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# Management of the Distal Radioulnar Joint in Rheumatoid Arthritis

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## History

The distal radioulnar joint (DRUJ) is frequently involved in rheumatoid arthritis (RA), but the amount of derangement is quite variable [1]. Occasionally, the DRUJ is the first joint affected by RA, with pain, swelling, and possibly joint subluxation occurring before other joints in the wrist and hand are affected. Conversely, a patient can present later with extensor tendon ruptures of the small and ring fingers, referred to as the Vaughan–Jackson lesion, with minimal history of pain and swelling of the DRUJ [2]. In most patients with radiocarpal arthritis symptoms, the DRUJ will also typically show arthritis by both physical and radiographic examinations; however, the only complaint may be a bump on the back of the wrist that represents dorsal prominence of the distal ulna.

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## Pathophysiology and Physical Examination Findings

The ulnar head is covered mostly by articular surface. The DRUJ capsule, and its synovial lining, is large and redundant to permit large amount of

motion. The large articular surface is inflamed causing swelling, tenderness, and ultimately joint destruction. A synovial reflection is present near the fovea of the ulnar head, which is the bony depression at the base of the ulnar styloid and the primary ulnar insertion site of the triangular fibrocartilage complex (TFCC) and the ulnocarpal ligaments (UCL). Chronic inflammation of this synovium results in damage to these important stabilizing ligaments [1, 2].

Physical examination demonstrates prominence of the distal ulna that is caused by joint swelling from synovitis occurring early in the disease but later results from a combination of synovitis and dorsal subluxation of the distal ulna, which is referred to as the caput ulnae syndrome. Distal ulna prominence is often accentuated by concurrent disease and deformity at the ulnocarpal joint in which the carpus supinates and volarly subluxates, resulting in substantially increased distance between the ulnar head and carpus.

Despite advanced DRUJ arthritis and deformity, forearm rotation is typically maintained because of excessive laxity in the joint caused by the disease. DRUJ crepitus is common but is often not associated with pain, even in severe disease. Crepitus is commonly associated with osteophytes that can contribute to mechanical damage of the overlying extensor tendons, resulting in tendon ruptures, especially of the small and ring fingers.

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Extensor carpi ulnaris (ECU) tenosynovitis is another frequent concurrent process that exacerbates the DRUJ deformity [2, 3]. The tenosynovitis causes weakening of the ECU subsheath and the overlying extensor retinaculum that results in volar subluxation of the tendon from its normal position in the osseous groove of the dorsal ulna head. The tendon subluxation substantially changes its action from wrist extension and ulnar deviation to wrist ulnar deviation alone. The ECU also loses its normal depressive action on the ulnar head. If the ECU tendon subluxates more volarly, the tendon may actually produce wrist flexion and exacerbate ulnar translocation and supination deformity of the radiocarpal joint.

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## Treatment Options

After ensuring the disease is being optimally treated by appropriate medications, early management of DRUJ synovitis includes corticosteroid injection into the joint and splinting of the wrist. An ulnar gutter splint or distal forearm band can be made to partially stabilize the DRUJ and partially restrict forearm rotation without substantially impeding finger or thumb motion. However, these devices may not be tolerated because they can restrict wrist motion, and, therefore, splints are typically worn intermittently for arthritic flares. Because of the risk of tendon ruptures associated with chronic DRUJ synovitis, examinations should be repeated regularly until the synovitis is confirmed to be substantially improved by medications and splinting.

If synovitis persists despite nonoperative treatment, especially if associated with dorsal ulnar head subluxation and crepitus, surgical treatment is considered before extensor tendon ruptures occur. The surgical options are similar to those used for arthritis of the DRUJ from other causes. However, when contemplating reconstruction, one needs to consider other concerns such as treating ECU tenosynovitis and subluxation, severe dorsal subluxation of the ulna, finger extensor tenosynovitis or ruptures, and ulnar translocation of the carpus. Furthermore, options may be influenced or limited by current overall

