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Triceps fascial tongue exposure for intra-articular distal humerus fracture: revisiting the Van Gorder approach

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Distal humerus fractures account for up to 7% of all fractures and 30% of elbow fractures. Sixty-one percent of these fractures involve the articular surface. The injuries present in a bimodal distribution: an early peak in young males associated with high-energy trauma and a late peak in elderly women with osteoporotic bone.[12,13,15] Articular fragment reduction, re-establishment of the joint axis, and early motion are key tenets to restore function. Many different surgical approaches have been well described, including olecranon osteotomy, triceps-reflecting anconeus flap, Bryan Morrey (Mayo), paratricipital, triceps splitting, and triceps-flexor carpi ulnaris.[3,11,20] To date, there appears to be no clear clinical advantage of one approach over the other.[6,16] The olecranon osteotomy has been considered the gold standard in complex distal humerus fractures as it is considered the most extensile and provides the most visualization of the articular surface.[18] However, complications including malunion, nonunion, symptomatic implant, and implant loosening can arise from performing the osteotomy.[1,7,16,19] Additionally, this approach increases expense and also increases the difficulty to convert to a total elbow arthroplasty (TEA), which can be as high as 25%.[8] As TEA becomes an increasingly used treatment option for distal humerus fractures, a universal surgical approach that allows adequate visualization of the articular surface while allowing for easy conversion to TEA becomes increasingly advantageous.[9,14]

Van Gorder originally described the triceps fascial tongue approach in 1940 for T-type distal humerus fractures.[17] However, other than the original description, there is a paucity of literature on the technique and it has been excluded in many review articles or comparison studies over the last 2 decades.[3,6,12,20] The triceps fascial tongue approach was reintroduced recently in 2015 as an approach for primary TEA.[9] In this technique article, we describe and illustrate this approach to the distal humerus in the setting of a complex intra-articular fracture with application of modern implants.

Case and surgical technique

Patient is a 38-year-old woman transferred to our level 1 trauma center with right comminuted intra-articular distal humerus fracture (Arbeitsgemeinschaft für Osteosynthesefragen / Orthopaedic Trauma Association [AO/OTA] type 13.C2) (Fig. 1). She underwent open reduction and internal fixation with the triceps fascial tongue approach. A detailed description of the approach is provided below.[9]

Surgery is performed under general anesthesia. The patient is placed in the lateral position on the bean bag with axillary support. The operated arm was supported over a radiolucent arm roll affixed to the side of the bed. The C-arm is brought in from the head, and preliminary radiographs are obtained to verify adequate imaging. The entire upper extremity is prepped to the shoulder. A sterile tourniquet is applied.

A standard posterior lateral para-midline incision is made avoiding the tip of the olecranon. Full-thickness skin flaps are elevated. The ulnar nerve is identified, mobilized, and protected throughout the case.

The triceps flap is distally based and measures approximately 10 cm in length and 2-3 cm wide (Fig. 2). Proximally, the flap can be rectangular or come to a point to allow for V-Y advancement. It is essential that a stout portion of the tendon remains intact on all sides of the tongue for tendon-to-tendon repair during closure. A robust cable within the triceps can be identified and divided medially and laterally as it is elevated.

No Institutional Review Board approval was required for this case report.

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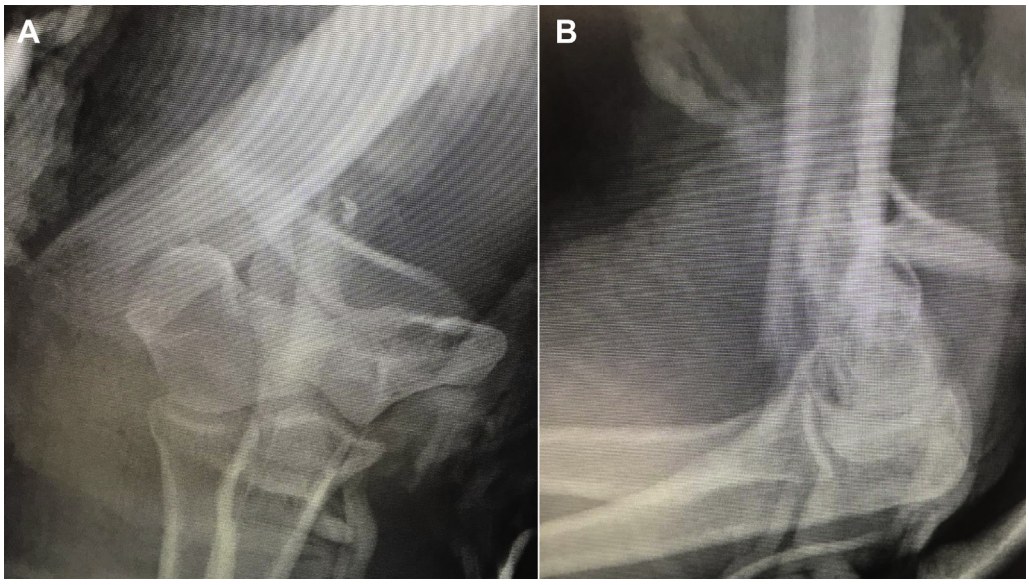

