Mod Rheumatol (2003) 13:239–242
DOI 10.1007/s10165-003-0229-6

ORIGINAL ARTICLE

Natsuko Nakagawa · Shuji Abe · Hiroshi Kimura
Shigeaki Imura · Yasuro Nishibayashi · Sinichi Yoshiya

Comparison of the Sauvé–Kapandji procedure and the Darrach procedure for the treatment of rheumatoid wrists

Received: November 13, 2002 / Accepted: December 25, 2002

Abstract In surgical treatment of the rheumatoid wrist, the Darrach procedure combined with synovectomy has been the treatment of choice in the past. However, owing to the significant ulnar carpal shift observed after the Darrach procedure, the Sauvé–Kapandji (S–K) procedure has become increasingly popular. The purpose of this study was to compare the clinical results of the S–K and Darrach procedures. Thirty-two wrists in the S–K-procedure group and 31 wrists in Darrach-procedure group were examined. Before and after surgery, clinical evaluations of pain, swelling, range of motion, grip strength, and radiological findings were performed and the results were compared. Both procedures resulted in decreased pain and swelling, as well as improved rotatory motion of the forearm. The S–K procedure was shown to be superior to the Darrach procedure in reducing ulnar carpal migration and improving grip strength. On the other hand, the prevention of carpal bone destruction could not be completely achieved in either procedure.

Key words Darrach procedure · Rheumatoid arthritis (RA) · Sauvé–Kapandji (S–K) procedure · Synovectomy

Introduction

The most common surgical procedure for the alleviation of symptoms caused by a rheumatoid wrist was, until recently, the Darrach procedure combined with synovectomy.[1,2] However, owing to postoperative problems with the Darrach procedure caused by significant ulnar carpal shift,[3–6] in recent years, the Sauvé–Kapandji (S–K) procedure has replaced the Darrach procedure as the most common surgical procedure for the treatment of a rheumatoid wrist.[7–9]

Since 1993, we have treated rheumatoid wrists with synovectomy combined with the S–K procedure, while prior to 1993 we used the Darrach procedure. This retrospective study evaluates and compares the clinical results of these two procedures.

N. Nakagawa (✉) · S. Abe · H. Kimura · S. Imura
Department of Orthopaedic Surgery, Konan Kakogawa Hospital, 1545-1 Saijo, Kanno-cho, Kakogawa 675-8545, Japan
Tel. +81-794-38-0621; Fax +81-794-38-1258
e-mail: nnakagawa_kkb@knc.kakogawa.or.jp

Y. Nishibayashi
Department of Orthopaedic Surgery, Miki–Sanyo Hospital, Miki, Japan

S. Yoshiya
Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine, Kobe, Japan

Patients and methods

Indications for surgery

The indications for surgery were as follows: (1) pain and swelling caused by rheumatoid wrist with radio-ulnar joint disorder, and (2) extensor tendon rupture caused by extensor tenosynovitis and radio-ulnar joint disorder. Surgery was recommended if those two findings were confirmed.

Patient profiles

S–K group. From June 1993 to April 1999, 28 patients (32 wrists) with symptoms caused by rheumatoid arthritis (RA) underwent synovectomy combined with the S–K procedure. There were 5 men and 23 women. Their mean age at the time of surgery was 56.6 years (range 34–86 years). The mean time from the operation to the most recent follow-up was 40 months (range 12–82 months).

Darrach group. From March 1985 to February 1993, 26 patients (31 wrists) with RA underwent synovectomy combined with the Darrach procedure. There were 3 men and 23 women. Their mean age at the time of surgery was 45.3 years (range 28–67 years). The mean time from the operation to the most recent follow-up was 92 months (range 84–151 months) (Table 1).

Table 1. Patient profiles

	S–K procedure	Darrach procedure
Subjects	32 wrists in 28 patients	31 wrists in 26 patients
Sex (male : female)	5 : 28	3 : 23
Average (range) age at operation (years)	56.6 (34–86)	45.3 (28–67)
Average (range) follow-up period (months)	40 (12–82)	92 (84–151)

Table 2. Wrist extension and flexion before and after surgery

		S–K procedure Mean ± SD	Darrach procedure Mean ± SD
Wrist extension (°)	Preoperative	23.7 ± 21.2	35.3 ± 19.2
	Postoperative	23.6 ± 22.3	27.3 ± 19.3*
Wrist flexion (°)	Preoperative	29.4 ± 23.6	29.6 ± 14.6
	Postoperative	8.5 ± 14.4*	13.3 ± 15.9*

* Significant difference compared with the preoperative value ($P < 0.05$)

Operative technique

S–K procedure. A longitudinal incision was made in the dorsum of the wrist, and the pretendinous retinaculum was exposed and incised along the fourth compartment. The retinaculum was reflected ulnarly, and the neck of the ulna was exposed. Then, transverse osteotomy was carried out with a small power saw at 1–1.5 cm proximal to the ulnar end to create the proximal pseudarthrosis. A segment of ulna was resected to a length of about 1 cm. The aim was to achieve a final gap of approximately 1 cm at the end of the procedure. Once the osteotomy had been performed the ulnar head became mobile, and synovectomy of the wrist was performed with the joint surfaces excised. To ensure fusion, two good cancellous surfaces were exposed. To fuse the head of the ulna to the distal radius, we have been using absorbable screws since 1998, while AO screws had been used prior to that time.

