SYNOVECTOMY IN JUVENILE RHEUMATOID ARTHRITIS*

BY

C. W. FINK, J. BAUM, L. H. PARADIES, AND B. C. CARRELL

From the Departments of Pediatrics and Orthopaedics, and the Rheumatic Disease Unit of the Department of Medicine, University of Texas Southwestern Medical School, and the Texas Scottish Rite Hospital for Crippled Children, Dallas, Texas

Synovectomy has been one of the forms of therapy in adult rheumatoid arthritis for about 15 years. Numerous authors (Preston and McEwen, 1968; Marmor, 1967; Wilkinson and Lowry, 1965; Chapchal, 1967) have described the procedure and results. So far there are no universally accepted criteria for its use although multicentre evaluation is planned. Its therapeutic value has never been evaluated in the juvenile form of the disease and indications for its use in children are even less well defined than in the adult. A discussion of the potential therapeutic benefits of synovectomy in juvenile rheumatoid arthritis has recently been published by Eyring (1968).

During the course of this study several indications for the procedure became apparent and will be presented in the discussion; 22 of the 39 synovectomies would be classified as "early" because of the absence of radiological changes, but significant cartilage damage was found in some at operation. In some patients operation was performed primarily for relief of pain in severely damaged joints.

Material and Methods

The patients in this study were followed in the Arthritis Clinic of the Texas Scottish Rite Hospital for Crippled Children in Dallas. The 23 (10 males and 13 females) included in this series had synovectomy performed between March, 1964, and March, 1968, with a follow-up period of 4 to 52 months after surgery. Since three patients had two synovectomies at widely separated intervals, they are included twice where appropriate. The arthritis was polyarticular in all but two cases, these having monoarticular involvement of the knee. During the 4 years of this study 85 patients with juvenile rheumatoid arthritis were being followed at Scottish Rite Hospital, 23 of them having one or more synovectomies performed. Since many of the patients live a considerable

distance from the hospital, it is possible that they represent a more severely affected group than might be expected from a representative sample of the total number of juvenile rheumatoid patients in the area served by the hospital.

In the majority of patients, surgery was done in the hope of preventing further joint damage. Altogether 39 synovectomies were done: 25 of the knee, five of the wrist, four of the ankle, four of the hip, and one of the elbow. The techniques were similar to those described in adults by Preston and McEwen (1968) except that both medial and lateral parapatellar incisions were used. At operation as much synovia as possible was removed. Manipulation under general anesthesia was done in the early post-operative period in half the knee synovectomies. These patients were not randomly selected.

The inflammatory activity in the individual joints was rated by the non-orthopaedic members of the team on a scale of 0 to 3+. The degree of swelling, heat, tenderness and pain on motion was the basis for the scoring used. Total disease activity was estimated by the number of active joints, the severity of inflammation, the presence and degree of fever, the duration of morning stiffness, and the medication being taken.

Results of Surgery

Table I lists the synovectomized joints in order of the chronological age of the patient at the time of surgery. When bilateral synovectomy was done on the same date, each joint was listed separately. In patient 9, a repeat synovectomy of one knee was done 9 months after the initial bilateral synovectomy.

The inflammatory activity of 38 of the 39 operated joints was decreased 4 to 8 months after surgery when compared to the preoperative state.

The total disease activity decreased in sixteen of the 26 patients following operation, was unchanged in nine, and increased in one.

The erythrocyte sedimentation rate showed a decrease of at least 10 mm./hr in fourteen patients, was unchanged in nine, and increased more than 10 mm./hr in three.

* Reprint requests to Dr. C. W. Fink, 5323 Harry Hines Boulevard, Dallas, Texas, 75235.

