Technical Note

# "All-Endoscopic" Management of Refractory Elbow Bicipitoradial Bursitis and Partial Distal Biceps Tendon Tears

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**Abstract:** Elbow bicipitoradial bursitis and partial distal biceps tendon (DBT) tears are a result of chronic overuse or other infective/inflammatory pathology and may be refractory to conservative treatment. The all-endoscopic approach provides minimally invasive access to the bursal space and DBT, and diagnostic and therapeutic procedures can be performed under direct endoscopic vision. The technique uses 2 portals, the proximal parabiceps portal and distal anterior portal, and the bursa is insufflated to create a working space. Tissue biopsies are obtained under direct endoscopic visualization, and debridement along 6 bursal zones can be effectively performed. An endoscopic probe test is demonstrated for assessment of partial DBT tears, and low-grade tears are debrided to stable tissue. The all-endoscopic technique is safe and reproducible, and it is a stepping-stone in the learning curve of all-endoscopic repair and reconstruction of distal biceps ruptures.

Bicipitoradial bursitis (BRB) is a painful and function limiting pathology of the bursal sac that envelopes the distal biceps tendon in the cubital fossa and proximal forearm. BRB is usually a result of chronic overuse (repetitive pronation and supination movements) and may coexist with partial insertional tears of distal biceps tendon.[1,2] The condition may also result from uncommon causes like chronic infections (tuberculosis), chronic inflammations (nonspecific/rheumatological/chemical synovitis), and tumor-like conditions (synovial chondromatosis, lipoma arborescens).[3,4] Clinically, the condition presents as a painful and tender swelling or fullness in the cubital fossa and weakness and pain during forceful forearm rotations (especially supination). Neurologic symptoms (parasthesias, radiating pain) may be present if adjacent nerves are inflamed/compressed. BRB is treated conservatively with rest, anti-inflammatories, and physical therapy. Sonography-guided fluid aspiration is indicated if symptoms persist, and local steroid injections are indicated in noninfective pathology. Open surgical debridement is necessary in refractory cases; however, the open approach is extensive, and involves a risk of neurologic injury and heterotopic ossification.[5,6] Moreover, proximal visualization along the tendon is limited, and important structures (e.g., transverse radioulnar ligament) that form the sliding mechanism of the tendon may be sacrificed inadvertently.[7]

The purpose of this report is to present an all-endoscopic technique for surgical management of refractory BRB. The technique permits excellent visualization of different anatomical structures along the entire bursal extent, and pathologic tissue can be biopsied and excised under endoscopic vision. The endoscopic probe test can help identify low-grade partial tears of the distal biceps tendon, and these are then treated with debridement.[7] The all-endoscopic technique is safe and reproducible, and it is a stepping-stone in the learning curve of all-endoscopic repair and reconstruction of distal biceps ruptures.[8-12]

## Surgical Technique (With Video Illustration)

The all-endoscopic technique is demonstrated in a case of refractory BRB with proximal extension along the distal biceps tendon (DBT). Magnetic resonance

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imaging is performed to identify the nature and extent of pathology (Fig 1).

The procedure is performed with the patient in supine position, and the arm is placed on a side table. A sterile removable support is placed under the elbow to permit hyperextension. A 2.9-mm arthroscope (30° and 70°, ConMed Linvatec, Largo, FL) is used via the proximal parabiceps portal for endoscopic visualization throughout the procedure. The key steps and surgical pearls of the technique are summarized in Tables 1 and 2, respectively, and the steps are demonstrated in Video 1.

### Step 1: Sonographic Marking and Portal Placement

Preoperative sonography is performed to mark anatomical landmarks: (1) DBT at musculotendinous junction, (2) brachial artery and its bifurcation, (3) radial and ulnar arteries, and (4) radial tuberosity.

Two portals are used (Figs 2 and 3):

(1) Proximal parabiceps portal (PBP): This is the viewing portal throughout the procedure. The portal is placed approximately 2 to 3 cm proximal to the anterior elbow crease on the lateral aspect of the musculotendinous junction of the DBT, as described previously.[10] The sheath is introduced via a 3-mm portal and angled slightly inferiorly and towards the radial tuberosity for approximately 6 to 7 mm.

(2) Distal anterior portal (DAP): This is the working portal throughout the procedure. DAP is placed 4 cm distal to the anterior elbow crease directly overlying the sonographically marked radial tuberosity.[10] A 6- to 8-mm incision is used and careful dissection is performed to identify and protect the radial artery and lateral cutaneous nerve. A 6-mm smooth cannula is introduced via DAP and perforates the superior bursal wall for intrabursal access.

### Step 2: Diagnostic Assessment and 6-Point Endoscopic Anatomy

Air is insufflated via PBP cannula, and the bursa is distended for preliminary evaluation. Thereafter, fluid inflow is started and the valve is closed periodically to prevent extravasation. A systematic examination is performed to evaluate the pathologic regions (Fig 2B): (1) Bare area of tuberosity; (2) bursal boundaries: distal, volar, and radial; (3) radial recess; (4) biceps sliding mechanism—transverse radioulnar ligament and bursal reflection; (5) DBT insertion and tuberosity sulcus; (6)