Darrach procedure. The surgical approach before creating the pseudarthrosis was almost identical to that of the S–K procedure. After the neck of the ulna was exposed, instead of fusing the ulnar end to the radius, the ulnar head was excised to a length of about 1–1.5 cm.

Postoperative management

Postoperative management was the same in both groups. Postoperatively, all patients were protected in a short arm cast for 3 weeks. Then, active range-of-motion exercises were started after removal of the cast.

Evaluation

At the time of the follow-up examination, symptoms (pain, swelling), range of motion, and grip strength were evaluated, and the patient's satisfaction was also assessed at face-to-face follow-up interviews. All the subjects were examined by the first author (N.N.). In a radiological examination, the collapse of the carpal bones was evaluated as carpal height ratio (CHR, i.e., the ratio of the distance between the radius and the hamate to the length of the third metacarpal bone), and ulnar dislocation of the carpal bones was evaluated as carpo radial distance ratio (CRDR, i.e., the ratio of the distance between the movement center of the wrist and the radial side of the radius to the length of the third metacarpal bone), as described by Youm et al.[10]

In the statistical analysis, Student's paired *t*-test was used to compare the results. The significance level was set at $P < 0.05$.

Results

Symptoms

At the latest follow-up, most patients reported no pain in both the S–K and Darrach groups, while 4 of the 32 (12.5%) wrists in the S–K group and 6 of the 31 wrists (19.4%) in the Darrach group complained of mild pain. Similarly, swelling had disappeared in most cases in both the S–K and Darrach groups, while 2 wrists (2.3%) in the S–K group and 5 wrists (15.7%) in the Darrach group showed mild residual swelling.

Range of motion

Range of motion was measured on the day before the operation and at the latest follow-up examination. In the S–K group, the mean wrist extension angles before and after the operation were almost the same, although wrist flexion angles showed a significant difference between pre- and postoperative values ($P < 0.05$) (Table 2). In the Darrach group, however, both wrist extension and flexion decreased significantly after surgery ($P < 0.05$) (Table 2).

On the other hand, when range of motion was examined for pronation and supination, significant postoperative

Table 3. Pronation and supination before and after surgery

		S–K procedure Mean ± SD	Darrach procedure Mean ± SD
Pronation (°)	Preoperative	75.8 ± 14.2	76.0 ± 15.1
	Postoperative	86.1 ± 14.5*	83.3 ± 14.0*
Supination (°)	Preoperative	77.8 ± 12.1	71.0 ± 25.9
	Postoperative	86.2 ± 13.4*	85.3 ± 6.2*

* Significant difference compared with the preoperative value ($P < 0.05$)

Table 4. Grip strength

		S–K procedure Mean ± SD	Darrach procedure Mean ± SD
Grip strength	Preoperative (mm Hg)	109.9 ± 47.2	109.9 ± 57.5
	Postoperative (mm Hg)	147.5 ± 50.5	127.5 ± 72.5
	Improvement ratio* (%)	35	16

* Difference between pre- and postoperative values/preoperative value

Table 5. Radiological parameters before and after surgery

		S–K procedure Mean ± SD	Darrach procedure Mean ± SD
Carpal height ratio	Preoperative	0.43 ± 0.07	0.44 ± 0.04
	Postoperative	0.40 ± 0.07*	0.38 ± 0.05*
Carpo-radial distance ratio	Preoperative	0.41 ± 0.05	0.403 ± 0.06
	Postoperative	0.41 ± 0.07	0.44 ± 0.06*

* Significant difference compared with the preoperative value ($P < 0.05$)

improvement in the range of motion was observed in both groups ($P < 0.05$) (Table 3).

Grip strength

In both groups, mean preoperative grip strength was 109.9 mm Hg. Postoperatively, measured value for the two groups increased 147.5 and 127.5 mm Hg, respectively. Thus, in both groups, grip strength improved significantly ($P < 0.01$). When the improvement ratio was compared between the two groups, the improvement was more distinct in the S–K group than the Darrach group (Table 4).

Radiological examination

The progression of carpal bone destruction presented as significant postoperative reduction in CHR value, was observed in both groups ($P < 0.01$). The extent of ulnar dislocation of the carpal bones, expressed as CRDR, remained at the same level in the S–K group (Fig. 1), while a significant progression in the deformity occurred postoperatively in the Darrach group (Fig. 2, Table 5).

