Failure of Wrist Hemiarthroplasty

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Abstract

Background: Wrist hemiarthroplasty has emerged as a motion-sparing option for severe wrist arthritis. It is technically easy with advantages of limited bone resection and no risk of nonunion. Given the relative infancy of the procedure in clinical practice, there are limited data on patient outcomes. **Methods:** Eleven patients were treated with wrist reconstructive hemiarthroplasty. Indications included 1 patient with scaphoid nonunion advanced collapse, 9 patients with scapholunate advanced collapse, and 1 patient with capitulunate arthritis. Average age was 63 years; average follow-up was 4 years. Objective parameters included Disabilities of the Arm Shoulder and Hand (DASH), grip strength, and range of motion. Implant failure defined by necessity of revision procedure. **Results:** DASH scores initially improved postoperatively but were not statistically significant. Grip strength was 60% of contralateral side. Postoperative range of motion at 6 months was flexion 40.3°, extension 39.3°, supination 87.0°, pronation 77.8°, radial deviation 14.5°, and ulnar deviation 13.8°. A 45% failure rate was observed. Complications included failure with conversion to Total Wrist Arthroplasty (TWA; n = 2) or wrist fusion (n = 3) secondary to development of ulnar-sided wrist pain. One additional patient experienced severe wrist pain but declined additional surgery. **Conclusions:** Wrist hemiarthroplasty in our series had a significant failure rate. In each case of failure, the patient developed ulnar-sided wrist pain. In the presence of more reliable procedures, wrist hemiarthroplasty is not indicated in its current incarnation.

Keywords: SNAC, SLAC, hemiarthroplasty, motion preserving, wrist arthritis

Introduction

There are multiple etiologies of wrist arthritis, all of which can be severely debilitating. Commonly seen in our practice is posttraumatic arthritis. Scaphoid nonunion or scapholunate disruption may progress to scaphoid nonunion advanced collapse (SNAC) and scapholunate advanced collapse (SLAC). Intra-articular distal radius fractures may also cause arthritis of the radiocarpal joint. Definitive treatment of severe arthritis that has failed conservative management is often total wrist fusion. However, the loss of motion associated with this procedure has led surgeons to seek other, motion-sparing alternatives. Proximal row carpectomy (PRC) was the first of these, described by Stamm⁵ in 1944. Swanson⁶ developed the first silicone wrist arthroplasty in 1967. Many newer arthroplasty implants have been developed since then. Watson and Ballet⁷ described the 4-corner fusion with scaphoid excision (SLAC procedure) in 1984 as another treatment option. Each of these presented a motion-preserving option for the arthritic wrist considering fusion. More recently wrist hemiarthroplasty has been used as a motion-sparing surgical option for end-stage wrist arthritis. One method involves arthroplasty of the radius side of the joint with a PRC.¹ This is considered advantageous in that

distal implant loosening is not possible. In the wrist with capitate arthritis and a healthy lunate facet, hemiarthroplasty of the carpal side of the wrist is one option as PRC is contraindicated. Wrist hemiarthroplasty is technically easy to perform with advantages of limited bone resection as compared with PRC and no risk of nonunion seen in wrist fusion and SLAC procedure. It also allows for conversion to Total Wrist Arthroplasty (TWA) or wrist fusion as a salvage procedure in the case of failure. Given the relative infancy of wrist hemiarthroplasty in clinical practice, there are limited data on patient outcomes especially with significant follow-up.

Materials and Methods

Eleven patients were treated with wrist reconstructive hemiarthroplasty (Biomet Maestro; Figure 1). Dorsal wrist

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Figure 1. Preoperative anteroposterior radiograph showing scaphoid nonunion advanced collapse wrist.

Figure 2. Preoperative lateral radiograph of scaphoid nonunion advanced collapse wrist.

Figure 3. Postoperative anteroposterior radiograph.

Figure 4. Postoperative lateral radiograph.

