Results of Anatomical Repair of the Distal Biceps via an Implant-Free Anterior Approach

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ABSTRACT

Introduction: There are numerous approaches for treating distal biceps injuries, each with varying success rates and associated complications. We describe an implant-free technique for anatomical reinsertion of the distal biceps through an anterior incision and report the clinical and functional outcomes. **Materials and Methods:** A retrospective review was conducted of 11 patients who underwent this surgical technique for the repair of their distal biceps injuries. The mean age was 43.8 years, and all patients were male. Demographic data were collected, as well as clinical and functional outcomes more than one year after surgery. **Results:** At the final assessment, no mobility deficits were found. All patients returned to their pre-injury work and sports activities. The mean residual pain score on the Visual Analog Scale was 0.22. The average QuickDASH score one year after surgery was 6.38. There were 3 cases with complications: 2 transient neuropraxias of the lateral antebrachial cutaneous nerve and one surgical wound infection. **Conclusions:** Our results with this technique for repairing distal biceps injuries are comparable to those obtained using implant-based techniques. Recovery was satisfactory in all cases, with a low complication rate. This technique may represent a viable alternative to other, more complex surgical approaches.

Keywords: Distal biceps injury; anterior approach; transosseous suture.
Level of Evidence: IV

Reparación anatómica del bíceps distal por un abordaje anterior sin el uso de implantes: resultados clínicos y funcionales

RESUMEN

Introducción: Existen múltiples enfoques quirúrgicos para abordar las lesiones del bíceps distal, con diferentes tasas de éxito y complicaciones asociadas. En este artículo, se describe una técnica quirúrgica sin implantes para la reinserción anatómica del bíceps distal a través de una incisión anterior, y se comunican los resultados clínicos y funcionales. **Materiales y Métodos:** Se evaluó retrospectivamente a 11 pacientes sometidos a esta técnica quirúrgica para la reparación de lesiones de bíceps distal. Todos eran hombres y la edad promedio era de 43.8 años. Se recopilaron parámetros demográficos, los resultados clínicos y funcionales a más de un año de la cirugía. **Resultados:** En la evaluación final, no se observaron déficits de movilidad. Todos los pacientes reanudaron sus tareas laborales y deportivas como antes de la lesión. El puntaje promedio de dolor residual en actividad, según la escala analógica visual, fue de 0,22. El puntaje de QuickDASH promedio después de un año de la operación fue de 6,38. Se produjeron 3 complicaciones: 2 neuropraxias transitorias del antebraquial cutáneo externo y una infección de la herida quirúrgica. **Conclusiones:** Nuestros resultados con esta técnica quirúrgica para la reparación de lesiones de bíceps distal son comparables con los obtenidos usando técnicas con implantes. La recuperación fue satisfactoria en todos los casos, con una tasa de complicaciones aceptable. Esta técnica podría representar una alternativa viable a otros enfoques quirúrgicos más complejos.

Palabras clave: Lesión; bíceps distal; abordaje anterior; sutura transósea.
Nivel de Evidencia: IV

INTRODUCTION

Avulsion of the distal biceps tendon from its insertion on the radial tuberosity of the proximal radius is uncommon (1.2–2.5 cases per 100,000 persons per year); it typically occurs when resisting a sudden load with the forearm in flexion and supination, as during weightlifting or when attempting to arrest the fall of a heavy object. Nonoperative treatment results in a 22-50% loss of supination strength and a 12-40% loss of flexion strength.[1,2]

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How to cite this article: Seré I, Llumipanta S, Carrizo J, Villa N, Deimundo M, Gobbi E. Results of Anatomical Repair of the Distal Biceps via an Implant-Free Anterior Approach. *Rev Asoc Argent Ortop Traumatol* 2026;91(2):XXX. https://doi.org/10.15417/issn.1852-7434.2026.91.2.2270

Although there remains some controversy regarding the need for repair of acute distal biceps avulsion, surgical repair has been associated with better outcomes in terms of strength, endurance, and cosmesis compared with nonoperative management.[1,2]

Currently, numerous surgical techniques are available for reattachment of the distal biceps brachii tendon, including fixation to the radial tuberosity using Endobutton® systems (cortical fixation with a titanium button), specifically designed interference screws, suture anchors, or transosseous sutures. The most commonly used method is the Endobutton® system combined with an interference screw. An important aspect of the native distal biceps tendon insertion is its ulnar and posterior position on the radial tuberosity, which enables effective forearm supination through contraction by exploiting the cam effect of the radial tuberosity. As the radial tuberosity projects eccentrically from the central axis of the radius, it increases the distance between the biceps tendon and the axis of rotation, thereby enhancing its moment arm.[3,4] Classically, the anterior approach allows fixation of the tendon on the anterior surface of the radial tuberosity, as with Endobutton® systems or suture anchors, which may reduce supination strength. In contrast, the Boyd two-incision approach allows for posterior reinsertion, but may interfere with pronation and also fails to fully exploit the cam effect, as it has been shown that, with a posterior insertion, the tendon migrates proximally on the tuberosity during contraction, thereby diminishing the cam effect.[3-5]

The transosseous suture technique through a single anterior approach used in this series allows replication of the native biceps insertion, maximizing the contact surface between the tendon and the radius and restoring the cam function of the radial tuberosity (Figure 1). This is achieved using transosseous sutures without implants or anchors, with minimal impact on the structural integrity of the radial tuberosity.[6,7]

The objectives of this study were to describe the surgical technique and to evaluate clinical and functional outcomes at more than one year postoperatively.

