

Maciej Grzegorz Bręborowicz, Leszek Kaczmarek, Ewa Bręborowicz, Leszek Romanowski

Chair and Department of Traumatology, Orthopedics and Surgery of the Hand, Poznan University of Medical Sciences, Poznań, Poland

Wrist arthroplasty, good alternative for rheumatoid wrist: Case report with literature review

ABSTRACT

Within the hand, the wrist is the most affected joint by rheumatoid arthritis (RA). Wrist fusion (WF) and wrist arthroplasty (WA) are solutions for severe arthritis of the wrist. WA decreases pain, and, contrary to WF, preserves motion. Reported clinical results of modern prosthesis constructs are good and the patients are satisfied. This research presents a pa-

tient with RA treated with WA. The follow-up is 13 years. There were 2 further synovectomies. Some bone erosion was observed. Apart from that, the patient is satisfied with WA. It seems that WA should be considered earlier in the treatment scheme in patients with RA.

Rheumatol. Forum 2022, vol. 8, No. 3: 129–134

KEY WORDS: wrist arthroplasty, wrist arthrosis, rheumatoid wrist

INTRODUCTION

Patients suffering from rheumatoid arthritis (RA) almost always seek help from hand surgeons. Within the hand, the wrist is the most common joint involved with RA at the earliest [1]. After 2 years of disease course, approximately 90% of patients will report impaired function and/or pain around the wrist [2]. Indisputably, the progress in nonoperative treatment of RA decreased the number of patients with severe arthritis and finally deformities. Nonetheless, the patients still require help around the hand.

CASE REPORT

A 43-year-old female patient with juvenile rheumatoid arthritis was referred to the Department of Traumatology, Orthopedics and Hand Surgery because of pain and swelling in her right wrist. Symptoms were a result of severe arthritis. The previous nonoperative treatment did not bring satisfactory results,

and symptoms had aggravated. In 2008 she was qualified for a right wrist arthroplasty (WA), the surgery was performed on 16th January 2009 and Maestro[®] Biomet endoprosthesis was implanted. There were no complications in the postoperative period and the surgical wound healed well. The postoperative protocol was applied. It consisted of a sling and a short forearm splint for 2 weeks. During this period the patient was encouraged to perform finger, elbow and shoulder exercises — active and active-assisted. After 2 weeks the splint was removed. Gentle active exercises of the wrist were applied. They included both assisted-by-therapist and self-assisted active exercises. After another month, vigorous exercises were started. The pace load increase was adjusted to the patient's progress.

In May 2016 she was admitted to the hospital because of pain and swelling around her right wrist. Imaging studies and laboratory tests were ordered. Ultrasound revealed enlarged inflammatory synovium around the wrist and distal radius and ulna. The length of synovium

Address for correspondence:

dr n. med.
Maciej Grzegorz Bręborowicz
Department of Traumatology,
Orthopedics and Surgery
of the Hand, Poznan University of
Medical Sciences
28 Czerwca 1956 roku 135/147,
61–545 Poznań
e-mail: mbreborowicz@gmail.com

was 40 mm and the thickness was between 7–10 mm. The biggest oedema was localized dorsally. There were no fluid collections. The decision was to aspirate fluid from endoprosthesis for microbiological examination together with steroid injection. The aspirate was microbiologically sterile. Since the symptoms increased after injection, in August 2016 right wrist synovectomy was performed. The symptoms subsided and rheumatologic treatment together with physiotherapy was continued.

Around the beginning of 2019 patient again began to complain of right wrist pain. The ultrasound revealed the soft tissue swelling dorsally between the radius and ulna. It resembled inflammatory synovium. In the X-ray, there was a suspicion of loosening around the ulnar edge of the proximal implant. Again, nonoperative treatment did not relieve the pain. The range of motion was 50 deg. palmar flexion, 45 deg. dorsal flexion, 80 deg. supination and 70 deg. pronation. The circumduction was mainly painful. In December of 2019 surgical revision of arthroplasty was performed. The inflammatory tissue was resected. The implants were stable. There was some resorption of the bone around the edges. The lateral part of the ulnar head was resorbed. Microbiology tests did not detect any infection.

