

# Survival Analysis and Longterm Results of Elbow Synovectomy in Rheumatoid Arthritis

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**ABSTRACT. Objective.** To evaluate longterm results and survival rate of open synovectomy of the elbow joint in patients with rheumatoid arthritis (RA).

**Methods.** Between 1986 and 2000, synovectomy of the elbow was performed on 103 joints in 92 patients with RA. Eighty-five joints were included in this study. Mean age at time of surgery was 52 years (range 13 to 62 yrs). On 13 elbows with Larsen stage I and II disease, early synovectomy preserving the radial head was performed; in 72 cases with Larsen stage III and IV, late synovectomy with radial head resection was necessary.

**Results.** In early synovectomy, one joint received prosthetic joint replacement and 2 joints underwent resynovectomy a mean of 9 years after primary surgery. The survival rate (no further operations) was 91% after 5 years and 78% after 10 years. In late synovectomy, 16 elbow joints were operated again a mean of 4.6 years after primary surgery (10 prosthetic joint replacements, 2 resection interposition arthroplasties, 4 resynovectomies). Survival rate was 82% after 5 years and 66% after 10 years. Sixty-one elbows were examined clinically at a mean followup period of 8.7 years (range 2.8–17.3 yrs). There was a significant improvement of the Morrey score at followup, especially due to effective relief of pain. Improvement of joint motion was seen in late synovectomy for pronation and supination. The mean preoperative Larsen stage was 3.11, which decreased significantly to 3.66 at followup.

**Conclusion.** Our findings suggest that synovectomy is a safe and effective procedure in differential treatment of RA of the elbow. (J Rheumatol 2006;33:892–6)

## Key Indexing Terms:

ELBOW SYNOVECTOMY

RHEUMATOID ARTHRITIS

Open synovectomy of the elbow is often described as a successful and safe procedure for patients with rheumatoid arthritis (RA)<sup>1-4</sup>. In recent years the management of RA of the elbow has changed and the number of patients requiring a synovectomy of the elbow has decreased, obviously due to the effect of modern disease-modifying agents<sup>5,6</sup>.

Arthroscopic synovectomy is a less invasive method compared to the open technique. Although rehabilitation is facilitated, the results deteriorate more rapidly than after open synovectomy<sup>7,8</sup>.

Constrained, semiconstrained, and unconstrained elbow joint replacements have emerged as a reliable intervention for later stages of RA of the elbow<sup>2,5</sup>. In younger patients it is not

the preferred treatment because of increased risk of revision. Conversion from elbows treated with synovectomy and radial head excision to total elbow arthroplasty seems to be more difficult, and results are inferior to those with primary total elbow arthroplasty<sup>9,10</sup>. A recent study indicated that previous synovectomy with resection of the radial head is not associated with an increased revision rate following subsequent arthroplasty of the elbow, although there was a higher complication rate<sup>11</sup>.

Our objective with this followup study was to evaluate the outcome of early and late open synovectomy of the elbow in RA and to detect predictive factors for the outcome. That elbow joint replacement has become a safer and more reliable procedure makes it very important to determine if this joint-preserving operation is justified in terms of fulfilling a patient's expectations of pain relief and functionality.

## MATERIALS AND METHODS

**Demographic data.** Between January 1986 and December 2000, synovectomy of the elbow was performed on 103 joints (70 from women, 30 from men) in 92 patients with RA. Mean age at time of surgery was 52 years (range 13–62 yrs). Seventeen patients with 18 operated elbows were lost to followup, resulting in a total of 85 operations reported on.

**Surgical procedure and postsurgical care.** The preoperative radiological destruction of the elbow joint was evaluated according to the Larsen classification<sup>12</sup>. On 13 elbows with Larsen stage I and II disease, an early synovectomy preserving the radial head was performed through the lateral approach according to Gschwend<sup>13</sup>. In 2 cases, an additional ventral approach (through

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the ventral capsule of the elbow joint) was necessary to resect an arthrocele, a huge hernia of proliferative synovial tissue. In one elbow the synovectomy was combined with lysis of the ulnar nerve through the medial approach.