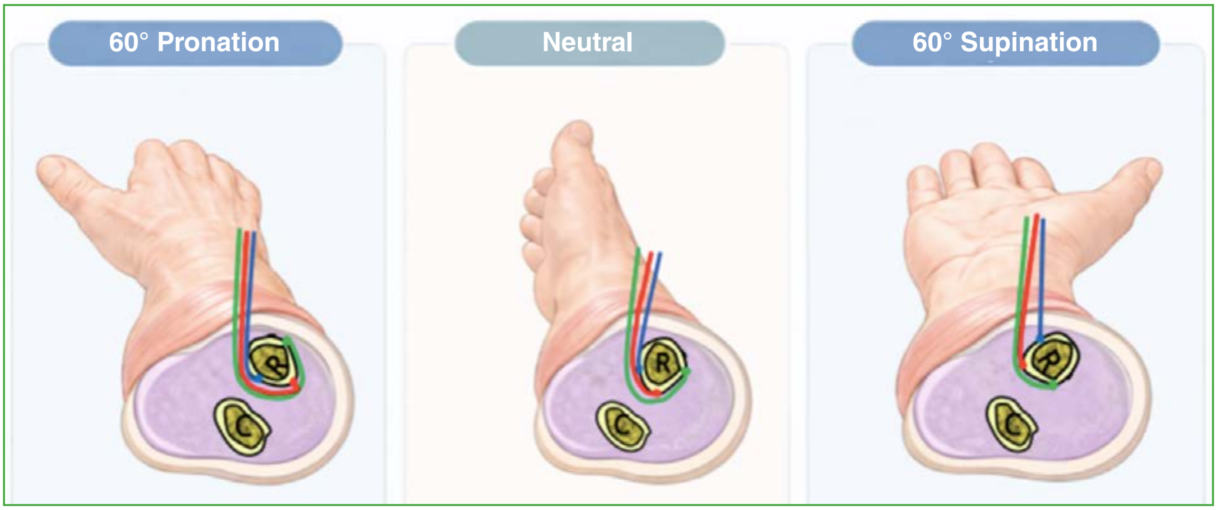

Figure 1. Schematic axial section of the proximal forearm at the level of the center of the bicipital tuberosity, in 60° pronation, neutral position, and 60° supination. With the native tendon insertion (red line), the bicipital tuberosity acts as a cam, increasing the moment arm of the biceps tendon by displacing its line of pull away from the axis of rotation of the radius. The anterior (more radial) insertion (blue line) shortens the moment arm, as does the posterior insertion (green line), since during effective contraction the biceps tendon migrates proximally and pulls over the superior edge of the tuberosity. R = radius; C = ulna. (Prepared by the authors.)

MATERIALS AND METHODS

We retrospectively reviewed the medical records of 14 patients who underwent distal biceps tendon repair between February 2021 and August 2024 and had a minimum postoperative follow-up of 12 months. Three patients were lost to follow-up and were excluded. The final study cohort consisted of 11 patients. All were men, with a mean age of 43.8 years (range 21-60; standard deviation [SD] 10.4). Four patients smoked more than 10 cigarettes per day, and two reported the use of creatine supplements to increase muscle mass. In eight cases, the injury involved the dominant limb. The mechanism of injury was consistently a sudden eccentric load against resistance, with the elbow in flexion and supination: weightlifting (6 patients), lifting heavy objects (3 patients), and use of tools (2 patients). The mean time from injury to surgery was 15 days (range 6-55; SD 14.4). Mean follow-up was 35.5 months (range 12-53; SD 13.4).

All procedures were performed by the same surgeon with Level III experience according to the Tang classification (defined as a surgeon with substantial experience in the relevant techniques and more than 5 years of specialist practice).[8]

Surgical Technique

A standard Henry approach to the radial tuberosity of the proximal radius was used. The skin incision was made longitudinally under fluoroscopic guidance. Three surgical planes were identified:

- Subcutaneous plane, containing the major superficial veins, the lacertus fibrosus, and the lateral antebrachial cutaneous nerve;

- Muscular plane, defined superficially by the flexor carpi radialis and brachioradialis, and deeply by the pronator teres and supinator muscles. This plane contains the radial artery and its branches, the deep venae comitantes, and the terminal branches of the radial nerve (superficial sensory branch and posterior interosseous nerve); and

- Osseous plane, at the level of the radial tuberosity.

Immediately beneath the dermis lies the superficial venous system, composed, from medial to lateral, of the basilic vein, the median antebrachial vein, the cephalic vein, and the accessory cephalic vein. The median antebrachial vein divides into a lateral branch, the median cephalic vein, and a medial branch, the median basilic vein, which join their respective veins at the elbow (Figure 2).[9]

