

# Surgical Approaches to the Distal Radioulnar Joint

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## ■ ABSTRACT

The distal radioulnar joint (DRUJ) is classified as a uniaxial synovial pivot joint between the convex head of the ulna and the concave ulnar notch of the radius.

The DRUJ can be approached from 3 sides with a refined dorsal approach retaining a robust retinacular-dorsal capsular layer preferred by most surgeons. Recent descriptions of safe and extensile volar approaches have broadened indications for a volar approach to the DRUJ. A subcutaneous ulnar approach remains an option particularly when dealing with additional distal ulnar pathology.

A description of technique and review of the surgical experience in exposure and treatment of DRUJ pathology will be presented, with advantages, disadvantages, and authors' preferred techniques.

**Keywords:** distal radioulnar joint, surgical approach, exposure, volar ulnar, wrist, distal radius

## ■ HISTORICAL PERSPECTIVES

With the advent of new techniques for the distal ulna and distal radioulnar joint (DRUJ), there has been an increased interest in surgical approaches to this region.

Most of the DRUJ operative procedures have been performed using a dorsal approach.<sup>1</sup> Subtle, but important, variations in the dorsal approach have been reported. In Bowers description, 2 soft tissue flaps are fashioned from the supratendinous layer of the extensor

retinaculum and used as an interposition flap stabilizing the DRUJ.<sup>2</sup> In a simplified technique, a composite interposition flap comprising extensor retinaculum and dorsal capsule is used for reconstruction. This technique was first described by Stanley and Herbert<sup>3</sup> for reconstruction of the DRUJ with a Swanson ulnar head spacer and subsequently reported by Bain et al<sup>2</sup> for matched hemiresection interposition arthroplasty of the DRUJ and van Schoonhoven and Herbert<sup>4</sup> for use in conjunction with an ulnar head prosthesis.

Exposure of the volar aspect of the distal forearm is most commonly required for the management of distal radius fractures. Most authors have approached the distal radius on the radial side of the flexor tendons.<sup>5–8</sup> Recently, some authors have reported approaching the distal radius on the ulnar side of the flexor tendons,<sup>9,10</sup> allowing improved access to the DRUJ and distal ulna.

As an alternative to the more commonly used dorsal and volar approaches to access the DRUJ, an ulnar subcutaneous approach has been used, particularly for exposure of the ulnar styloid process and for fixation of distal ulna fractures.<sup>11,12</sup>

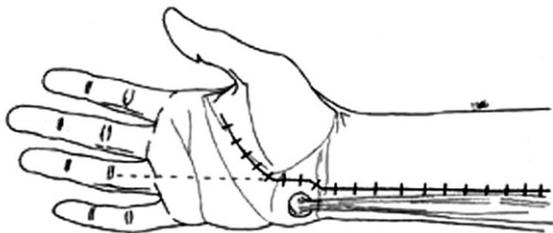
## ■ INDICATIONS FOR A VOLAR APPROACH

Many approaches to the distal radius, DRUJ, and carpus have been reported; however, most cannot be used as a universal approach to all pathologies in this region.<sup>5,8,9,13</sup> We find that the volar-ulnar approach serves as a universal extensile approach to this complex region and is our preferred volar exposure technique. It decompresses the ulnar and median nerves at the level

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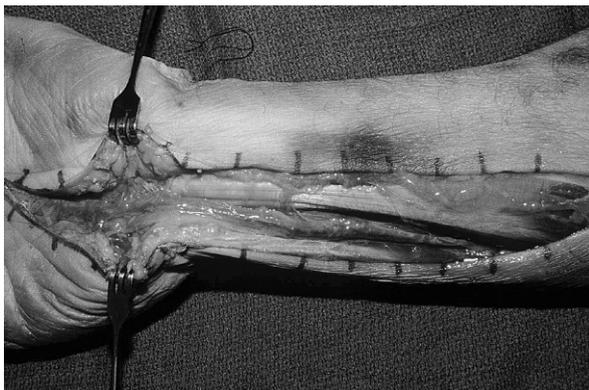
A



B

**FIGURE 1.** A and B, Skin incision for volar-ulnar approach to the distal radius and carpus. In the forearm, the incision is just radial to the FCU tendon and crosses the wrist skin creases obliquely. It passes across the transverse carpal ligament along the line of the ring finger and enters the palm just ulnar to the thenar crease. Reprinted with permission from *Can J Plast Surg.* 1999;7(6):273–277.

of the wrist and provides excellent exposure of the flexor tendons, distal radius, DRUJ, and carpus. It can also be used for excision of hook of hamate, nonunion, carpal tunnel release, fasciotomy, and sigmoid notch osteotomy.<sup>14–16</sup>



**FIGURE 2.** Superficial exposure; proximally between FCU and long flexor tendons, distally exposing the ulnar nerve by releasing Guyon canal and incising the palmar aponeurosis.



