Long-term results of Swanson interpositional wrist arthroplasty: Part II

Fifty-eight Swanson silicone interpositional wrist arthroplasties were done in 47 patients between 1974 and 1984. Thirty-nine of these original wrists were available for follow-up an average of 5.8 years after operation. This is a continuation of our study previously published in this JOURNAL. With increased follow-up, progressive deterioration of clinical results was noted. With a follow-up of less than 2.5 years, 75% had relief of pain. After a follow-up of 4.8 years, 67% had relief of pain. Finally, with an average follow-up of 5.8 years, only 51% had relief of pain. Progressive radiographic changes are now obvious in each case compared with 70% of those cases reviewed at 4.8 years. Furthermore, we now have noted cystic changes in a significant proportion of the wrists radiographically. In several of these, silicone synovitis has been documented histologically. Our indications for this procedure have drastically narrowed. (J HAND SURG 1991;16A:432-7.)

John F. Fatti, MD, Andrew K. Palmer, MD, Seth Greenky, MD, and John F. Mosher, MD, Syracuse, N.Y.

The painful arthritic wrist remains a formidable challenge to the hand surgeon. One can relieve pain and obtain stability with a wrist arthrodesis.1-5 This sacrifices motion, which may be very important to the upper extremity with polyarticular disease.6,9 In trying to maintain a functional range of motion, we have used Swanson silicone rubber interpositional wrist arthroplasties since 1974. This article is the second retrospective review of the Swanson wrist arthroplasty procedures done in Syracuse, N.Y.

Materials and methods

Fifty-eight flexible Swanson silicone rubber interpositional wrist arthroplasties were done for 47 patients between 1974 and 1984. Eleven patients had bilateral Swanson wrist replacements. In our previous review, 53 arthroplasties in 42 patients were available for follow-up. We have continued to follow these index patients and recently reviewed the 39 wrists in the remaining available 30 patients. These patients are the same ones reviewed in the previous study.10 Seven patients (eight wrists) have died, and five patients (six wrists) were lost to follow-up, despite all attempts to find these patients.

Twenty-three females and seven males were available for follow-up. The average age at operation was 51.3 years. The average preoperative duration of arthritis was 4.5 years (range, 1 to 15 years). The most common preoperative diagnosis, seen in 77%, was rheumatoid arthritis (Table I). Wrist pain was the most common indication for surgery (Table II). There were 39 concomitant procedures done on the ipsilateral hand (Table III).

All procedures were carried out by or under the direction of two of the authors (A. K. P. or J. F. M.). The recommended operative technique for wrist arthroplasty described by Swanson was used in all cases. This operative technique has been described elsewhere in detail.10-13

The average follow-up was 5.8 years. All patients were followed-up for more than 3 years. Follow-up examinations were done by an independent observer. The wrists were rated objectively and subjectively as excellent, good, fair, or poor in the same manner as they were rated in the first retrospective review.10

Results

The overall results in these 39 wrists were more discouraging compared with those reported in our previous

From the Department of Orthopedic Surgery, SUNY Health Science Center; Syracuse, N.Y.
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Reprint requests: Andrew K. Palmer, MD, 550 Harrison Center, Syracuse, NY 13202.
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Table I. Preop Swanson wrist

Table II. Indx wrist replacement

Table III. Concomitant procedures

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Table I. Preoperative diagnosis in patients with Swanson wrist replacement

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Patients (No.)</th>
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<tr>
<td>Rheumatoid arthritis</td>
<td>23</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>4</td>
</tr>
<tr>
<td>Posttrauma</td>
<td>1</td>
</tr>
<tr>
<td>Juvenile rheumatoid arthritis</td>
<td>1</td>
</tr>
<tr>
<td>Ankylosing spondylitis</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>30</strong></td>
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Table II. Indications for Swanson wrist replacement

<table>
<thead>
<tr>
<th>Indication</th>
<th>Wrist (No.)</th>
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<tr>
<td>Pain</td>
<td>29</td>
</tr>
<tr>
<td>Extensor tendon rupture</td>
<td>2</td>
</tr>
<tr>
<td>Pain and extensor tendon rupture</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>39</strong></td>
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Table III. Concomitant hand procedures with wrist replacements

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number</th>
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<tbody>
<tr>
<td>Clear cap (5)</td>
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<tr>
<td>Extensor tendon transfer (8)</td>
<td></td>
</tr>
<tr>
<td>Extensor tendon repair (5)</td>
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<tr>
<td>MP arthroplasty (4)</td>
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<tr>
<td>MP synovectomy and intrinsic release (1)</td>
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<td>PIP arthroplasty (1)</td>
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<tr>
<td>Extensor tendon free graft (1)</td>
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<tr>
<td>PIP arthrodesis (3)</td>
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<tr>
<td>PIP manipulation and pinning (2)</td>
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</tr>
<tr>
<td>Thumb IP joint fusion (6)</td>
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<tr>
<td>Thumb CMC arthroplasty (1)</td>
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<tr>
<td>Flexor tenosynovectomy (2)</td>
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</table>