Seventy-two joints in roentgenographic Larsen stage III and IV underwent a late synovectomy. The head of the radius was always resected by a longitudinal incision in the proximal insertion of the hand and finger extensors. The annular ligament was protected or reconstructed, and the proximal stump of the radius was rounded. In 9 cases, uneven and deformed joint surfaces of the ulna and humerus were reshaped by removing large osteophytes. In 59 elbows, only the lateral approach was used; in 19 cases an additional medial approach was performed, with lysis of the ulnar nerve in 16 cases.

Immediately after the operation a dorsal plaster splint (elbow in 90° flexion and neutral forearm rotation) was applied. Physiotherapy started 2 days after surgery. In early cases, 2 additional plaster splints, one in the maximum flexion and one in maximum extension, were used; later, passive motion by motor splints replaced this procedure.

*Data acquisition and evaluation.* For clinical evaluation of the outcome of synovectomy of the elbow, the score by Morrey, *et al*<sup>14</sup> was used (maximum 100 points). Preoperatively and at followup, standard radiographs in the anteroposterior and lateral projection were performed and stage of deterioration was determined by the Larsen classification<sup>12</sup>. The Morrey score was assessed preoperatively and at followup. Joint function, range of motion, strength, and stability according to the Morrey score were documented, and a complete history of the patient was taken.

For statistical evaluation, the Wilcoxon test was used for parameters pre- and postoperatively. The chi-square test was used to compare categorical values. Survival analysis was performed according to Kaplan and Meier with a confidence level of 0.95.

## RESULTS

*Patient data.* From 1986 to 2000, synovectomy was performed on 103 elbows of 92 patients with RA. Five of these died a mean 6.3 years postoperatively before followup. Eleven patients with 18 operated elbows were lost to followup and excluded from this study. At followup 11 elbows had been converted to prosthetic joint replacement an average of 4.4 years after synovectomy (range 0.8–9.3 yrs). Another 8 elbows needed further operation a mean of 5.0 years after synovectomy (range 0.4–9.9 yrs). In 5 of these cases resynovectomy was performed, one with an additional resection of the radial head. Two elbows underwent resection, interposition, and suspension arthroplasty (RISAP: after remodeling of the humeroulnar joint surfaces and resection of the radial head, a distally based central strip of the triceps tendon was used for interposition and suspension of the ulna against the humerus). One arthrolysis was necessary. These 19 elbows were recorded as failures. Sixty-one elbows were examined clinically at a mean followup period of 8.7 years (range 2.8–17.3 yrs) (Table 1).

*Postoperative complications.* Ten (11.8%) patients developed early postoperative complications. Four hematomas were seen; one deep joint infection needed to be revised. In 4 cases the range of motion was limited and mobilization of the joint under general anesthesia was performed. A lesion of the ulnar nerve was seen in 2 patients, involving an irritation of the nerve for a couple of weeks after surgery with sensory loss over the little finger. There was no loss of motor function. At followup no signs of a lesion of the nerve were found. One

Table 1. Synovectomy of the elbow was performed on 103 joints in 92 patients with RA between 1986 and 2000.

Variable	Joints, n (patients)	Mean yrs
Followup	61 (57)	8.7
Alloarthroplasty	11 (11)	4.4
Other operative procedures	8 (8)	5.0
Deceased	5 (5)	6.3
Total	103 (92)	
Lost to followup	18 (11)	
Total included in study	85 (81)	

lesion of the radial nerve occurred, with persisting wrist drop for almost half a year, but function was eventually restored.

*Survival analysis.* Eighty-five elbows could be included in the survival analysis according to Kaplan and Meier survivorship estimates. As described above, 19 joints required further surgery a mean of 4.7 years after synovectomy and were recorded as failures. Six elbows had a score that was worse or the same at followup compared with the preoperative results. They were also recorded as failures.