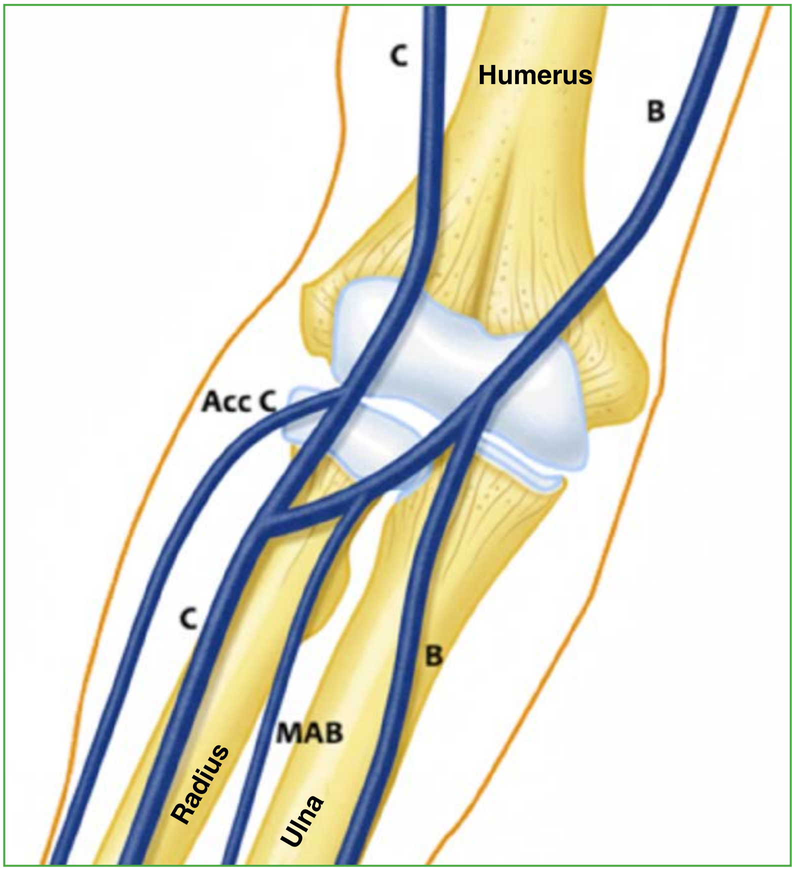

Figure 2. Superficial venous system at the anterior aspect of the elbow.
Acc C = accessory cephalic vein; B = basilic vein; C = cephalic vein;
MAB = median antebrachial vein. (Prepared by the authors.)

Deep to the cephalic vein lies the lateral antebrachial cutaneous nerve, a terminal branch of the musculocutaneous nerve, which enters the lateral bicipital groove of the elbow from the interval between the biceps brachii and brachialis muscles. It continues along the anterolateral aspect of the forearm, providing cutaneous innervation as far as the wrist (Figure 3).[1] The lacertus fibrosus originates from the musculotendinous junction of the distal biceps, extends over the flexor muscles of the forearm, blends with their superficial fascia, and inserts into the subcutaneous border of the ulna. It acts as a stabilizer of the distal biceps tendon (Figure 3).[1]

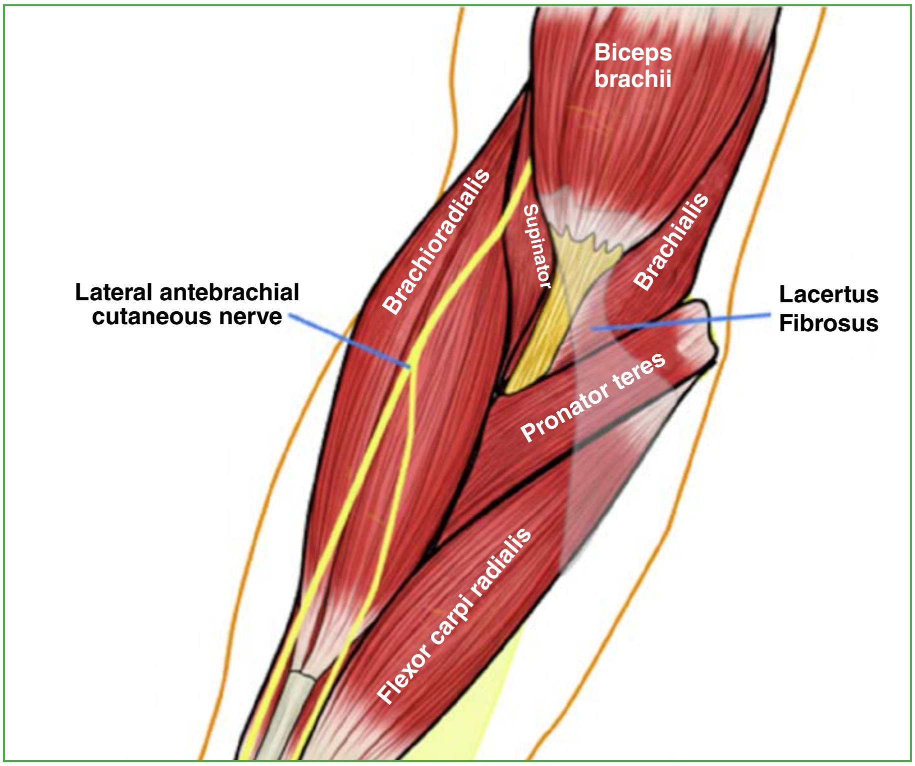

Figure 3. Anterior view of the muscular planes of the elbow, showing the lacertus fibrosus and the lateral antebrachial cutaneous nerve. (Prepared by the authors.)

The muscular planes (Figure 3) can be easily and safely separated by blunt dissection with the index finger. Although arterial variations are not uncommon, in approximately 47% of patients, the brachial artery (before bifurcating into the ulnar and radial arteries) gives rise to an accessory dorsal radial recurrent branch posterior to the biceps tendon (Figure 4). The radial artery courses just medial to the biceps tendon and gives rise to the radial recurrent artery, which runs anterior to the tendon, transversely across the forearm axis, approximately 4 mm proximal to the most proximal aspect of the radial tuberosity (Figure 5). This artery anastomoses with the anterior radial collateral artery (a branch of the profunda brachii artery), forming the so-called Henry vascular leash (Figure 4).[9] The deep venous system accompanies the arterial system in a more anterior plane as venae comitantes, with multiple anastomoses forming a venous plexus that communicates with the superficial venous system through perforating veins.[9] If the radial recurrent artery or its venae comitantes interfere with visualization or limit adequate exposure of the radial tuberosity, they may be ligated.[1,2,6,7,9]