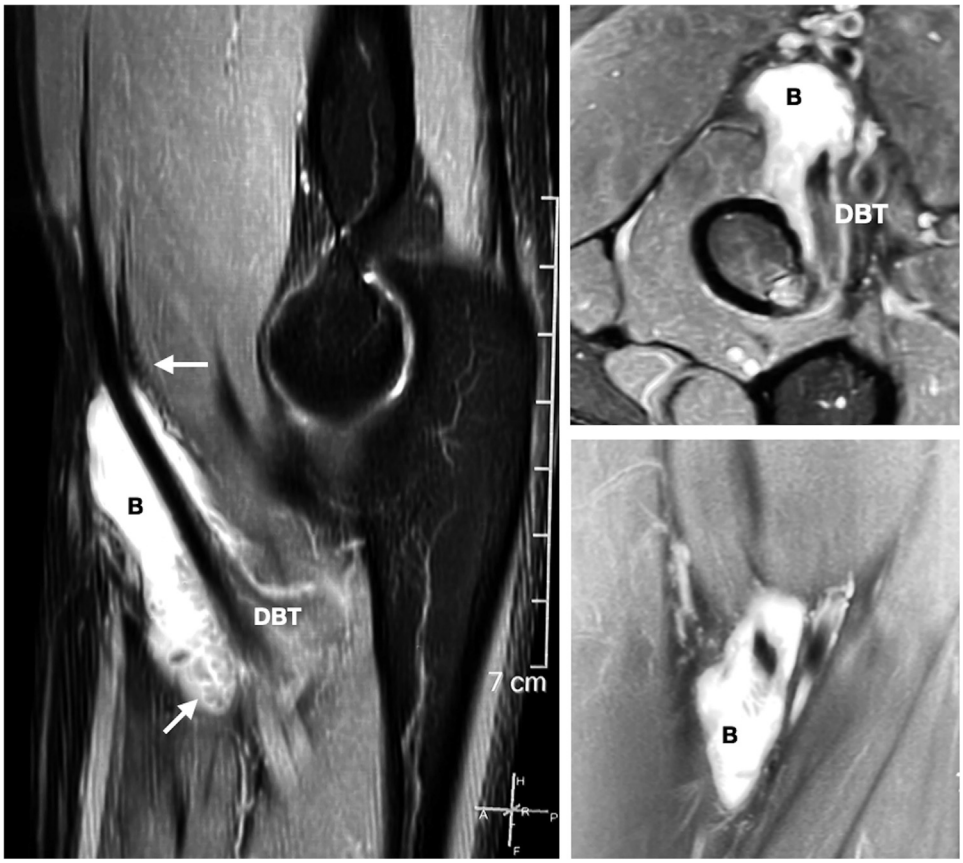


**Fig 1.** Magnetic resonance image (right elbow) of bicipitoradial bursitis (B) extending from the insertional region to 5 cm proximal (upper arrow) along the distal biceps tendon (DBT). Lower arrow shows synovial proliferative pathology in the distal bursal region and along DBT. The DBT insertion shows appearance of tendinosis without an obvious tear (upper right image).

dorsoradial (tuberosity-side) surface of DBT; (7) volar–ulnar (ulnar side) surface of DBT; and (8) proximal DBT and its bursal extension. Each structure is further probed via DAP, and synovial tissue is retracted to visualize deeper structures. The forearm is rotated to visualize the sliding of the DBT, and the most proximal attachment (long head) is seen in full supination (Fig 3B).[7]

### Step 3: Endoscopic Tissue Biopsy

A grasper is used via DAP and pathologic tissues (synovial nodules and fronds, etc.) are excised from different regions. Care is taken to avoid disruption of bursal boundaries to avoid loss of distention and working space (Fig 4).

### Step 4: Endoscopic Synovectomy and Debridement

A 3.5-mm nonaggressive shaver blade (ConMed Linvatec) is used through the DAP cannula. Pathologic tissue is meticulously excised along each of the 6 anatomical regions. Minimal suction is used while shaving to avoid bursal disruption and injury to surrounding vital structures. The volar–ulnar DBT surface is in close proximity to ulnar artery, and full supination is necessary to safeguard the artery while debriding this surface. A radiofrequency device (Edge; ConMed Linvatec) is used at a reduced setting via the DAP to complete the debridement (Figs 5 and 6). If the bursal tissue is pathologic, bursal excision is performed as the last step to avoid extravasation of fluid.

### Step 5: Partial DBT Tear Assessment and Management: The Endoscopic Probe Test

The dorsoradial surface of DBT should be assessed after completion of synovectomy for better visualization. The most proximal aspect of DBT tuberosity insertion is visualized when the forearm is brought into full supination (Fig 3B). This proximal attachment is the long head component, and the larger distal attachment comprises of the short head of DBT; the insertions of the 2 heads form a distinct footprint on the tuberosity.[13] A visual assessment is performed to assess surface fraying of the tendon. An endoscopic probe test is performed to detect a more significant "high-grade" tendon tear that is usually not identifiable by visualization.[2,7] A probe is introduced via DAP, and the forearm is brought into full supination. The DBT surface and the tendon–bone junction is palpated with the probe, and an attempt is made to drive the blunt probe through the tendon surface. In a low-grade frayed tendon, the footprint is intact and the probe cannot be passed through the DBT-tuberosity junction (negative probe test) (Fig 7). If the probe passes through the tendon, and the ulnar surface of the tuberosity can be palpated, the test is positive and the partial tear is "significant" or high-grade. Low-grade tears are carefully debrided, whereas high-grade tears are converted

**Table 1.** Key Steps of the Procedure

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| Preoperative sonography marking of vital neurovascular structures is important, especially in the early learning curve of the procedure. |
| The proximal parabiceps portal (PBP) and distal anterior portal (DAP) are placed at the origin and insertion of the DBT, distal biceps tendon (DBT). This permits a large safe working space of 4-5 cm and preserves the bursal boundaries. A 6-point evaluation of the DBT and bursa is performed. |
| Tissue biopsy is performed using a grasper through the DAP. Six anatomical zones can be accessed via the DAP cannula for tissue samples. |
| Debridement and synovectomy are performed under excellent endoscopic vision in 6 anatomical zones around DBT. |
| Partial tears of DAP are evaluated via the endoscopic probe test. Low-grade tears are debrided, and significant/high-grade tears are converted to complete tears and repaired. |
| Final assessment is performed using a 70° arthroscope to detect "hidden" pathologic tissue and to ensure adequate synovectomy. |