Late synovectomy was performed on 72 elbows. From this group, 16 elbow joints required further surgery a mean of 4.6 years after primary surgery (10 prosthetic joint replacements, 2 resection interposition arthroplasties, 4 resynovectomies). At a mean followup of 12.1 years, 4 elbow joints had a score that was worse in comparison to the preoperative results. Two elbows had the same score preoperatively and at followup, with a followup period of 16 and 4 years, respectively. These 6 elbows were also recorded as failures. Five patients who had been operated on unilaterally died a mean of 6.3 years postoperatively before a mean followup of 7.2 years. Late synovectomy achieved a 5-year survival rate of 82% and 10-year survival rate of 66% (Figure 1).

Out of 13 elbows with early synovectomy, one joint received an alloarthroplasty and 2 joints underwent resynovectomy a mean of 9 years after primary surgery (mean followup 10.1 yrs). The survival rate (no further operations) was 91% after 5 years and 78% after 10 years.

*Clinical outcome.* For clinical evaluation the score by Morrey, *et al*<sup>14</sup> was used. Results according to the Morrey score were graded as good and excellent in 52.5% (n = 32) after elbow synovectomy; 27 elbows (44.3%) showed a fair result; and 2 elbows (3.2%) were graded as poor. The score changed from 56.1 points before surgery to 78.1 points at followup (mean: p < 0.01; n = 61). Four elbows had a decreased score at followup compared to before surgery, 55 elbows had an increased score. Two joints showed the same number of points. The elbow joints that underwent further surgery had a mean Morrey score of 57.8 preoperatively (n = 19), not significantly different from elbow joints that had not received any further surgery (Morrey score 56.2; n = 61). Improvement

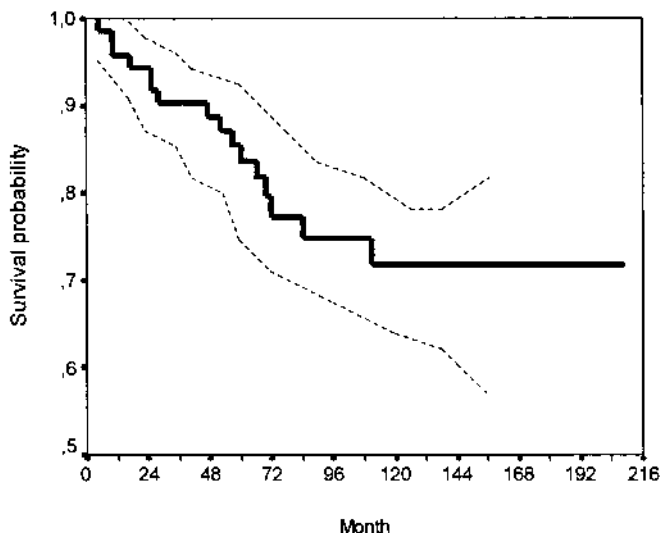


Figure 1. Survival probability curve for 72 elbows treated with late synovectomy. The 5 and 10-year survival rates are 0.084 (84%) and 0.071 (71%) respectively. The 95% confidence interval is represented by the broken lines.

in Morrey score in early synovectomy ( $n = 10$ ) from 63.5 preoperatively to 85.4 points at followup was not significantly higher than in late synovectomy ( $n = 51$ ), which improved from 54.7 to 77.1 points.

