A Population Based Assessment of the Use of Orthopedic Surgery in Patients with Rheumatoid Arthritis

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ABSTRACT. ***Objective.*** To describe the use of orthopedic surgery, including joint replacement surgery, in a well defined population based cohort of patients with rheumatoid arthritis (RA) and to identify characteristics that predict such use.

Methods. A retrospective medical record review was performed of cases of RA incident in Rochester, MN, during the years 1955-85. Patients were followed until 1998. All joint surgeries were recorded, including joint reconstructive surgeries, total joint arthroplasty (TJA), and other joint reconstructive procedures (JRP) such as tendon transfers and resections, joint fusions, and surgeries for fractures and infections involving joints.

Results. Of the total 424 RA incident cases, 148 (34.9%) patients underwent one or more (maximum of 20/patient) surgical procedures involving joints during their followup (median 14.8 yrs, range 0.2–42.8 yrs). Overall, this RA cohort had 9.7 surgeries per 100 person-yrs of followup. The estimated cumulative incidence of surgical procedures for RA at 30 yrs was 52.7% ± SE 4.2. Surgeries for arthritis related joint disease of RA included: primary TJA 76 patients (31.3 ± 4.1); JRP joint fusion 78 patients (29.4 ± 3.5); JRP soft tissue 92 patients (29.8 ± 3.3); and cervical spine fusion one patient. Non-RA (trauma and other) joint surgeries included TJA 26 patients (13.5 ± 3.4) and arthrotomy for septic arthritis 8 patients (2.4 ± 0.9). Based on Cox proportional hazards regression, the risk of having a disease related joint surgery for RA is increased in patients who are younger ($p < 0.001$), have positive rheumatoid factor ($p = 0.01$), and those with rheumatoid nodules ($p < 0.001$). There was a borderline significant increase in the risk of first joint surgery in women ($p = 0.09$). Women also had significantly more joint surgeries (11.5/100 person-yrs) than men (4.9/100 person-yrs; $p < 0.001$). Survival of patients who had surgery for RA related joint disease was similar to those who did not.

Conclusion. This is the first population based assessment of joint surgeries performed in patients with RA. Reconstructive surgeries were common, and women had significantly more surgeries than men. Survivorship among patients with RA undergoing surgeries was similar to that of the RA patient population at large. (J Rheumatol 2002;29:52–6)

Key Indexing Terms:
RHEUMATOID ARTHRITIC EPIDEMIOLOGY ORTHOPEDIC JOINT SURGERY

Rheumatoid arthritis (RA) is a common inflammatory joint disease that affects about 1% of the population and up to 3% of the population over age 65. The disease is an immune mediated process that affects the synovial, lined appendicular joints as well as the atlantoaxial joint of the cervical spine. It is associated with marked disability and decreased life expectancy[1-3]. The need for orthopedic surgery is considered a marker of disease severity[4]. Orthopedic procedures including joint replacement surgeries have substantially improved the overall function and quality of life of patients with RA[4]. At the same time, they are a major factor in the higher medical cost for patients with this disease[3].

There are no studies for rates of reconstructive procedures including joint replacement surgeries among patients with RA, nor are there studies evaluating survivorship of patients with RA who have undergone reconstructive joint surgery. We describe the use of orthopedic surgery, including joint replacement surgery, in a population of patients with RA incident in Rochester, Minnesota, during the years 1955–85 and followed from 1955 to 1998. Knowledge of disease and patient associated risk factors for joint surgery provides important insight into the disease and its course and effects in patients and an indication of the disease burden in the population, with potential consequences for health care resource utilization planning.

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Submitted February 28, 2001; revision accepted July 5, 2001.

MATERIALS AND METHODS

Patients. Using the facilities of the Rochester Epidemiology Project, a cohort of 425 patients with RA incident in Rochester between 1950 and 1985 was assembled for a study on mortality in RA in this community population[5]. In that study all residents of Rochester, Minnesota, with cases of RA were identified by searching the computerized diagnostic index for any diagnosis of arthritis (excluding degenerative arthritis or osteoarthritis) made any time between January 1, 1955, and January 1, 1985, among Rochester residents ≥ 35 years of age[6,7]. The complete (inpatient and outpatient care by any provider) medical record was reviewed by a trained nurse abstractor using a pretested data collection form, and confirmation or rejection of the diagnosis was based on the 1987 American College of Rheumatology (ACR) diagnostic criteria for RA[5]. All cases were followed longitudinally until 1998 or until death or migration out of the county.