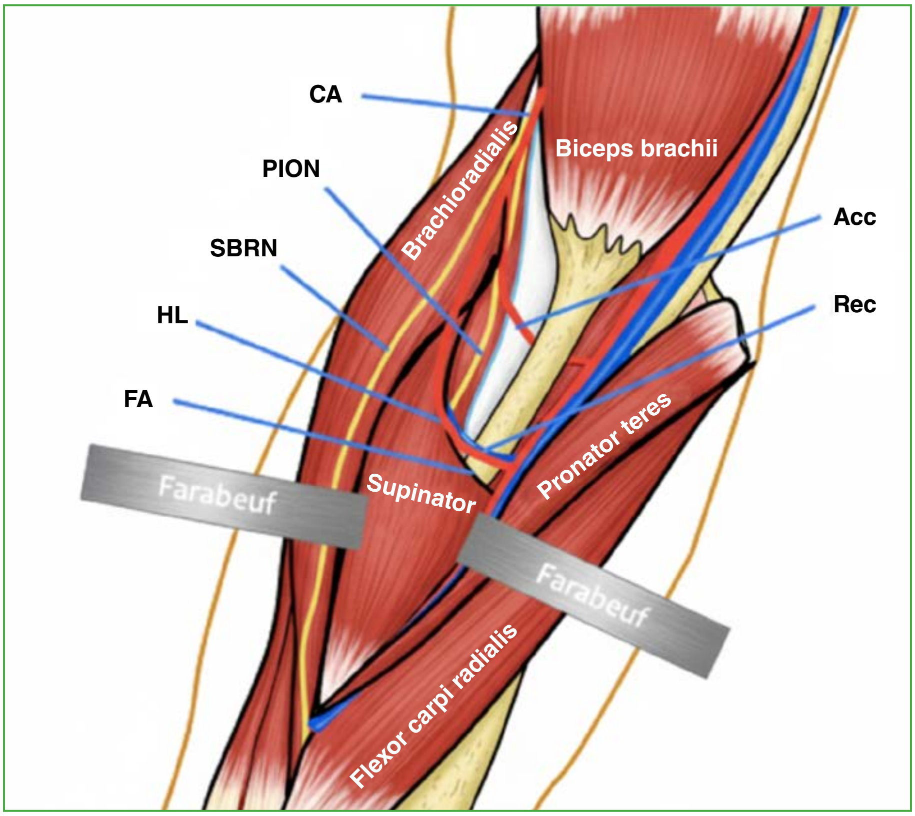

Figure 4. Schematic representation of the deep arterial and venous pattern (right elbow, anterior view): the dorsal accessory radial recurrent artery (Acc) arises from the brachial artery in 47% of cases and passes posterior to the biceps tendon. The radial recurrent artery (Rec) crosses anterior to the biceps tendon and anastomoses with the anterior radial collateral artery (CA), forming Henry's leash (HL). FA = Frohse's arcade; Farabeuf = Farabeuf retractor; PION = posterior interosseous nerve; SBRN = superficial sensory branch of the radial nerve. (Prepared by the authors.)

The radial nerve divides into its superficial (sensory) branch and its deep motor branch (posterior interosseous nerve) proximal to the arcade of the supinator muscle (arcade of Frohse).[10] The superficial sensory branch travels along the medial aspect of the brachioradialis muscle, accompanies the radial artery, and continues toward the wrist and hand. The deep motor branch, corresponding to the posterior interosseous nerve, continues distally in close contact with the lateral aspect of the radial neck, making it particularly vulnerable to injury when using Hohmann retractors at the lateral border of the radial neck. Forearm supination is recommended, as it moves the nerve into a more posterior and lateral position (whereas pronation shifts it anteriorly and medially),[10] along with a triangular retractor configuration to access the radial tuberosity, using two long-blade Farabeuf retractors laterally and a medial Hohmann retractor (Figure 5).[11]

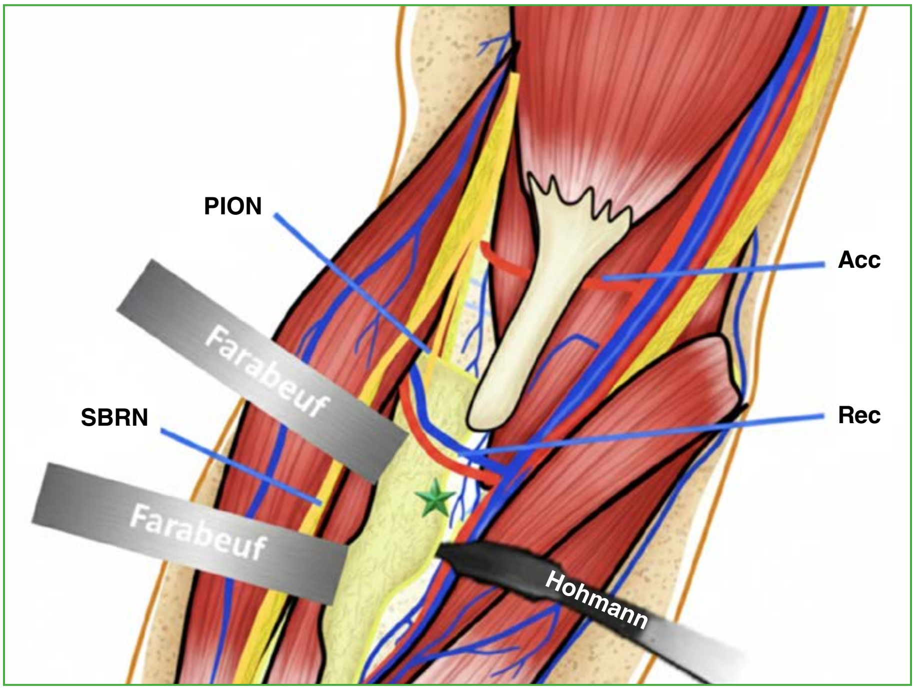

Figure 5. The biceps tendon is depicted as detached, and the supinator muscle is shown retracted laterally to access the bicipital tuberosity using a triangular configuration of two lateral Farabeuf retractors and one medial Hohmann retractor. The radial recurrent artery (Rec) crosses anterior to the biceps tendon approximately 4 mm proximal to the proximal edge of the bicipital tuberosity (green star). Acc = dorsal accessory radial recurrent branch; Farabeuf = Farabeuf retractor; PION = posterior interosseous nerve; SBRN = superficial sensory branch of the radial nerve. (Prepared by the authors.)

Dissection of the aforementioned anatomical structures allows access to the anterior surface of the radial tuberosity, whose apex, as a reference point, is oriented opposite to the radial styloid process.[4] The residual distal biceps tendon is detached from the tuberosity using a rongeur or curette. The tuberosity bed is then prepared on its posteromedial surface using a curette or rasp, which corresponds to the native insertion footprint.