Figure 1 (**A**) Anteroposterior and (**B**) lateral views of a comminuted intra-articular distal humerus fracture (AO/OTA 13.C2).

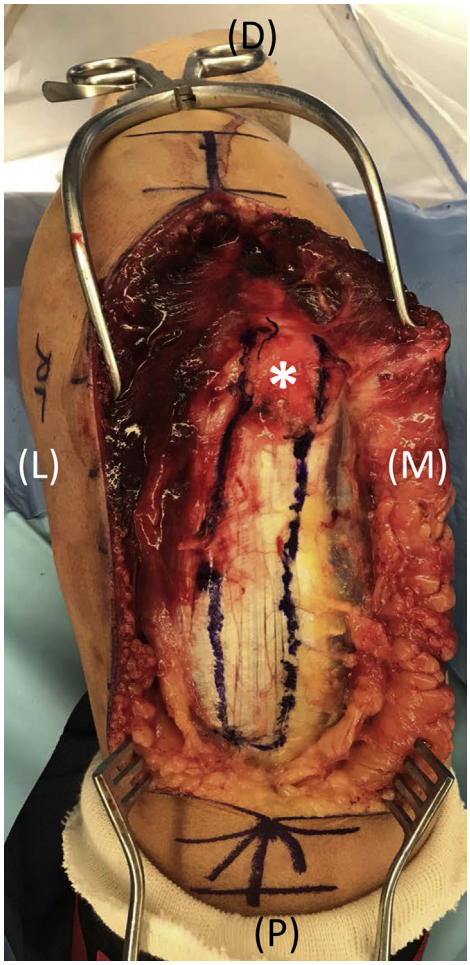

Figure 2 Intraoperative photograph of the planned triceps fascial tongue. This is a distally based flap 10 cm in length and 2 cm in width where the triceps attachment to the olecranon (*) is preserved. *L*, lateral; *M*, medial; *D*, distal; *P*, proximal.

The flap is then elevated off the underlying muscle (leaving some muscle on the tendon to avoid buttonholing) with an elevator or scalpel but remains attached to the olecranon distally (Fig. 3). A holding stitch is placed to keep the flap reflected distally. A moist gauze can be used to keep the tendon from desiccating throughout the case. The underlying triceps muscle is split longitudinally in the midline with electrocautery and retracted to both sides revealing the distal humeral shaft as in the standard triceps splitting approach (Fig. 4). The radial nerve is identified and carefully mobilized if a more proximal exposure is required.

Distally, the posterior capsule is elevated and the olecranon fossa is débrided. The posterior band of the medial collateral ligament is released. Continued elevation of the triceps muscle and intermuscular septum will adequately expose the lateral and medial columns for plate application. A medial or lateral window along the distal triceps fascia can be developed to expose the epicondyles (Fig. 5). For increased exposure, as in the case of TEA, the tongue is continued distally, reflecting the flexor and extensor muscles off the ulna, but leaving some fascia on the ulna for closure. Then the insertions of the medial and lateral collateral ligaments can be released off the ulna as in the triceps-splitting approach. The olecranon tip can be excised, and the olecranon pulled away from the trochlea to expose the articular surface.[9,18] Extensile exposure was not performed in this case and the collateral ligaments were preserved.

Standard reduction and fixation techniques along with orthogonal or parallel plating constructs can be used at the surgeon's discretion (Figs. 5 and 6).