Orthopedic surgeries. The entire medical record of each patient was reviewed to obtain the data on orthopedic procedures. The date of each procedure was registered. Surgeries before the incident date of the diagnoses of RA were excluded. Joint surgery data were collected for the following joints: right and left temporomandibular joints, shoulders, elbows, wrists, thumbs [base, metacarpophalangeal joint (MCP), interphalangeal joint (IP)], other fingers [MCP, proximal interphalangeal joint (PIP), distal interphalangeal joint (DIP)], hips, knees, ankles, first toes [metatarsophalangeal joint (MTP) and IP], MTP 2–5, toes 2–5 (PIP, DIP), and cervical spine. Procedures were recorded as: (1) Implant arthroplasty with a total joint arthroplasty (TJA) or hemiarthroplasty with an implant component; (2) non-implant arthroplasty: resection arthroplasty (such as Keller bunionectomy), fusion, wire arthrodesis, Girdlestone procedure, osteoectomy, or osteotomy; (3) soft tissue procedures: synovectomies, tendon repairs, tendon transfers, tendon releases, ligament releases (such as carpal tunnel release), cartilage repair, or meniscus repair; (4) fractures with a non-implant surgical repair (plates and spinning) or amputations at a joint level; (5) fractures repaired with an implant TJA; (6) arthrotomy for a septic native joint; (7) arthrotomy for a septic prosthetic joint; (8) diagnostic arthroscopy and or biopsy; (9) revision surgery of an implant prosthesis; (10) revision surgery for the other procedures; (11) cervical spine atlantoaxial fusion or multiple level fusions performed for RA related cervical spine disease.

Data analysis and measurements. The demographic and disease-specific characteristics of the population were assessed and the orthopedic surgeries of each patient were recorded. The Kaplan-Meier method was used to estimate the cumulative incidence of any orthopedic surgery (1 – survival free of surgery) following the incident diagnosis of RA. Similarly, the incidence of surgery of specific sites was estimated for those sites. The Cox proportional hazards model was used to determine the influence of sex, age, rheumatoid factor (RF), and extraarticular manifestations on the cumulative incidence of first surgery. The proportional hazards model was also used to assess the influence of joint surgeries on survival.

RESULTS

There were 425 Rochester residents aged ≥ 35 years who first fulfilled the 1987 ACR criteria for RA between 1955 and 1985, forming the incident RA cohort, and 424 were included because one patient denied consent[5]. Of these, 73.5% (312) were women and 26.6% (112) were men. During the followup period, 169 patients developed extraarticular manifestations of RA [estimated cumulative incidence at 30 years (30 yr CI): 57.1%, standard error (SE): 3.8%] and 114 patients developed subcutaneous nodules (30 yr CI: 39.4%, SE: 3.6%)[7]. The average age at diagnosis was 60.2 years. The average age at first surgery was 61.4 years (range 35–87). These patients were followed until 1998. The mean followup was 15.1 years (range 0.2–42).

Surgical procedures involving joints for RA related disease were performed in 34.9% of patients during their disease course, and surgeries for non-RA related causes including trauma, sepsis, and revision surgeries were performed in 11.3%. The number and types of surgeries and estimated cumulative incidence at 30 years of these procedures are provided in Table 1. The median number of RA related procedures per patient in the 148 patients who had surgery was 2 (minimum 1/patient and maximum 20/patient). Many patients underwent multiple different types of surgeries, and many patients had multiples of each type of surgery. For example, 76 patients had primary TJA; of these, 31 (40%) had only one primary TJA, 29 (38%) had 2 TJA, and 6 (8%) had 3 TJA. The results for primary TJA, non-arthroplasty joint reconstructive procedures (JRP), and soft tissue procedures (STP) are shown in Table 2. TJA was most frequently performed in the hip (Table 3), which was also the most frequently operated joint in this cohort (Table 4). For surgery related to RA itself the knee joints were the most frequently operated, followed by joints of the wrist, first toes, and fingers (Table 4).

Several patient and disease related characteristics were evaluated as risk factors for having a RA related joint surgery, including age, sex, the presence of any extraarticular manifestation including subcutaneous nodules (evaluated separately), RF positivity (titer ≥ 1:40), and calendar year of RA diagnosis. In univariate Cox proportional hazards models, the risk of having a disease related joint surgery for RA was increased in patients who were younger [relative risk (RR) 0.75; 95% CI 0.65, 0.86 per 10 year increase in age at diagnosis of RA; $p < 0.001$], and in those with subcutaneous nodules (RR 2.97; 95% CI 2.06, 4.29; $p < 0.001$). There was a borderline increase in the risk to first joint surgery in women ($p = 0.09$). Women also had significantly more joint surgeries than men, with a rate of 11.5/100 RA related surgeries per person-year; for men the rate was 4.9/100 person-year; $p < 0.001$). The effect of calendar year of surgery was only of borderline significance ($p = 0.048$), with risk of surgery increasing with calendar year (RR 1.22 for each 10 year increase in calendar year, 95% CI 1.00–1.48). The same is true of presence of positive RF (RR 1.59; 95% CI 1.12, 2.25; $p = 0.01$). In total 261 patients died during the followup period. The survival of patients undergoing joint surgeries for RA related disease was similar to those who did not. The 30 year survival estimate is 29.0% (95% CI 21.5–39.0) for those with RA related surgery and 21.3% (95% CI 15.6–29.2) for those without RA related surgery.