**FIGURE 3.** The ulnar neurovascular bundle is identified proximally beneath the flexor carpi ulnaris tendon and followed distally into Guyon canal. Multiple small vessels on the radial side of the ulnar neurovascular bundle are divided to allow it to be retracted to expose the ulnar attachment of the transverse carpal ligament. Reprinted with permission from *Can J Plast Surg.* 1999;7(6):273–277.

Nana et al<sup>16</sup> advocated this technique for patients who required exposure of the distal radius and an open carpal tunnel release because it minimized the risk of injury to the palmar cutaneous branch of the median nerve.

It has been shown to be a safe approach that avoids injury to important structures, including the palmar cutaneous and the recurrent motor branches of the median nerve and palmar cutaneous branch of the ulnar nerve.

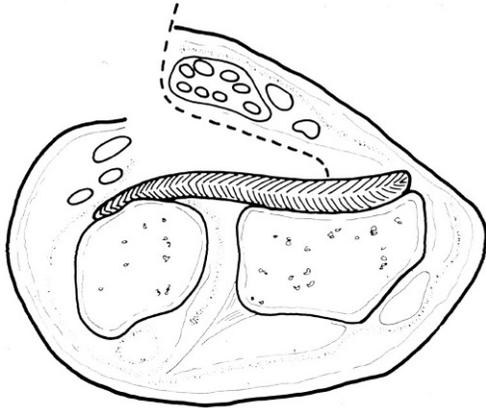
## ■ VOLAR-ULNAR APPROACH

### Setup and Incision

The patient is positioned supine with the arm on a hand table and hand fully supinated. The approach<sup>14</sup> is made



**FIGURE 4.** With the transverse carpal ligament divided, flexion at the wrist and retraction of the flexor tendons with Hohmann retractors expose the pronator quadratus and wrist capsule. Reprinted with permission from *Can J Plast Surg.* 1999;7(6):273–277.

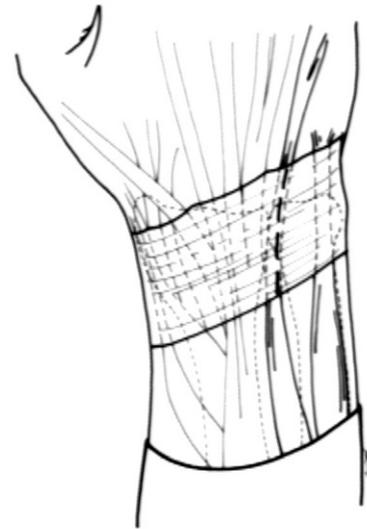


**FIGURE 5.** Cross-sectional diagram of the distal forearms showing the interval for the volar-ulnar approach to the distal radius and carpus. Reprinted with permission from *Can J Plast Surg.* 1999;7(6):273–277.

with the aid of loupe magnification and a tourniquet on the upper arm. The incision is made immediately radial to the flexor carpi ulnaris (FCU) tendon and the pisiform and crosses the flexion crease of the wrist at 45 degrees. It crosses the transverse carpal ligament in the line of the ring finger and then curves gently to the radial side, just distal to the thenar crease (Figs. 1A, B).

#### Release of Guyon Canal and Carpal Tunnel

Blunt dissection is used to divide the subcutaneous tissue so any cutaneous nerves can be identified (Fig. 2). The antebrachial fascia is divided on the radial side of the FCU tendon and the ulnar neurovascular bundle identified just radial and deep to this tendon. The ulnar neurovascular bundle is released from the forearm to the palm by dividing the antebrachial fascia, the volar



**FIGURE 7.** Operative technique. An incision is made through the fifth extensor compartment. *Hand Surg [Am]*, 20, Bain GI, Pugh DMW, MacDermid JC, Roth JH. Matched hemiresection interposition arthroplasty of the distal radioulnar joint. pp 944–950, (1995), with permission from The American Society for Surgery of the Hand.

carpal ligament, which forms the roof of the Guyon canal, and the palmar aponeurosis, which overlies the superficial palmar arch (Fig. 3). Multiple small vessels on the radial side of the ulnar neurovascular bundle are divided with bipolar cautery to allow it to be retracted in an ulnar direction to expose the ulnar attachment of the transverse carpal ligament, which is then divided (Fig. 4). The hook of the hamate is easily palpated and is a good landmark to the ulnar border of the flexor retinaculum.