The patient was satisfied with the treatment she has undergone in the summary of the medical history.

Except for the wrist deformity, she had a history of left hip arthroplasty in 2006. Between 2009 and 2016 she was treated because of infection, abscess, dislocation and finally loosening of left hip arthroplasty. The treatment consisted of debridement and implantation of antibiotics on the foam. Later the implant was removed and a hanging hip was left. The arthroplasty of her right hip was performed in 2013. In 2014 left hip underwent re-alloplasty.

Untreated RA of the wrist leads finally to severe painful deformities. The function and cosmetics are strongly impaired. Usually, it starts with pain and oedema. It is a result of the proliferation of inflammatory synovium. Joint cavity and tendon sheaths are affected. Wrist deformity results from three phenomena. The first is mentioned before — synovial membrane proliferation; the next is ligament laxity, and the last is cartilage destruction. Acting together, they destroy bone and relatively lengthen the ligaments. Insufficiency of scapholunate ligaments (SL) increases the gap

between the scaphoid and lunate. It results in arthritis-like scapholunate advance collapse (SLAC). Apart from the radiocarpal joint, the radioulnar joint is affected. The ligaments become lax. Altogether, the wrist rotates to the supination position. As a result, radiocarpal joint destruction is aggravated. Distorted dimensions of the wrist cause change in muscle/tendon actions. The tendon tension directions are changed. It also increases deformity. Finally, the wrist is subluxated volarly and ulnarily. As a biomechanical cascade, it leads to metacarpal radialisation and finger ulnarization.

INDICATIONS FOR WRIST ARTHROPLASTY

The indication for WA is RA. The patient should be cooperative. The bone stock should be preserved. The wrist must be stable and balanced with tendon stabilizers. The course of the disease also must be stable and well-controlled [3]. The RA wrist should resemble a pure arthritis wrist [1, 4]. Wrist arthroplasty is contraindicated in young and active patients and patients with poor bone stock. Also, high physical demand patients are not candidates for such surgery [5]. However, good results of modern WA bring back a question about its application in younger patients with osteoarthritis [6].

HISTORY OF WRIST ARTHROPLASTY

In the 1890s Themistocles Gluck used a wrist prosthesis to treat the damage done by tuberculosis. It was the first report of WA. The ivory implant consisted of two parts. The proximal implant was settled in the radius and ulna. The distal one was anchored in metacarpals. The patient was satisfied. Nonetheless, after around one year the implant had to be removed. The reason was chronic fistula, caused probably by tuberculosis.

In the 1920s, different materials were used to construct implants. It included moulded glass, gold, platinum, and silver. They were abandoned because the mechanical criteria were not fulfilled.

During World War II prosthesis production depended on Vitallium alloy. It was applied to WA. However, all arthroplasties within the hand did not arouse much interest. Altogether, a dysfunction was considered less important than a lower limb disability.

In the 1960s, Swanson designed silicone implants. The construct was based on a single element. It was implanted in the radius and