**Table 2.** Technical Pearls and Pitfalls

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| Pearls |
| The proximal parabiceps portal (PBP) is placed close to the distal biceps tendon (DBT); the DBT and the sheath should be passed parallel to the tendon. The sheath should pass smoothly and without any resistance for approximately 7 cm. The end point is bony feel of the bare area of bicipital tuberosity. |
| The tuberosity bare area is a consistent endoscopic landmark, and visualization of this area suggests correct placement of the sheath. |
| While placing the distal anterior portal (DAP) cannula, the illumination from the arthroscope lens should be used as a guide to ensure correct plane of dissection. |
| Bursal walls and its reflections, and the biceps sliding mechanism (TRUL) should be preserved during the procedure. Bursal preservation ensures a safe working space for debridement. A nonaggressive shaver blade and low radiofrequency settings are used to excise pathologic tissue without disrupting bursal boundaries. |
| Full supination of the forearm is necessary to safeguard the ulnar artery, especially while debriding the volar–ulnar DBT surface. |
| The proximal bursal sac is narrow and may be difficult to visualize. A 70° arthroscope through the PBP is useful to visualize "hidden" areas of pathologic tissue. |
| Pitfalls |
| The 2 portals are close to several neurovascular structures and should be placed carefully. Familiarity with the course of vital neurovascular structures and an understanding of their changing relationship with DBT with dynamic rotation is necessary. |
| The lateral cutaneous nerve is at risk of injury while placing the PBP, and the radial artery may be injured during placement of DAP. The ulnar artery is in close proximity to DBT and is in contact with DBT in neutral forearm rotation. |
| Aggressive shaving along the DBT may result in iatrogenic damage to the tendon. |
| Low-pressure inflow is necessary to avoid rapid rise in compartment pressures. |

TRUL, transverse radioulnar ligament.

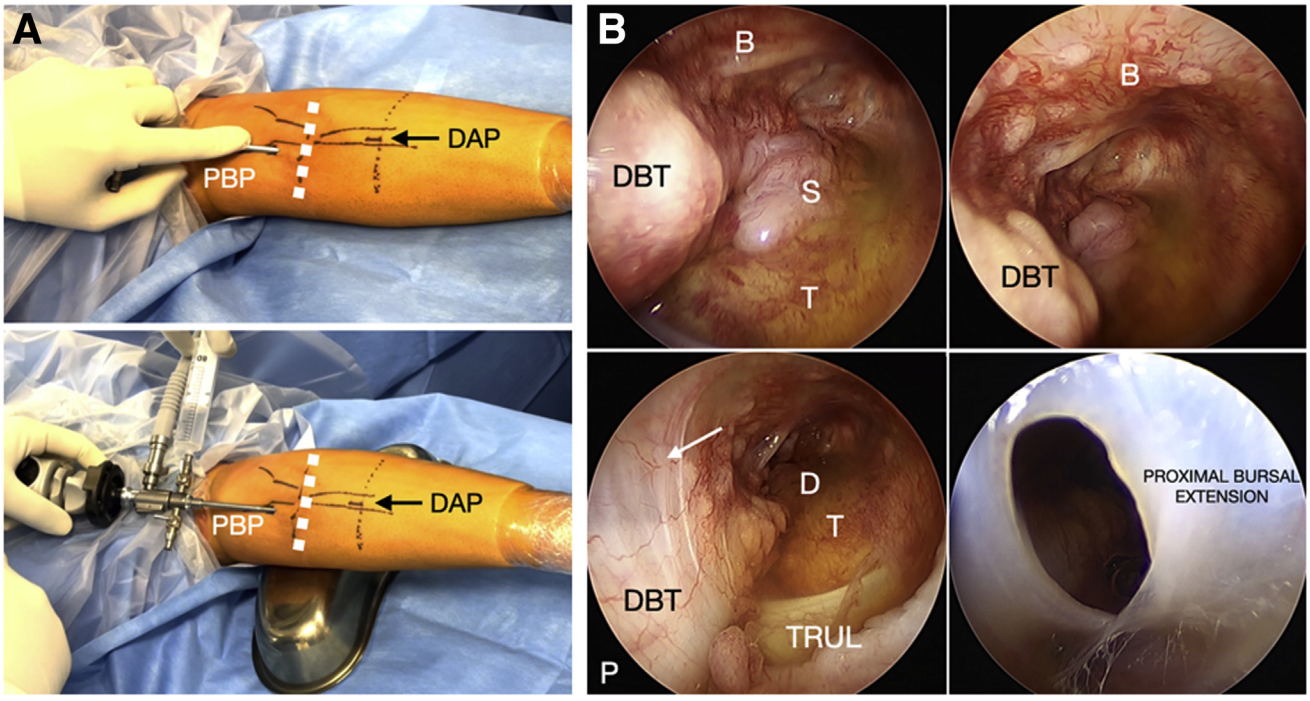


**Fig 2.** (A) Proximal parabiceps portal (PBP) and distal anterior portals (DAP) are shown in relation to the anterior elbow crease (dotted line). Air insufflation (lower image) is used to distend the bursa to create a working space (right elbow, supine position, elbow in supination and extension). (B) Dry-endoscopic view via PBP after distension of the bursal sac (B) demonstrates the pathologic anatomy. Distal extent of the bursal sac (top left) shows proliferative synovitis (S) along the bare area of tuberosity (T) and along the dorsoradial tendon surface (DBT). Superior (volar) view (top right) shows synovitis along volar bursal wall (B) and over the volar–ulnar DBT surface. The proximal (P) bursal sac is visualized as the arthroscope is withdrawn proximally (bottom left). The proximal DBT is visualized, and the reflection of the volar bursal wall (arrow) along the volar–ulnar DBT is seen. Dynamic rotation demonstrates the sliding of DBT along the transverse radioulnar ligament (TRUL) in the distal extent of the space (D). As the arthroscope is withdrawn further proximally (bottom right), the proximal wall of the bursa is visualized. (right elbow in supination and extension, 30° endoscopic view via PBP) (DBT, distal biceps tendon.)

to complete tears and repaired endoscopically using suture anchors.[2]

### Step 6: Final Visualization and Assessment

A final assessment within the 6 anatomical zones is performed using a 70° arthroscope (Fig 8). The most proximal bursal zone is better visualized using this angle, and any remaining synovitis or pathologic tissue is excised. Finally, the arthroscope and cannula are withdrawn and the portals are closed.