Repair of the triceps is the most important aspect of the closure to ensure functional recovery. Heavy nonabsorbable sutures (no. 2 braided polyester) can be placed at the 4 corners of the triceps tongue in figure-of-8 fashion, capturing the intratendinous cable, while the elbow is kept flexed at 60°. The remainder of the triceps is closed proximally with interrupted no. 0 absorbable sutures (polyglactin), and distally with a running no. 2-0 absorbable suture. The ulnar nerve can be left in situ or transposed. The subcutaneous tissue is closed using no. 3-0 absorbable sutures and the skin is closed with staples. A sterile dressing is then applied, and a posterior mold splint with the elbow in 60°-70° of flexion is placed.

The patient is kept immobilized in the posterior mold splint for 7-14 days. Patients are encouraged to start digital motion

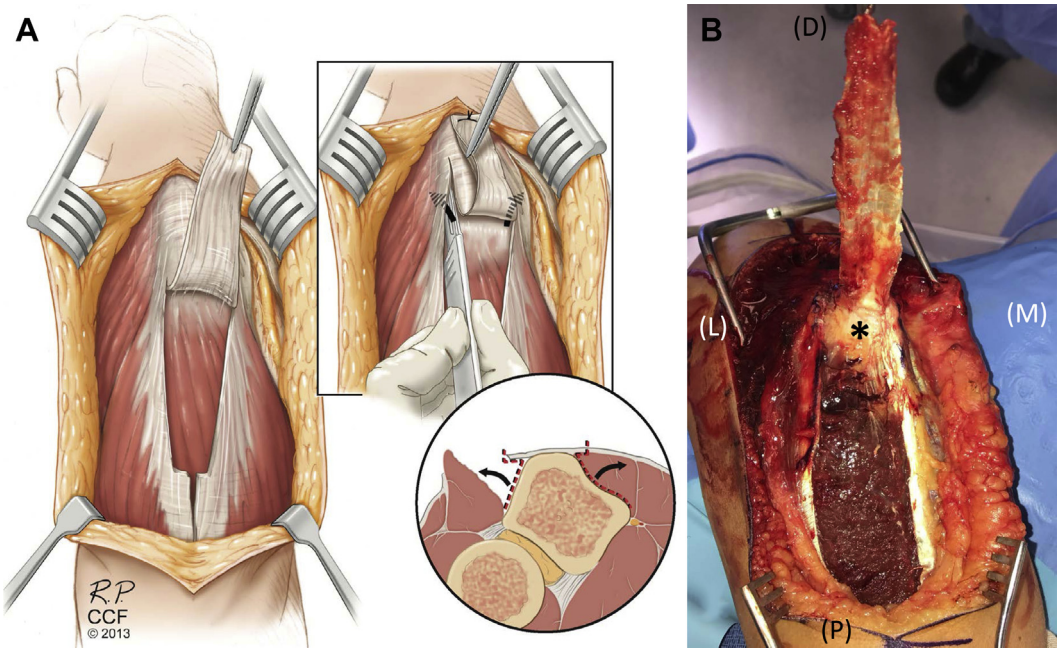

Figure 3 (**A**) Illustration of triceps tongue elevation. (**B**) Intraoperative photographs of elevation of triceps fascial tongue. *L*, lateral; *M*, medial; *D*, distal; *P*, proximal; *, olecranon. Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2013. All rights reserved.

