Salvage procedures for degenerative osteoarthritis of the wrist due to advanced carpal collapse

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INTRODUCTION

A lot has been written on the degenerative osteoarthritis of the wrist due to advanced carpal collapse since the pattern has been described in 1984 by Watson and Ballet (56). Several operative treatment options have been advocated: radio-carpal arthrodesis (RCA), partial wrist arthrodesis, resection or prosthetic arthroplasty and denervation all have been reported as valuable procedures. None of the comparative studies between proximal row carpectomy (PRC) and the four-corner procedure could demonstrate a significant difference (6, 31, 36, 39, 53, 60). Krimmer (32) compared partial four-corner arthrodesis with full radiocarpal arthrodesis and found no difference either. A previous survey of radiocarpal arthrodeses in our department revealed disappointing results (11).

The purpose of this paper is to see if four-corner arthrodesis (4CA) and PRC resulted in a better outcome than the full radiocarpometacarpal arthrodesis.

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MATERIAL AND METHODS

This is a retrospective survey in a training hospital with all inherent inconveniences. We reviewed all patients who were treated for degenerative osteoarthritis of the wrist due to advanced carpal collapse: scapholunate advanced collapse (SLAC) and scaphoid non-union advanced collapse (SNAC). Sixty-three patients with 63 involved wrists could be retrieved: 19 underwent an RCA, 26 a PRC and 18 a 4CA. The choice of the procedure was mainly determined by the surgeons’ preference (five surgeons were involved). PRC was judged not indicated when severe damage on the head of the capitate was radiologically visible; minor cartilaginous damage on the capitate observed during a PRC did not change the operative plan. The surgical procedures have been described previously by several authors. There were 47 men and 16 women with a mean age of 50 years (range 28 to 73 y). The right side was involved 36 times, the left 27 times; the dominant side 38 times, the non-dominant 25 times. There were 42 SLAC wrists and 21 SNAC wrists. There were no significant differences concerning age, gender distribution, pathology and involved side (left/right and dominant/non-dominant) between the patients in the three groups. The RCA group included significantly more blue collar workers than the 4CA group (p < 0.01 t-test). The PRC group was somewhat between both and not significantly different from the two other groups (table I).

The follow-up examination was performed by independent observers not involved in the patients’ treatment: they asked for patients satisfaction (more than 75% satisfied with the procedure or not?), the DASH score (22) was used to evaluate the disability; range of motion and gripping strength were measured. The follow-up time was 64 months (SD 19.2) for RCA, 68 for (SD 35.3) PRC and 31 (SD 24.1) for 4CA. The difference in follow-up between RCA and PRC was not significant, but the 4CA was only performed more recently, with as a result a significantly shorter follow-up than in the PRC and RCA groups (p < 0.01, t-test).

All data were analysed and compared with chi square test and Students’ t-test and paired t-test. Significance was set at p < 0.05.

RESULTS

The results are summarised in table II. In the RCA group, 10 patients were satisfied, 9 were not; in the PRC group 16 were satisfied, 10 were not and in the 4CA, 8 were satisfied, 10 were not. Differences were statistically not significant (chi square p > 0.1). The mean DASH score was 45.2 (SD 23.6) for RCA, 16.0 (SD 16.8) for PRC and 38.7 (SD 30.9) for 4CA. There were no significant differences between PRC and 4CA, but for the outcome (DASH) score the difference was significant between RCA and PRC (Student’s t-test, p < 0.001) and between PRC and 4CA (Student’s t-test p = 0.003).

The range of motion after PRC and 4CA was in the functional range. Between these two groups the values were not significantly different (p > 0.05) (t-test). Gripping force was not significantly different between the three groups. Only in the PRC group did we note a significant increase from preoperative to postoperative values (p < 0.006, paired t-test). There was a significant correlation between the DASH score and the gripping force at follow-up: (p = 0.046 with a correlation coefficient r = −0.39).

DISCUSSION

For several decades, and up until now in numerous publications and textbooks, total wrist arthrodesis or radiocarpometacarpal arthrodesis has been considered the gold standard for unsolved wrist problems. These often follow occupational

<table>
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<tr>
<th>Table I. — Summary of the data of the cohort</th>
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<tbody>
<tr>
<td>N°</td>
</tr>
<tr>
<td>RCA</td>
</tr>
<tr>
<td>PRC</td>
</tr>
<tr>
<td>4 CA</td>
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injuries and, for most insurance companies, this statement is of interest, as wrist fusion makes it possible to put an end to a sometimes long history. However there have been more critical voices (10, 11, 16, 38). The outcome of wrist arthrodesis has been studied by several authors. Their results have varied widely, and the outcome probably depends on socio-economic provisions, the composition of the patient cohort and the outcome assessment method used by the author(s) (5, 10, 14, 16, 20, 21, 29, 34, 38, 42, 44, 46, 49, 57, 58). Complete pain relief has been reported respectively in all patients (57), in 84% of cases (42), in 76% (21) and in 70% (44). However other series have less optimistic results: Nagy and Buchler (38) found that only 56% of their patients had relief while only 25% of Gaisne et al (16) patients were pain free. Field et al (14) found a postoperative visual analogue score for pain of 4/10 and Sauerbier et al (46) reported that pain was reduced on average by half. The postoperative DASH scores were 46 and 52 in two recent series (29, 46). The mean time off work has been reported in recent studies to be between 4.5 and 6 months (14, 46, 57) but 15% to 54% of the patients did not return to work. Gaisne et al (16) reported a mean time off work of 15 months and only seven patients could resume their previous work, seven had a lighter job and 17 of the 34 remained unemployed.

