The triceps–flexor carpi ulnaris (TRIFCU) approach to the elbow

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ABSTRACT

INTRODUCTION Intra-articular fractures of the distal humerus frequently require internal fixation. Several approaches have been described, with the posterior approaches being most common. We present a new approach to the distal humerus via the lateral border of the triceps muscle.

PATIENTS AND METHODS The senior author has used this technique for fixation of intra-articular fractures of the distal humerus in 12 patients.

RESULTS The approach is equally useful for intra- and extra-articular fractures. No cases of postoperative ulna nerve neuropraxia have been encountered. There have been no postoperative wound complications. The exposure has allowed sufficient access to allow anatomically contoured plates to be easily applied to both sides of the distal humerus with confirmation of intra-articular fracture reduction.

CONCLUSIONS The approach has the advantages of leaving the muscular bed of the ulna nerve undisturbed, whilst still providing excellent exposure of the distal humerus. The triceps mechanism is not divided or split allowing rapid recovery of extensor function. Additionally, because of the natural carrying angle of the elbow, repositioning of the reflected triceps aponeurosis is easy.

KEYWORDS

Intra-articular fractures – Humerus – Triceps – Flexor carpi ulnaris

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Intra-articular fractures of the distal humerus frequently require internal fixation. Several approaches have been described, with the posterior approaches being most common. These include the olecranon osteotomy approach, tongue of triceps approach, posteromedial approach, posteriolateral approach and tricep splitting approaches.^{1–4} We present a new approach to the distal humerus via the lateral border of the triceps muscle.

Patients and Methods

Operative technique

The anaesthetized patient is positioned in a lateral position with the upper arm resting on a support and the elbow flexed. A tourniquet is placed as proximally as possible on the arm. With the arm hanging over the support, we prefer that the hand is rested on a Mayo table to keep the elbow flexed to approximately 20°. A standard midline posterior incision is made over the elbow from approximately 15 cm above the olecranon to 10 cm below the olecranon. The incision is curved laterally around the olecranon to avoid

the scar lying directly over the olecranon. The skin and subcutaneous tissues are reflected laterally and medially exposing the triceps and olecranon (Fig. 1). Next, the ulna nerve is identified proximally and followed distally around the medial epicondyle. Care is taken not to mobilise or directly handle the nerve to minimise the risk of neuropraxia. We do not routinely use a tape around the ulna nerve to identify or retract it. The lateral border of the triceps muscle is identified and a plane is developed between this muscle and the lateral intermuscular septum. The lateral border of the insertion of triceps on the tip of the olecranon is identified. The anconeus muscle lies lateral to this plane. The triceps is reflected medially and, as this progresses distally, fascia covering the anconeus muscle is encountered. This fascia is incised half-way over the anconeus muscle. The distal insertion of anconeus muscle is detached and reflected medially away from its insertion, exposing the lateral border of the ulna (Fig. 2). As the triceps is being medially reflected, the origins of the flexor carpi ulnaris (FCU) and flexor digitorum superficialis (FDS) are encountered. These are subperiosteally reflected medially with the triceps tendon

Figure 1 Superficial exposure after skin incision showing extensor mechanism inserting onto olecranon and deep fascia of the forearm. The dotted line shows the site of incision of the deep fascia of the forearm.

Figure 2 Intermediate exposure showing medial reflection of the triceps mechanism. Olecranon exposure is achieved by detaching the distal insertion of anconeus and partial subperiosteal reflection of FCU and FDS origins.

as one continuous musculocutaneous entity. The ulna nerve lies undisturbed on the outside of this flap. A small osteotome can be used to remove a wafer-thin osteoperiosteal section of the triceps insertion on the olecranon to facilitate this medial reflection of triceps. Periosteum over the subcutaneous border of the ulna will have to be incised to aid reflection of the musculocutaneous flap, which contains the triceps mechanism and the ulna origin of FCU and FDS muscles (Fig. 3). Care is taken to avoid injuring the medial collateral ligament of the elbow. The ulna nerve remains untouched and protected, lying on the other side of the musculocutaneous flap. The distal third of the humerus is now exposed and a clear view of the elbow joint is observed allowing internal fixation of the distal humerus fracture. Closure is achieved by interrupted sutures re-attaching the triceps insertion to the deep fascia. This is a thick, well-developed layer allowing a large suture to be used confidently. The wound is then washed out before the midline incision is closed in the normal fashion.