### Postoperative Management and Rehabilitation

The elbow is placed in a sling for comfort, and the sling is discarded within a week. Elbow movements are permitted for all activities of daily living. Upper-limb strengthening exercises are started from the third postoperative week and is gradually progressed over the next 3 months. Return to heavy work and sports is permitted thereafter.

## Discussion

The technique presented here describes an all-endoscopic approach for DBT exploration using the distended bicipitoradial bursa as a working space. The procedure involves standard instruments, and it is safe and reproducible. The advantages and disadvantages of the procedure are listed in Table 3.

The elbow region can be conceptualized as a multilayered soft-tissue sleeve of muscles, ligaments, and several vital neurovascular structures.[14] The DBT originates in the first muscular layer (musculotendinous junction), and passes obliquely across the deeper layers to attach at the bicipital tuberosity. Traditional open surgery involves use of the classic Henry's approach, and proximal extension of pathology necessitates an extensile approach for access across the elbow crease. Deep and proximal visualization is limited in an open approach, and retractors must be used to gain access for instrumentation. This extensive open approach also is associated with a greater complication rate, especially when a repair procedure is involved.[5,15] The all-endoscopic technique is based on 3 key anatomical structures: (1) parabiceps space, (2) bare area of tuberosity, and (3) intact biciptoradial bursa.[7] The parabiceps space is formed by the proximal extension of BRB that ensheathes the DBT for 3 to 5 cm proximal to insertion.

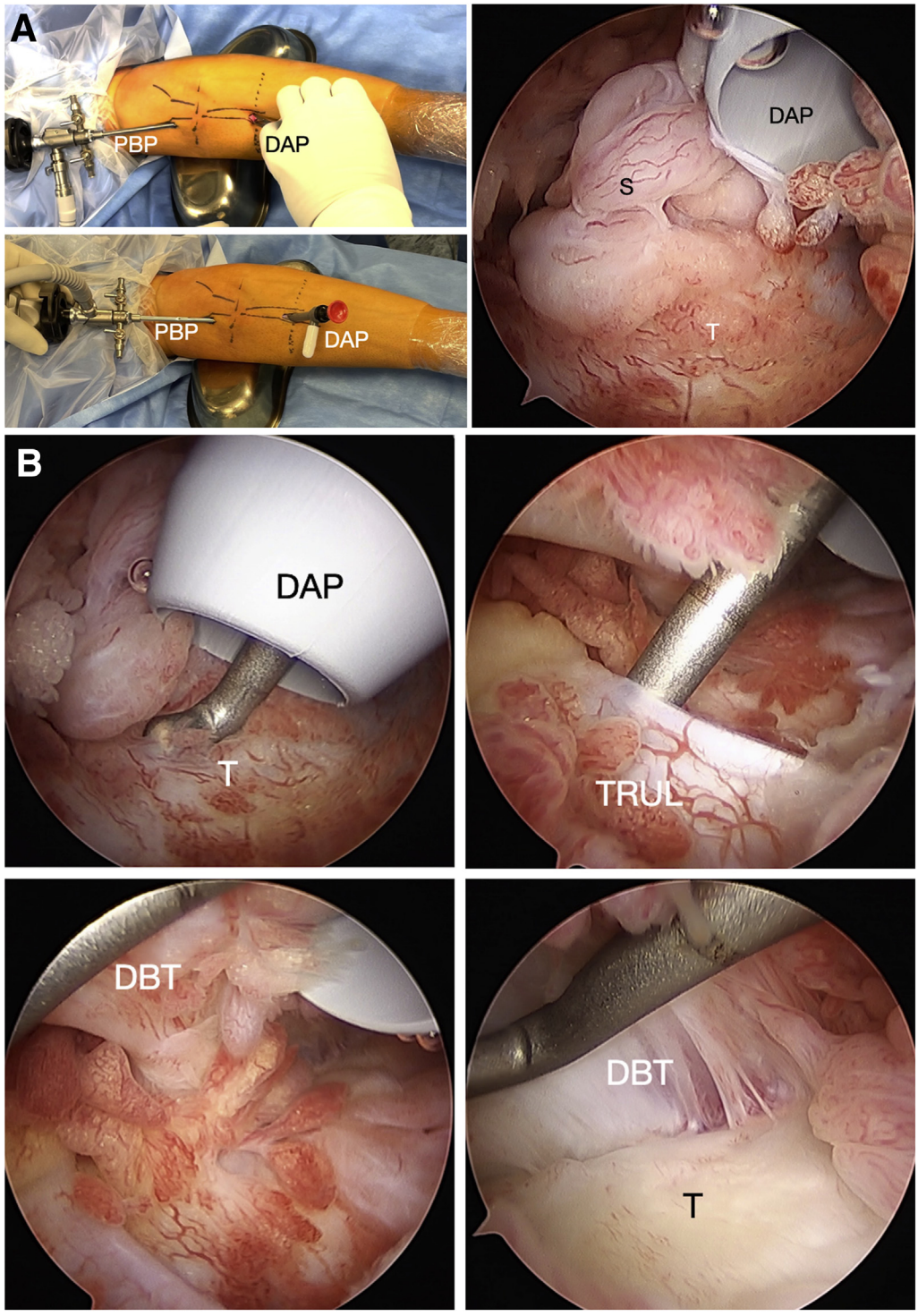


**Fig 3.** (A) Placement of the distal anterior portal (DAP) is demonstrated using careful dissection under endoscopic visualization via PBP (right images). The DAP cannula provides direct access to the tuberosity (T) and synovial tissue (S) (left image) (right elbow in supination and extension). (B) A probe is used via the DAP cannula to assess the bare tuberosity area (T, top left), and the transverse radio-ulnar ligament (TRUL, top right) overlying the proximal supinator. The forearm is rotated to full supination to visualize the proximal DBT (bottom left), and the DBT insertion at T (bottom right) (right elbow in supination and extension, 30° endoscopic view via PBP). (DBT, distal biceps tendon.)