Table IV. Results of Swanson wrists (average follow-up 5.75 years)

<table>
<thead>
<tr>
<th>Quality</th>
<th>Patients</th>
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</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>3</td>
</tr>
<tr>
<td>Good</td>
<td>7</td>
</tr>
<tr>
<td>Fair</td>
<td>10</td>
</tr>
<tr>
<td>Poor</td>
<td>19</td>
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Table V. Wrist alignment at last visit or previous reoperation

<table>
<thead>
<tr>
<th>Deviation</th>
<th>Mild</th>
<th>Severe</th>
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<tbody>
<tr>
<td>Radial</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Ulnar</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Neutral</td>
<td>17</td>
<td></td>
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Table VI. Radiologic evaluation of Swanson wrist implants

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Implant collar settling into distal radius and carpus</td>
<td>23</td>
</tr>
<tr>
<td>Abutment of remaining carpus onto the distal radius</td>
<td>17</td>
</tr>
<tr>
<td>Cystic changes in distal radius and/or carpus</td>
<td>10</td>
</tr>
<tr>
<td>Wrist implant breakage</td>
<td>8</td>
</tr>
<tr>
<td>Ulnar deviation of distal implant</td>
<td>8</td>
</tr>
<tr>
<td>Radial deviation of distal implant</td>
<td>5</td>
</tr>
<tr>
<td>Ulnar cap broken</td>
<td>2</td>
</tr>
<tr>
<td>Distal implant not in third metacarpal</td>
<td>1</td>
</tr>
<tr>
<td>Palmar wrist subluxation</td>
<td>1</td>
</tr>
</tbody>
</table>

strength testing. There were no objective differences in strength in pre- versus post-wrist replacement. Preoperative grip strength averaged 13.5 pounds and 12.6 pounds after operation. Pinch strength ranged from 4.5 pounds to 4.9 pounds. Subjectively, most patients believed that the hand was stronger.

Wrist alignment. Immediately after operation, 30 of the 39 wrists were well aligned. The remaining nine wrists had mild ulnar or radial deviation. Follow-up before failure or at the last visit revealed only 17 of the 39 wrists remained well aligned. Eleven had mild ulnar or radial deviation and 11 had severe ulnar or radial deviation (Table V).

Complications and reoperations. Sixteen reoperations were necessary in 39 wrists. Unremitting pain in five wrists, a painful broken prosthesis with wrist subluxation in nine wrists, and a deep infection in two wrists necessitated these reoperations.

Fourteen prostheses were broken. Nine were revised because of pain and subluxation. Five broken prostheses remained without operation.

Radiographic analysis. Complete radiographic anal-
analysis was available for 35 of the 39 wrists. Progressive radiographic deterioration was noted in every wrist followed-up for more than 3 years (Table VI). The most common finding was settling of the implant collar into the distal radius proximally and the remaining carpal bones distally (Fig. 1). Progressive abutment of the carpus on the distal radius was also very common. Cystic changes in the radius and/or carpus, a feature not observed in our last review, was also noted in 10 wrists.

We could not establish a statistically significant correlation between radiographic characteristics and clinical results. X-ray findings were not used to determine results. As noted in our last review, all the wrists that were clinical failures were also radiographic failures.

Silicone synovitis. Our radiographic review revealed 10 cases where cystic changes were present in the radius and/or carpus. This radiographic appearance was typical of those reports demonstrating silicone synovitis. Since we did not operate on each of these 10 cases, it is possible that these were rheumatoid bone cysts. However, pathologic specimens from two of the cases, where a fractured prosthesis was removed, revealed silicone particles with a giant cell foreign body reaction (Fig. 2). Those areas were seen as frank cysts invading the normal bone. These findings are different from those in our first retrospective review when there were no signs of silicone synovitis, either radiographically or histologically.

Analysis of poor results. A careful analysis of the results in 1984, and of those in this review, revealed that the final result was not affected by prior surgery in the wrist, handedness, sex, age, chronic systemic steroids, duration of postoperative immobilization, or degree of postoperative wrist ROM. It was noted that a preoperative diagnosis of osteoarthritis, posttraumatic arthritis, or rheumatoid arthritis that continued with severe systemic activity had an increased incidence of poor results. Most notably, irrespective of a diagnosis, the incidence of failure dramatically increased with time.