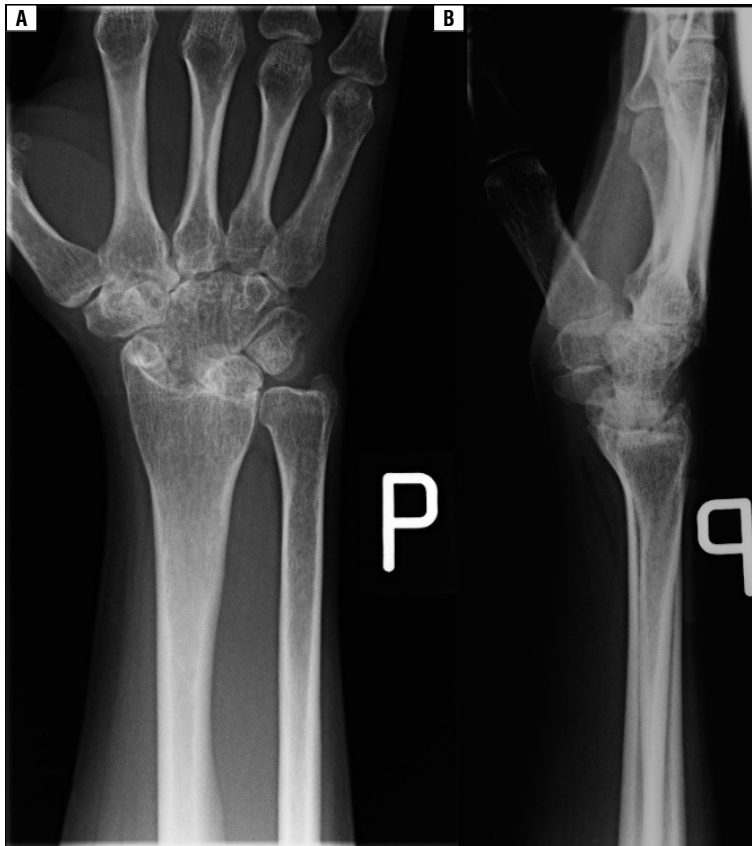


Figure 1. Pre-operative X-ray of right wrist 14 January 2009: **A.** Anterior-posterior; **B.** Lateral

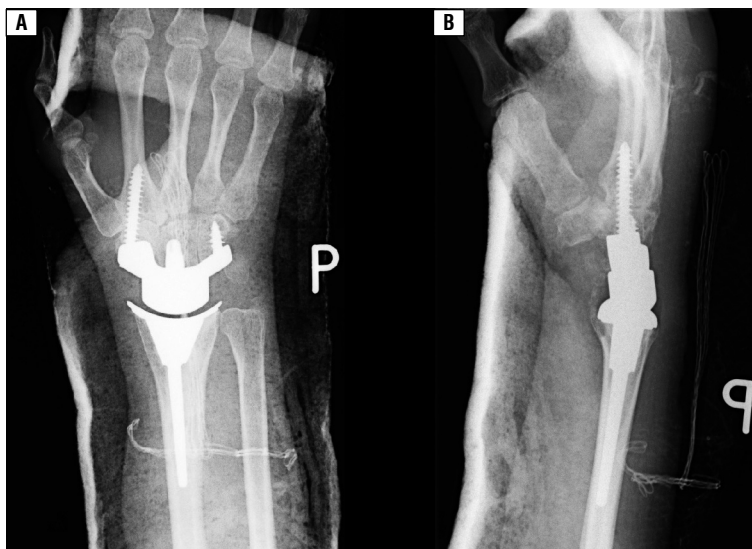


Figure 2. Post-operative X-ray of right wrist 19 January 2009: **A.** Anterior-posterior; **B.** Lateral

metacarpals. There was not any chance to establish a stable connection between bone and implant. Micromotions occur on the interface bone-silicone during wrist movements. With time implant became surrounded by fibrous tissue. The aim was to distribute the load evenly. This was interposition-type arthroplasty.

By the end of the 1960s, the first modern modular prosthesis was designed and manufactured in Germany. The long-term results were bad. It was attributed to the construction of the implant-hinge type arthroplasty. The next idea was to use ball and socket articulation, non-constrained. Still the results were unsatisfactory, and many complications were unacceptable.