With the forearm in 45° of supination, two holes are drilled using a 2-mm drill bit, approximately 1 cm apart. The drill is directed from the anterior aspect of the radial tuberosity at a 30° medial angle toward the dorsoulnar cortex of the radius (Figure 6A). The use of a soft-tissue protector facilitates the procedure. The 45° supination position and the ulnar direction of the drill holes facilitate suture passage and maximize the distance between the drill bit and the posterior interosseous nerve.[6,7,10]

A strong monofilament suture (Prolene, PDS, or 0 nylon) is then passed through the radius to serve as a shuttle suture, as follows: a standard right-angle clamp is introduced from the medial side to the posterior aspect of the radius, aligned with one of the drill holes (Figure 6B). An 18G spinal needle is inserted through the drill hole from anterior to posterior until the surgeon feels contact with the tip of the clamp. The clamp is slightly opened, the needle is advanced a few millimeters, and the clamp is then gently closed to grasp the needle. The stylet is removed, and the monofilament suture is passed through the needle lumen. The assistant advances the suture as far as possible; the clamp is then gently opened, and the needle is withdrawn a few millimeters while maintaining tension on the suture to prevent it from backing out. The clamp is then closed to grasp the suture, which is retrieved through the interval between the radius and ulna. The same procedure is repeated for the second drill hole, resulting in a monofilament shuttle suture in each hole, passing from the anterior cortex of the radius and exiting posteriorly into the radioulnar space (Figure 6C).

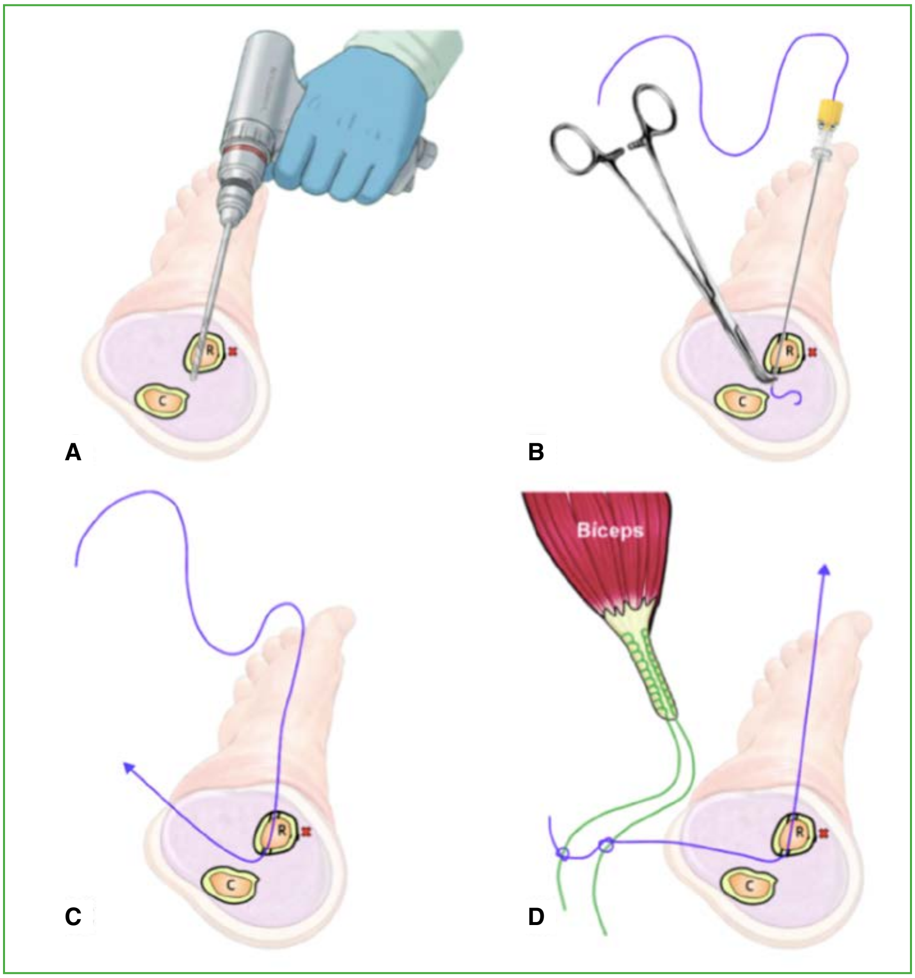

Figure 6. A. Drilling of the radial tuberosity with a 2-mm drill bit from anterior to posterior, angled 30° toward the ulna. The forearm is positioned in 45° supination. **B.** A strong monofilament suture (blue) is passed through a spinal needle and retrieved with a right-angle clamp from posterior into the radioulnar space. **C and D.** Monofilament shuttle suture in place, ready to pass the braided sutures (green) from the avulsed distal biceps tendon from posterior to anterior.
Red X = position of the posterior interosseous nerve; C = Ulna; R = radius. (Prepared by the authors.)

The avulsed distal biceps tendon is identified by digital proximal dissection, with the elbow flexed to bring the incision closer to the retracted tendon stump. Typically, a smooth anterior surface and a posterior surface can be distinguished, the latter often showing a lateral bundle (long head) and a medial bundle (short head). The tendon is secured using two Krackow locking sutures placed in a running fashion along each border, using high-strength flat braided nonabsorbable suture (No. 1.5 or 2), with the sutures overlapping so that the four free ends exit posteriorly 2–3 mm from the distal end of the tendon. This configuration provides a compressive effect, seating the tendon against its bony insertion site (Figure 7B). For a more anatomic repair, the external rotation of the tendon at its insertion must be considered: the long head inserts more proximally (superiorly) on the radial tuberosity, whereas the short head inserts more distally (inferiorly). Accordingly, the medial Krackow suture should be passed through the distal drill hole, and the lateral suture through the proximal drill hole, ensuring restoration of the tendon's native external rotation.[3,4] Intermediate sutures are passed one through each hole.