Endoscopic access to this space provides a safe entry into BRB and DBT insertional region, and is the most important step in the procedure. Endoscopic access via a proximal portal (PBP) has the advantage of preserving the pathologic anatomy of the space that would otherwise be distorted if a traditional open or endoscopic-assisted approach was used.[16] Bursal preservation provides a space that can be distended for viewing, and a working cannula provides access for instrumentation. The bare area of bicipitoradial tuberosity is a consistent endoscopic landmark; this area is bounded by the supinator on 3 sides and by the DBT on the ulnar aspect.[7] The bare area is of significance as visualization of this area confirms correct placement of arthroscope.

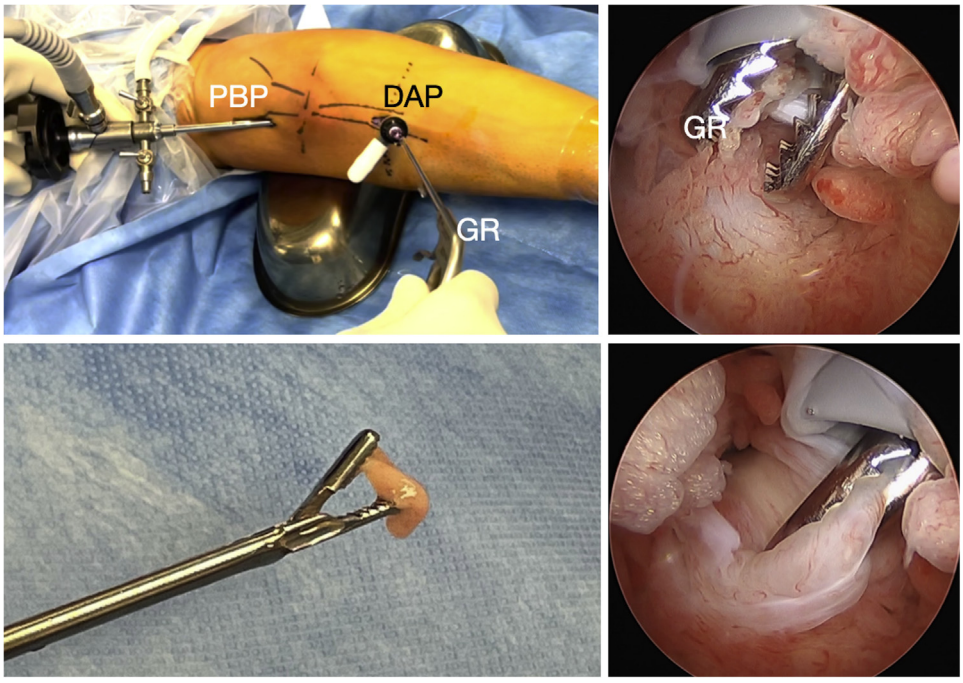


**Fig 4.** Endoscopic biopsy of pathologic synovial tissue is shown while viewing via PBP. A grasper (GR) is used via DAP cannula to excise pathological tissue from different regions along the bursal sac. Care is taken to avoid disruption of bursal walls to prevent fluid extravasation into forearm (right elbow in supination and extension, 30° endoscopic view via PBP). (PBP, proximal parabiceps portal.)

The safety of the all-endoscopic procedure has been analyzed in several studies, and adherence to anatomical guidelines described in these studies is necessary to avoid iatrogenic neurovascular injury.[8,9,17,18] The PBP is in the safe zone for direct placement; however, the DAP should be placed carefully after identifying the radial artery and lateral cutaneous nerve.[8,9] Rotational position of the limb is important; the ulnar artery is closest to DBT insertion in neutral rotation and farthest away in full supination.[17] Lastly, a trifurcate insertion of the DBT has been described, and the unusual

