

RADIAL OSTEOTOMY AND SAUVÉ-KAPANDJI PROCEDURE FOR DEFORMITIES OF THE DISTAL RADIUS

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We treated 12 patients with a posttraumatic or congenital deformity of the distal radius. A radial osteotomy and a Sauvé-Kapandji procedure were carried out. In 9 patients the deformity was caused by a malunited fracture ; the other 3 patients were referred to us with a Madelung deformity. We performed 6 open wedge osteotomies and 6 closing wedge osteotomies.

All but one patient rated the result of the operation as good or excellent. The reason for the only failure could be carpal instability.

Keywords : radius ; ulna ; osteotomy ; Sauvé-Kapandji.

Mots-clés : radius ; cubitus ; ostéotomie ; Sauvé-Kapandji.

INTRODUCTION

Malunion is a well-known complication of fractures of the distal radius. It causes pain, functional impairment and cosmetic problems. Several operations have been described. Excision of the distal end of the ulna was made popular by Darrach. This operation has been the method of choice for several years, although several articles reported poor results (1, 7). Some authors performed a radial osteotomy alone (5, 10, 12), an operation giving a good or excellent result in about 75% of the cases. Later Fernandez introduced a radial osteotomy in association with a Bowers arthroplasty (6). To avoid problems with the distal ulnar stump we performed a Sauvé-Kapandji instead of the Bowers procedure (3, 15).

MATERIAL AND METHODS

We operated on 12 patients. Because of the similarity, we also included 3 patients with a Madelung deformity.

The sex ratio was 9 women to 3 men, and the mean age was 31 years (14 to 58 years). The follow-up ranged from 5 months to 36 months.

In 9 patients the deformity was caused by a malunited fracture ; 6 had a Colles fracture and 3 a Smith fracture. The other 3 patients were referred to us with a Madelung deformity. We performed 6 open wedge osteotomies and 6 closing wedge osteotomies.

All patients were referred to us by other hospitals. They were examined preoperatively. The Cooney score was used to evaluate the end results (2) (table I). Radiographs were evaluated and compared to normals (13). A neutral observer asked the patients to rate the result of the operation.

Surgical technique

We performed an open wedge osteotomy of the radius in 6 cases and a closing wedge osteotomy in the other 6 cases. We used the palmar approach in 7 cases and the dorsal approach in 5 cases. The graft was taken from the iliac crest. The osteotomy was stabilized with Kirschner wires or with a T-plate. The Sauvé-Kapandji procedure was carried out using a different approach (3). To prevent union of the ulnar osteotomy the pronator quadratus muscle was sutured into the gap. After the operation, patients wore a cast for 6 weeks. In 6 patients the fixation device was removed afterwards.

The mean time between the fracture and our operation was 13.2 months (range 5 to 36 months).

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Table I. — Cooney's clinical scoring chart

Pain (25 points)	25	No pain
	20	Mild occasional
	15	Moderate, tolerable
	0	Severe to intolerable
Functional status (25 points)	25	Returned to regular employment
	20	Restricted employment
	15	Able to work, unemployed
	0	Unable to work because of pain
Range of motion (25 points)	Percentage of normal	
	25	100%
	15	75-100%
	10	50-75%
	5	25-50%
	0	0-25%
	DF-PF Arcs if only injured hand reported	
	25	120° or more
	15	90-120
	10	60-90
5	30-60	
0	30 or less	
Grip strength	Percentage of normal	
	25	100%
	15	75%-100%
	10	50%-75%
	5	25%-50%
	0	0%-25%

All but one fracture were initially treated conservatively. One patient had a second manipulation and fixation with Kirschner wires. In another patient where the malunion was fixed, an attempt at correction was made with an Ilizarov fixation. The patient developed a compartment syndrome and an urgent fasciotomy had to be performed. Unfortunately, the malunion still persisted. All patients had pain which interfered with daily activities. The range of motion was decreased in all cases (table II).

RESULTS (See table II)

Eleven of the 12 patients rated the result of the operation as excellent or good. One was not satisfied, and carpal instability may be the reason for this failure, as an arthrogram showed complete disruption of the scapholunar ligament. Ten patients performed at the same level as before the injury. One patient required adaptation of his working conditions, whereas the dissatisfied patient never resumed work.

