafts for LTT.[18-20] There was no donor site morbidity, and the surgical time was reduced. However, there are concerns regarding the use of allografts, including infections and graft rejection. Allografts are expensive, and their availability is limited in developing countries. Alternative

Table 1. Pearls and Pitfalls of Arthroscopy-Assisted Transosseous Lower Trapezius Transfer

Sample Number	Procedure	Pitfall	Pearls
1	Lateral decubitus positioning of the patient	The orientation is difficult in complex procedures like LTT. Since the procedure can be prolonged, the risk of compression neuropathy is high. Hence, adequate padding is needed.	The risk of complications like cerebral hypoperfusion is very low.
2	Tunnel placement for transosseous repair	Close placement of anterior and posterior tunnels or angulation of jig can result in tunnel coalition.	Appropriate placement of the anterior and posterior tunnels can help utilization of the same tunnels for biceps superior capsular reconstruction and partial repair of the posterior cuff, respectively, whenever possible.
3	Harvest of PL graft	Care should be taken not to injure the common peroneal nerve proximally.	The PL graft harvest is relatively simple, reproducible, and less morbid compared to the hamstring or fascia lata harvest.
4	Lower trapezius harvest	Identification of the tendon can be a challenge. Care should be taken to avoid injury to the spinal accessory nerve.	Sequential dissection of the superomedial aspect of the scapula, staying lateral to the medial border of the scapula, will help in the easy identification of the lower trapezius.
5	Graft tensioning and fixation	Improper graft tensioning can lead to weak postoperative external rotation.	The graft is first fixed at the rotator cuff footprint. Subsequently, it is attached to the lower trapezius using the Pulvertaft technique in 60° abduction and maximal external rotation to obtain appropriate tension.

LTT, lower trapezius transfer; PL, peroneus longus.

Table 2. Advantages and Disadvantages of Arthroscopy-Assisted Transosseous Lower Trapezius Transfer

Sample Number	Advantages	Disadvantages
1	Good initial fixation strength	Technically demanding with a steep learning curve
2	Cost-effective when compared to suture anchor-based repair	Possible tunnel confluence between the anterior and posterior tunnels
3	Bone marrow seepage from the tunnels allows for biological repair	Medial tunnel placement can be difficult if there is a large lateral acromial overhang
4	Multiple possible suture configurations include partial rotator cuff repair and biceps superior capsular reconstruction	Chances of failure by bone cut-through

options for interposition grafts include autologous fascia lata and hamstring grafts.[4,5] The PL has recently been used as an interpositional graft for LTT.[6,21] The PL has limited donor site morbidity and tensile strength comparable to that of hamstring tendons.[22,23]

We have described a cost-effective technique of arthroscopy-assisted LTT using a reusable transosseous device with the PL as the interposition graft. This technique combines the inherent advantages of transosseous repair with autograft use.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: S.R. is a board member of SPowerN and is a consultant and advisor for SPowerN. All other authors (G.C., R.G.A.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors thank Dr. Nehru Ravi and Om Prakash for their important role in the development of the "Arthrocuff" jig system.

Funding

Supported by a grant from the National Hub for Healthcare Instrumentation and Development, India, for the initial development of the "Arthrocuff" jig system.