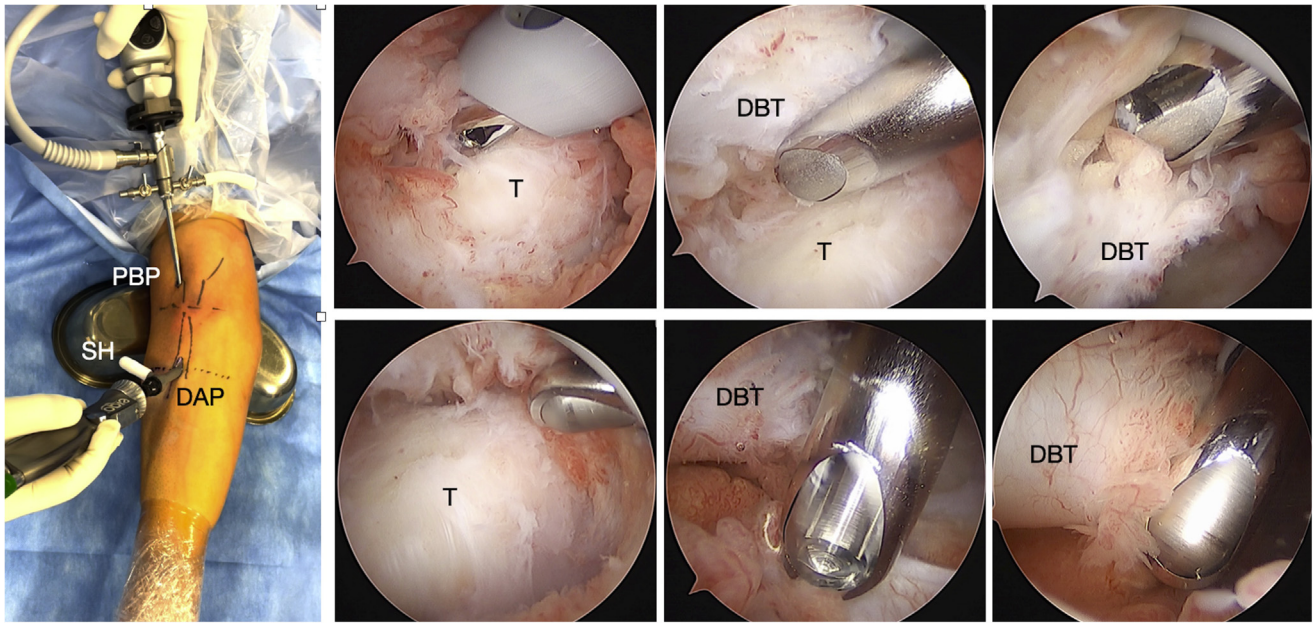


**Fig 5.** A 3.5-mm shaver (SH) is used via the DAP portal (external image) and synovectomy and debridement is performed under direct endoscopic vision (PBP) along the tuberosity bare area (T, top first image), dorsoradial DBT (top second image), volar-ulnar DBT (top third image), lateral bursal wall (bottom first image), proximal DBT insertional region (bottom second image), and finally the proximal bursal extension (bottom third image) (right elbow in supination and extension, 30° endoscopic view via PBP). (DBT, distal biceps tendon; PBP, proximal parabiceps portal.)

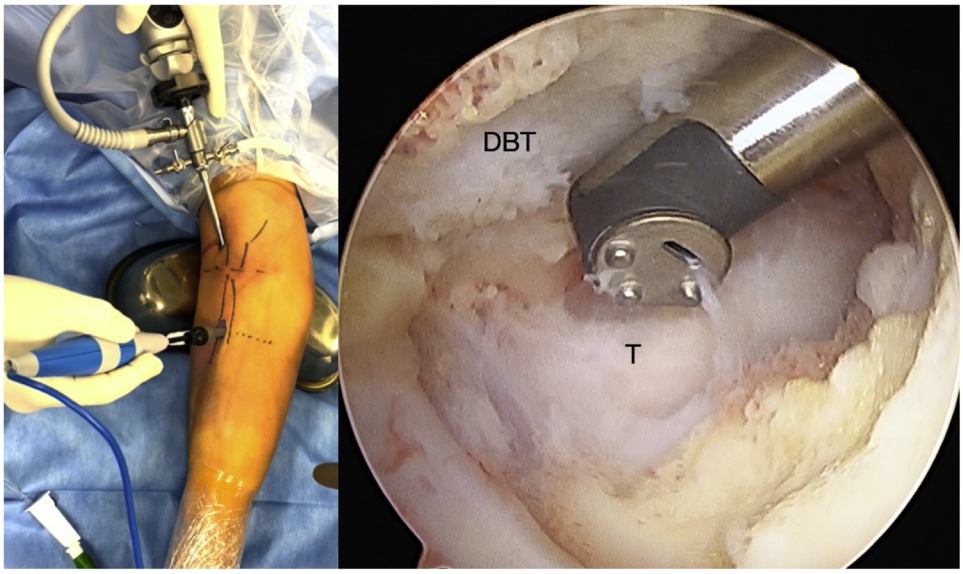


**Fig 6.** A radiofrequency probe is used via the working cannula and is used for hemostasis and debridement along the tuberosity (T) and distal biceps tendon (DBT) (right elbow in supination and extension, 30° endoscopic view via PBP). (PBP, proximal parabiceps portal.)

appearance of this rare variant should be considered during the endoscopic procedure.[19]

The technique described here has utility in diagnostic and therapeutic procedures, for bursitis, partial tears, and even retracted ruptures. Low-grade partial tears