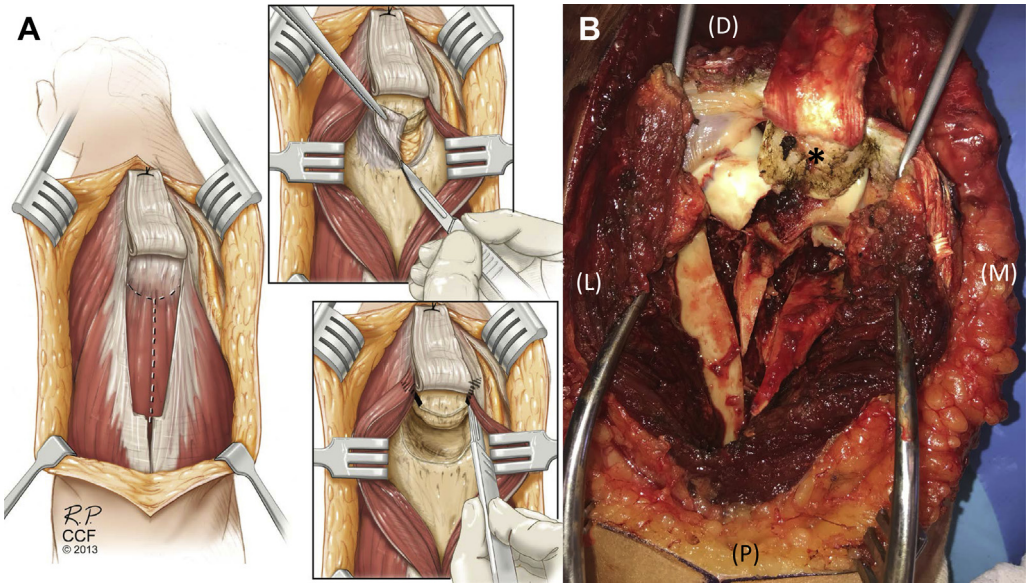

Figure 4 (**A**) Illustration of triceps muscle split and elevation followed by release of the medial and lateral collateral ligaments off the ulna. (**B**) Intraoperative photograph of split and elevation of the triceps muscle with excellent visualization of the metadiaphyseal comminution as well as the articular surface. *L*, lateral; *M*, medial; *D*, distal; *P*, proximal; *, olecranon. Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2013. All rights reserved.

immediately. At the first postoperative visit, the splint and staples are removed. The patient is sent to occupational therapy where a thermoplastic posterior elbow splint is made. The therapist then starts edema control, digital motion, and elbow active gravity-assisted flexion with gravity-assisted extension avoiding arm abduction with the arm at the side to avoid any varus or valgus stress. Supination and pronation are done with the elbow flexed at 90°. Weight-bearing activity begins at 6 weeks. Static progressive splinting can be considered after bone union, if required.

At the 6-week follow-up, our case example showed signs of early stiffness with a range of motion of 45°-90° and was started on static progressive splinting while also advancing to protected weight bearing. At 3 months, her fracture showed continued consolidation, and she began full weight-bearing activities with improved range of motion of 30°-100°. At 6 months, she had improved flexion but worsening extension of 45°-120°. Plain radiographs and CT imaging showed no heterotopic ossification or bony block to motion. The patient also complained of medial epicondylar tenderness consistent with symptomatic hardware. She underwent removal of both plates and open capsular release 7 months after the index surgery followed by therapy and nighttime extension splinting. Twelve months after her index procedure, she achieved near full range of motion of 5°-130°, 5/5 elbow flexion and extension strength, and Disabilities of the Arm Shoulder and Hand (QuickDASH) score of 0 (Fig. 7).

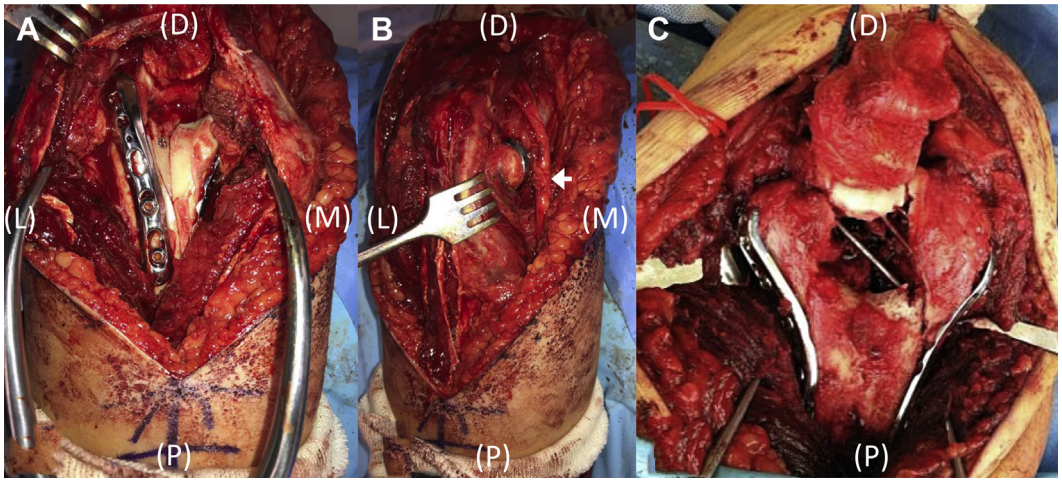

Figure 5 (**A**) Intraoperative photographs after orthogonal plating with posterolateral plate applied through the triceps split. (**B**) Medial plate placement with the aid of a medial paratricipital window. (C) Intraoperative photographs of a different patient showing a parallel plate construct with extensile exposure without the use of paratricipital windows. *L*, lateral; *M*, medial; *D*, distal; *P*, proximal; *white arrow*, ulnar nerve.