To pass the high-strength sutures through the radial drill holes, one end of each braided suture is tied to the posteromedial end of the monofilament shuttle suture previously passed through the radius (Figure 6D). Then, traction is applied to the monofilament from the anterior aspect, allowing the high-strength sutures to be shuttled from posterior to anterior. This process is repeated for the second hole. With the forearm in full supination and approximately 70° of flexion, an assistant applies traction to one pair of sutures, reducing the tendon onto the posteroulnar aspect of the radial tuberosity (Figure 7A). This reduction suture is maintained under tension while the surgeon ties the second high-strength suture over the anterior cortical bone bridge between the drill holes. The remaining suture is then tied over the same cortical bridge, completing the repair. After thorough irrigation and meticulous hemostasis, the wound is closed in layers, with skin closure only.

The mean operative time from skin incision to sling placement was 105.5 minutes (range 75-175; SD 32.12).

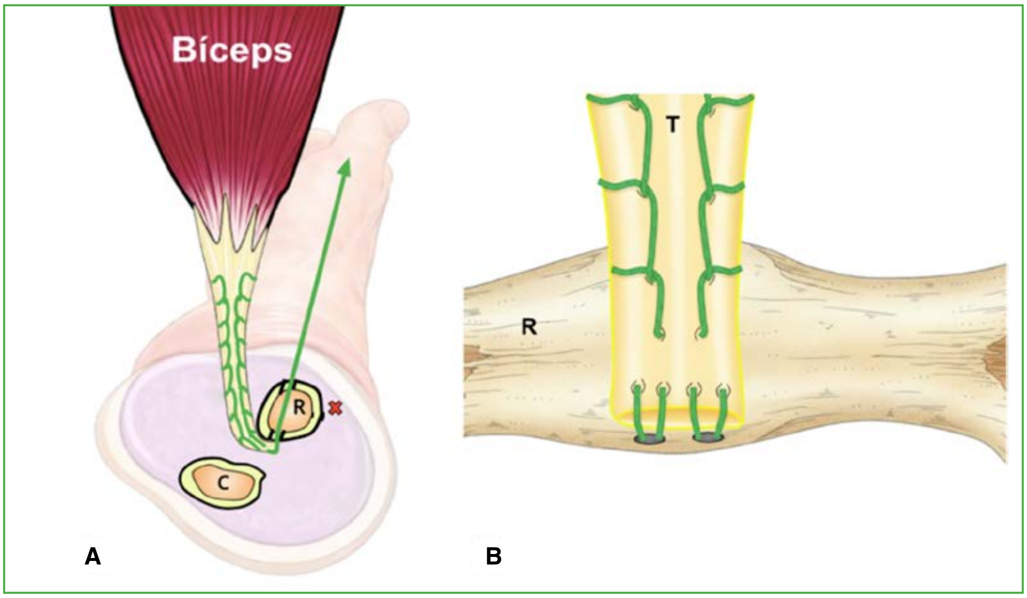

Figure 7. A. Traction on the anterior ends of the braided sutures reduces the distal biceps tendon, allowing the sutures to be tied over the anterior cortical bone bridge between the drill holes.
B. Posteromedial view of the bicipital tuberosity with the repaired tendon, demonstrating the compressive effect generated by posterior suture exit toward the bone. For proper anatomical orientation, the suture from the medial portion should be passed through the distal hole and the suture from the lateral portion through the proximal hole, restoring the native external rotation of the tendon.
C = Ulna; R = radius. (Prepared by the authors.)

Postoperative Protocol

A sling is applied with a short arm cast, with the elbow at 90° of flexion and the forearm in neutral rotation, for 10 days to reduce pain and edema. Passive range of motion is then initiated as tolerated, with limits of 30° of elbow extension and 30° of forearm rotation, while maintaining continuous sling use (removed only for exercises) until 4 weeks postoperatively. After this period, the sling is used only when going out and during sleep for an additional 2 weeks. At 6 weeks, the sling is discontinued and active range of motion is allowed, without resistance. Gradual and progressive strengthening is initiated at 12 weeks, and unrestricted use of the arm, according to tolerance, is permitted after 6 months.[12]

We reviewed the medical records of patients with at least 12 months of follow-up. Patients were evaluated using the QuickDASH score,[13] the visual analog scale (VAS) for pain,[14] and were asked whether they had returned to their pre-injury level of activity. The contralateral limb served as a control for assessing range of motion and subjective weakness. Patients were also asked whether their decision to undergo surgery was driven by functional or aesthetic concerns.

RESULTS

Eleven patients with postoperative follow-up >12 months were included. Eight reported undergoing surgery for both functional and aesthetic reasons, and three for functional reasons only. Eight of the repairs were performed on the dominant side. The mean follow-up was 35.5 months (range 12-53).

No differences were observed in pronation-supination or flexion-extension arcs compared with the contralateral side. Mean values were 138° of flexion, 3° of extension, 76° of pronation, and 75° of supination.

The mean QuickDASH score was 6.38 (range 2.7-13.6). The mean VAS score during exertion was 0.22/10 (range 0-2). Eight patients reported no postoperative symptoms. All patients returned to their usual work and sports activities, and were allowed to resume exertional activities 6 months after surgery.

The complications observed were as follows: two patients developed lateral antebrachial cutaneous nerve neuropraxia with transient symptoms that resolved after 4 months; and one patient developed a wound infection requiring surgical debridement and antibiotic therapy. This patient, who was also involved in a labor dispute, had the worst outcomes on the QuickDASH (13.6) and VAS (2/10 with exertion), and reported persistent subjective weakness.

In one patient with symptoms unrelated to the biceps tendon, postoperative magnetic resonance imaging of the elbow was performed. The images confirmed reinsertion of the tendon onto the posterior ulnar aspect of the radial tuberosity (Figure 8).

