Concomitant Total Wrist and Total Elbow Arthroplasty in a Rheumatoid Patient

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Abstract

Background Concomitant arthroplasty has been described to have several benefits over multistage procedures. Ipsilateral total elbow and total shoulder arthroplasty has been reported with good outcomes in upper extremity concomitant arthroplasty.

Case Description A 65-year-old woman presented with ipsilateral left-sided wrist and elbow joint degeneration as a result of longstanding rheumatoid arthritis. Concomitant total wrist and total elbow arthroplasty was performed with satisfactory results at both joints. She tolerated the procedure well and had an uneventful clinical course postoperatively.

Literature Review Currently, no literature exists that describes one-stage total wrist and total elbow arthroplasty. Individually, total wrist and total elbow arthroplasty have both been reported to result in good outcomes and patient satisfaction. Previous studies have reported the utility of concomitant ipsilateral upper extremity procedures with a one-stage total elbow and total shoulder arthroplasty having been identified as a cost-saving procedure with expedited return to functionality versus a two-stage procedure.

Clinical Relevance Patients with ipsilateral degenerative changes in the wrist and elbow should be considered on an individual case basis for concomitant total wrist and total elbow arthroplasty.

Keywords

- rheumatoid
- one-stage
- concomitant
- arthroplasty

Total wrist arthroplasty (TWA) and total elbow arthroplasty (TEA) have been used extensively in the treatment of excessively arthritic and degenerative joints.^{1–4} Both have good reported outcomes and have proven to be effective therapies for restoring and preserving upper extremity function in rheumatoid arthritis (RA) patients.^{1,4} Occasionally, patients present with severe arthritic joint disease, simultaneously affecting the elbow and wrist. For these unique circumstances, total joint arthroplasty of both the wrist and elbow provides a potential treatment option.

One-stage, concomitant arthroplasties have been described in the literature with good outcomes and distinct advantages over two-stage procedures, including reduced

cost, shorter hospital stay, quicker return to functionality, and, potentially, decreased morbidity.^{5–7} One-staged upper extremity arthroplasties have previously been described with concomitant ipsilateral TEA and total shoulder arthroplasty (TSA). This combined procedure has been reported to hold distinct benefits as compared with two-stage procedures,^{6–9} with several reports specifically identifying success in the setting of RA with one-stage TEA and TSA.^{5,6} However, to our knowledge this is the first case report of a TWA and TEA being performed during the same operation.

We present a unique case of a patient with progressive RA who was treated surgically with concomitant TWA and TEA to decrease the morbidity of two successive surgical procedures

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and avoid future sequelae associated with progressive RA in multiple joint spaces. The purpose of this case report is to introduce and identify the utility of a concomitant ipsilateral TWA and TEA.

Case Report

A 63-year-old, left-hand-dominant woman presented with progressive bilateral RA and bilateral cubital tunnel syndrome resulting from RA joint degeneration. The patient was a former smoker with a medical history significant for osteopenia. Following multiple years of conservative treatment for bilateral elbow pain, initial surgical

intervention consisted of a TEA 7 years prior to the reported case for right elbow degenerative arthritis. After review of her disease progression, failed conservative treatments, and her current functional limitations, a planning meeting was held with the patient to review possible treatment options, and the decision was made to pursue both left TWA and TEA. Specific to this case, the patient is a registered nurse with excellent understanding of her disease process and significant motivation to pursue both procedures simultaneously.

Preoperative evaluation showed marked crepitus with flexion and extension at both the wrist and elbow. Wrist and elbow flexion and extension arcs were significantly

Table 1 Preoperative and postoperative clinical exam assessment and plan

Time after surgery	Left elbow (E), left wrist (W) ROM (degrees)	Imaging	Additional tests	Additional comments	Plan
Preoperative					
-10 wk	E: flex 20–135, pro 80, sup 70 W: flex 30, ext 40	Significant joint degeneration of both left wrist and elbow (► Figs. 1 and 2)	JAMAR grip R/L 50/55 setting II	Failed steroid injection. Marked crepitus during range of motion testing	Concomitant left TWA, TEA
Date of operation					
Postoperative					
1 wk	E: positive ext W: positive ext	Excellent alignment of both prosthesis (► Figs. 3 and 4)	Limited cross finger test	128 s of vibration, numbness and tingling in small fingers	Therapy: active ROM; continue extension splint
2 wk			Neg cross finger. Neg Wartenberg sign. Neg Froment sign. Weak intrinsic muscles. Flexor profundus intact	128 s of vibration, numbness and tingling in L ring and small fingers from elbow, signs of ulnar nerve recovery	Therapy: improve flexion in elbow and wrist
1 mo	E: flex 5–135 W: ext 50, flex 40		Neg cross finger. Neg Wartenberg sign. Neg Froment sign	Stable ring and small finger numbness. Normal dexterity	Continue therapy
5 wk	E: flex 10–135, pro 80, sup 80 W: flex 30, ext 50, radial deviation 10, ulnar deviation 30				Continue therapy; begin strengthening
2 mo	E: flex 0–130, pro 80, sup 80 W: flex 50, ext 60		Negative cross finger test bilaterally. Mild positive Froment sign bilaterally. Positive carpal tunnel Tinel sign bilaterally	No pain. Numbness and tingling in left small finger	Continue therapy. Return to work; gradual return to full-time status over 1-mo period.
6 mo	E: flex 0–130, pro 80, sup 80 W: flex 60, ext 55	Excellent alignment of both prostheses	JAMAR grip strength R/L 60/45 setting II		