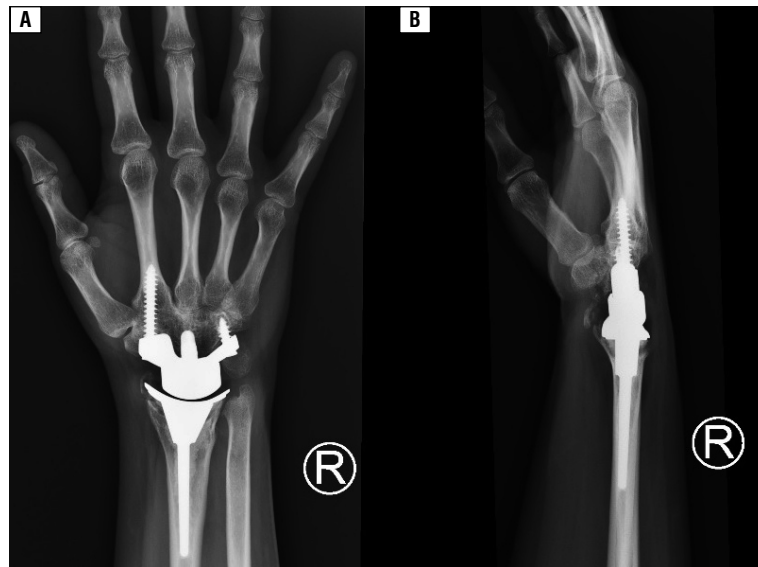


Figure 3. Follow-up (10 years) X-ray of right wrist 4 December 2019: **A.** Anterior-posterior; **B.** Lateral

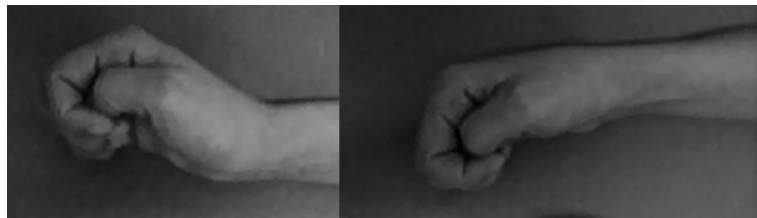


Figure 4. Range of movement before surgery

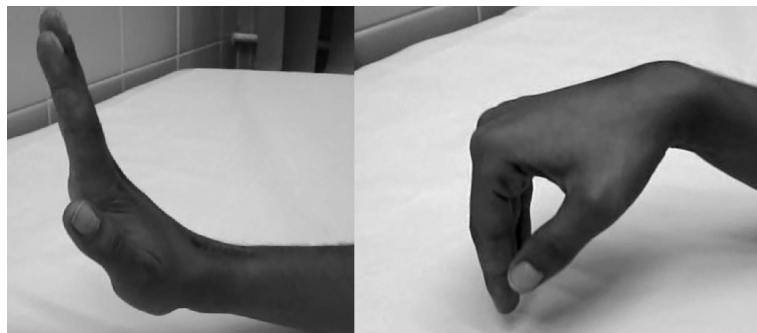


Figure 5. Range of movement 3 weeks after surgery

The next generations can be described as resurfacing arthroplasties. The first was the Biax prosthesis. Articular surfaces were ellipsoid and were set perpendicularly to the axis of the forearm.

Despite the changes in the construction, still, distal element stable fixation was a problem. Aseptic loosening was occurring frequently. Most of the subsequent arthroplasties were modifications of Biax. Screw fixation was chosen to improve the distal element stability. The other concept was also to preserve

wrist bone stock. Altogether it decreased the risk of loosening [5].

One of the most recent implants is Motec[®] with a ball and socket articulation. It is interesting because according to its construction it should be classified as an older generation type of implant [7].

Both distal and proximal implants are settled in bone like a screw. In case of necessity to perform arthrodesis, the Motec system allows such conversion without removal of proximal and distal stems.

TREATMENT OF SEVERE ARTHRITIS OF THE WRIST

Surgical wrist fusion (WF) is the most classic and well-recognized method of treatment of severe deformities. Both partial and complete. However, it is mandatory not to forget about WA. Depending on the criterion, it may have at least the same success rate.

Wrist arthrodesis is very effective. The results are predictable. The surgical technique is well described. It relieves the pain but is not cost-free. However, all the movements are completely blocked, apart from pronation and supination. Interestingly, most of the patients are satisfied. Heavy objects lifting is allowed.

Wrist arthroplasty is an interesting alternative. Historically, WA was applied mostly in patients who suffer from RA — 50–71% of all WA cases. Modern RA drugs, however, slightly decrease this percentage [6].