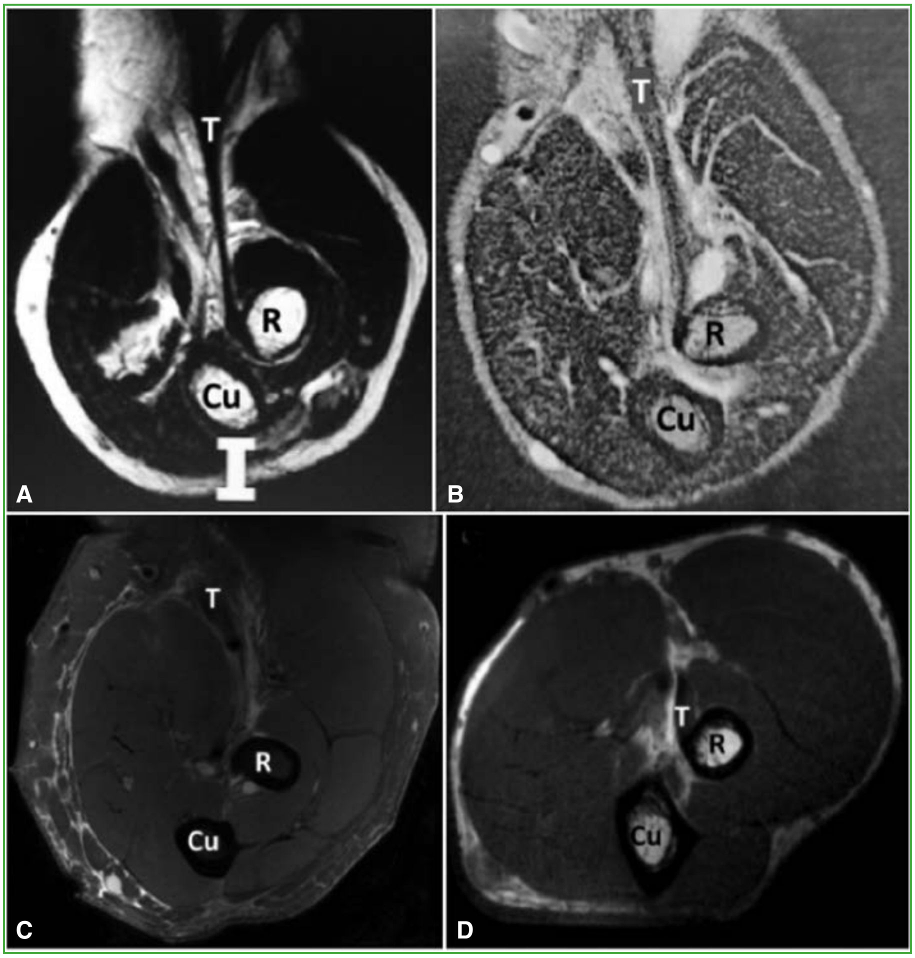

Figure 8. Magnetic resonance imaging of the proximal forearm, axial section at the level of the bicipital tuberosity, at different degrees of supination. **A**. 0° supination: normal insertion of the distal biceps tendon. **B**. 30° supination: partial tear of the distal biceps tendon. **C**. Maximum supination: complete avulsion of the distal biceps tendon. **D**. Reinsertion of the distal biceps tendon into the radial tuberosity using transosseous sutures in neutral pronosupination. Cu = Ulna; R = radius; T = distal biceps tendon.

DISCUSSION

The key to successful distal biceps tendon repair lies in a thorough understanding of regional anatomy. On the one hand, surgical exposure in the deep aspect of the elbow requires careful anticipation of the neurovascular structures encountered, allowing the surgeon to perform a safe and effective repair of the distal biceps tendon. On the other hand, accurate restoration of the native insertion footprint of the distal biceps tendon enables patients to achieve functional outcomes as close to normal as possible.

A crucial concept for understanding the supination function of the biceps is the generation of supination torque as a function of tendon position throughout forearm rotation. The native insertion of the distal biceps tendon wraps around the apex of the radial tuberosity, which plays a key biomechanical role by acting as a cam, displacing the line of pull away from the center of rotation of the radius and thereby enhancing supination strength.[3,7] Reinsertion of the distal biceps tendon is classically performed using either a single anterior approach or a two-incision technique.[5] Traditional anterior repairs (using suture anchors, interference screws, or cortical buttons), which fix the tendon to the anterior surface of the tuberosity, restore less than 10% of the native biceps footprint.[4] Schmidt et al. demonstrated that, in some cases, tendons repaired on the anterior surface of the radius may function as pronators near terminal supination.[3] Posterior repairs using the Boyd and Anderson two-incision technique may limit pronation and do not reproduce the additional cam effect of the radial tuberosity, as, during effective contraction, the tendon translates proximally and exerts its pull above the tuberosity.[4]

Maximal supination strength following both single-incision anterior and two-incision repairs may reach more than 90% of the contralateral side when assessed in mid-pronation; however, evaluation of supination strength throughout the full arc of forearm rotation is not commonly reported. In a study of anterior distal biceps repairs, a 33% deficit in supination strength was observed compared with the contralateral side when measured at 60° of supination.[3,6,7] In the technique used in our study, the biceps tendon is reattached to the posterior ulnar aspect of the radial tuberosity (Figure 6), thereby maximizing supination strength throughout all positions of forearm rotation.

From a clinical standpoint, both short- and long-term follow-up show no differences in mean outcome scores between the anterior approach and the two-incision technique. However, significantly more (minor) complications were observed in the single-incision group, primarily due to transient neuropraxias of the lateral antebrachial cutaneous nerve. Conversely, a higher incidence of significant loss of forearm rotation due to heterotopic ossification was observed with the two-incision approach.[5]

Aesthetics may play an important role, as many of our patients (8 of 11) acknowledged that it influenced their decision to undergo surgery. However, aesthetic outcomes are notably not included in commonly used instruments for evaluating elbow function.

