Results of extensor carpi ulnaris tenodesis in the rheumatoid wrist undergoing a distal ulnar excision

Distal ulna resections that are done in patients with rheumatoid arthritis to alleviate pain, correct alignment, and prevent tendon rupture may contribute to distal ulnar instability. A distally based slip of the extensor carpi ulnaris tendon has been used to both stabilize the distal ulnar remnant and to prevent recurrent deformity in 26 rheumatoid wrists, with an average follow-up of 3.5 years. In all postoperative cases, the distal ulna was no longer prominent and the wrist was well aligned. The distal ulna was stabilized in 96% of the patients. Subjectively, pain was relieved in 85% and grip strength improved in 77%. (J HAND SURG 1990;15A:547-51.)

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In rheumatoid arthritis, any synovial-lined joint is at risk for the development of destructive arthritis. The distal radial-ulnar joint is frequently involved. The synovitis may be seen initially as a swelling and tenderness in the region of the distal radial-ulnar joint. With progressive involvement, there is a weakening of the surrounding ligamentous structures, destruction of the articular cartilage, and erosive changes in the underlying subchondral bone. This combination of articular damage, bony destruction, and ligamentous laxity was described by Bäckdahl as the caput ulnae syndrome. The caput ulnae syndrome is defined as wrist pain, hand weakness, and a prominent distal ulna. The superficiality of the rheumatoid hand on the pronated forearm and the volarly subluxated carpus contributes to the displaced appearance of the distal ulna. With time, the combination of active distal radial-ulnar joint synovitis and erosive changes in the distal ulna may contribute to extensor tendon ruptures.

One of the most popular surgical treatments for the caput ulnae syndrome has been a distal ulnar resection, the so-called Darrach procedure. The procedure that Darrach published in 1912 had been described earlier by a number of authors. Leibolt credited Severinus (1644), Rognetta (1834), and Dupuytren (1839) with the resection of the distal end of the ulna. Moore described dislocation of the distal radial-ulnar joint treated with resection of the distal end of the ulna. Taleisnik attributed the first description of distal ulna resection to Desault. In 1940 Smith-Peterson and associates presented the advantages of a distal ulna excision in rheumatoid arthritis. Dingman reviewed 24 patients who had a resection of the distal portion of the ulna for treatment of trauma. Seventeen of the 24 patients had good to excellent results; the bad results were related to an excessive amount of distal ulna excision.

The distal radial-ulnar joint is stabilized by the triangular fibrocartilage complex (TFCC), the radial-ulnar ligaments, and the extensor carpi ulnaris (ECU). A Darrach procedure removes these restraints. After a Darrach procedure, the stability of the distal ulna depends on the perioseal sleeve, the remaining interosseous membrane, and the pronator quadratus. The majority of patients with rheumatoid arthritis who have symptoms of distal radial-ulnar joint involvement do well with a distal ulnar resection. In some patients, however, instability of the distal ulna may develop after a distal ulnar resection. A number of authors have commented on the postoperative occurrence of dorsal subluxation associated with snapping, discomfort, or weakness of grip. Some have noted that after an
Fig. 1. A, The distal ulna is exposed by subperiosteal dissection. An osteotomy is made proximal to the sigmoid notch. The ECU tendon can be seen ulnar and palmar to the distal ulna. B, A distally based slip of the ECU tendon is created by dividing the tendon longitudinally and transecting one slip proximally. C, A drill hole is made in the dorsal cortex of the distal ulna. The distally based slip of ECU tendon is passed through the drill hole and out the intramedullary canal. D, The distally based slip of ECU tendon is sutured to itself under maximal tension while supporting the hand in the corrected posture.

Osteotomy of the distal ulna may erode through the overlying soft tissues causing an extensor tendon rupture (personal communication, Edward A. Nalebuff, MD, 1989). To prevent the development of such complications, a number of different soft tissue stabilization procedures have been described. Fascia lata has been used to create a static radio-ulnar sling. Both the flexor carpi ulnaris and the extensor carpi ulnaris have been used as dynamic slings to stabilize the distal ulna. Use of a distally based slip of the flexor carpi ulnaris tendon or a proximally based slip of the extensor carpi ulnaris tendon has also been described. Bunnell secured a free tendon graft about the ulnar head to the adjacent flexor carpi ulnaris tendon. Blatt and Ashworth secured the distal ulna to the volar capsule. Rowland had good results with a distally based slip of extensor carpi ulnaris tendon after a Swanson wrist arthroplasty and a distal ulna excision. Linscheid and Dobyns, Ruby, and Kelikian described a distally based slip of the extensor carpi ulnaris tendon as a method for both stabilizing the resected distal ulna and maintaining the wrist in a corrected posture.