Abbreviations: ext, extension; flex, flexion; neg, negative; pro, pronation; ROM, range of motion; sup, supination.

Notes: This patient demonstrated marked improvement during her postoperative course. At final follow-up exam, the patient had excellent ROM with no residual neuropathy.

Fig. 1 Preoperative radiography of left wrist, showing diffuse degenerative changes throughout the wrist joint, typical for rheumatoid arthritis.

Fig. 2 (A, B) Preoperative radiography of left elbow, showing extensive damage to the ulnohumeral joint space and olecranon of the left elbow. The pathology seen in the image is indicative of severe RA damage to the elbow.

limited; motion at the wrist showed 30-degree flexion and 40-degree extension with elbow range of motion (ROM) from 20 to 135 degrees (► **Table 1**). Preoperative imaging displayed significant arthritic degenerative changes of both the wrist (► **Fig. 1**) and elbow (► **Fig. 2**).

A standard Maestro total wrist replacement (Zimmer Biomet, Warsaw, IN) was utilized in standard technique. There were no intraoperative complications, and after implant, insertion ROM was noted to be excellent with 40-degree flexion and 40-degree extension, confirmed with fluoroscopy. Attention was then turned to the elbow. A standard Discovery elbow system (Zimmer Biomet, Warsaw, IN) was utilized in standard technique with antibiotic-containing bone cement. Full motion from 0 to 135 degrees in extension/flexion with pronation of 80 degrees and supination of 80 degrees was obtained intraoperatively, and satisfactory device placement was confirmed with

fluoroscopy. The incisions were closed in a layered fashion, and the patient was placed in a bulky dressing with the wrist in neutral and elbow in extension.

Postoperatively, radiographs at 1 week showed excellent alignment of both prostheses, while clinically the patient was able to extend both the wrist and the elbow (► **Figs. 3 and 4**). Numbness and tingling were noted in the left ring and small fingers. At that point, the patient was started on occupational therapy with a registered occupational therapist for active ROM while being maintained in an extension splint.

At 1 month, the patient was noted to have mild redness over her left arm without fever or drainage. She was subsequently put on cephalexin and seen back in the clinic in 1 week. At the follow-up visit 5 weeks postoperatively, she was noted to have healed incisions and excellent ROM despite continued numbness in her left ring and small fingers (► **Table 1**). With good alignment shown on radiographs

Fig. 3 Postoperative radiography of wrist, showing successful implantation of the total wrist prosthesis with excellent positioning and purchase through the radius proximally and distally through the distal carpal row and second metacarpal.

Fig. 4 Postoperative radiography of elbow (A) in extension and (B) in flexion, showing successful implantation of the total elbow prosthesis in both positions. Both the coronal and sagittal perspectives show excellent positioning of the elbow prosthesis. Apparent improvement in range of motion can be appreciated between this image and ▶Fig. 2.

and preliminary signs of an appropriate healing process, the patient was started on a strengthening program.

Two months postoperatively, the patient had no residual pain and further improvement in her wrist and elbow flexion and extension (▶Table 1). At that time she was cleared to begin a gradual return to full-time work over the course of the next 4 weeks.

At her 6-month follow-up visit, the patient had made further progress with her elbow and wrist flexion and extension. She had grip strength approximating her preoperative testing and had minor complaints of lateral elbow soreness with heavy use. At that point, the patient no longer had complaints of numbness or tingling with ulnar neuropathy.

Discussion

To date, there have been no published case reports of concomitant TWA with TEA. One-stage dual arthroplasty has been described for bilateral total knee arthroplasty and ipsilateral TEA with TSA. The reports from those concomitant arthroplasty procedures identified good clinical out-

comes at a decreased cost, providing both clinical and financial incentive to investigate further application of one-stage dual arthroplasty procedures.