Clinical experience

The senior author has used this exposure for fixation of intra-articular fractures of the distal humerus in 12 patients. The approach is equally useful for intra- and extra-articular fractures. No cases of postoperative ulna nerve neuropraxia have been encountered. There have been no postoperative wound complications. The exposure has allowed sufficient access to allow anatomically contoured plates to be easily applied to both sides of the distal humerus with confirmation of intra-articular fracture reduction.

Discussion

Previously described approaches to the distal humerus and elbow joint include the olecranon osteotomy, the Kocher approach, the tongue of triceps approach, lateral reflection of the triceps and triceps splitting approaches.⁶ The olecranon osteotomy provides excellent exposure of the distal humerus, allowing direct visualisation of the articular surface. However, osteotomy non-union rates have been reported in the region of 2%.⁶ The tongue of triceps

Figure 3 Deep exposure after medial reflection of the 'musculocutaneous flap'. The ulna nerve lies undisturbed on its muscular bed, medial to all reflected structures.

approach has been described by Campbell.⁵ This was originally indicated for patients with chronic elbow contracture, such as following chronic elbow dislocation. This lengthens the triceps, increasing elbow flexion, although at the expense of triceps power. This has led to some authors recommending this approach should only be used for the original indication of the chronic elbow contracture.² The Kocher approach utilises the interval between the anconeus muscle and extensor carpi ulnaris. Bryan and Morrey² described the posteromedial approach whereby most of the triceps mechanism was mobilised laterally after the ulna nerve was identified and dissected. They described the advantage of mobilising the entire triceps mechanism without disturbing it. However, they encountered a 13% (10 of 80 patients) incidence of ulna nerve neuropraxia following surgery which was felt to be due to traction or pressure on the ulna nerve. Other authors have modified this approach where the triceps is split leaving 25% medially with the ulna nerve and mobilising the remaining 75% laterally.⁷ This approach appears to reduce the risk of ulna nerve injury with one temporary ulna nerve neuropraxia in a series of 106 patients. This approach still has the disadvantages of dividing and disrupting the extensor mechanism. Bryan and Morrey² also described a modified extensile Kocher approach involving mobilising the triceps mechanism medially. This approach involves mobilising the anconeus insertion medially with the triceps mechanism. In our experience, this provides excellent exposure of the lateral elbow structures but limited exposure of the medial structures. By mobilising the anconeus insertion laterally and the FCU/FDS origins medially, we find the approach stays more mid-line making access to the both sides of the distal humerus easier. This is of particular value in the management of complex intra-articular fractures.

The approach described in this paper has the advantages of leaving the muscular bed of the ulna nerve undisturbed, whilst still providing excellent exposure of the distal humerus. The triceps mechanism is not divided or split

allowing rapid recovery of extensor function. Additionally, because of the natural carrying angle of the elbow, repositioning of the reflected triceps aponeurosis is easy. We also feel that postoperatively, as the triceps function returns, it will aid the repositioning of the flap further – active triceps extension will detension the repair, rather than pulling it away from the tip of the olecranon as might occur with classical osteoanconeus approach.^{2,5} The plane between the triceps and anconeus muscle is not an internervous plane and will potentially interfere with the nerve supply to the anconeus muscle. However, in our experience, this has not had any clinically implications, particularly as the principal elbow extensor is not disturbed. In 1940, Boyd¹ described the posterolateral approach to the proximal ulna and radius for fractures of these bones. This did not describe mobilising the triceps medially, nor describe the approach to the distal humerus as has been suggested by some authors.^{1,6,7} To the best of our knowledge, this is the first description of the posterolateral approach to the distal humerus using this approach. We feel it will be of use to surgeons treating fractures of the distal humerus.

References

1. Boyd HB. Surgical exposure of the ulnar and proximal one third of the radius through one incision. *Surg Gynecol* 1940; **71**: 86–8.
2. Bryan RS, Morrey BF. Extensive posterior exposure of the elbow; a triceps sparing approach. *Clin Orthop* 1982; **116**: 188–92.
3. Campbell WC. Incision for exposure of the elbow joint. *Am J Surg* 1932; **15**: 65–7.
4. Crenshaw AH. Surgical approaches. In: Crenshaw AH. (ed) *Campbell's operative orthopaedics*. St Louis, MO: Mosby, 1987; 88–94.
5. Jupiter JB, Neff U, Holzach P, Allgower M. Intercondylar fractures of the humerus. An operative approach. *J Bone Joint Surg Am* 1985; **67**: 226–39.
6. Mehta JA, Bain GI. Surgical approaches to the elbow. *Hand Clin* 2004; **20**: 375–87.
7. Shahane SA, Stanley D. A posterior approach to the elbow joint. *J Bone Joint Surg Br* 1999; **81**: 1020–2.