PRC converts a complex link joint system to a simple hinge joint by creating a radio-capitate articulation. The result is not physiologic and normal kinetics should not be expected, but satisfactory clinical results have been reported in most follow-up series (1, 3, 7, 8, 13, 15, 19, 23-27, 33, 35, 40, 41, 43, 45, 48, 50-52, 59). Jebson et al (26) revealed only a trend toward an increasing prevalence and degree of osteoarthritis with longer follow-up evaluation: range of postoperative motion reported in prior studies has been variable, ranging from 40% to 60% of the unaffected side. Radial deviation has consistently been the movement most affected. A major criticism of PRC is weakness, which is believed to be secondary to the mechanical effect of the relative tendon lengthening. A large literature review has been presented by Nagelvoort et al in 2002 (37). They found a mean gripping force varying between 60 and 100% of the contralateral side. Trackle et al in 2003 obtained only 54% gripping force (54). Only the recent articles mention the DASH score; it ranges between 9 and 36 (12, 36, 37, 51, 54). A large series of 50 patients with a minimum follow-up of one year in our department found a DASH score of 18 and a gripping force of 70% (Robijns et al, Scand J Plast, Reconstr & Hand Surgery, accepted for publication).

In 1984 Watson and Ballet (56) described the SLAC pattern and proposed scaphoid replacement

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**Table IIa. — Outcome (DASH) and range of motion (ROM) (mean SD)**

<table>
<thead>
<tr>
<th>Follow-up (months)</th>
<th>Satisfaction Yes/No</th>
<th>DASH Score</th>
<th>Extension/flexion</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCA</td>
<td>64</td>
<td>10/9</td>
<td>45.2 (23.6)</td>
</tr>
<tr>
<td>PRC</td>
<td>68</td>
<td>16/10</td>
<td>16 (16.8)</td>
</tr>
<tr>
<td>4CA</td>
<td>31</td>
<td>8/10</td>
<td>39 (30.9)</td>
</tr>
</tbody>
</table>

**Table IIb. — Gripping force: mean (standard deviation) in kgf**

<table>
<thead>
<tr>
<th>Preop force</th>
<th>Postop force</th>
<th>contralateral</th>
</tr>
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<tbody>
<tr>
<td>RCA</td>
<td>13 (6.6)</td>
<td>20 (12.5)</td>
</tr>
<tr>
<td>PRC</td>
<td>22 (11.7)</td>
<td>31 (26.8)</td>
</tr>
<tr>
<td>4CA</td>
<td>24 (5.7)</td>
<td>24 (12.0)</td>
</tr>
</tbody>
</table>

(PRC = proximal row carpectomy, 4CA = four corner arthrodesis, RCA = radiocarpal arthrodesis).
with a silicone implant, combined with a 4CA. Later on, due to the ongoing problems with silicone implants, scaphoid excision rather than replacement was combined with four-corner arthrodesis. Since then numerous investigators have reported favourable outcome with this procedure (2, 4, 9, 17, 18, 28, 30, 31, 47, 55, 60).

A few authors compared PRC with partial arthrodesis (scaphoidectomy and 4-corner arthrodesis); none of them observed any significant differences in terms of functional results (6, 31, 36, 39, 53, 60).

Krimmer et al in 2000 (32) compared RCA with 4CA and found no significant difference in DASH score (33 for 4CA in 97 patients and 45 for RCA in 41 patients) and both groups were satisfied (respectively 86 and 84%).

Dap et al (10) compared their arthrodesis group with a multicentre group of PRC patients; this was in favour of PRC, but the study did not compare similar groups.

The strength of this study is that is a relatively homogeneous series with well-defined pathology in one institution. There were reasonably complete data available and the DASH score was used for final evaluation.

All recent follow-up studies have introduced this concept of disability evaluation in their outcome analysis. A quick search in Medline revealed more than 200 case controlled studies since 1997 using the DASH questionnaire. The weakness of this study however is its retrospective nature with all drawbacks inherent to retrospective studies: missing data, lost to follow-up, incomplete files, dissimilar indications. Besides, the allocation of the individual patients to a specific operative technique was not randomised, but was decided by the responsible surgeon based on specific clinical and radiological features, so that the three groups may not have been entirely comparable, all the more as five surgeons and several residents and fellows were involved, and the techniques were not always similar.

This survey demonstrates that PRC gives less disability than arthrodesis, partial or total, although prospective randomised investigations however are required for confirmation. The functional result following partial arthrodesis (4CA) was not significantly different from RCA, but the preservation of a functional range of motion was preferred by most patients. Concerning gripping force, the three groups had a similar outcome, with a recovery which was in no instance comparable with the non-operated side. The classical statement that RCA produces stronger hands than PRC did not hold true in this survey.

REFERENCES