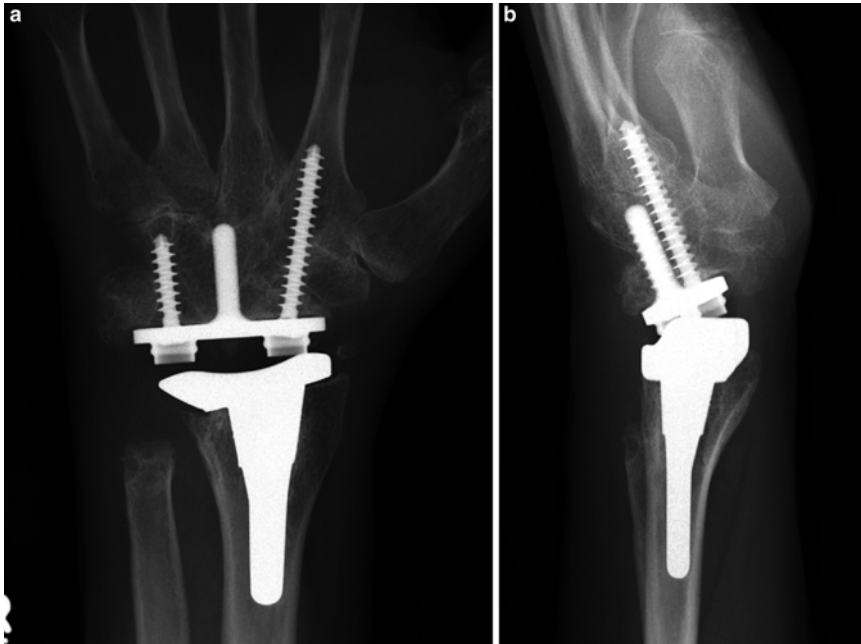
disease control, concurrent treatment requirement for the radiocarpal joint, previous surgical procedures that altered the local tissues typically used for a reconstruction, as well as the patient's rehabilitation capacity.

The three primary traditional treatment options are the Darrach resection, Sauvé-Kapandji procedure, and hemiresection of the distal ulna. Each of these procedures is often combined with a stabilization of the distal ulna using a local tenodesis or capsular flap and a soft tissue interposition between the distal ulna and radius to reduce ulna impingement against the radius. In some patients in whom the overall rheumatoid disease is quiescent and well controlled, the DRUJ is not subluxated, the bone quality is adequate, and an implant arthroplasty can be considered. Although there are many specific anatomic factors associated with the indications for each of these procedures, there are some that are considered more important, which will be emphasized during the description of each procedure.

## Darrach Procedure

Rheumatoid disease remains one of the main indications for the Darrach procedure because it is simple, alleviates pain, provides cosmetic improvement, and removes the cause for extensor tendon injury [4–6]. However, it has been reported to increase the risk of initiating or worsening ulnar translocation of the carpus, which is a common malady of the rheumatoid wrist. After a Darrach procedure, a younger patient may complain of reduced power grip, which is likely caused by the reduced support of the carpus. Almost all patients claim to have some crepitus during forearm rotation caused by rubbing between the ulnar stump and radius, but unlike nonrheumatoid patients, this is typically not symptomatic, especially in the lower-demand elderly patient.

A wide variation of technical modifications has been described, including level of ulnar resection, retention of ulnar styloid, mechanism of ulnar stump stabilization, and use of soft tissue



**Fig. 10.1** Darrach procedure performed in combination with a total wrist arthroplasty. Note the remodeling of the distal ulna that has occurred

interposition [6]. The severity of the bone destruction, joint subluxation, and soft tissue attenuation often limits the potential modifications that can be used. In most rheumatoid cases, the ulnar resection is performed at the level just proximal to the sigmoid notch without retaining the ulnar styloid, the ulnar stump is slightly contoured to remove sharp edges, and a flap of volar capsule is transferred to the stump and secured by sutures placed through small holes in the stump [7]. In younger more active patients, alternative stump stabilization using either an ECU or flexor carpi ulnaris (FCU) tenodesis along with soft tissue interposition using capsule or pronator quadratus is often performed [8–11].