TABLE I
EFFECT OF SYNOVECTOMY ON PARAMETERS OF ACTIVITY 4 to 8 MONTHS POSTOPERATIVELY

Operated Joints	Patient*	Age at Operation (yrs.)	Individual Joint Activity		Total Disease Activity		Erythrocyte Sedimentation Rate (mm./hr Westergren)	
			Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
Knees (25)	1†	3	2+	0	0	0	27	5
	2	3½	3+	2+	2+	2+	27	4
	3†	3½	1+	0	0	0	6	11
	4	4	3+ 3+	1+ 1+	3+	1+	52	9
	5	4½	2+ 2+	0 0	1+	1+	7	9
	6	6½	1+	0	2+	2+	56	38
	7	9½	3+	0	3+	1+	49	41
	8	9½	2+	0	1+	0	24	11
	9	10 10½ 10½	2+ 3+ 3+	1+ 1+ 1+	3+ 2+	1+ 1+	92 62	47 35
	10	11	2+ 2+	0 0	3+	1+	41	40
	11	11½ 12½	3+ 1+	0 0	3+ 1+	1+ 0	59 89	76 52
	12	12	3+ 3+	0 3+	3+	3+	111	64
	13	12½	1+ 3+	0 2+	2+	1+	28	18
	14	13½ 14	3+ 3+	0 0	2+ 1+	1+ 0	61 39	39 20
	15	16½	2+ 2+	0 1+	1+	0	24	22
Wrists (5)	4	4	3+ 3+	0 0	2+	2+	52	96
	6	6½	2+	0	2+	2+	56	38
	16	9½	1+	0	1+	0	22	7
	17	11	3+	0	1+	1+	35	42
Ankles (4)	18	9	3+ 3+	0 0	3+	0	20	14
	19	10½	2+ 3+	1+ 1+	1+	1+	36	35
Hips (4)	20	7½	2+	0	1+	0	60	32
	21	9	3+	0	1+	0	61	40
	22	13½	2+	0	1+	2+	20	31
	23	14½	3+	0	1+	0	37	25
Elbows (1)	9	10½	3+	1+	2+	1+	62	35

*Where two sets of figures are given, bilateral synovectomy was done on the same date.

†Monoarticular arthritis.

‡Synovitis of right knee recurred. Repeat synovectomy done 9 months later.

Thus, in all but one of the operated joints the inflammatory activity decreased, although in fourteen of 26 patients the total disease activity and erythrocyte sedimentation rate remained unchanged or

actually increased. The beneficial effect of surgery seems to have been primarily on the operated joint. Both the local and systemic improvement cannot, of course, be separated from that due to natural

remission or benefit from concomitant drug therapy. However, since the local effect was more prominent, this would indicate that surgery was in itself effective.

Table II compares the range of motion before and 4 to 8 months after surgery. The range is listed as *same* if at 4 to 8 months after operation it was essentially unchanged from that before surgery. If it significantly increased, it is listed as *improved*, and if it significantly decreased, as *worse*. The majority of the knee joints in which the range of motion was worse were so classified because of significant loss of flexion. On the other hand, most of those listed as improved had flexion contractures before surgery and showed a significant improvement in extension of at least 10° afterwards.

TABLE II
RANGE OF MOTION 4 TO 8 MONTHS AFTER
SYNOVECTOMY

Operated Joint	Range of Motion		
	Worse	Same	Improved
Knee	10	9	6
Wrist	1	1	3
Ankle	0	0	4
Hip	0	3	1
Elbow	0	0	1

Table III shows the effect on the range of motion of postoperative manipulation of the knees. The results are almost identical in the two groups, though there may be some bias against the manipulated group. In four of the 5 patients in this group there were associated factors that may have influenced the poor result. This group includes the two youngest children who also were the only ones with monoarticular arthritis. Another child, our first patient, had delayed manipulation one month after surgery and sustained a juxta-epiphyseal fracture of the femur with displacement of the epiphysis. The fourth developed generalized bullous lesions shortly after surgery which prevented adequate postoperative physical therapy. On the other hand, some of those scheduled for manipulation 7 to 10 days after surgery had full extension and at least 90° flexion at this time. Therefore, they were not manipulated and continued to have a full range of motion.

TABLE III
EFFECT OF MANIPULATION OF 25 KNEES ON RANGE OF
MOTION 4 TO 8 MONTHS AFTER SYNOVECTOMY

Postoperative Treatment	Range of Motion			
	Worse	Same	Improved	Total
Manipulated	5	4	3	12
Not Manipulated	5	5	3	13

In Table IV the range of motion 4 to 8 months after synovectomy is compared with the operative and radiological appearance of the individual joint. There is no correlation between the degree of joint involvement and the range of motion. Some of the most severely affected joints subsequently showed a better range of motion than some of the less involved joints. The four joints showing the greatest degree of joint involvement were all ankles. The two patients concerned had marked relief of pain as well as a return to virtually a full range of motion.

TABLE IV
RANGE OF MOTION 4 TO 8 MONTHS AFTER
SYNOVECTOMY COMPARED WITH THE OPERATIVE
AND RADIOLOGICAL APPEARANCE OF THE 39
INDIVIDUAL JOINTS

Degree of Joint Involvement*	Range of Motion			
	Worse	Same	Better	Total
0	1	0	3	4
1	5	8	5	18
2	3	3	2	8
3	1	2	2	5
4	0	0	4	4

* 0 = Normal by x ray; no erosions at operation

1 = Normal by x ray; significant erosions at operation

3 = Erosions by x ray; significant erosions at operation

4 = Marked erosions by x ray; marked erosions at operation

In Table V the range of motion 4 to 8 months after synovectomy is compared with that found at the final examination in 25 joints which were seen 12 to 52 months after surgery. In the majority of patients the range of motion was unchanged. The numbers here are smaller since in the other fourteen operated joints, the follow-up period had been less than one year.