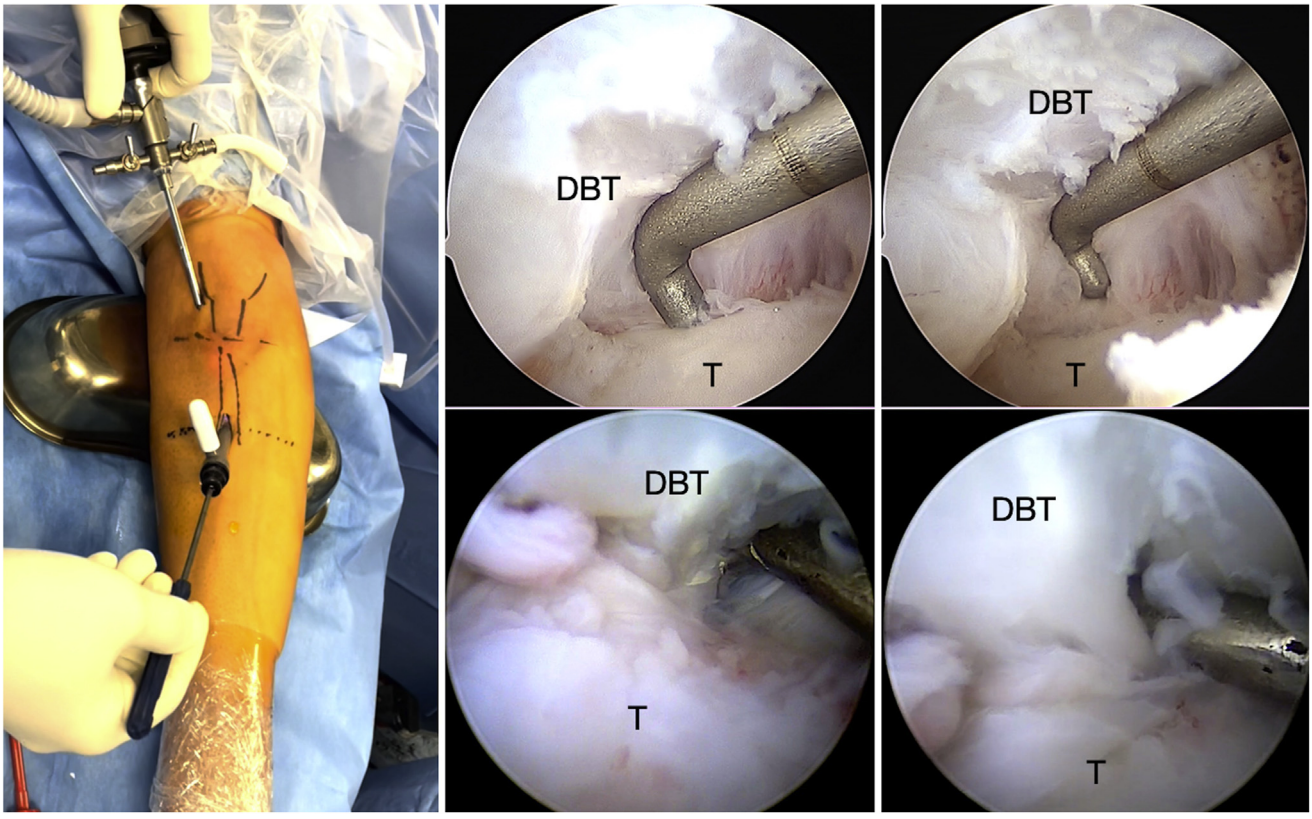


**Fig 7.** The endoscopic biceps test is demonstrated (right elbow in supination and extension, 30° endoscopic view via PBP). Under endoscopic visualization, a probe (P) is passed via the working cannula and the DBT insertion is probed (left external image). The probe is placed at the tendon bone junction and firm pressure is applied on the tendon surface. In a low-grade partial DBT tear, the intact tendon fibers resist the passage of the probe, and probe does not pass through the fibers onto the ulnar surface of tuberosity (top endoscopic images). In a high-grade tear (from another case), the ulnar tuberosity can be probed through the torn DBT fibers (bottom endoscopic images). (DBT, distal biceps tendon; PBP, proximal parabiceps portal; T, bare area of tuberosity).

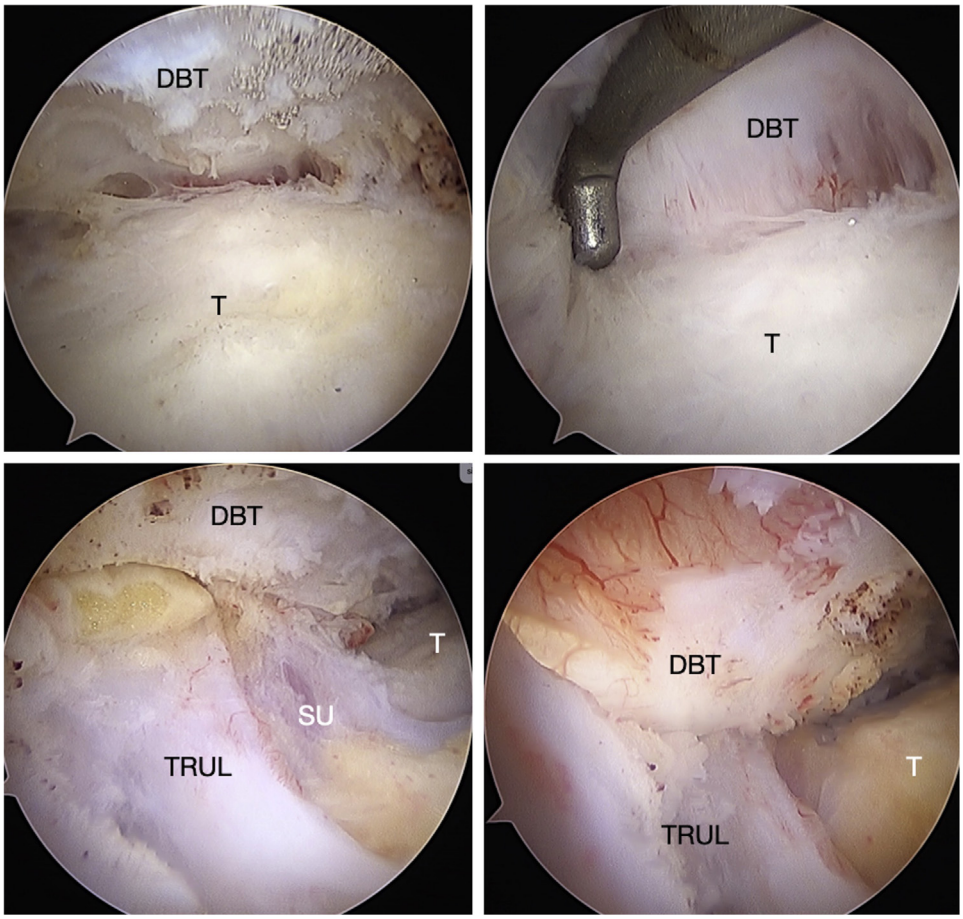


**Fig 8.** Final assessment of the DBT demonstrates adequate debridement along the tuberosity (T, top images), and along the dorsal (bottom left) and volar (bottom right) surfaces of DBT. (70-degree endoscopic view via the PBP). (DBT, distal biceps tendon; PBP, proximal parabiceps portal; SU, supinator; T, bare area of tuberosity; TRUL, transverse radioulnar ligament.)

with a negative endoscopic probe test are debrided, whereas high-grade tears are completed and repaired endoscopically. Retracted tears are retrieved using an additional mid-biceps portal, and tendon deficiencies can be reconstructed endoscopically using autografts.[11,12] A possible disadvantage with this technique is that initial cadaveric experience is necessary for correct portal placement and orientation; however, the procedure has a short learning curve and the 2-portal technique described here helps in learning the more complex all-endoscopic repair and graft reconstruction technique.