In patients with active radiocarpal synovitis and evidence of ulnar translocation of the carpus, a Darrach may increase the translocation by removing the buttressing effect of the distal ulna. A combined procedure maybe required if such cases, which includes a radiolunate or radioscapulolunate fusion to stabilize the carpus. Because the Darrach procedure is typically an uncomplicated procedure, it can be combined with more

complex procedures such as total wrist replacement that also stabilizes the radiocarpal joint (Fig. 10.1). ECU subluxation can be treated at the same time by relocating the tendon over the dorsal aspect of the ulnar stump and stabilizing the tendon in this position by reefing the extensor tendon retinaculum or creating a sling using a strip of the retinaculum [3]. Relocating the ECU tendon will help stabilize the ulnar stump, reduce its deforming force on the wrist, and possibly improve wrist extension. Some surgeons prefer to stabilize the ECU by performing an extensor carpi radialis longus (ECRL) to ECU tendon transfer, which may also provide some dynamic counter to the deforming forces across the wrist.

A dorsal surgical approach over the ulnar head is typically used to preserve any remaining TFCC components; however, some variation is dependent on concurrent procedures. If the ECU tendon does not require repositioning, then an approach through the fifth extensor compartment or between the fifth and sixth compartments is most efficient and allows closure by directly repairing the capsule and retinaculum together. If

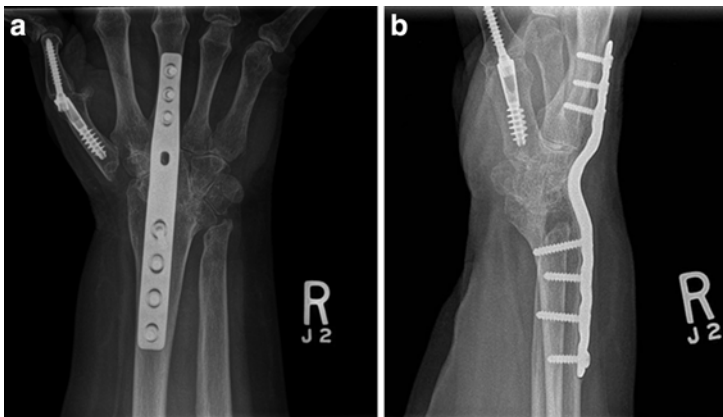
the ECU tendon requires repositioning, then a radially based extensor retinaculum flap can be raised first in order to be used as a sling for the ECU tendon, followed by an approach through the floor of the sixth compartment. This approach also allows access to the fifth extensor compartment for tenosynovectomy; the fifth compartment tendons are typically left superficial to the retinaculum at time of repair. If there is severe ulnar translocation of the carpus and a radiolunate fusion is also planned, then the capsulotomy can be extended distally to include the ulnocarpal joint and lunate fossa for joint preparation.

### Hemiresection of the Distal Ulna

Because instability is associated with the Darrach procedure, hemiresection (HR) of the distal ulna, which removes the articular surface and a few millimeters of the underlying cancellous bone but when possible retains the ulnar attachments of the TFCC, has the potential advantages of preserving some stabilizers of the distal ulna, and the exposed cancellous bone encourages healing to the surrounding soft tissue sleeve (Fig. 10.2) [12, 13]. Although its primary indications are post-traumatic or degenerative arthritis because the procedure is designed to have a functioning TFCC, the procedure can be useful in select rheumatoid patients, usually younger, whose primary

problem at the DRUJ is articular surface degeneration with minimal joint subluxation. Because some convergence of the radius and ulna will occur after partial resection of the ulnar head, ulnar-positive variance is a relative contraindication because it increases the likelihood of impingement between the ulnar styloid and triquetrum; however, a concurrent ulna shortening through the cancellous portion of the ulnar head can be performed to reduce this risk. However, ulnar shortening increases the complexity of the procedure and thus reduces its relative benefit over other options. Irreparable damage to the TFCC and ulnar carpal translocation are relative contraindications because the resection may exacerbate the translation and because the procedure has minimal benefit over a Darrach procedure. However, the HR procedure can be combined with ECU tendon repositioning and stabilization procedures. Unlike the Darrach procedure, HR nearly always includes a soft tissue interposition using local capsule, pronator quadratus, or allograft tissue.