Results of reoperations. In assessing our reoperations, two patients who had an infection had a resection arthroplasty with one fair and one poor result. Of the other 14 wrists that were revised, 12 had a revision silicone arthroplasty, 2 with excellent results, 2 with good, 5 with fair, and 2 with poor results (Fig. 3). Two were converted, both with excellent results.

Discussion

This is a reexamination of a group of patients, all with silicone wrist arthroplasties, who were first reviewed in 1984. Progressive deterioration of clinical results has occurred with longer follow-up. Our earlier report revealed that individuals with follow-up of less than 2.5 years had 77% good or excellent results. Those with follow-up averaging 4.8 years had 61% good or excellent results. Our present review, with a follow-up of 5.8 years, revealed only 26% still have good or excellent results. We concur with Brase and Millender,4 and more recently, with Comstock and colleagues15 that there is a high failure rate of silicone rubber wrist arthroplasty which further deteriorates with time.

In an effort to compare the same populations, the 39 wrists presently being studied were extracted from the 53 wrists that were studied in the 1984 review. Thus we analyzed a fixed population over time. Good-to-excellent results were found in 23 (59%) of 39 wrists in the 1984 study. In the present study, only 10 (26%) of 39 wrists had good-to-excellent results.

As in other reviews, our most common operative indication was a painful rheumatoid wrist.11-15 Pain relief was uniform early in follow-up, which agrees with many of the other studies. However, with this report at a follow-up time of 5.8 years, only 51% had relief of pain.

Wrist implant fracture has become more prevalent with further follow-up. Thirty-six percent of the 39 wrists followed-up for 5.8 years had a fractured prosthesis. Nine of the fourteen had a painful subluxed wrist which required revision. This again coincides with the findings of Comstock and associates15 whose implant
Fig. 1. Forty-eight-year-old patient with rheumatoid arthritis. A, progressive ulnar deviation, ulnar cap breakage, radiocarpal abutment, and possible cyst formation (shaft and base of third metacarpal, intramedullary canal of distal radius). B, On revision for pain, Swanson wrist and ulnar cap both were broken.

Fig. 2. Histologic section from wrist revision where prosthesis was found broken. Center areas contain a foreign body giant cell reaction containing a fibro-inflammatory infiltrate, engulfed silicone particles (smaller arrows) that are nonbirefringent, and giant cells. The surrounding area is remodeling bone (large arrows). (Magnification ×40.)

fracture rate was 65%. All of the fractures in our wrists occurred at the junction of the distal stem and collar of the prosthesis. We did not use the titanium grommets now recommended by Swanson in any of these cases. In contrast to our 1984 radiographic review in which 70% of the wrists showed some deterioration, we noted that 100% of the wrists reviewed were now radiographically abnormal. Other than prosthetic fracture, there were no radiographic findings that could be correlated with clinical results.
Fig. 3A and B. This 52-year-old patient with rheumatoid arthritis had a wrist arthroplasty in 1981. By 1983, the patient had prosthetic breakage (noted best on the lateral view). There is possible cyst formation (intramedullary radius endosteal scalloping) at this time.

Fig. 3C and D. At revision surgery, the prosthesis was broken and a high performance wide Swanson wrist was used for revision.

Fig. 3E and F. Within 10 months, the revision wrist implant was also broken.

Significantly, in contrast with our previous review, 10 wrists now had radiographic changes consistent with silicone synovitis. Cystic changes in the distal radius or remaining carpal bones were found in these wrists. Documentation of silicone synovitis (foreign body giant cells, fibroinflammatory tissue, nonbirefringent crystals) has been obtained histologically on removal of two of the implants. These findings may have significant implications for long-term placement of these prostheses.

Results of salvage surgery with a revision arthroplasty were not as encouraging as in our last report. Twelve wrists underwent revision to another prosthesis (two Volz wrist replacements, one Hamus wrist replacement, and nine high-performance wide Swanson silicone wrists). Five of 12 of these have good or ex-
excellent results as compared with six of eight in the 1984 review.

Our continued follow-up of Swanson wrist arthroplasties, now with an average follow-up of 5.8 years, has resulted in some distressing findings. Continued clinical deterioration, progressive radiologic changes, and the possibility of increasing silicone synovitis have narrowed our indications for this procedure dramatically. We use silicone wrist replacement for rheumatoid arthritis with nonactive disease, who have a very low demand on their upper extremity, whose wrist is well aligned and has good bone stock, and who does not need that hand for ambulatory aid use. We consider other wrist reconstructive procedures first, such as wrist synovectomy and distal ulnar resection, scapho-lunate fusion, and total wrist fusion depending on the patient's individual circumstances. We follow these patients very closely and advise them of the possibility of prosthetic deterioration and the need for future re-revision surgery.

REFERENCES