This article is a retrospective review of the use of a distally based slip of the extensor carpi ulnaris to stabilize the distal ulna in 26 rheumatoid wrists. The operation on all 26 rheumatoid wrists was done by one
Materials and methods

Twenty-six rheumatoid wrists had a distally based extensor carpi ulnaris tenodesis in conjunction with a distal ulna excision. The operation was done as the sole procedure or in conjunction with either a wrist fusion or a silicone wrist arthroplasty. The patients were followed for an average of 3.5 years (range, 1 to 6 years). Eighteen wrists had a distal ulna excision and a distally based extensor carpi ulnaris tenodesis as an isolated procedure. Five wrists had a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a total wrist fusion. Three wrists had a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a silicone wrist arthroplasty.

The 26 wrists were examined both before operation and after operation by subjective and objective criteria. The patients were evaluated according to pain, wrist range of motion, wrist alignment, and distal radial-ulnar joint stability. Pain was described as either moderate, severe, or subsistent pain requiring nonnarcotic medication, or minimal, if the patients had intermittent pain not requiring medication. Although difficult to quantify, stability was determined by the radioulnar shift test described by Bäckdahl. Grip strength was difficult to measure objectively because of the associated deformities that impeded meaningful use of the dynamometer. There were no tendon ruptures noted either before operation or after operation.

Operative technique

The distal radial-ulnar joint is exposed with a straight, dorsal oblique incision. The incision extends from the proximal ulnar aspect of the distal forearm to the distal radial aspect of the wrist. The extensor retinaculum is opened through the fourth compartment and, if necessary, a dorsal tenosynovectomy is done. The distal ulna is exposed by subperiosteal dissection. An osteotomy is made just proximal to the sigmoid notch. The extensor carpi ulnaris tendon is identified and the tendon split longitudinally in equal halves from its origin at the musculotendinous junction to its insertion at the base of the fifth metacarpal (Fig. 1). Occasionally, some of the muscular insertion needs to be stripped proximally to provide adequate tendon length. One of the halves is then used as a distally based tendinous slip. The distally based tendon slip is passed through a previously made drill hole in the dorsal distal cortex of the distal ulna and out through the intramedullary canal. The tendon does not go through the volar cortex of the distal ulna. The free end of the distally based slip is woven about itself and then sutured under maximal tension while the hand is pronated, the carpus translated radially, and the wrist ulnarily deviated. The remaining intact portion of the extensor carpi ulnaris tendon is then placed dorsal to the ulnar stump by creating a radially based flap of extensor retinaculum after the method of Swanson. The approach can also be made through the interval between the extensor carpi ulnaris and the extensor digiti quinti if it is unnecessary to explore the extensor compartments.

Results

The preoperative pain in the 26 wrists was graded as moderate. After operation 22 wrists were graded as free of pain and four were graded as having mild pain. In the 18 wrists treated with only a distal ulna excision and a distally based extensor carpi ulnaris tenodesis; 15 were free of pain and 3 had mild postoperative pain. In the five patients treated with a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a total wrist fusion, four were pain free, and one had mild postoperative pain. In the three wrists tenodesis combined with a silicone wrist arthroplasty all three were pain free. After surgery, 22 (85%) of 26 wrists were pain free and 4 (15%) of 26 wrists had only mild pain.

All wrists had a symptomatic preoperative distal radial-ulnar click. The patients noticed this click on pronation and supination. We suspect that the click represented dorsal subluxation of the ulna head out of the sigmoid notch. We assume that the click was eliminated by the distal ulna resection. In the 18 wrists treated with only a distal ulna excision and a distally based extensor carpi ulnaris tenodesis, there were no postoperative clicks. Of the five wrists treated with a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a total wrist fusion, four had no postoperative clicks. The one wrist treated with a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a total wrist fusion that had a persistent click was also the same wrist with mild postoperative pain. There were no symptomatic distal radial-ulnar joint clicks in those wrists that had a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a silicone wrist arthroplasty.

Because of the diffuse hand involvement, it was im-
Table I. Average postoperative range of motion