#### Deep Exposure

The surgeon's finger is used to separate the finger flexor tendons from the ulnar neurovascular bundle and FCU. Flexion of the wrist allows the flexor tendons and median nerve to be delivered from the carpal tunnel. The synovial membranes surrounding the flexor tendons are not disturbed unless individual tendons require exposure (Fig. 5). One or 2 Hohmann retractors (Hohmann Medical Equipment, Bensheim, Germany) are placed on the radial side of the radius to retract the flexor tendons and expose the pronator quadratus. The pronator quadratus is divided with cautery over the radius and then reflected subperiosteally to provide exposure of the distal radius (Fig. 6).

The carpus can be exposed by dividing the volar carpal ligaments. The volar DRUJ can be exposed by performing a volar DRUJ capsulotomy.

The exposure can be extended proximally between the finger flexor tendons and the FCU. Distally, the



**FIGURE 6.** The pronator quadratus muscle has been reflected from the radius. It is usually divided with cutting cautery over the radius and reflected subperiosteally. Reprinted with permission from *Can J Plast Surg.* 1999;7(6):273–277.

exposure is limited by the superficial palmar arch at the distal aspect of the outstretched thumb.<sup>17</sup>

### ■ COMPLICATIONS OF VOLAR-ULNAR APPROACH

In an independent review of the procedure performed for a variety of pathologies on a series of 51 patients, there were no significant complications reported.<sup>14</sup> A very low average postoperative pain score and a very high satisfaction level were reported with most of the patients, returning to their previous occupation and achieving an almost full return of preoperative range of motion. Complications to the ulna and median nerve are unlikely because they are directly visualized. Injury to the palmar cutaneous branches of the median and ulnar nerves should not occur because the surgical interval is at the internervous plane between these branches.

### ■ INDICATIONS FOR A DORSAL APPROACH

In the authors' experience, the best approach to the dorsal DRUJ is through the floor of the fifth extensor compartment containing the tendon of extensor digiti minimi (EDM). This technique provides good exposure of the joint and is extensible to the shaft of the ulna. Through this approach, a joint synovectomy or intra-articular distal ulnar fracture fixation can be performed. It can also be used for reconstruction of the DRUJ<sup>3</sup> and

for salvage options, including matched hemiresection interposition arthroplasty<sup>2</sup> or ulnar head replacement arthroplasty.<sup>4</sup>

### ■ DORSAL APPROACH

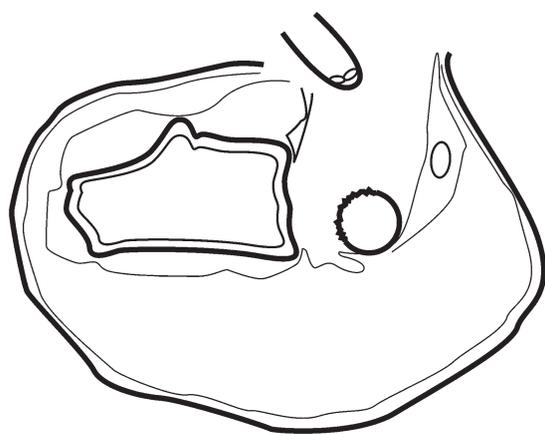
#### Setup and Incision

The patient is positioned supine with the arm on a hand table and hand fully pronated. The approach is made with the aid of loupe magnification and a tourniquet on the upper arm. The longitudinal skin incision is made in line with the fifth extensor compartment (Fig. 7).

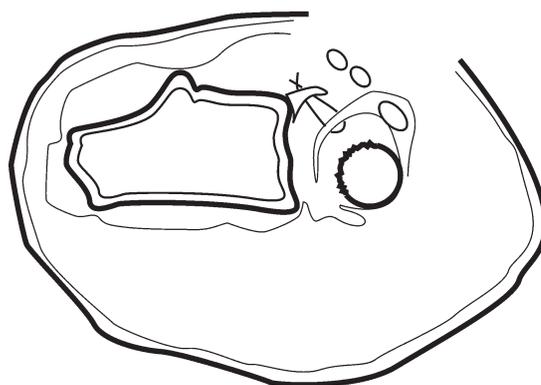
#### Deep Exposure

The extensor retinaculum is divided over the most radial aspect of the EDM tendon in the fifth extensor compartment. The tendon is retracted to expose the floor of the compartment, and the incision is extended through the floor into the DRUJ. An ulnar-based flap of extensor retinaculum and capsule is elevated from the ulnar head. The capsule can be released off the dorsal triangular fibrocartilage complex to provide a larger flap if required. When incising the capsule at this level, a 1-mm cuff of capsule should be left attached to the sigmoid notch for later repair.

