

Excision of the ulnar head in patients with rheumatoid arthritis

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SUMMARY In 40 patients with rheumatoid arthritis 43 operations for excision of the ulnar head were performed. A follow-up study was performed after 35 months. In 38 patients wrist pain had disappeared completely or almost completely. The function in use, supination and pronation of the wrists, and wrist strength had all much improved. The stability of the radiocarpal joint was good after operation. Only minor complications were seen.

A symmetrical involvement of the wrists is found in 95% of patients with rheumatoid arthritis (RA). The symptoms usually start in the ulnar part with proliferative synovitis affecting both radioulnar and radiocarpal joints. There is swelling with ligamentous laxity, often resulting in dorsal-ulnar subluxation or dislocation of the ulnar head. Owing to pain and mechanical blocking rotation of the forearm and movements of the wrists are restricted. The adjacent extensor tendons may be involved and may rupture. The condition is presumably further enhanced by the attrition of the dislocated and deformed ulnar head on the tendons during rotational movements.

A characteristic picture based on these changes appears, described¹ under the name 'caput ulnae syndrome', with the following features: (1) wrist weakness, rotational pain, and limitation of rotation of the forearm; (2) dislocation of the caput ulnae and possible rupture of the long extensor tendons; and (3) soft tender fluctuating swelling. Rana and Taylor² suggested adding to these symptoms: (4) poor grip and reduced function of the hand.

Since one painful joint may thus limit function and use of many adjacent joints, it is important to treat such a joint if possible. The wrist joint is an excellent example of this situation, and when general therapy and perhaps local corticosteroids have failed to improve the condition surgery may be required.

The original description of a distal ulnar resection by Moore³ was for traumatic disorganisation of the inferior radioulnar joint. Darrach⁴ performed a

subperiosteal excision of 3 cm with preservation of the styloid process and ulnar collateral ligaments, and Dingman⁵ found no difference between extra- and subperiosteal excision, with and without ulnar styloid preservation, to relieve symptoms and improve wrist function in derangement of the distal radio-ulnar joint secondary to trauma. Smith-Petersen *et al.*⁶ resected the ulnar head in patients with RA, mostly as part of a technique of arthrodesis. Afterwards resection of the distal end of the ulna was more often undertaken on patients with RA,^{1, 7-16} especially in cases with attrition rupture of the extensor tendons.

Jackson *et al.*¹⁷ Rana and Taylor², and Cracchiolo and Marmor¹⁸ described large series with 'reasonable' results, yet in 1974 Flatt¹⁰ described the operation as 'rather unsatisfactory'.

Patients and methods

Of 42 patients with RA who underwent resection of the ulnar head between 1968 and 1973 2 had died from unrelated diseases and therefore only 40 could be taken into this follow-up study, 11 males and 29 females. Three patients had bilateral resections, 37 unilateral, giving a total of 43 operated wrists. The mean duration of their arthritis was 11.5 years, with mean wrist involvement of 8.8 years in the operated wrists and 5.2 years in the nonoperated wrists. The patients' mean age at control was 54.6 years (range 22-75) and the follow-up period 34.9 months (range 16-60). One patient had possible RA and one definite; all the others had classical RA (ARA grading¹⁹) and were restricted in their daily activities.

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Most wrists also showed severe changes on the x-rays. Radiological grading of the wrists is shown in Table 1. Before operation all patients had undergone prolonged conservative treatment, including antimalarials (25 patients), gold (37 patients), analgesic or antiphlogistic drugs (38 patients), and general corticosteroids (3 patients), splints, and in 11 cases intra-articular injections of hydrocortisone, before being considered for operation.

All were motivated, co-operative patients with severe wrist pain and loss of function as their main complaints. The wrist function was reduced and motion frequently impaired. Often they could not open doors, handle a kettle, or receive loose change.

All wrists were swollen and in most cases there was a dorsally dislocated ulnar head with painful piano-key sign. This sign is elicited by pressing gently downwards over the dorsally prominent lower end of the ulna.

All patients were investigated extensively by one of us (R.L.F.N.) preoperatively. Postoperative clinical assessment was carried out by a rheumatologist and a surgeon (J.J.R. and E.F.M.V.) who had not operated on anyone in this series. Pain was evaluated at follow-up on a 6-point score (see Fig. 1). The function in use was assessed on a 4-point scale (Table 2).