**Table 3.** Advantages and Disadvantages

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| Advantages |
| The all-endoscopic approach permits direct and safe access to the deepest plane in the cubital fossa. This eliminates the need for dissection through 2 layers of musculature and several neurovascular structures. Endoscopic access provides excellent visualization and helps in preservation of important structures during debridement and repair process. |
| The all-endoscopic approach is useful for diagnostic (evaluation and tissue biopsy, grading of partial tears) and therapeutic purposes (debridement, repair, or graft reconstruction of acute and chronic tears). |
| Standard arthroscopy instruments are used in the procedure. |
| Disadvantages |
| Endoscopic exploration in the cubital fossa needs experience and training. The procedure is safe and reproducible in experienced hands, and has a short learning curve. |
| Iatrogenic injury to major neurovascular structures is possible, and familiarity with anatomical relationships is necessary. |
| Complete extension of the elbow joint is a prerequisite, and the procedure should not be performed if a fixed flexion deformity is present at the elbow. |

## References

1. Skaf AY, Boutin RD, Dantas RW, et al. Bicipitoradial bursitis: MR imaging findings in eight patients and anatomic data from contrast material opacification of bursae followed by routine radiography and MR imaging in cadavers. *Radiology* 1999;212:111e6.
2. Bhatia DN. All-endoscopic management of partial tears of distal biceps tendon. In: Bhatia DN, Bain GI, Poehling GG, Graves BR, eds. *Arthroscopy and endoscopy of the elbow, wrist and hand*. Cham: Springer, 2022. https://doi.org/10.1007/978-3-030-79423-1_49.
3. Dinauer P, Bojescul JA, Kaplan KJ, et al. Bilateral lipoma arborescens of the bicipitoradial bursa. *Skeletal Radiol* 2002;31:661e5.
4. Nishida J, Furumachi K, Ehara S, et al. Tuberculous bicipitoradial bursitis: A case report. *Skeletal Radiol* 2007;36:445e8.

5. Behun MA, Geeslin AG, O'Hagan EC, King JC. Partial tears of the distal biceps brachii tendon: A systematic review of surgical outcomes. *J Hand Surg Am* 2016;41: e175-e189. https://doi.org/10.1016/j.jhsa.2016.04.019.
6. Karanjia ND, Stiles PJ. Cubital bursitis. *J Bone Joint Surg Br* 1988;70:832-833.
7. Bhatia DN. Endoscopic anatomy of distal biceps tendon insertion and bicipitoradial bursa: A cadaveric study. *J Shoulder Elbow Surg* 2021;30:1759-1767. https://doi.org/10.1016/j.jse.2020.11.033.
8. Bhatia DN, DasGupta B, Panjwani T. Cadaveric study of anterior and posterior elbow endoscopy portals for endoscopic distal biceps repair: Comparative anatomy-at-risk. *Surg Radiol Anat* 2016;38:781-791. https://doi.org/10.1007/s00276-016-1637-6.
9. Bhatia DN, Kandhari V. Analysis of technical feasibility and neurovascular safety of endoscopic distal biceps repair: A cadaveric study. *J Shoulder Elbow Surg* 2018;27: 2057-2067.
10. Bhatia DN. Endoscopic distal biceps repair: endoscopic anatomy and dual-anchor repair using a proximal anterolateral "parabiceps portal. *Arthrosc Tech* 2015;4: e785-e&93.
11. Bhatia DN. Endoscopic repair of acute and chronic retracted distal biceps ruptures. *J Hand Surg Am* 2016;41: e501-e507.
12. Bhatia DN. All-endoscopic autograft augmentation and reconstruction of chronic retracted distal biceps tendon tears. In: Bhatia DN, Bain GI, Poehling GG, Graves BR, eds. *Arthroscopy and endoscopy of the elbow, wrist and hand*. Cham: Springer, 2022. https://doi.org/10.1007/978-3-030-79423-1_51.
13. Bhatia DN, Kandhari V, DasGupta B. Cadaveric study of insertional anatomy of distal biceps tendon and its relationship to the dynamic proximal radioulnar space. *J Hand Surg Am* 2017;42:e15-e23.
14. Bhatia DN. Elbow anatomy: A layered approach. In: Bhatia DN, Bain GI, Poehling GG, Graves BR, eds. *Arthroscopy and endoscopy of the elbow, wrist and hand*. Cham: Springer, 2022. https://doi.org/10.1007/978-3-030-79423-1_4.
15. Amarasooriya M, Bain GI, Roper T, Bryant K, Iqbal K, Phadnis J. Complications after distal biceps tendon repair: A systematic review. *Am J Sports Med* 2020;48:3103-3111. https://doi.org/10.1177/0363546519899933.
16. Phadnis J, Bain G. Endoscopic-assisted distal biceps footprint repair. *Tech Hand Up Extrem Surg* 2015;19:55-59.
17. Bhatia D, Naskar R, DeNiese P. Dynamic rotational alteration in positional relationship of neurovascular structures and distal biceps tendon insertion: A cadaveric study. *J ISAKOS* 2019;4:296-301. https://doi.org/10.1136/jisakos-2019-000326.
18. Zeltser DW, Strauch RJ. Vascular anatomy relevant to distal biceps tendon repair. *J Shoulder Elbow Surg* 2016;25: 283-288. https://doi.org/10.1016/j.jse.2015.08.042.
19. Bhatia DN. Distal biceps tendon insertional trifurcation and a new footprint configuration: Case report of an anatomical variant. *Eur J Anat* 2020;24:235-238.