The surgical approach is similar to that described above for the Darrach procedure. Because this procedure will typically be used for a stable DRUJ, performing the exposure through the fifth extensor compartment allows the best preservation of the stabilizing soft tissues and optimum closure using combined repair of the capsule and extensor retinaculum. The tissue



**Fig. 10.2** A hemiresection arthroplasty was performed in conjunction with a total wrist arthrodesis and an arthrodesis of the thumb MCP joint

used for interposition is often determined at the time of surgery, which depends on its quality and mobility for transferring into the space. In case the local tissue is not adequate for interposition, having allograft or other commercial biologic substitute available at surgery is desirable.

### Sauvé–Kapandji Procedure

The Sauvé–Kapandji (SK) procedure consists of a radioulnar joint fusion and creation of a pseudoarthrosis proximal to the fusion by resecting the ulnar neck (Fig. 10.3) [14–17]. The procedure may include a stabilization technique for the ulnar stump and a soft interposition between the stump and distal radius [18]. Although the indications are similar to those for the Darrach and

HR procedures, it has a potential advantage because it retains support for the ulnar carpus and thus reduces the risk of ulnar carpal translocation, which is common in rheumatoid arthritis. However, it has the same disadvantage of the Darrach procedure regarding instability of the ulnar stump.

Either a dorsal or ulnar surgical approach can be used, which may depend on the necessity for concurrent procedures. Preparation of the fusion site is easier through a dorsal exposure similar to that described above for a Darrach or HR, whereas fixation is usually easier when using an ulnar approach. The periosteum is excised around the ulnar neck and approximately 1 cm of the neck is resected with an oscillating saw. If there is ulnar-positive variance, a correspondingly greater segment of ulna is removed so that when



**Fig. 10.3** Sauvé–Kapandji procedure performed using two screws for fixation. (a and b) Preoperative X-rays and (c and d) postoperative X-rays

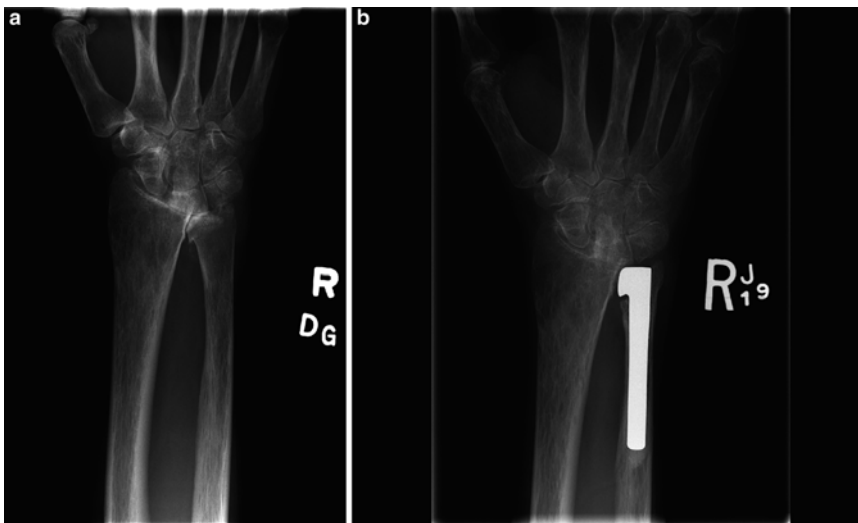
the head is recessed to neutral variance, the resulting gap will be 1 cm. The opposing articular surfaces of the ulnar head and sigmoid notch are denuded to cancellous bone. The ulnar head is held against the sigmoid notch in neutral rotation and at the proper longitudinal position. Two parallel guide wires are inserted into the head just beneath the ECU sheath and into the radius; their positions are confirmed with fluoroscopy. The choice of fixation depends on the size and quality of the bone. If the ulnar head is sufficient, the use of two cannulated screws for fixation is optimal but cannot always be achieved. Do not allow the head to tilt while tightening the screws to avoid stylocarpal impingement. If the pronator quadratus muscle is to be used for interposition, it can be detached from its ulnar insertion and advanced into the osteotomy site and sutured in place to the ECU sheath. To gain additional stability of the proximal ulnar stump in a younger patient, I use the FCU tenodesis technique described by Lamey and Fernandez, in which a distally based strip of FCU tendon is raised and passed into the exposed medullary canal of the ulnar stump and out through a hole drilled in the stump; it is then sutured back onto itself under tension.

