Rheumatoid arthritis of the elbow

Pattern of joint involvement, and results of synovectomy with excision of the radial head

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Stein, H., Dickson, R. A., and Bentley, G. (1975). *Annals of the Rheumatic Diseases*, 34, 403–408. **Rheumatoid arthritis of the elbow. Pattern of joint involvement, and results of synovectomy with excision of the radial head.** Thirty-two rheumatoid elbow joints in 25 patients which had undergone synovectomy and excision of the radial head have been studied from the point of view of pattern of joint involvement and the efficacy of surgery. In this group of patients there was a significant trend towards affection of proximal joints occurring earlier in the course of the disease than distal joints. There was a high incidence of involvement of wrist and knee. There was a positive relationship between dominance and the elbow affected.

Pain was diminished in all cases after surgery, and there was a significant improvement in hinge movement but no significant improvement in range of forearm rotation though it was less painful. A single lateral approach gave satisfactory exposure and is favoured. Complications of the procedure were few.

The elbow joint is frequently affected in rheumatoid arthritis. Freyberg (1968) found that 21 out of 56 patients with a 5- to 25-year history of rheumatoid arthritis had clinical and radiological evidence of elbow joint destruction. Porter, Richardson, and Vainio (1974) reported a 25% incidence of severe disability in one or both upper limbs resulting wholly or partly from disease of the elbow in 225 hospital in-patients.

The elbow is a hinge joint but the particular problem of the rheumatoid elbow is that lateral stability is lost as the disease advances. Also, involvement of the superior radioulnar joint by disease results in restriction of rotation of the forearm by pain. Since there is no satisfactory total joint replacement for the elbow, great interest has centred on more limited procedures as a means of relieving pain while maintaining mobility and lateral stability.

Swett (1923) reported the first synovectomy of a rheumatoid elbow, and Smith Petersen, Aufranc, and Larson (1943) proposed the addition of radial head excision to subtotal synovectomy in order to reduce pain and improve forearm rotation. The addi-

tion of radial head excision improved his results markedly. Subsequently, all authors have reported pain relief after synovectomy of the elbow and excision of the radial head. Smith Peterson and others (1943), Mori (1969), Anderson and Heppenstall (1971), Inglis, Ranawat, and Straub (1971), Marmor (1972), Wilson, Arden, and Ansell (1973), and Porter, and others (1974) suggested that in addition to pain relief improvement in the range of motion of the elbow can be expected. Emphasis has been laid on the technique of operation and Laine and Vainio (1969a, b) recommended synovectomy by both medial and lateral incisions in addition to the excision of the radial head. By contrast Inglis and others (1971) favoured a posterior approach with an osteotomy of the olecranon.

In view of the conflicting reports of the value of synovectomy and excision of the radial head in relieving pain and restoring mobility without sacrificing stability of the elbow and the preference for different techniques, patients so treated were reviewed by an independent observer (H.S.). Simultaneously a study was made of the pattern of joint involvement in these patients who had undergone elbow surgery.

Patients

Forty-two synovectomies of the elbow combined with excision of the radial head were performed in 35 patients for rheumatoid arthritis between 1966 and 1973. Of the 35 patients, 7 had bilateral operations; 25 attended for review, of whom 7 had undergone bilateral elbow synovectomy and excision of the radial head. A total of 32 elbows were reviewed. Follow-up was from 6 months to 8 years, with a mean of 3.3 years. With the exception of four seronegative and four left-handed patients, all were seropositive and the right hand was dominant.

The age distribution of the 25 patients is shown in Table I. Seventeen patients (68%) were in the age range 50 to 69 and the mean age of the patients was 56.7 years.

DURATION OF DISEASE

The duration of the disease from diagnosis to time of elbow surgery varied from 2 years to 45 years. Eighteen patients (72%) had had the disease for less than 20 years and the mean duration of disease was 14.9 years.

DURATION OF ELBOW SYMPTOMS

Duration from time of first symptoms to time of surgery varied from 6 months to 12 years, with a mean of 4 years.

DURATION OF FOLLOW-UP

Duration was from 6 months to 8 years with a mean period of 3.3 years.

PRESENTING SYMPTOMS (TABLE II)

Pain was present in all 32 elbows and stiffness in 18 (56%). Swelling was present in only 6 elbows.

Surgical approach

Through a posterolateral incision, the interval between anconeus and extensor carpi ulnaris was developed. The capsule of the elbow joint was exposed and incised longitudinally. This incision terminated distally at the radial neck in order to preserve the posterior interosseus branch of the radial nerve. The radial head was resected, the joint inspected, and the synovium excised using sharp dissection. The capsule was repaired and the incision closed.

A medial approach was used, in addition, on three occasions but this did not yield any further synovium. Ulnar nerve transposition anteriorly was carried out on 5 patients who had symptoms of entrapment at the elbow. Postoperatively the arm was rested in a sling and the elbow dressed with a compression bandage. Active mobilization of the elbow began after 14 days when the sutures were removed.