TABLE V
RANGE OF MOTION at 4 to 8 MONTHS COMPARED WITH
THAT at 12 to 52 MONTHS AFTER SYNOVECTOMY
in 25 JOINTS

Direction of Change	Number and Type of Synovectomized Joints					
	Knees	Hips	Ankles	Wrists	Elbows	Total
Improved	1	1	0	0	0	2
Same	13	1	2	3	1	20
Worse	3	0	0	0	0	3
Total	17	2	2	3	1	25

Discussion

Synovectomy, and particularly early synovectomy (Gariépy, Demers, and Laurin, 1966), has recently become an important part of the therapy of adult rheumatoid arthritis. Within the past 10 years, many papers and monographs have been devoted to the surgical therapy of rheumatoid arthritis, synovectomy being one of the chief procedures discussed.

But its use in the juvenile form of the disease is briefly discussed in only two publications (Jakubowski and Ruszczynska, 1967; Eyring, 1968). In recent books on the surgical treatment of rheumatoid arthritis by Preston and McEwen (1968) and Marmor (1967) and in the proceedings of a recent symposium (Chapchal, 1967) held in Switzerland on synovectomy in adult rheumatoid arthritis, there was no specific discussion of the use or results of synovectomy during the course of juvenile rheumatoid arthritis.

We began to include synovectomy in the treatment of juvenile rheumatoid arthritis 5 years ago. The joints chosen for this procedure were those which had failed to respond adequately to conventional therapy. It was planned to carry out synovectomy relatively early in the course of the disease in an attempt to prevent further joint damage. The major problem was in the selection of patients. The desire to do surgery early was counterbalanced by the possibility that this type of patient might have a spontaneous remission. Initially, patients were chosen who had had at least one year of persistent activity in the joint selected for synovectomy. However, patients operated upon after this duration of disease often showed cartilage damage at surgery. Therefore, the shortest time between onset of persistent synovitis and operation has been reduced to about 6 months. Another reason for consideration of synovectomy was the presence of a persistent flexion contracture. Lack of response to intra-articular injection of steroids was another factor. A marked increase in the number of cells in the synovial fluid with a preponderance of polymorphonuclear leucocytes may prove to be helpful in choosing joints for synovectomy, but our data is insufficient to draw any conclusions on this point. During the course of the study, several synovectomies were done in children whose joints had been affected for at least 4 years, and in whom the disease was far advanced radiologically. Although relief of pain was a major object, there was also a postoperative improvement in range of motion. Healing of erosions and apparent increase in joint space have also been seen after synovectomy. The potential for regrowth of cartilage is probably greater in the child than in the adult. One of the most significant features of this study appears to be an absence of any demonstrable detrimental effect of surgery on the course of the disease.

As would be expected, there was a decrease in inflammatory activity in those joints from which the diseased synovial tissue was removed. There have been several temporary recurrences of activity in the operated joints, but in only one patient (Case 9) has

the reaccumulation of synovium been felt to require repeat synovectomy. This patient also required reoperation of the elbow after the data for this series was compiled. His synovial cells are peculiar in their selective mitogenic effect on lymphocytes from rheumatoid patients (Stastny and Ziff, 1967), and his synovial tissue may have different properties from that of the usual juvenile rheumatoid. Mikkelsen (1967) reported repeat synovectomy in eleven of 184 knees in adults, and stated that the indication for surgery was largely the same as for the initial synovectomy. We feel that the indications for repeat synovectomy are similar in children.

It is difficult to know whether the improvement in total disease activity and the decrease in the erythrocyte sedimentation rate which occurred in over half the patients had any relationship to the surgery performed or was part of the natural fluctuation of the disease. However, there were several patients in whom there was a decrease in the activity of the operated joint in the face of no change or worsening of overall disease activity and sedimentation rate. In a study of synovectomy in adults by de Sèze, Debeyre, Debeyre, and Couchet (1967), the effects on the systemic disease and sedimentation rate were similar to those seen in our study, although there is a tendency towards a more favourable result in children.

It was difficult to correlate the patient's age at the time of synovectomy with the functional result. However, all of the five patients operated on before the age of 6 years had a poor result with a decreased range of motion. A comparison of the total duration of disease with the range of motion at 4 to 8 months after synovectomy did not show any particular pattern. It should be noted, however, that a number of patients with arthritis for 5 or more years improved after surgery.