**Joint motion.** Active range of motion (ROM) in early synovectomy ( $n = 10$ ) increased from  $98^\circ$  preoperatively to  $111^\circ$  for flexion and extension, and decreased from  $150^\circ$  to  $144^\circ$  for pronation and supination at mean. These changes were not statistically significant ( $p > 0.05$ ). In 8 elbows the ROM for flexion/extension improved, in 2 elbows it worsened. For pronation/supination only 5 elbows had an improved ROM; 5 had a reduced ROM. In late synovectomy ( $n = 51$ ) there was a significant improvement of joint motion for pronation/supination (Table 2). The active ROM increased from  $114^\circ$  to  $135^\circ$  ( $p < 0.05$ ). In 42 elbows movement was improved; in 9 elbows it was reduced. For flexion/extension no significant differences were seen; the ROM increased from  $95^\circ$  preoperatively to  $104^\circ$  at followup ( $p > 0.05$ ). For 36 elbows the ROM increased; for 15 it declined. The preoperative joint motion of elbows that had further surgery (e.g., prosthetic joint replacement) was not

significantly different from the preoperative ROM of the joints seen at followup. There is also no significant correlation between preoperative ROM and clinical outcome.

**Pain.** Evaluation of pain according to the Morrey score (maximum 30 points) showed significant pain relief. Complete pain relief or only slight pain after elbow synovectomy was obtained in 75.4% ( $n = 46$ ) of cases. Fourteen (22.9%) elbows showed moderate or moderately severe pain; one patient complained of severe and constant pain of the elbow at followup. For early synovectomy ( $n = 10$ ) the score increased from 13.5 points preoperatively to 28.5 points at followup; for late synovectomy ( $n = 51$ ) the score improved from 11.6 before surgery to 22.8 at followup at mean ( $p < 0.05$ ). Two elbows with late synovectomy had more pain at followup than before surgery (Table 3).

**Stability.** Assessment for joint stability resulted in no or slight instability ( $0^\circ$ – $5^\circ$ ) for 20 elbows, moderate ( $6^\circ$ – $10^\circ$ ) for 33 elbows, and marked ( $> 10^\circ$ ) for 8 elbows.

Early synovectomy showed 4 elbows with no or slight instability, 5 with moderate, and one elbow with marked instability at followup. For late synovectomy no or slight instability was found in 16 elbows, moderate in 28 elbows, and marked in 7 elbows. Preoperatively, the elbows with late synovectomy showed no significant difference in stability assessment: 19 elbows with no or slight instability, 31 elbows with moderate, and 3 with marked instability ( $p > 0.05$ ). Elbows with early synovectomy also had no significant differences in stability compared with the preoperative situation (6 elbows had no or slight instability and 4 had moderate instability). No correlation was established between stability and subjective assessment; the instability did not interfere with function. There was no significant correlation between stability and radial head resection.

**Activities of daily living.** Function of the elbow joint was evaluated according to the Morrey score. Twelve questions concerning activities of daily living such as combing hair, eating with utensils, perineal care, carrying weight, dressing, and others were asked. A maximum of 12 points could be achieved. Comparing the preoperative result with the situation at followup, there was a moderate, not significant, improvement in function: the score increased from 8.1 to 9.2 points at mean ( $n = 61$ ). However, function of the shoulder, wrist, and

Table 2. Range of motion (ROM) of 61 elbows at followup. There was a significant improvement for pronation and supination in late synovectomy: ROM increased from  $115^\circ$  to  $135^\circ$  ( $p < 0.05$ ).

	Mean ROM (range)			
	Preoperative		At Followup	
	Flexion/Extension	Pronation/Supination	Flexion/Extension	Pronation/Supination
Early synovectomy ( $n = 10$ )	$98^\circ$ ( $50^\circ$ – $125^\circ$ )	$150^\circ$ ( $130^\circ$ – $180^\circ$ )	$111^\circ$ ( $60^\circ$ – $135^\circ$ )	$144^\circ$ ( $90^\circ$ – $180^\circ$ )
Late synovectomy ( $n = 51$ )	$95^\circ$ ( $60^\circ$ – $135^\circ$ )	$114^\circ$ ( $60^\circ$ – $180^\circ$ )	$104^\circ$ ( $70^\circ$ – $150^\circ$ )	$135^\circ$ ( $80^\circ$ – $180^\circ$ )

Table 3. Evaluation of pain according to Morrey score (maximum 30 points) showed significant pain relief ( $p < 0.05$ ) at followup. Two elbows with late synovectomy had more pain at followup than before surgery.