Figure 6 Intraoperative fluoroscopic images of (**A**) anteroposterior and (**B**) lateral distal humerus showing anatomic reconstruction of the joint and restoration of length, alignment, and rotation of the metadiaphyseal region.

Discussion

The triceps fascial tongue approach to the distal humerus originally described by Van Gorder may be a useful approach for distal humerus fractures providing added benefits in the modern era. It is not technically challenging and provides excellent visualization of the articular surface and metadiaphyseal region for fracture fixation. By avoiding an olecranon osteotomy, the ulna is not violated, fewer implants are used, and operation time is reduced. Moreover, another major advantage of this approach is that it is easy to convert from attempted osteosynthesis to TEA. In our experience, the major limitation for this exposure is complete access to the anterior capitellum and trochlea articular surfaces. Therefore, patients with highly comminuted capitellar or trochlear fractures in which the surgeon is not considering a total elbow may be better candidates for an olecranon osteotomy.

Elmadag et al[2] compared olecranon osteotomy to the triceps fascial tongue approach and showed that the tongue group had 10° more flexion contracture and lower Mayo elbow scores. However, there were 2 confounding factors in their study. First, the tongue group had more complex fractures—60% type C2 or C3 compared with 40% in the osteotomy group. Second, the tongue group underwent 3 weeks of immobilization whereas the osteotomy group underwent only 2 weeks of immobilization prior to initiating therapy. At our institutions, 2 weeks or less is adequate postoperative immobilization—consistent with our treatment protocols for other tendon conditions—and we have not experienced any triceps failures or hardware failures with early protected motion. Our TEA patients consistently begin motion at 7-14 days postoperatively. Though our patient did experience postoperative elbow stiffness, the authors believe this is a result of the severity of the fracture but acknowledge further research is required to validate this assumption.

Historically, a common complication reported with the triceps fascial tongue approach is triceps weakness.[4,5,10] However, more recent data presented by Na et al[11] showed all 21 patients in their study had grade V or IV triceps strength post elbow arthroplasty with the triceps fascial tongue approach. When compared to preoperative examination, triceps strength was significantly improved.

Conclusion

The triceps fascial tongue approach is both extensile and versatile. It provides excellent visualization of the metadiaphysis and articular surface to aid in anatomic reduction while allowing for easy conversion to arthroplasty in unreconstructable fractures. It is easy to teach and master, allows for timely exposure of the distal humerus, and requires no additional implants. The current literature raises questions regarding triceps insufficiency and postoperative elbow stiffness. Additional clinical studies are needed to formally address these concerns. We believe the triceps fascial tongue is a useful approach for surgeons treating distal humerus fractures to have in their armamentarium. It is our exposure of choice for complex distal humerus fractures.

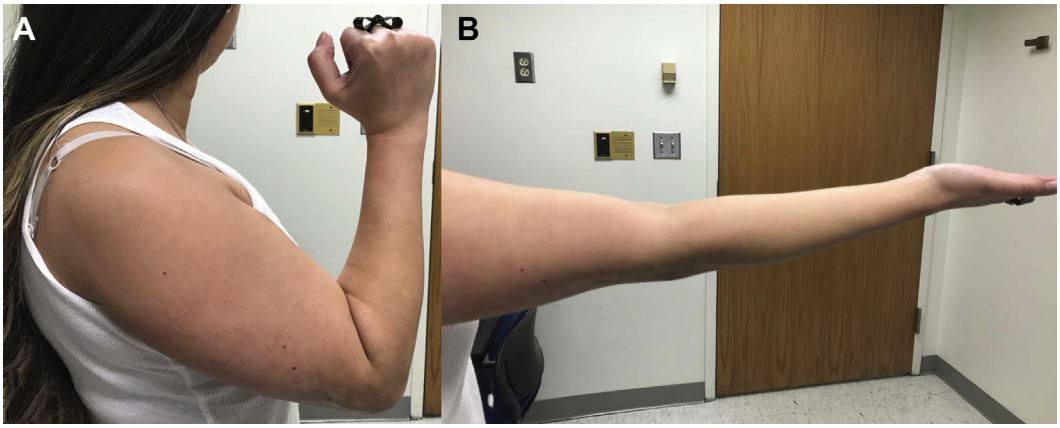

Figure 7 Twelve months post index surgery showing (**A**) 130° of flexion and (**B**) near full extension. Patient had maintained triceps integrity and strength with no disability at final follow-up.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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