Table I *Age of patients (years)*

Age	20-29	30-39	40-49	50-59	60-69	70-79
No. of patients (25)	1	1	4	6	11	2

Table II *Presenting symptoms*

Pain	32	(100%)
Stiffness	18	(56%)
Swelling	6	(18%)

Method of review

SEQUENCE OF JOINT INVOLVEMENT

The chronological order of involvement of the upper and lower limb joints was recorded by history and from case notes for each patient, scoring each joint according to the time of initial involvement. The upper limb was represented by shoulder, elbow, wrist, metacarpophalangeal, and proximal interphalangeal joints, while the lower limb was represented by hip, knee, ankle, foot, metatarsophalangeal, and proximal interphalangeal joints. The data were then subjected to a two-way analysis of variance using the Friedman test. In addition, the relationship between dominance and elbow affected was determined.

EFFICACY OF SYNOVECTOMY OF ELBOW COMBINED WITH EXCISION OF RADIAL HEAD IN RHEUMATOID DISEASE

Three variables were measured for each patient: (i) degree of pain, (ii) radiological grading, (iii) range of motion. These were recorded before operation and at follow-up.

Degree of pain was assessed as severe (+++), moderate (++) , mild (+), and absent (0). The following radiological grading, modified from Laine and Vainio (1969a, b), was used for preoperative and review x-rays.

Grade 1—no bony involvement.

Grade 2—local rarefaction of the bone structure in the frontal aspect of humeral condyle as well as of the radial head (osteoporosis).

Grade 3—osteoporosis and cysts.

Grade 4—secondary degeneration.

Grade 5—ankylosis or dislocation.

Range of motion was recorded in degrees in both flexion and extension and supination and pronation, and the values analysed by the Wilcoxon signed rank test. Post-operative complications were recorded.

Results

PATTERN OF JOINT INVOLVEMENT

The percentage affected and the percentage first affected of the 11 pairs of joints studied is shown in Table III. There was a significant trend for proximal joints to be affected earlier in the course of the disease than distal joints ($P < 0.001$, Friedman test). This

Table III Joint involvement

	Proximal			Distal		Proximal			Distal		
	Shoulder	Elbow	Wrist	MCP	PIP	Hip	Knee	Ankle	Foot	MTP	PIP
Percentage distribution of affected joints (100% = all affected joints)	6.4	21.9	16.5	9.1	7.0	4.2	14.9	7.4	6.4	4.8	1.1
Percentage distribution of first affected joints (100% = all first affected joints)	11.0	18.5	7.4	14.8	11.0	3.7	18.5	3.7	11.0	0	0

Table IV Effect of surgery on pain

	Severe (+++)	Moderate (++)	Mild (+)	Absent (0)
No. of elbows				
Before operation	25 (78%)	7 (22%)		
After operation			9 (28%)	23 (72%)

was equally significant when the analysis was performed with the elbow joints excluded. However, when only the first affected joint per patient was studied, 63% were seen to be proximal joints and 37% distal but this difference in percentages was not significant at the 5% level.

Four patients were left-handed and in these patients the left elbow alone was affected. The remaining 21 patients were right-handed and in this group 14 patients had disease in the right elbow alone while 7 patients had bilateral elbow disease. In addition, these patients had frequent associated involvement of the wrist (75%) and knee (68%).

EFFICACY OF SYNOVECTOMY OF ELBOW COMBINED WITH EXCISION OF RADIAL HEAD IN RHEUMATOID ARTHRITIS

(i) Pain

The effect of surgery on pain is shown in Table IV. All 32 elbows were painful before operation and 25 (78%) were severely so; 23 (72%) were completely relieved of pain after surgery and the remainder had only mild pain.

Table VI Effect of surgery on hinge movement

Range of motion (degrees)	0-29	30-59	60-89	90-119	120-149	150-180
No. of elbows						
Before operation	3	10	10	8	1	
After operation	1	4	11	12	4	
Mean change in range of movement	+ 18.4°					
Median change	+ 10.0°					
	P < 0.001					

(ii) Radiological gradings

The effect of surgery on the radiological appearance of the elbow is shown in Table V. Before operation the 32 elbows were classed as grades 2, 3, and 4, and afterwards 24 (75%) remained at the same grade and 8 (25%) improved by one grade (Figs 1 and 2).

(iii) Range of motion

(a) Hinge movement. The effect of surgery on flexion and extension is shown in Table VI. There was a significant improvement in the range of flexion and extension after elbow synovectomy and excision of the radial head ($P < 0.001$, Wilcoxon signed rank test). There was a mean increase of 18.4 degrees and half the patients achieved a 10-degree improvement or more.