The results during the later follow-up period, extending from 12 to 52 months, indicate that the beneficial effects appearing 4 to 8 months after surgery can be expected to persist. A longer follow-up period will be necessary to confirm these results. A number of patients have had some fluid in the operated joint for several months after surgery, but this usually disappeared with time.

The reasons for the poor results seen in two children with monoarticular arthritis of the knee (Cases 1 and 3) are uncertain. Both had a decreased range of motion after synovectomy, but this is slowly improving. They both had a marked flexion contracture before surgery which could not be decreased

by intensive physical therapy, serial casting, and, in one, even by the use of Turner irons. It is not known whether the poor results in these patients are a result of their age, 3 and 3½ years at the time of surgery, or whether it is due to some feature of their monoarticular disease. Because of poor results in several other young children with polyarticular disease, it is felt that there may be a greater risk of a poor result after surgery in a child below the age of 6 years. They do not cooperate well in the postoperative therapy programme and are less tolerant of pain than older children.

It is hoped that the results of this preliminary study will promote further investigation of the role of

synovectomy in the therapy of juvenile rheumatoid arthritis.

Summary

During a 4-year period, 39 synovectomies were performed in 23 patients with juvenile rheumatoid arthritis; 25 involved knee joints. In 38 of 39 joints, the inflammatory activity after synovectomy was less than before surgery. The effect on disease activity and erythrocyte sedimentation rate was significant, but less striking. The postoperative range of motion was increased in about 50 per cent. of patients. Synovectomy is probably a useful procedure in juvenile rheumatoid arthritis.

REFERENCES

- Chapchal, G. (1967). "Synovectomy and Arthroplasty in Rheumatoid Arthritis: Second International Symposium in Basle, Switzerland, 1967", ed. G. Chapchal. Thieme, Stuttgart.
- Eyring, E. J. (1968). *Arthr. and Rheum.*, **11**, 688 (The therapeutic potential of synovectomy in juvenile rheumatoid arthritis).
- Gariépy, R., Demers, R., and Laurin, C. A. (1966). *Canad. med. Ass. J.*, **94**, 1,349 (The prophylactic effect of synovectomy of the knee in rheumatoid arthritis).
- Jakubowski, S., and Rusczyńska, J. (1967). *Acta rheum. scand.*, **13**, 113 (The possibility of surgical treatment in cases of juvenile rheumatoid arthritis).
- Marmor, L. (1967). "Surgery of Rheumatoid Arthritis". Philadelphia, Lea and Febiger.
- Mikkelsen, O. A. (1967). *Nord. Med.*, **78**, 1,483 (Residiv etter knesynovectomi ved rheumatoid arthritt).
- Preston, R. L., and McEwen, C. (1968). "The Surgical Management of Rheumatoid Arthritis". Saunders, Philadelphia.
- Sèze, S. de, Debeyre, J., Debeyre, N., and Couchet, J. (1967). *Rev. Rhum.*, **34**, 416 (Indications et résultats de la synovectomie au cours des rhumatismes inflammatoires).
- Stastny, P., and Ziff, M. (1967). *Arthr. and Rheum.*, **10**, 316 (A strain of synovial cells mitogenic for lymphocytes of patients with rheumatoid arthritis).
- Wilkinson, M. C., and Lowry, J. H. (1965). *J. Bone Jt Surg.*, **47B**, 482 (Synovectomy for rheumatoid arthritis).

La synovectomie dans la polyarthrite rhumatoïde juvénile

RÉSUMÉ

Pendant une période de quatre ans, 39 synovectomies ont été faites chez 23 malades atteints de polyarthrite rhumatoïde juvénile; 25 sur l'articulation du genou. Dans 38 des 39 articulations, l'activité inflammatoire après la synovectomie était moins qu'avant l'intervention chirurgicale. L'effet sur l'activité de la maladie et la vitesse de sédimentation des érythrocytes étaient significatifs, mais moins marqué. L'étendue des mouvements post-opératoires des jointures était augmentée chez presque 50 pour cent des malades. La synovectomie est probablement un procédé utile dans la polyarthrite rhumatoïde juvénile.

Sinovectomía en la poliartritis reumatoide juvenil

SUMARIO

Durante un periodo de cuatro años se practicaron 39 sinovectomías en 23 pacientes con poliartritis reumatoide juvenil; 25 afectaban articulaciones de la rodilla. En 38 de 39 articulaciones, la actividad inflamatoria después de la sinovectomía era menor que antes de la operación. El efecto en la actividad de la enfermedad y en la velocidad de sedimentación eritrocítica era significativo, pero menos acusado. El grado de movimiento postoperatorio aumentó en aproximadamente un cincuenta por ciento de pacientes. La sinovectomía es, probablemente, un método útil en la poliartritis reumatoide juvenil.