References

1. Hazra MED, Hazra ROD, Hanson JA, et al. Treatment options for massive irreparable rotator cuff tears: A review of arthroscopic surgical options. *EFORT Open Rev* 2023;8:35-44.
2. Hartzler RU, Barlow JD, An KN, Elhassan BT. Biomechanical effectiveness of different types of tendon transfers to the shoulder for external rotation. *J Shoulder Elbow Surg* 2012;21:1370-1376.
3. Elhassan BT, Alentorn-Geli E, Assenmacher AT, Wagner ER. Arthroscopic-assisted lower trapezius tendon transfer for massive irreparable posterior-superior rotator cuff tears: Surgical technique. *Arthrosc Tech* 2016;5:e981-e988.
4. Baek CH, Kim BT, Kim JG. Arthroscopic-assisted lower trapezius tendon transfer using a fasciae lata autograft in treatment of posterior superior irreparable rotator cuff tears in lateral decubitus position. *Arthrosc Tech* 2023;12:e2227-e2237.
5. Almeida TB, Pascarelli L, Bongiovanni RR, Tamaoki MJ, Rodrigues LM. Outcomes of lower trapezius transfer with hamstring tendons for irreparable rotator cuff tears. *Shoulder Elb* 2023;15:63-71.
6. Premsiri A, Mahasupachai N, Chanlalit C. Arthroscopic-assisted lower trapezius transfer with peroneus longus graft for massive irreparable rotator cuff tear and glenohumeral joint instability: A case report. *JSES Rev Rep Tech* 2022;2:539-545.
7. Black EM, Austin LS, Narzikul A, Seidl AJ, Martens K, Lazarus MD. Comparison of implant cost and surgical time in arthroscopic transosseous and transosseous equivalent rotator cuff repair. *J Shoulder Elbow Surg* 2016;25:1449-1456.
8. Rajagopalan S, Sridharan RB, Ravi N. Surgical technique of arthroscopic transosseous implant-less rotator cuff repair using "Arthrocuff" system. *Arthrosc Tech* 2022;11:e833-e839.
9. Binder H, Buxbaumer P, Steinitz A, et al. Arthroscopic anchorless transosseous rotator cuff repair produces equivalent clinical outcomes and imaging results as a standard suture bridge technique with anchors. *Arthrosc Sports Med Rehabil* 2022;4:e2025-e2034.
10. Stenson J, Sanders B, Lazarus M, Austin L. Arthroscopic transosseous rotator cuff repair. *J Am Acad Orthop Surg* 2023;31:e366-e375.
11. Xu C, Zhao J, Li D. Meta-analysis comparing single-row and double-row repair techniques in the arthroscopic treatment of rotator cuff tears. *J Shoulder Elbow Surg* 2014;23:182-188.
12. Ro K, Pancholi S, Son HS, Rhee YG. Perianchor cyst formation after arthroscopic rotator cuff repair using all-suture-type, bioabsorbable-type, and PEEK-type anchors. *Arthroscopy* 2019;35:2284-2292.
13. Garofalo R, Castagna A, Borroni M, Krishnan SG. Arthroscopic transosseous (anchorless) rotator cuff repair. *Knee Surg Sports Traumatol Arthrosc* 2012;20:1031-1035.
14. Kuroda S, Ishige N, Mikasa M. Advantages of arthroscopic transosseous suture repair of the rotator cuff without the use of anchors. *Clin Orthop* 2013;471:3514-3522.
15. Seidl AJ, Lombardi NJ, Lazarus MD, et al. Arthroscopic transosseous and transosseous-equivalent rotator cuff repair: An analysis of cost, operative time, and clinical outcomes. *Am J Orthop* 2016;45:E415-E420.
16. Randelli P, Stoppani CA, Zaolino C, Menon A, Randelli F, Cabitza P. Advantages of arthroscopic rotator cuff repair with a transosseous suture technique: A prospective randomized controlled trial. *Am J Sports Med* 2017;45:2000-2009.
17. Chopra A, Wright MA, Murthi AM. Outcomes after arthroscopically assisted lower trapezius transfer with Achilles tendon allograft. *J Shoulder Elbow Surg* 2024;33:321-327.
18. Elhassan BT, Sanchez-Sotelo J, Wagner ER. Outcome of arthroscopically assisted lower trapezius transfer to reconstruct massive irreparable posterior-superior rotator cuff tears. *J Shoulder Elbow Surg* 2020;29:2135-2142.
19. Baek CH, Lim C, Kim JG. Superior capsular reconstruction versus lower trapezius transfer for posterosuperior irreparable rotator cuff tears with high-grade fatty infiltration in the infraspinatus. *Am J Sports Med* 2022;50:1938-1947.
20. Ghoraishian M, Stone MA, Elhassan B, Abboud J, Namdari S. Techniques for lower trapezius tendon transfer for the management of irreparable posterosuperior rotator cuff tears. *J Orthop* 2020;22:331-335.
21. Bozoğlan M, Danışman M, Demir T, Karaca H, Esenyel CZ. The clinical results of lower trapezius tendon transfer with the peroneus longus allograft augmentation combined with interpositional repair with fascia lata in massive irreparable rotator cuff tears. *Saudi Med J* 2023;44:164-170.
22. Park JY, Fernandes A, Park SY, et al. Comparative effectiveness of peroneus longus tendon (PLT) autografts versus hamstring tendon (HT) autografts in anterior cruciate ligament reconstruction: A comprehensive systematic review and meta analysis. *Eur J Orthop Surg Traumatol Orthop Traumatol* 2024;34:2691-2699.
23. Nguyen Hoang Q, Nguyen Manh K. Anatomical and biomechanical characteristics of peroneus longus tendon: applications in knee cruciate ligament reconstruction surgery. *Adv Orthop* 2023;2023:2018363.