Biomechanical studies evaluating various repair techniques have demonstrated the ability to withstand loads of 200-400 N, including those using transosseous tunnels similar to those employed in our technique.[3,6,7] This has encouraged us to initiate early active mobilization.

A simple cost analysis comparing the use of sutures alone with commercially available devices for distal biceps reinsertion reveals substantial cost savings with this technique. Furthermore, the implants used in distal biceps repair are not free from complications, such as osteolysis, migration, or failure of fixation systems (Figure 9).

Complications have been reported with all repair techniques, the most common being sensory nerve disturbances. In our series of 11 patients, two cases of transient neuropraxia of the lateral antebrachial cutaneous nerve were observed. Although the rate of re-tear remains unclear, such events have been reported; however, no cases were observed in our series at the time of study closure.

This study has several limitations, including the small sample size, retrospective design, absence of a control group, and reliance on subjective outcome measures. Another limitation is the lack of objective assessment of supination strength. In this regard, there is currently no consensus regarding the optimal method for evaluating forearm supination strength following distal biceps repair. Isotonic, isometric, and isokinetic methods have been described, and even within these categories, different testing parameters have been used.[3] Current outcome scoring systems also appear to have limitations and have not provided data that clearly differentiate between repair techniques.

Figure 9. Anteroposterior and lateral elbow radiographs of a patient treated with a cortical button and interference screw for distal biceps repair. Note the marked osteolysis of the proximal radius, which may result in an area of bone weakness.

CONCLUSIONS

We describe a distal biceps repair technique that restores native insertion through an anterior approach. By reproducing the anatomical footprint, this technique may maximize supination strength without compromising range of motion. Additionally, by eliminating the need for anchors or specialized implants, the procedure is cost-effective and may preserve the structural integrity of the radius. However, further studies are required to evaluate the long-term outcomes of this technique and to compare it with other established surgical approaches.

Conflicts of interest: The authors declare no conflicts of interest.

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REFERENCES

1. Tjoumakaris FP, Bradley JP. Distal biceps injuries. *Clin Sports Med* 2020;39(3):661-72. https://doi.org/10.1016/j.csm.2020.02.004
2. Almigdad A, Saleem S, Malhas A. Distal biceps brachii rupture. *Clin Orthop Surg* 2025;17(2):267-73. https://doi.org/10.4055/cios24185
3. Schmidt CC, Weir DM, Wong AS, Howard M, Miller MC. The effect of biceps reattachment site. *J Shoulder Elbow Surg* 2010;19(8):1157-65. https://doi.org/10.1016/j.jse.2010.05.027
4. van den Bekerom MP, Kodde IF, Aster A, Bleys RL, Eygendaal D. Clinical relevance of distal biceps insertional and footprint anatomy. *Knee Surg Sports Traumatol Arthrosc* 2016;24(7):2300-7. https://doi.org/10.1007/s00167-014-3322-9

5. Castioni D, Mercurio M, Fanelli D, Cosentino O, Gasparini G, Galasso O. Single- versus double-incision technique for the treatment of distal biceps tendon rupture. *Bone Joint J* 2020;102-B(12):1608-17. https://doi.org/10.1302/0301-620X.102B12.BJJ-2020-0822.R2
6. Tanner C, Johnson T, Muradov P, Husak L. Single incision power optimizing cost-effective (SPOC) distal biceps repair. *J Shoulder Elbow Surg* 2013;22(3):305-11. https://doi.org/10.1016/j.jse.2012.10.044
7. Li J, Seiler LM, Hoekzema NA, Johnson TR, Lee J, Ridenauer JL, Tanner CM. Distal biceps reconstruction: a long-term follow-up of the complications and durability of the single-incision power optimizing cost-effective (SPOC) repair. *JSES Int* 2023;7(6):2547-52. https://doi.org/10.1016/j.jseint.2023.07.016
8. Tang JB. Re: Levels of experience of surgeons in clinical studies. *J Hand Surg Eur Vol* 2009;34(01):137-8. https://doi.org/10.1177/17531934097321
9. Zeltser DW, Strauch RJ. Vascular anatomy relevant to distal biceps tendon repair. *J Shoulder Elbow Surg* 2016;25(2):283-8. https://doi.org/10.1016/j.jse.2015.08.042
10. Arrigoni P, Cucchi D, Menon A, Guerra E, Nicoletti S, Colozza A, et al. The posterior interosseous nerve crosses the radial head midline and increases its distance from bony structures with supination of the forearm. *J Shoulder Elbow Surg* 2019;28(2):365-70. https://doi.org/10.1016/j.jse.2018.08.019
11. Ding DY, Ryan WE, Strauss EJ, Jazrawi LM. Chronic distal biceps repair with an Achilles allograft. *Arthrosc Tech* 2016;5(3):e525-9. https://doi.org/10.1016/j.eats.2016.02.016
12. Horschig A, Sayers SP, Lafontaine T, Scheussler S. Rehabilitation of a surgically repaired rupture of the distal biceps tendon in an active middle aged male: a case report. *Int J Sports Phys Ther* 2012;7(6):663-71. PMID: 23316429
13. Bersusky E, Arzac Ulla I, Loterzo L, Ricciardi GA, Zanotti G, Patiño J. Puntajes II. *Rev Asoc Argent Ortop Traumatol* 2022;87(3):447-53. https://doi.org/10.15417/issn.1852-7434.2022.87.3.1583
14. Vicente Herrero MT, Delgado Bueno S, Bandrés Moyá M, Ramírez Iñiguez de la Torre V, Capdevila García L. Valoración del dolor. Revisión comparativa de escalas y cuestionarios. *Rev Soc Esp Dolor* 2018;25(4):228-36. https://doi.org/10.20986/resed.2018.3632/2017