	Mean Pain Score (range)		Preoperative-Followup		
	Preoperative	Followup	Better	Worse	Equal
Early synovectomy (n = 10)	13.5 (5-25)	28.5 (25-30)	10	0	0
Late synovectomy (n = 51)	11.6 (5-25)	22.8 (5-30)	42	2	7

hand had an important effect on these results, which made it extremely difficult to analyze and estimate improvement of function due to synovectomy.

**Roentgenographic findings.** Roentgenographic examinations could be performed in 61 elbows preoperatively and at followup. Of 103 elbows, 5 patients had died, 19 had further operations, and 18 were lost to followup, so that only a relatively small percentage of the initial sample was available for radiological followup.

Out of 3 elbows preoperatively staged as Larsen 0, 2 were staged as Larsen II and one as Larsen III at followup. One elbow at Larsen I was staged as Larsen III at followup. Out of 8 joints preoperatively staged as Larsen II, one remained in stage II, 6 were staged as Larsen III, and one as Larsen IV at followup. Out of 27 elbows preoperatively staged as Larsen III, 9 remained at stage III and 18 were staged as Larsen IV at followup. Out of 22 elbows preoperatively staged as Larsen stage IV, 19 remained at stage IV at followup and 3 increased to stage V. The mean preoperative Larsen stage was 3.11 and this decreased significantly to 3.66 at followup (Figure 2).

Improvement of the Morrey score by early or late synovectomy was independent of the preoperative Larsen stage. Late synovectomies performed in Larsen stage III or IV were not significantly different in clinical outcome according to the

Morrey score at followup. The radiographic progressions were also independent of the Morrey score.

## DISCUSSION

About 39% to 70% of patients with RA show elbow involvement with limitation of the upper extremity function, usually within 5 to 10 years of disease onset<sup>15,16</sup>. Although there is a high incidence of cubarthrits in patients with RA, the frequency of operative treatment is rather low<sup>3,15,16</sup>. In addition, the rate of early synovectomy compared to late synovectomy is less than one-third, although there are excellent results for early synovectomy<sup>1,3,4,6</sup>. In our study the rate of early synovectomy amounted to only 14%.

Overall, the operation frequency of elbow synovectomy decreased. In the Orthopaedic Department at the Rheumaklinik Bad Bramstedt, 10 to 15 synovectomies of the elbow were performed per year between 1992 and 1995. Since 2000 the number of elbow synovectomies has reached only 3 to 5 each year. It cannot yet be determined whether this is an effect of new disease-modifying agents, or if there are other reasons.

Considering the young age of patients with cubarthrits (the mean age of patients at operation in this study was 52 years; range 13-62 yrs), joint-preserving techniques should be favored to delay the need for prosthetic joint replacement. Results of elbow endoprostheses after synovectomy and radial head resection seem to be inferior to those of primary arthroplasty<sup>9,10</sup>. According to our own findings, intraoperative and postoperative complications, as well as the rate of failures and radiolucent lines, showed a significant relationship to previous operations of the elbow joints, especially with resection, interposition, and suspension arthroplasty<sup>9</sup>. Others have indicated no association with an increased rate of revision or failure of endoprosthetic joint replacement following elbow synovectomy<sup>11</sup>.

In this study the 5-year survival rate for late synovectomy was 82%; the 10-year survival rate was 66%. Maenpaa, *et al*<sup>17</sup> described a 5-year survival rate of 77%. They concluded that late synovectomy yielded more temporary pain relief with a high rate of elbow arthroplasties. In contrast, Schill, *et al*<sup>3</sup> reported on 50 patients with late synovectomy and radial head resection, with an overall revision rate of only 8.2% after 8.3 years. They mentioned that elbow function was maintained for a long time and valuable time was gained before reconstructive surgery was necessary.