Table V Effect of surgery on radiological appearance of the elbow

Grade	4	3	2
No. of elbows			
Before operation	11 (34%)	17 (53%)	4 (13%)
After operation	7 (22%)	17 (53%)	8 (25%)

FIG. 1 *Lateral view of an elbow affected by rheumatoid arthritis. There is rarefaction of all 3 affected bones with marked cyst formation in the coronoid process and coronoid fossa. The joint space has almost entirely disappeared, and the radial head shows marked irregularities (grade 3)*

FIG. 2 *Four years after synovectomy and excision of radial head (same patient as in Fig. 1). An apparent increase in bone density in all the 3 affected bones is seen. The joint line has reappeared, and the coronoid fossa shows only a limited area of bone rarefaction with no cysts*

(b) Rotation. The effect of surgery on the range of supination and pronation is shown in Table VII. There was no significant improvement in rotation after surgery ($P > 0.05$, Wilcoxon rank test).

Complications
There were no wound infections and no evidence of delayed wound healing. Only 5 patients (16%) were noted at follow-up to have evidence of between 10

Table VII *Effect of surgery on rotation*

Range of motion (degrees)	0-29	30-59	60-89	90-119	120-149	150-180
No. of elbows						
Before operation	2	4	3	8	1	14
After operation		1	2	8	11	10
Mean change in range of motion	+ 11.9					
Median change in range of motion	0					
	$P > 0.05$					

degrees and 30 degrees of varus and valgus instability. Four patients (12.5%) had persistent pain and swelling at follow-up.

Discussion

PATTERN OF JOINT INVOLVEMENT

Rheumatoid disease is generally regarded as starting in a single distal joint and rapidly spreading to other joints to produce a polyarthropathy. The pattern of joint involvement in this disease has not been established, and few authors have published data on the frequency of affected elbows. Laine and Vainio (1969a, b) reported that two-thirds of 191 rheumatoid arthritis patients had elbow involvement, that it occurs more often in younger individuals, and that the symptoms develop insidiously so the patient is unaware of them for a long time. Recently, Porter, and others (1974) showed that only 28% of the investigated population of rheumatoid arthritis patients had no elbow involvement whatsoever, and Freyberg (1969) claimed that 72% of his patients who had elbow symptoms developed them after 10 years of synovitis in that joint.

The elbow, however, is merely a connecting joint between the hand and the trunk, and restricted motion can be compensated for in other joints (Peterson and Jones, 1971). In this series of patients undergoing elbow surgery, proximal joints were affected earlier in the course of the disease than distal joints. Furthermore, over two-thirds had significant involvement of the wrist and knee, which should be considered when planning surgical treatment in a patient with atypically located initial joint disease.

That a relationship existed between dominance and elbow affection further supports the theory that degree of joint involvement is a function of the forces acting on that joint (Virtama, Helela, and Kalliomaki, 1968; Dickson, Pake, and Calnan, 1973). The radiohumeral joint appears always to show destructive changes if there is significant synovitis (Anderson and Heppenstall, 1971), and even without rheumatoid arthritis the mechanical effect of simultaneous rotational and gliding movements in this joint seem to cause the cartilage destruction that affects the capitellum and radial head (Goodfellow and Bullough, 1967).

EFFICACY OF SYNOVECTOMY OF ELBOW JOINT COMBINED WITH EXCISION OF RADIAL HEAD

The degree of pain relief achieved in these patients is comparable with other published reports (Anderson and Heppenstall, 1971; Inglis, and others, 1971; Laine and Vainio, 1969a, b; Marmor, 1972; Peterson and Jones, 1971; Porter, and others, 1974; Torgerson and Leach, 1970; Wilson and others, 1973.) In all but three cases a lateral approach only to the elbow was used. Therefore there appears to be no obvious benefit

in terms of pain relief from a bilateral, more extensive, surgical procedure, as proposed by Laine and Vainio (1969a, b).

RADIOLOGICAL GRADING

The effect of joint synovectomy practised for prophylactic purposes is uncertain. Here, radiological evidence is presented in favour of elbow synovectomy preventing continued joint destruction. Whether this radiological improvement was caused by removal of the diseased synovium or by improvement of the bony architecture as a result of the increased activity of the affected but now pain-free joint is indefinite.

RANGE OF MOTION

The significant improvement in hinge movement at the elbow after surgery is not only important for the patient but also supports performing a lateral arthrotomy alone. The lack of improvement in forearm rotation with radial head excision conflicts with the findings of Wilson and others (1973), and may be explained by severe involvement of the inferior radioulnar joint in many of these patients (Fig. 3).

FIG. 3 Severe destruction of the inferior radioulnar joint, with total loss of the ulnar head

COMPLICATIONS

Although 5 patients had evidence of lateral instability of the elbow after surgery they were symptom free. A 12.5% incidence of persistent pain and swelling is comparable with that in other reports and again fails to support the bilateral surgical approach.

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