Older patients who accept resignation from forceful activities and heavy object lifting are the best candidates. This technique decreases or even eliminates the pain while motion is preserved.

Wrist arthroplasty is technically more demanding. It is recommended for a wrist with adequate bone stock without collapse. This is of utmost importance for reliable implantation. The proper positioning of the implant is most important. Usually, problems occur around the carpal implant. The central stem/peg should be placed precisely in the axis of the third metacarpal. It is difficult because RA wrists are ulnar subluxated [7].

Wrist arthroplasty created new possibilities. For a long time, WF was concerned as an irreversible procedure. Modern implants have changed it. There are reports of conversion of WF to WA [6].

DISCUSSION

Wrist arthroplasties decrease the pain and preserve the range of motion to some extent. Mainly wrist extension is reduced. In most cases, it does not reach the so-called functional range of motion. However, both decreases in pain with some preserved range of motion improve patients' quality of life [2, 7]. The risk of failure is reported as similar or higher to wrist fusion [3]. It stresses the importance of proper patient selection for that procedure [2].

Each subsequent generation decreases the risk of failure and increases the survival

rate. Therefore, it approximates them to wrist fusion [8]. Still, the survival rate of WA cannot be compared with knee or hip arthroplasty, but it becomes similar to shoulder and elbow arthroplasty [7].

Compared to fusion, postoperative rehabilitation is longer and more difficult. But the preservation of a range of motion is highly appreciated by patients. Even patients who had a failure in primary WA claim that they would like to undergo the next WA. On the other hand, patients treated with WF are willing to undergo surgery that would regain some motion. Nydick et al. [9] presented good short-term results of WA after a mean follow-up of 28 months. Pfanner et al. [6] evaluated the results of WA in 22 RA patients after a mean FU of 82.3 months. 10 of them had contralateral arthrodesis around the wrist (5 total and 5 radioscapolunate). All of them preferred WA hand [3]. Those results are encouraging, especially compared to the results of Radmer et al. [10] from 2003. APH® prosthesis follow-up was evaluated. All the patients were RA. In all cases revision surgery was necessary.

The complications include fracture, loosening, infection, dislocation, and implant failure. RA increases the risk of inferior results and implant failure. The soft tissue envelope of the wrist, ligament quality and function of tendon stabilizers are impaired in RA [6].

Pfanner et al. [6] evaluated the results of Universal 2® WA in 22 patients with RA. All the patients had pain relief. The mean arc of flexion-extension was 72 degrees. There were 6 revisions: 2 because of carpal implant issues and 4 because of whole prosthesis failure [3]. Frequently RA patients have both wrists affected. In such cases, it is recommended to perform a fusion of the dominant hand wrist. The strong and stable grip is likely to be preserved. Wrist arthroplasty is of choice for the non-dominant hand. The preserved mobility enables easier and more comfortable personal hygiene [1].

Nowadays Motec® WA is gaining more and more attention. The results are good; they raise a question about the application of Motec® in younger patients [11].

All the results of 3/4th generation WA are encouraging. Literature reports very good results of The Maestro® WA [7, 8]. However, in 2018 the manufacturer Zimmer-Biomet Holdings Inc. withdrew the implant from the market and provided the following informa-

tion: The Maestro™ WRS is approved only for its cemented use by the US Food and Drug Administration (FDA) and there are no publications in the literature worldwide on favourable results with its cemented use. Therefore, the surveillance of this implant cannot be guaranteed by the company if it is inserted in a non-cemented manner (i.e. “off-label” use).

CONCLUSIONS

Positive results of modern WA suggest that this technique should not be considered as the last resort. It is a good solution to reconstruct the wrist and regain its function. Postponing the decision of WA may result in inferior results and an increased risk of failure [3].