Clinical outcome at followup (a mean of 8.7 yrs after surgery) for elbows with no further surgery after synovectomy

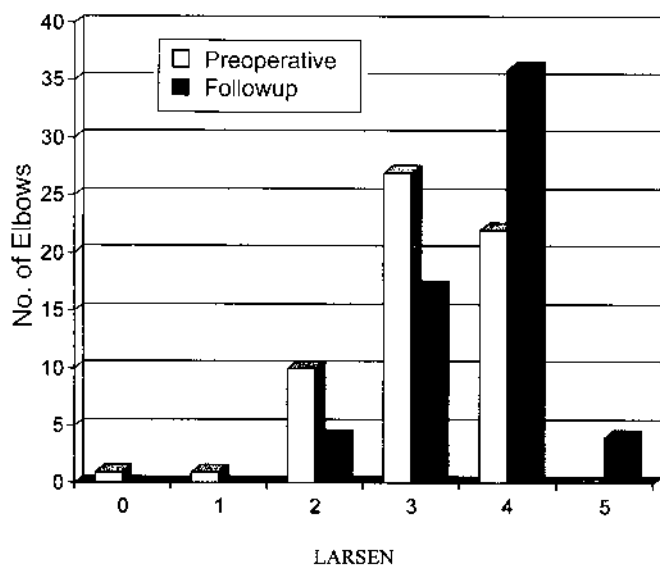


Figure 2. Larsen stage of the 61 elbows preoperatively and at followup. The mean preoperative Larsen stage decreased significantly from 3.11 to 3.66 at followup.

showed excellent and good results for 32 (52.5%) patients; a fair result for 27 (44.3%); and poor results according to the Morrey score for 2 (3.2%). There was a significant improvement of the score comparing the preoperative situation with the situation at followup. This was especially due to effective relief of pain: 75.4% of the patients had no or only slight pain at followup; only one patient complained of severe and constant pain. Pain was reported to be improved in other studies of elbow synovectomy<sup>1,3,4,18</sup>. Measurement of function of the elbow joint is difficult and is influenced by additional limitations of shoulder, wrist, and hand function. This might explain the discrepancy between pain relief and outcome according to the Morrey score. Concerning pain relief, no significant differences were observed in our study in the comparison of early and late synovectomies.

Some authors describe a significant gain of elbow joint motion due to synovectomy<sup>1,4</sup>; the same applies to flexion/extension and to pronation/supination. In our study there was a significant improvement of combined pronation/supination in late synovectomy. In our opinion the gain in motion and pain relief are effects of radial head resection in late synovectomy. Resection of the often totally destroyed radiohumeral joint leads to pain relief, especially during motion, and gain of forearm rotation. Early synovectomy showed no significant changes of joint motion; in late synovectomy the combined flexion/extension was also not improved.

Stability of the elbow did not change significantly from preoperative to followup. There was no significant loss of stability after radial head excision.

We found no or slight instability (0°–5°) in 20 elbows, moderate (6°–10°) in 33, and marked (> 10°) in 8 elbows at followup. There was no significant correlation between instability and clinical outcome. Obviously, gain of function due to pain relief and improved range of motion is more important. Other investigators found some instability, especially after radial head excision. According to the findings of this study, a relevant effect on clinical outcome was not described<sup>1,3,19</sup>.

Our findings suggest, in accord with other authors<sup>1,3,4,6,20</sup>, that synovectomy of the elbow in patients with RA, and especially late synovectomy in combination with radial head excision, is a safe and effective procedure, preferably performed in the early Larsen stages of the disease. The main goal of this procedure is the relief of pain in relatively young patients with cubarthritis and the improvement of function over a long period until conversion to prosthetic joint replacement becomes necessary. Although the results of alloarthroplasty after synovectomy and radial head excision are inferior to those of primary arthroplasty<sup>9,10</sup>, and although elbow joint replacement has emerged as a reliable procedure<sup>5</sup>, there is still a good indication for synovectomy and radial head excision in the differential treatment of rheumatoid cubarthritis. In late Larsen stage V, prosthetic joint replacement should be preferred.

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