<table>
<thead>
<tr>
<th>Patients (No.)</th>
<th>Preoperative motion</th>
<th>Postoperative motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal ulna excision and distally based ECU tenodesis</td>
<td>Flexion = 45</td>
<td>Flexion = 42</td>
</tr>
<tr>
<td></td>
<td>Extension = 38</td>
<td>Extension = 40</td>
</tr>
<tr>
<td></td>
<td>Pronation = 75</td>
<td>Pronation = 85</td>
</tr>
<tr>
<td></td>
<td>Supination = 75</td>
<td>Supination = 65</td>
</tr>
<tr>
<td>Distal ulna excision and distally based ECU tenodesis and wrist fusion</td>
<td>Flexion = 20</td>
<td>Fused in neutral</td>
</tr>
<tr>
<td></td>
<td>Extension = 15</td>
<td>Fused in neutral</td>
</tr>
<tr>
<td></td>
<td>Pronation = 65</td>
<td>Pronation = 60</td>
</tr>
<tr>
<td></td>
<td>Supination = 65</td>
<td>Supination = 60</td>
</tr>
<tr>
<td>Distal ulna excision and distally based ECU tenodesis and wrist arthroplasty</td>
<td>Flexion = 35</td>
<td>Flexion = 30</td>
</tr>
<tr>
<td></td>
<td>Extension = 15</td>
<td>Extension = 25</td>
</tr>
<tr>
<td></td>
<td>Pronation = 70</td>
<td>Pronation = 75</td>
</tr>
<tr>
<td></td>
<td>Supination = 45</td>
<td>Supination = 65</td>
</tr>
</tbody>
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possible to precisely measure grip strength. We relied on the patients’ subjective grip strength. In the 18 wrists treated with only a distal ulna excision and a distally based extensor carpi ulnaris tenodesis, 14 had an improved grip strength. Of the five wrists treated with a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a total wrist fusion, four had an improved grip strength. The one patient who claimed to have no improvement in grip strength after a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a total wrist fusion was also the same patient who had mild postoperative pain and a persistent click. Two of the three wrists that had a distal ulna excision and a distally based extensor carpi ulnaris tenodesis combined with a silicone wrist arthroplasty had an improved grip strength. After surgery, 20 (77%) of 26 wrists had a subjective improvement in grip strength.

Wrist range of motion was measured both before operation and after operation. The change was not dramatic. The average preoperative and postoperative range of motion is presented in Table I.

After operation the distal ulna was no longer prominent dorsally. In all patients, the wrist was well aligned, with the third metacarpal in line with the radius. There were no postoperative extensor tendon ruptures.

Discussion

Distal ulna resections are done in patients with rheumatoid arthritis to alleviate pain, correct alignment, and prevent tendon rupture. A number of operations have been described. The general success of the various procedures can be attributed to the low demand of patients with rheumatoid arthritis. We have had good success combining a distal ulna excision with an extensor carpi ulnaris tenodesis.

A number of mechanisms have been proposed to explain the radial deviation that is commonly seen in the rheumatoid wrist. Common to all is the tendon imbalance created about the wrist. Radial deviation of the wrist increases the moment arm of the tendons ulnar to the capitate. An extensor carpi ulnaris tenodesis corrects this imbalance. The anatomic position of the extensor carpi ulnaris makes it a logical choice to stabilize the distal ulna and maintain the carpus in its corrected, pronated position on the forearm. The extensor carpi ulnaris inserts on the dorsal-ulnar aspect of the fifth metacarpal. A distally based slip of the extensor carpi ulnaris passed through a dorsal hole in the distal ulna and sutured under maximal tension effectively corrects both the tendency towards radial deviation commonly seen in rheumatoid wrists and provides a rotational force that assists in the correction of the supination deformity. The distal slip of the extensor carpi ulnaris does not completely stabilize the distal ulna in a dorsal-palmar direction nor does it stabilize the distal ulna when the wrist is in extension and ulnar deviation. There is some motion when the distal ulna is subjected to the radio-ulnar shift test described by Bäckdahl. The tenodesis, however, does maintain the wrist in the corrected posture and minimizes recurrent deformity. Passing the distally based slip through a dorsal drill hole also interposes additional tissue between the distal end of the ulna and the overlying extensor tendons. This may possibly contribute to the decreased chance of postoperative extensor tendon rupture(s). In all 26 patients, an extensor carpi ulnaris tenodesis resulted in excellent
wrist alignment. After the tenodesis, the distal ulna was no longer prominent, the third metacarpal was in line with the radius, and there were no extensor tendon ruptures.

Objective measurements in patients with rheumatoid arthritis are always difficult. The progression of the disease is inconstant, and the joint involvement is variable. If an operation is performed on the wrist, but the fingers will not open to allow the use of a dynamometer, grip strength can not be measured. Similarly, if the fingers will open, but the disease is active, a diminished grip strength would reflect the active disease and not a successful operation. For these reasons, subjective impressions should be included in the evaluation of a rheumatoid operation. Subjectively, pain was relieved in 85% of the patients and grip strength was improved in 77%. All but one (96%) patient had relief of their preoperative distal radial-ulnar click.

The combination of a distal ulnar resection and an extensor carpi ulnaris tenodesis successfully corrected both the distal ulnar deformity and the wrist alignment. In the majority of patients it also relieved pain and improved subjective grip strength.

REFERENCES