The thick capsuloretinacular flap is left intact, and no effort is made to separate the 2 layers. The remaining flap is robust and an ideal tissue for strong repair, reconstruction, or interposition. These layers are naturally adherent, particularly ulnarly, and attempting to separate them is likely to buttonhole the dorsal DRUJ capsule.<sup>2</sup> The extensor carpi ulnaris (ECU) tendon remains within the retinacular flap (Fig. 8).



**FIGURE 8.** The fifth extensor compartment is divided, the EDM is retracted, and the dorsal capsule and the infratendinous portion of the extensor retinaculum are divided 1 mm from their radial insertion. A matched resection of the distal ulna is then performed. *J Hand Surg [Am]*, Vol 20(6), Bain GI, Pugh DMW, MacDermid JC, Roth JH. Matched hemiresection interposition arthroplasty of the distal radioulnar joint. pp 944–950 (1995).



**FIGURE 9.** The ulnar-based retinacular flap is mobilized and then sutured to the 1-mm flap. This transfers the ECU to the dorsal aspect of the distal ulna. *J Hand Surg [Am]*, Vol 20(6), Bain GI, Pugh DMW, MacDermid JC, Roth JH. Matched hemiresection interposition arthroplasty of the distal radioulnar joint. pp 944–950 (1995).

### **Matched Hemiresection Interposition Arthroplasty**

Having obtained this exposure, a matched hemiresection interposition arthroplasty is easy to perform.<sup>2</sup> An oblique osteotomy of the distal ulna is performed, and the distal ulna is shaped to match the contour of the distal radius throughout the arc of rotation. Care is taken to ensure that a ridge of the ulna is not likely to catch throughout forearm rotation.

The ulnar-based retinacular flap is undermined from the adjacent ulna and tendons, allowing it to be mobilized and used as an interposition graft. This also transfers the ECU tendon to a more dorsal position, allowing it to act as a dynamic stabilizer. The ulnar-based retinacular flap is sutured to the 1-mm cuff (Fig. 9). The interposed tissue can also be sutured to palmar tissues. The retinaculum is repaired distally to prevent bowstringing of the EDM tendon.

### **■ COMPLICATIONS OF THE DORSAL APPROACH**

The safety of this approach was reported in a retrospective review of 55 wrists, with the majority reporting pain improvement and satisfaction with the procedure.<sup>2</sup> One complication relating to the exposure was reported being neuroma formation of the dorsal sensory branch of the ulnar nerve. Ulnar-carpal impaction can also occur from the stump of the distal ulna.

With careful surgical technique, this complication can be avoided. The dorsal sensory branch of the ulnar nerve has origin immediately before the parent nerve emerging from behind the tendon of FCU just proximal to the wrist. The ulnar nerve passes anterior to the flexor retinaculum, whereas the dorsal sensory branch passes dorsally between the tendon of FCU and the ulna, supplying the dorsal ulnar aspect of the hand and fingers.<sup>17</sup>

Careful blunt dissection and identification and protection of the nerve after initial skin incision over the most radial extent of the fifth extensor compartment can help prevent damage and subsequent troublesome neuroma formation.

### **■ INDICATIONS FOR AN ULNAR SUBCUTANEOUS APPROACH**

This approach is used for exposure of the ulnar styloid process and for repair of distal ulna fractures<sup>11,12</sup> in conjunction with exposure of the DRUJ.

### **■ TECHNIQUE FOR AN ULNAR SUBCUTANEOUS APPROACH**

The patient is positioned supine with the elbow resting on a hand table and the forearm gently flexed over the

torso of the patient, with an assistant holding the hand in pronation so that the ulnar subcutaneous border is facing the surgeon. The approach is made with the aid of loupe magnification and a tourniquet on the upper arm.

The skin incision is parallel to crest with the shaft exposed between the ECU and FCU muscles. The shaft and distal ulna are exposed in the subperiosteal in the plane. Great care must be taken to protect the dorsal sensory branch of the ulnar nerve, which courses dorsally at the level of the ulnar styloid.<sup>17</sup>

### **■ SUMMARY**

The DRUJ can be approached from 3 sides with a refined dorsal approach, retaining a robust retinacular-dorsal capsular layer preferred by most surgeons. Recent descriptions of safe and extensile volar approaches have broadened indications for a volar approach to the DRUJ. A subcutaneous ulnar approach remains an option particularly when dealing with additional distal ulnar pathology.

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