References

1. Kozlow JH, Chung KC. Current concepts in the surgical management of rheumatoid and osteoarthritic hands and wrists. *Hand Clin.* 2011; 27(1): 31–41, doi: [10.1016/j.hcl.2010.09.003](https://doi.org/10.1016/j.hcl.2010.09.003), indexed in Pubmed: [21176798](https://pubmed.ncbi.nlm.nih.gov/21176798/).
2. Rizzo M, Cooney WP. Current concepts and treatment for the rheumatoid wrist. *Hand Clin.* 2011; 27(1): 57–72, doi: [10.1016/j.hcl.2010.09.004](https://doi.org/10.1016/j.hcl.2010.09.004), indexed in Pubmed: [21176801](https://pubmed.ncbi.nlm.nih.gov/21176801/).
3. Schmidt I. A critical appraisal to the decision by the company Zimmer Biomet to withdraw the Maestro™ Wrist Reconstructive System from the marketplace. *Trauma Emerg Care.* 2018; 3(2), doi: [10.15761/tec.1000162](https://doi.org/10.15761/tec.1000162).
4. Schmidt I. Functional outcomes after salvage procedures for wrist trauma and arthritis (four-corner fusion, proximal row carpectomy, total wrist arthroplasty, total wrist fusion, wrist denervation): A review of literature. *The Open Orthopaedics Journal.* 2019; 13(1): 217–231, doi: [10.2174/1874325001913010217](https://doi.org/10.2174/1874325001913010217).
5. Boeckstyns MEH, Herzberg G. Current European practice in wrist arthroplasty. *Hand Clin.* 2017; 33(3): 521–528, doi: [10.1016/j.hcl.2017.04.004](https://doi.org/10.1016/j.hcl.2017.04.004), indexed in Pubmed: [28673628](https://pubmed.ncbi.nlm.nih.gov/28673628/).
6. Pfanner S, Munz G, Guidi G, et al. Universal 2 wrist arthroplasty in rheumatoid arthritis. *J Wrist Surg.* 2017; 6(3): 206–215, doi: [10.1055/s-0037-1598637](https://doi.org/10.1055/s-0037-1598637), indexed in Pubmed: [28725502](https://pubmed.ncbi.nlm.nih.gov/28725502/).
7. Nair R. Review article: Total wrist arthroplasty. *J Orthop Surg (Hong Kong).* 2014; 22(3): 399–405, doi: [10.1177/230949901402200326](https://doi.org/10.1177/230949901402200326), indexed in Pubmed: [25550026](https://pubmed.ncbi.nlm.nih.gov/25550026/).
8. Berber O, Garagnani L, Gidwani S. Systematic review of total wrist arthroplasty and arthrodesis in wrist arthritis. *J Wrist Surg.* 2018; 7(5): 424–440, doi: [10.1055/s-0038-1646956](https://doi.org/10.1055/s-0038-1646956), indexed in Pubmed: [30349758](https://pubmed.ncbi.nlm.nih.gov/30349758/).
9. Nydick JA, Greenberg SM, Stone JD, et al. Clinical outcomes of total wrist arthroplasty. *J Hand Surg Am.* 2012; 37(8): 1580–1584, doi: [10.1016/j.jhsa.2012.05.016](https://doi.org/10.1016/j.jhsa.2012.05.016), indexed in Pubmed: [22763052](https://pubmed.ncbi.nlm.nih.gov/22763052/).
10. Radmer S, Andresen R, Sparmann M. Total wrist arthroplasty in patients with rheumatoid arthritis. *J Hand Surg Am.* 2003; 28(5): 789–794, doi: [10.1016/s0363-5023\(03\)00307-1](https://doi.org/10.1016/s0363-5023(03)00307-1), indexed in Pubmed: [14507509](https://pubmed.ncbi.nlm.nih.gov/14507509/).
11. Giwa L, Siddiqui A, Packer G. Motec wrist arthroplasty: 4 years of promising results. *J Hand Surg Asian Pac Vol.* 2018; 23(3): 364–368, doi: [10.1142/S2424835518500388](https://doi.org/10.1142/S2424835518500388), indexed in Pubmed: [30282544](https://pubmed.ncbi.nlm.nih.gov/30282544/).