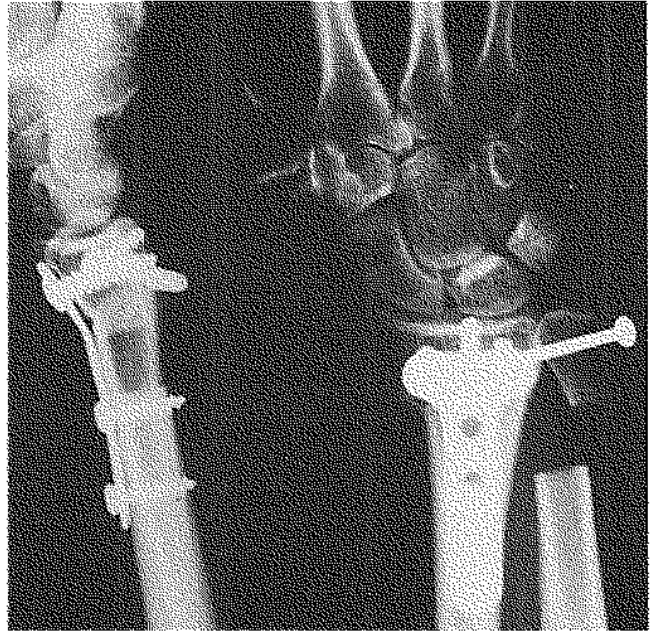
The improvement in range of motion was less spectacular. A gain in total flexion-extension range of 25% was found. All patients regained full pronation and supination (mean increase 21%). The grip strength improved in all cases. However the same strength as in the normal hand was never achieved.

Table II. — Functional results

Sex/ Age	Type	R.O.M. preop		R.O.M. postop		Force %	Cooney	Patient Satisfaction
		Ext/Flex	Pro/Sup	Ext/Flex	Pro/Sup			
f/23y	Smith	90/45	90/90	58/70	90/90	74%	90	good
f/48y	Colles	60/45	20/90	50/30	90/90	50%	45	poor
f/19y	Colles	30/80	90/90	50/60	90/90	52%	65	excellent
f/58y	Colles	50/60	90/90	50/60	90/90	57%	75	excellent
m/23y	Smith	10/25	45/45	40/40	90/90	67%	75	excellent
f/35y	Colles	45/40	60/60	50/50	90/90	64%	75	good
f/56y	Smith	20/50	90/20	60/80	90/90	50%	85	excellent
m/14y	Madelung	55/70	90/30	60/60	90/90	62.5%	90	excellent
f/16y	Madelung	5/10	30/60	90/90	90/90	80%	90	excellent
f/24y	Madelung	45/55	90/30	85/100	90/90	54%	85	excellent
f/41y	Colles	110/50	90/90	90/50	90/90	55%	80	excellent
m/19y	Colles	90/80	90/90	55/45	90/90	73%	85	good



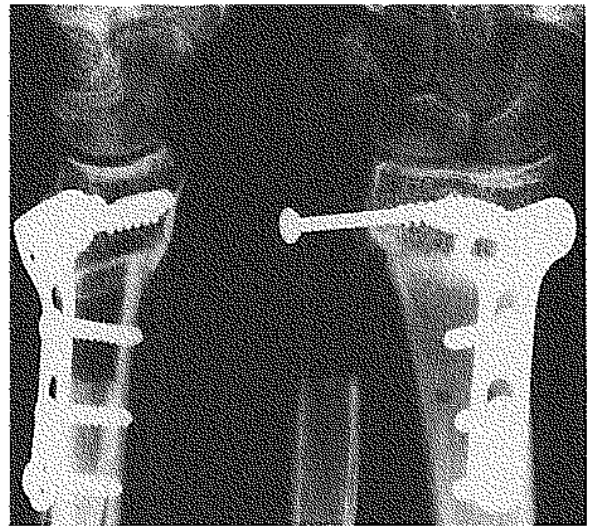
Fig. 1. — a. Preoperative x ray of a malunited Colles fracture.



b. Corrected malunion of a Colles fracture.



Fig. 2. — a. Preoperative x ray of a malunited Smith fracture.



b. Corrected malunion of a Smith fracture.

The Cooney score objectively evaluates all the previous assessments. None of the patients had an excellent score. However, 10 patients scored above 75 points, whereas one patient scored 65 and one only 45 points.

In one patient the ulnar osteotomy fused anyway. This osteotomy was redone with bony resection. In one patient a rupture of the extensor

pollicis longus tendon occurred 3 months after the operation.