Hands and wrists were x-rayed preoperatively and at follow-up in 3 directions: antero-posterior, radioulnar, and at 45 degrees. At the final examination an x-ray in maximal ulnar and radial deviation was also taken.

X-rays were read by a radiologist (T.) and a surgeon (E.F.M.V.), according to an agreed plan and without knowledge of clinical details under 'blind' conditions. Interpretation of osteoporosis

Table 1 X-ray grading

	Operated side		Nonoperated side	
	Pre-	Post-	Pre-	Post
0	0	0	5	5
1	1	4	2	0
2	3	5	3	2
3	39	32	27	26
4	0	2	0	4
	43	43	37	37

Individual changes in x-ray grading

	Improved	Same	Worse
Operated side	8	31	4
Nonoperated side	2	26	9

- 0 No abnormalities
- 1 No destructive changes, osteoporosis may be present, soft tissue swelling
- 2 Osteoporosis with or without subchondral bone destruction
- 3 Cartilage and bone destruction, joint deformity
- 4 Fibrosis or bony ankylosis with grade 3 criteria

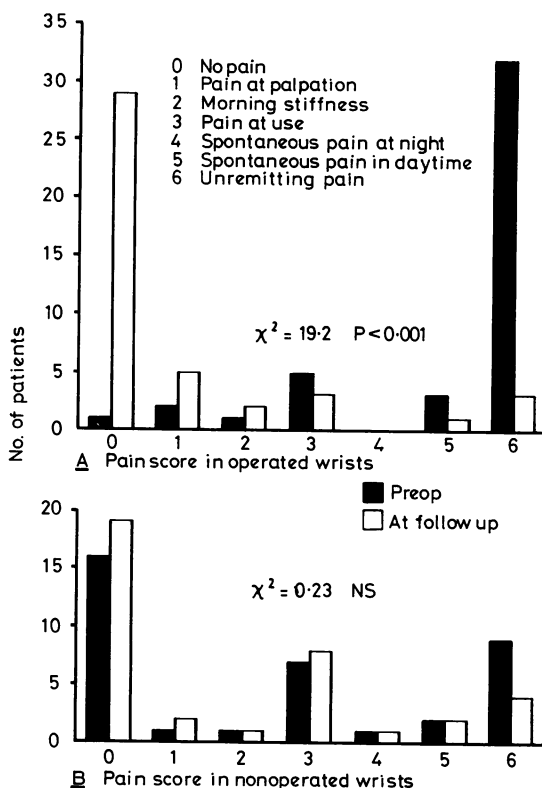


Table 2 Function in use

	Operated wrist*		Nonoperated wrist**	
	Preop	At follow-up	Preop	At follow-up
Undisturbed	4	21	14	16
Undisturbed with pain	10	10	11	9
Restricted movement	25	12	11	12
No use	4	0	1	0

*Difference between preop. and at follow-up highly significant $\chi^2 = 14.4$, P < 0.001.

**Difference between preop. and at follow-up nonsignificant $\chi^2 = 0.055$, NS.

Table 3 Indications for operation

Symptom	Number of wrists
Pain only	1
Pain and synovitis	8
Pain and limited movement	3
Pain, limited movement, and synovitis	24
Pain, synovitis, and extensor tendon rupture	4
Pain and ulnar and median nerve compression	1
Limited movement only	1
Synovitis only	1
Total	43

was assessed subjectively as absent or present; the x-rays were graded by the ARA criteria.¹⁹

Indications for operation are summarised in Table 3. In nearly all cases pain was one of the indications for operation and in most cases synovitis and loss of function.

OPERATIVE TECHNIQUE

The operation was performed by a group of 3 plastic surgeons using a pneumatic tourniquet for a bloodless field and general anaesthesia. The ulnar head was exposed by an incision directly over the tendon of extensor carpi ulnaris, and in most cases a 'lazy S' was used when surgery of extensor tendon or wrist joint was planned. After division and reflection of the extensor retinaculum, the extensor carpi ulnaris tendon was cleared of synovia and granulations. The ulnar collateral ligament of the wrist was divided and the ulnar head exposed subperiosteally. The neck was divided with bone cutters at a distance of 3 cm from the distal end. The bone was finally fixed with bone forceps and dissected from its surrounding attachments with a knife.

The triangular cartilage was excised and a total synovectomy performed with bone nibblers and a curette. Particular care was taken to clear out the portion between the radius and ulna, often containing a large amount of synovium. The fibrous structures were stitched carefully to prevent dorsal dislocation of the ulnar stump.