There is a growing list of advantages to TWA over wrist arthrodesis, which has led to the increased popularity of TWA over the past two decades.³ Improved designs with advances in prosthesis mechanics have enabled newer-generation TWA implants to mimic native mechanics more closely, improving functional outcomes and providing increased patient satisfaction.^{3,10–12} Painful wrist arthritis is the primary indication for TWA, with RA contributing significantly to the patient population seeking TWA. Special surgical considerations must be made for a TWA in a patient with RA; however, favorable outcomes have become reproducible for this unique population.⁴ Once wrist function begins to decline, and especially after failed medical therapy, a painful RA wrist should be evaluated for TWA before total autoimmune joint destruction.⁴ As a stand-alone procedure, TWA has been reported to result in improved pain scores, with 81 to 100% of patients experiencing no pain at final follow-up with patient

satisfaction in 95 to 100% of those who underwent the procedure.^{12,13} Functionally, ROM has been shown to improve by an average flexion/extension arc of 12 degrees and an average radial/ulnar deviation arc of 7 degrees, with a total flexion/extension arc of 67 to 68 degrees and a total radial/ulnar deviation of 24 to 27 degrees.^{12,13} In this case, the patient has a preoperative flexion/extension arc of 70 degrees; however, the ROM was inhibited by marked crepitus throughout the arc. Postoperatively, that flexion/extension was improved further to 90 degrees (→Table 1).

Intervention for RA joint degeneration at the elbow has also been successfully addressed through total joint arthroplasty. TEA has been well described in the literature as an effective surgical option to address a multitude of elbow pathologies including RA. Pain with a degenerative joint is the most common indication for TEA.¹ Specifically for RA patients, like TWA, TEA should be considered with progression of joint degeneration despite available nonsurgical medical management, before total autoimmune joint destruction.^{1,14} Outcomes of TEA have generally been favorable, with pain relief and improved functionality along with a high level of patient satisfaction.^{2,15,16} When evaluated as a single procedure, TEA also has shown very good sustained results, with longevity for RA patients with a reported survival rate of 97.7% at 5 years and 91.0% at 10 years.¹⁷ Arc of flexion/extension has been reported to have improved by an average of 33 degrees and arc of pronation/supination by an average of 44 degrees, with patients expressing a significant improvement in subjective performance.^{16,17} Preoperatively, our patient was unable to extend her elbow past 20 degrees of flexion, although she had maintained pronation of 80 degrees and supination of 70 degrees up until the time of surgery. Postoperatively, the patient was able to extend her elbow to 0 degree of flexion while maintaining flexion of 130 degrees and adding 10 degrees to her supination, resulting in 80 degrees of pronation and 80 degrees of supination.

The decision to pursue one-stage versus two-stage dual arthroplasty has received support in the literature based on several factors. Recently, the relevant focus of concomitant arthroplasty has been on ipsilateral TEA and TSA, with reports favoring a one-stage procedure.^{5,9} One-staged ipsilateral TEA and TSA was reported to have equivalent outcomes of both joints individually with the financial, psychological, and functional recovery time advantages that could be expected by limiting patients to one operation versus two.^{5,6,9} In light of the reported effectiveness of concomitant ipsilateral upper extremity total arthroplasty, we were encouraged to pursue a novel operative technique to restore declining function in our patient. With dual joint arthroplasty performed during one operation, patients can expect their total hospital stay and cost to be reduced by up to half of what they might expect with two-stage procedures.^{6,7,9} There may be reduced risk in avoiding a second operation with additional administration of anesthesia as well as other perioperative risks such as thrombi or simply psychological stress associated with undergoing a second operation.¹⁸ Additionally, patients may begin rehabilita-

tion programs sooner, recover more quickly, and return to maximized functional status more expeditiously.⁹ The patient specific to this case benefited in synchrony at both joints, as demonstrated by her improved ROM and her subjective satisfaction with the procedure.

In a patient such as the one presented here, with a high level of motivation plus the above-stated considerations for concomitant ipsilateral arthroplasty, consideration can be given to concomitant total wrist and elbow joint replacements. Relevant peer-reviewed literature suggests that both TWA and TEA are appropriate treatment modalities for intervention of degenerative RA at the wrist and elbow. Additionally, the benefit of concomitant dual joint arthroplasty has been reported to harbor a multitude of benefits, importantly including decreased recovery time and total cost. This procedure is not routinely recommended, nor should it be conducted in all patients with ipsilateral wrist and elbow joint degeneration; however, with appropriate patient selection, it should be strongly considered to expedite the healing process and alleviate some of the morbidities and burden associated with two consecutive operations.

Conflict of Interest

None.

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