A modified technique was described by Fujita that is particularly useful for patients with

advance rheumatoid disease of the DRUJ in whom the ulnar head is severely eroded and therefore could not be used successfully for a standard SK procedure [19]. In this modification, the ulnar osteotomy is made approximately 2 cm proximal to the head, the head–neck piece is rotated 90° from its normal orientation, and then the neck is inserted into a large hole drilled in the sigmoid notch. A screw is inserted through the head and down the medullary canal of the neck and into the distal radius to gain fixation of the construct. Although the technique creates an articular surface with the nonarticular part of the ulna, it does construct a strong support for the ulnar carpus.

### Implant Arthroplasty

Although distal ulnar implant arthroplasty is gaining popularity for a variety of arthritic conditions involving the DRUJ because it reproduces near-normal kinematics of the joint, there are greater challenges when using this technique for rheumatoid arthritis (Fig. 10.4) [20, 21]. The two primary concerns are joint stability and bone quality. With the exception of using a constrained implant, implant arthroplasty relies on soft tissue con-



**Fig. 10.4** A partial ulnar head replacement was implanted in combination with a radiolunate arthrodesis in an active female with minimal active rheumatoid disease

straints, which are typically attenuated or eventually affected in rheumatoid arthritis, and thus the risk of developing joint instability is substantial. Because bone quality is affected by the rheumatoid disease and its medical treatment, progressive and excessive erosion of the sigmoid notch following total or partial ulnar head replacement is a concern. A total joint replacement, either constrained or unconstrained, may initially obviate some of these concerns; however, the relative functional benefits of these more complex and costly procedures compared to traditional procedures in this patient population are small, particularly because the potential complications of implant loosening and infection are higher. Therefore, implant arthroplasty should likely be reserved for younger, active rheumatoid patients with a painful DRUJ due to articular degeneration but who have a relatively stable and well-aligned joint and adequate bone quality (Fig. 10.4).

## Outcomes

The results of the three traditional procedures are generally good for relief of pain, elimination of offending mechanical reasons for tendon ruptures, and aesthetic improvement by reducing or eliminating the prominence of the ulnar head. Fortunately, radioulnar impingement with associated crepitus is rarely painful or substantially noticeable and typically improves as the distal ulna remodels. The distal radius also frequently remodels at the site of the pseudo-articulation between the radius and ulnar stump following a Darrach or SK procedure. The distal ulna also remodels following an HR procedure but the radius is often not affected.

The overall improvement in pain and function may be affected by concurrent procedures depending on the severity of the conditions necessitating these procedures. For example, a younger patient with severe ulnar translocation of the carpus that is treated by a Darrach or HR procedure and concurrent radiolunate fusion will likely require a longer recovery and rehabilitation and be more affected by the change in wrist motion than the distal ulna procedure. Similarly,

a distal ulna procedure will often have less impact on recovery and ultimate hand function than concurrent finger joint reconstructions or tendon transfers.

With the exception of possible progressive ulnar translocation of the carpus following a Darrach or HR procedure, there is little risk of functional deterioration of these traditional procedures despite pseudo-joint formation with possible narrowing of the distal ulna and remodeling of the radius. Although there is no clear evidence that one of the three traditional procedures provides a better long-term functional outcome, selecting a given procedure based on local anatomical deformity, systemic disease activity, and patient goals may provide some benefits toward better wrist function, lower risk, and more rapid recovery.

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