After operation a pressure dressing was applied with a volar plaster-of-Paris splint for 1 week, the wrist was then mobilised under the care of the physiotherapist. Other procedures performed at the same time are summarised in Table 4.

Results

Forty patients (43 wrists) were followed up for between 16 and 60 months (mean 35 months). A deterioration of the general state of RA was seen in 12 patients regarding functional capacity, improvement in only 2. An increase in general activity of RA

was also expressed by criteria such as the erythrocyte sedimentation rate (ESR) and Rose-Waaler test, which were significantly higher at follow-up than preoperatively. The ESR preoperatively was 34 mm at 1 h (standard 23) and at follow-up 51 mm (standard 35), a significant difference ($t=3.95$, $P<0.001$). Rose-Waaler titres preoperatively were 17 times 1:64 or higher, and postoperatively 30 times.

Pain was completely relieved in 29 of the wrists and almost completely in a further 7 cases, the patients suffering only minor discomfort not interfering with their normal activities. In 7 cases moderate to severe pain remained or appeared after operation, but 2 of these were much better than before operation. In most cases the worse hand was operated upon, and postoperatively it appeared that the operated side was by far the least painful (Fig. 1)

The *function in use* of the operated wrist, a subjective measurement, was improved markedly, while the nonoperated hand remained the same (Table 2). We may conclude that a significant improvement was seen after operation.

The *wrist strength* was not measured by a grip method, for in many cases the metacarpophalangeal joints had been operated upon at the same time, and this might bias our results. By subjective assessment 21 patients stated that the strength had improved after operation, in 14 cases it was unchanged, and in only 7 was the strength impaired (in 1 patient this feature was not noted).

Wrist mobility. In most patients a highly significant improvement in pronation and supination was observed in the operated wrists. In the nonoperated wrists a slight but not significant improvement in supination and pronation was also seen. As regards supination and pronation the operated wrists fared better than the nonoperated wrists (Tables 5 and 6).

A slight but not significant improvement was also seen in ulnar deviation and radial deviation. The dorsal and palmar flexion were unchanged (Table 5).

Although the *appearance* of the wrists was never a primary indication for operation, all patients were pleased with it.

Table 4 Other procedures performed at the same time and duration of total operation

	No. of cases
Synovectomy radiocarpal joint	28
metacarpophalangeal joints	28
extensor tendon	16
flexor tendon	2
Extensor tendon repair	1
Artificial joints (Swanson) mcp	1
pip	0
Drain postoperatively	16
Duration of operation: Mean 66 minutes, SD 17.6 (min. 40, max. 90)	

Table 5 Mobility of wrist pre- and postoperatively in the operated side (n=43)

	Preoperative Postoperative					
	0	1	2	0	1	2
Supination	15	18	10	33	8	2
Pronation	16	19	8	33	9	1
Ulnar deviation	2	22	17	7	24	12
Radial deviation	3	21	17	8	21	14
Dorsiflexion	1	22	20	1	25	10
Palmar flexion	3	24	16	4	25	14

Table 6 Mobility of wrist preoperatively and at follow-up in the nonoperated side (n=37)

	Preoperative			Postoperative			
	0	1	2	0	1	2	
Supination	18	16	3	26	6	5	($\chi^2=3.6$, NS)
Pronation	19	15	3	24	10	3	($\chi^2=1.4$, NS)
Ulnar deviation	8	18	9	9	17	11	
Radial deviation	8	17	10	5	19	13	
Dorsiflexion	8	18	9	9	17	11	(2 not noted preop.)
Palmar flexion	9	20	8	8	20	8	

0 Undisturbed, full range. 1 Slightly disturbed mobility, more than half of full range. 2 Greatly disturbed, less than half of the full range.

Contentedness of patients. When asked whether they would have this procedure performed again, knowing the outcome beforehand, 37 out of 40 patients said they would.

Radiological findings. Radiological improvement of the wrist was found in the operated side in 8 patients and in the nonoperated side in only 2 patients. Radiological deterioration was found in the operated side in 4 cases compared with 9 non-operated wrists (Table 1).

Ulnar deviation of the carpal bones was no more frequent in the operated wrists than in the non-operated (Table 7). Postoperatively a dislocation of the ulna was visible on the x-ray in 4 cases; in three this was regarded as a dorsolateral subluxation, and in the other the dislocation was palmar. Other findings, such as exostoses, bone apposition, regeneration, and calcification, are summarised in Table 7.