Patient satisfaction

In the patient's subjective assessment, satisfactory results were achieved for 87.5% of the S–K group and 70.9% of the

Fig. 1. Pre- and postoperative anteroposterior radiographs of a 75-year-old woman who underwent the S–K procedure. Five years after surgery, the wrist pain and swelling had disappeared, and carpal height as well as carpo-radial distance showed no significant difference compared with those before surgery

Fig. 2. Pre- and postoperative anteroposterior radiographs of a 54-year-old woman who underwent the Darrach procedure. Fifteen years after surgery, a significant progression in ulnar carpal migration and carpal bone destruction was observed

Darrach group. The predominant factors associated with the unsatisfactory results were the instability of the carpal bones and ulnar deviation.

Discussion

The clinical significance of synovectomy for RA wrists has been established because of consistent results in the relief of pain and the low recurrence rate. Although wrist synovectomy was conventionally combined with resection of the distal end of the ulna (Darrach procedure), recently, the S–K procedure has become the procedure of choice owing to the lower rate of ulnar migration, improved grip strength, and postoperative cosmetic benefits.[11,12]

The results of the present study comparing the two procedures confirmed that the S–K procedure is superior to the Darrach procedure in reducing the incidence of postoperative ulnar migration and radial rotation. Although it has been reported that the Darrach procedure is acceptable in cases where the radio-carpal bones are already fused and stabilized, we have consistently used the S–K procedure since 1993. The postoperative cosmetic aspect is another factor that favors the S–K procedure.

However, there have been several reports suggesting potential problems and limitations associated with the use of the S–K procedure. First, the progression of ulnar carpal migration cannot be completely prevented by the S–K procedure.[12] Secondly, the postoperative range of motion of the wrist joint in flexion and extension has been reported to decrease after this procedure, while improvements in pronation and supination have also been observed. This reduction in flexion and extension could be advantageous in terms of wrist stability. On the other hand, the decrease in the range of motion of the wrist clearly hampers some of the activities of daily living. Ideally, RA patients should have a stable wrist with a good range of motion. Therefore, it is necessary to consult the patient before surgery and assess their needs before determining the surgical indications and the procedure selection.

In addition, the S–K procedure cannot prevent carpal bone destruction and instability on the volar side of the wrist. Therefore, other procedures must be selected for some cases such as carpal bone dislocation from the volar side, cases of severe ulnar carpal migration, and those with reduced carpal height for the scapho-lunate dislocation. In such cases, it is suggested that radio-lunate fusion should be performed to correct the carpal bone position and prevent deformity.[13] Moreover, for cases with seriously destroyed carpal bones associated with incorrect joint structure, total wrist joint fusion might also be indicated. However, in our clinical experience, a relatively good radio-carpal joint can be maintained even with destroyed carpal bones. These cases could be managed with the fibrous nonunion procedure, in which repositioned carpal bones are temporarily fixed with K-wire, thus maintaining a small amount of joint motion and preventing total wrist fusion.

Both the S–K and Darrach procedures are able to decrease pain and swelling, as well as improve the rotatory motion of the forearm. However, the S–K procedure is superior to the Darrach procedure in reducing ulnar migration, and improving grip strength and postoperative cosmetic outcome. On the other hand, the prevention of carpal bone destruction could not be completely achieved with either procedure.

References

1. Darrach W. Anterior dislocation of the head of the ulna. Ann Surg 1912;56:802–3.
2. Darrach W. Partial excision of the lower shaft of the ulna for deformity following Colles fracture. Ann Surg 1913;57:764–5.
3. Ishikawa H, Hanyu T, Tajima T. Rheumatoid wrists treated with synovectomy of the extensor tendons and the wrist joint combined with the Darrach procedure. J Hand Surg 1992;17A:1109–17.
4. Jackson I, Milward TM, Lee P, Webb J. Ulnar head resection in rheumatoid arthritis. Hand 1974;6:172–80.
5. Jensen CM. Synovectomy with resection of the distal ulna in rheumatoid arthritis of the wrist. Acta Orthop Scand 1983;54:754–9.
6. Thirupathi RG, Ferlic DC, Clayton ML. Dorsal wrist synovectomy in rheumatoid arthritis–a long-term study. J Hand Surg 1983;8:848–56.
7. Kapandji AI. The Sauvé–Kapandji procedure. J Hand Surg 1992;17B:125–6.
8. Taleisnik J. The Sauvé–Kapandji procedure. Clin Orthop 1992;275:110–23.
9. Millroy P, Coleman S, Ivers R. The Sauvé–Kapandji operation. J Hand Surg 1992;17B:411–4.
10. Youm Y, McMurtry RY, Gillespie TE. Kinematics of the wrist. J Bone Joint Surg 1978;60-A:423–31.
11. Vincent KA, Szabo RM, Agee JM. The Sauvé–Kapandji procedure for reconstruction of the rheumatoid distal radioulnar joint. J Hand Surg 1993;18-A:978–83.
12. Chantelot C, Fontaine C, Flipo RM, Migaud H, Le Coustumer F, Duquennoy A. Synovectomy combined with the Sauvé–Kapandji procedure for the rheumatoid wrist. J Hand Surg 1999;24B:405–9.
13. Ishikawa H, Hanyu T, Saito H, Takahashi H. Limited arthrodesis for the rheumatoid wrist. J Hand Surg 1992;17A:1103–9.