Radiological assessment

Dorsal tilt was present preoperatively in the 6 cases of Colles fracture. The average tilt was 27.5° (range 42° to 15°). Palmar tilt was seen

in the other 6 cases. Here we had a mean of -16.9° (range -40° to 0°). After the operation we found an improvement of the dorsal tilt in 5 of the 6 patients. The dorsal tilt ranged from 0° to 12° with a mean of 5° . In the patient with the bad result there was an overcorrection to 10° of palmar tilt. Palmar tilt improved in the 6 patients, and 5 had a good correction. The dorsal tilt ranged from $+2^\circ$ to -15° . One patient was undercorrected and still had a palmar tilt of -24° . She rated the results as good. Ulnar tilt of the radius was increased in the 3 wrists with Madelung deformity. We found 38° , 42° and 44° with a mean of 41.3° . The tilt tended to be decreased in the malunited fractures, with a mean of 11.3° (range 0° to 24°). Postoperatively we noted an improvement in the patients with a Madelung deformity: 30° , 21° and 26° (mean 25.6°). In the others we achieved a mean improvement to 14.3° (range 0° to 35°).

DISCUSSION

Malunion results in shortening or radial impaction and volar dorsal angulation. A rotatory deformity can cause problems in the distal radioulnar joint. Malunion does not cause bony deformities alone, but also affects the articular disc, the ulnar collateral ligament and the dorsal and palmar radioulnar ligaments (10).

Martini and Fromm (9) observed that malalignment of the carpal articular surface of the radius resulted in a decrease in the range of motion; this was recently confirmed by Kazuki *et al.* (8). This loss of movement was well tolerated by the patients and did not cause pain. Much more evident was pain and decreased motion in the distal radioulnar joint. The extent of osteoarthritis in the distal radioulnar joint is correlated to the loss of pronation and supination. A study of ulnar wrist pain after Colles fracture from Tsukazaki, showed that ulnar pain is correlated with the final dorsal angulation of the radius. Such pain is the most frequent complaint after Colles fracture (14).

Unfortunately, not only does the wrist joint deteriorate, but the malunion also causes abnormalities in the carpal alignment. Radial shortening

of more than 2 mm causes an increase in the total contact area in the lunate fossa. Angulation of the distal radius of more than 20° (either palmar or dorsal), gives dorsal shift in the scaphoid and lunate high pressure area (11).

The deformity usually becomes symptomatic when the angulation of the distal articular surface of the radius is more than 25 to 30° in the sagittal or frontal plane and when there is a significant discrepancy between the lengths of the radius and ulna compared with the other side. This is particularly evident when the patient is young and manually active.

In the older patient, a Darrach resection of the distal end of the ulna has been the method of choice for the treatment of painful subluxation of the distal radioulnar joint due to malunion of a Colles fracture. In the young patient however, the Darrach procedure is not recommended because of painful instability of the residual ulnar stump (7). When symptoms are limited to the ulnar side of the wrist, a simple Sauvé-Kapandji procedure can be performed.

Other reconstructions of the distal radioulnar joint (matched resections, ligamentoplasties) do exist, but in our hands were insufficient to relieve ulnar wrist pain. Shortening osteotomies of the ulna could, on a theoretical basis, rebalance the distal radioulnar joint, but persisting lack of congruity is an important drawback of this procedure in posttraumatic disorders. Therefore we combined a radial osteotomy with a Sauvé-Kapandji procedure. In the Sauvé-Kapandji procedure, the arthrodesis of the distal radioulnar joint relieves the pain, while the bony resection preserves a good range of movement. The radial osteotomy gives a better cosmetic appearance and prevents further carpal deterioration.

CONCLUSION

We believe that radial osteotomy with a Sauvé-Kapandji procedure is a good solution for malunion of a distal radial fracture. This operation seems to be successful only when there is no established carpal instability.

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SAMENVATTING

I. SCHROVEN, L. DE SMET, B. ZACHEE, A. STEENWERCKX, G. FABRY. Osteotomie van de radius en Sauvé-Kapandji voor afwijkingen van de distale radius.

Bij 12 patiënten met een posttraumatische (9 gevallen) of congenitale (3 Madelung deformities) misvorming van de distale radius, werd de osteotomie gecombineerd aan een Sauvé-Kapandji procedure.

Er werd 6 maal een openingsosteotomie en 6 maal een sluitingsosteotomie uitgevoerd. Bij 11 van hen was het resultaat goed of uitstekend, één falings was waarschijnlijk het gevolg van een carpale instabiliteit.

RÉSUMÉ

I. SCHROVEN, L. DE SMET, B. ZACHEE, A. STEENWERCKX, G. FABRY. Traitement des déformations de l'extrémité distale du radius par ostéotomie du radius et opération de Sauvé-Kapandji.

Chez 12 patients présentant une déformation de l'extrémité distale du radius, d'origine traumatique (9 cas) ou congénitale (3 cas de Madelung), une ostéotomie radiale correctrice a été combinée avec une opération de Sauvé-Kapandji. Onze cas ont obtenu un résultat bon ou excellent. Un échec est probablement dû à une instabilité du carpe.