Complications. In 13 cases there was a complication after operation. In 8 cases a small region of sensory loss on the dorsum of the hand was seen. In 4 cases wound healing was disturbed by infection (including infected wounds from the other procedures), and in 3 patients there was a haematoma. In 2 patients a further resection was necessary, in

one case owing to threatening synostosis and persisting pain in the wrist, while in the other case the piece of ulna removed was too small and pain persisted after operation. Clicking of the ulna was seen 3 times, caused by snapping of the extensor carpi ulnaris tendon over the distal end of the ulna. An unstable radiocarpal joint with carpal ulnar drift was seen in only 1 patient, a waiter who was unable to lift trays after operation, though he was unable to do so before operation either. Dislocation of the ulna was seen before operation in 15 cases and at follow-up in 4 out of 43 wrists.

Discussion

The most important conclusion of this study is that pain in the radioulnar joint may be a good indication for this operation and that the operation can be performed without impairing wrist function and wrist mobility. Wrist mobility, especially supination and pronation, are in fact improved after operation.

The *function* in use and mobility of the wrist are surprisingly good after operation, and often people can use their hands better. This is not surprising when one realises that rotational pain and reduction of movement are important factors in limiting the use of the hand in such common everyday movements required for washing, dressing, turning the handles of doors, etc. A painful and badly functioning wrist will at the same time contribute to the inactivity of the adjacent joints. The *grip strength* was not studied in our group of patients, as the many operations performed on metacarpophalangeal and proximal interphalangeal joints might have biased our results. In our series the strength of the wrist was generally unchanged or slightly improved subjectively. Cracchiolo and Marmor¹⁸ found increased strength in 60%. Møller²⁰ describes a reduction in 21 out of 47 cases, but the fact that he removed 3–4 cm of the distal ulna may have influenced his results. It does not appear to be necessary to combine the operation with radius-head resection to obtain a good supination, as suggested by Jackson *et al.*¹⁷

Radiological examination showed improvement in a number of operated wrists, significantly more than in those not operated on. This is at variance with the findings of Rana and Taylor.² We did not observe migration of carpal bones into the space produced by resecting the ulnar head, and ulnar deviation of the carpal bones was found equally in operated and nonoperated wrists. Ulnar regeneration was found in 4 cases but did not give rise to complaints.

Our series differed from earlier reports in that only a few (3 out of 40) patients were treated with

Table 7 Conclusions—radiology

	Non-operated	Operated wrists		
		Unilat.	Bilat.	Total
Number of cases	37	37	6	43
New bone apposition	1	2	—	2
Old bone apposition	1	2	—	2
Old bone apposition disappeared	1	1	(resected)	1
New exostoses	5	8	1	9
Old exostoses	7	7	2	9
New ulnar deviation carpus	5	7	2	9
Old ulnar deviation carpus	5	6	2	8
Regeneration	—	3	1	4
Calcification, new	1	1	—	1
Calcification disappeared	0	1	—	1

long-term corticosteroids. This might be an explanation for the fact that joint laxity was less frequently seen in our series. It is known that laxity in metacarpophalangeal joints and neck are more frequently observed in steroid treated patients.²¹ In our series no operations were performed on the radial head, and no fixation of the ulna on the radius was carried out. This fixation of the ulna is apparently not necessary to obtain good stability.

The *stability* is good after operation, which is in keeping with the fact that the distal end of the ulna does not give support to the bones of the carpus. Marmor¹⁶ states that the stability is probably better when between 1 and 1.5 cm is removed from the distal end of the ulna and also the styloid process and triangular disc. When more than 1.5 cm is removed it tends to cause instability,²² but Møller²⁰ did not observe any unstable joints, even though he removed 3–4 cm. Our findings are in keeping with Møller's. Ulnar dislocation of the wrist is seen after this operation, but in our series it is just as frequently observed in nonoperated wrists as in operated wrists. It is possible that this phenomenon is due to RA itself rather than to the operation.

A *snapping sensation* was seldom seen in our patients. Rana and Taylor² found it in 23 out of 86 wrists and Møller²¹ in 16 out of 45, but in their patients the symptoms disappeared within the first year. Jackson *et al.*¹⁷ suggested a fixation of the carpi ulnaris tendon to the ulna to prevent it from flicking over the ulnar stump during certain wrist movements, but from the result of our series it appears that this procedure is not necessary to prevent a snapping sensation.

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