Figure 5. Anteroposterior radiograph of failed hemiarthroplasty.

incision was made and dissection taken down to the level of the extensor retinaculum. The third dorsal compartment was opened, and the Extensor Pollicis Longus (EPL) was mobilized and retracted. The remaining dorsal compartments were elevated. The carpal resection guide was placed to allow for approximately 2 mm of the capitate to be resected and held in place by Kirschner wires. Carpal bones were resected according to the guide, and it was removed. A Kirschner wire was placed in the proximal capitate, and cannulated reamers were serially passed over the wire to the correct size. After trial fit, including scaphoid augments, the final implant was placed into the capitate and secured with hamate and trapezoid/second metacarpal screws. Care was taken to avoid damage to the radioscaphocapitate (RSC) ligament, which was preserved in each case. Closure was in layers including joint capsule, extensor retinaculum, and skin. Indications included 1 patient with SNAC, 9 patients with SLAC, and 1 patient with capitolunate arthritis. Average age was 63 years; average follow-up was 4 years. Objective parameters included Disabilities of the Arm Shoulder and Hand (DASH), grip strength, and range of motion (ROM). Implant failure defined by necessity of revision procedure.

Figure 6. Lateral radiograph of failed hemiarthroplasty.

Results

DASH scores minimally improved postoperatively (55.7 vs 58.3) but were not statically significant. Grip strength was 60% of contralateral side. Postoperative ROM at 6 months was flexion 40.3°, extension 39.3°, supination 87.0°, pronation 77.8°, radial deviation 14.5°, and ulnar deviation 13.8°. A 45% failure rate was observed. Complications included 2 failures with conversion to TWA (Figures 4-8) and 3 failures with conversion to wrist fusion (Figures 9-12) secondary to development of ulnar-sided wrist pain. No infections were seen. The study was abandoned due to high failure rate. Failures

Figure 7. Anteroposterior radiograph after conversion to total wrist arthroplasty.

occurred in 4 men and 1 woman. The average age of patients with failure was 57 (range: 50-65). The average time to revision was 19 months (range: 12-24 months). The 2 patients revised to TWA were older than 60, whereas the 3 wrist fusions were done in patients younger than 60. All of the failures were seen in patients with preoperative diagnosis of SLAC wrist. Medical comorbidities in the failure group included hypertension ($n = 3$), hyperlipidemia ($n = 1$), and obstructive sleep apnea ($n = 1$). One patient was a smoker.

Discussion

The postoperative course of the patients was initially very encouraging. No infections were seen nor were any intraoperative or immediate postoperative complications. The DASH scores improved slightly despite a lack of significance. Importantly, grip strength was 60% of the unaffected hand. This is similar to 4-corner fusion with scaphoid excision but lower than PRC in recent literature.⁴ Range of motion was

Figure 8. Postoperative radiograph after conversion to total wrist arthroplasty.

acceptable when compared with the functional ROM described by Palmer et al.² and Ryu et al.³ Despite promising early results, wrist hemiarthroplasty in our series had a significant failure rate. All failures were seen in patients with a

Figure 9. Anteroposterior radiograph of failed hemiarthroplasty.

Figure 10. Lateral radiograph of failed hemiarthroplasty.

Figure 11. Anteroposterior radiograph after conversion to wrist fusion.

preoperative diagnosis of SLAC wrist. This diagnosis made up 9 of the 11 patients in the study, so it is difficult to determine whether other diagnoses would fare better with this procedure. The patients in the failure group were slightly younger than the overall cohort (57 vs 63), but the failure group included patients with age up to 65. Only one failure was a smoker, and the identified medical comorbidities were not

Figure 12. Lateral radiograph after conversion to wrist fusion.

thought to increase the risk of failure. In each case of failure, the patient developed ulnar-sided wrist pain. Ulnar subsidence

and sclerosis of the lunate facet were seen in all failures despite an intact RSC ligament. It is believed that this is due to increased forces on the lunate facet caused by articulation with the metal implant. This likely represents a combination of inappropriate material and poor geometric fit. The Biomet Maestro is designed as a TWA implant but is also available as a carpal-sided hemiarthroplasty. With the TWA, the carpal side implant does not require anatomic fit with the lunate facet; it only has to match the polyethylene on the radial side. When used as a hemiarthroplasty, the native lunate facet articulates with the implant and appears to be a mismatch. Future developments may include adjusting implant geometry to be more similar to that of the native lunate or possibly the capitate given the success of PRC. Also, alternative biomaterials (ie, pyrocarbon) may be investigated for use. It is possible that this procedure is an evolutionary blind alley that will not result in a viable procedure. In the presence of more reliable procedures, wrist hemiarthroplasty is not indicated in its current incarnation, and we have at this time discontinued its use in our practice.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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