DISCUSSION

This study is the first population based assessment of joint surgeries in patients with RA. We found that reconstructive surgeries for RA were common (34.9% of 424 patients with RA). The estimated cumulative incidence at 30 years was

Table 1. Orthopedic surgeries performed in 424 patients with incident RA in Rochester, Minnesota, followed 1955–98.

Type of Surgery	Patients Having Surgery, Total n, M/F	Estimated Cumulative Incidence at 30 Years % (± SE)		
		Total	Male	Female
RA disease related	148, 31/117	52.7 ± 4.2	45.7 ± 10.5	54.6 ± 4.3
Primary total joint arthroplasty*	76, 15/61	31.3 ± 4.1	23.8 ± 8.2	33.9 ± 4.7
Joint reconstructive procedures*	78, 7/71	29.4 ± 3.5	14.4 ± 7.8	34.2 ± 3.7
Soft tissue procedures*	91, 18/73	29.8 ± 3.3	25.7 ± 8.1	31.3 ± 3.5
Non RA related (trauma and other) surgeries	88, 14/74	38.3 ± 4.3	25.5 ± 8.1	41.7 ± 4.9
Total joint arthroplasty	26, 2/24	13.5 ± 3.4	3.9 ± 2.8	16.2 ± 4.2
Septic joint arthroplasty	8, 2/6	2.4 ± 0.9	3.3 ± 2.4	2.2 ± 1.0
Open fracture reduction	43, 9/34	16.9 ± 2.9	11.6 ± 4.1	18.2 ± 3.4
Revision of total joint arthroplasty	20, 2/18	11.0 ± 3.1	4.6 ± 3.3	12.8 ± 3.8

* See Materials and Methods for explanation of these surgeries.

Table 2. Types and frequencies of orthopedic procedures performed for RA related joint disease.

Type of Surgery*	Total Number of Patients	Total Number of Procedures	Number of Patients Each Having 1,2,3,4 or 5+ of Each Type of Surgery				
			1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 or More n (%)
TJA	76	159	31 (41)	29 (38)	6 (8)	3 (4)	7 (9)
JRP	78	233	25 (32)	21 (27)	5 (6)	10 (13)	17 (22)
STP	91	192	46 (51)	23 (25)	5 (5)	8 (9)	9 (10)

* See Materials and Methods for explanation of these surgeries. TJA: primary total joint arthroplasty, JRP: non-TJA joint reconstructive procedure, STP: soft tissue procedure.

Table 3. Total joint arthroplasties performed in patients with RA.

Joint	RA Disease Related (76 Patients) n (procedures)	Non-RA Related (Trauma and other Surgeries; 26 Patients) n (procedures)	Revision (20 Patients) n (procedures)
Shoulder	10	0	0
Elbow	4	0	0
Wrist	12	0	6
Thumb	4	0	2
MCP	17	0	7
Hip	31	28	10
Knee	68	0	7
Ankle	0	0	0
Midfoot	0	0	0
Toe	0	13	3
TMJ	0	0	0
Total procedures	146	35	35

52.7%. The most frequent procedure performed for RA was TJA, with an estimated cumulative incidence at 30 years of 31.7%. Surgery of the knee for RA related disease was more frequent than any other joint or group of joints (multiple MCP or MTP joints operated on during one operative session considered together).

The likelihood of surgery was more pronounced in patients who were younger at disease diagnosis; there was a 25% decrease in risk for every 10 years of age at incidence. A woman with RA was twice as likely to have an orthopedic surgery than a man, a finding noted by other authors in a cohort of patients referred to Mayo Clinic for evaluation of

Table 4. Joints involved in orthopedic surgery in 424 patients with RA.

Joint	All Joint Surgeries Estimated Cumulative Incidence				Joint Surgeries For RA Related Disease Only Estimated Cumulative Incidence at 30 Years			
	M/F Total (n) M/F	Total % (± SE)	Male % (± SE)	Female % (± SE)	M/F Total (n)	Total % (± SE)	Male % (± SE)	Female % (± SE)
Hip	73, 10/63	30.2 ± 3.9	10.8 ± 3.5	35.4 ± 4.7	25, 4/21	11.1 ± 2.9	3.1 ± 1.8	13.6 ± 3.8
Knee	59, 14/45	24.0 ± 3.5	24.8 ± 8.8	23.9 ± 3.8	57, 14/43	23.9 ± 3.6	24.8 ± 8.8	23.6 ± 3.8
Wrist	58, 9/49	22.0 ± 3.2	15.8 ± 7.0	24.2 ± 3.7	57, 9/48	21.7 ± 3.2	15.8 ± 7.0	23.8 ± 3.7
First toes (MTP, IP)*	44, 3/41	18.2 ± 3.1	9.8 ± 7.4	21.1 ± 3.3	41, 3/38	16.3 ± 2.9	9.8 ± 7.4	18.7 ± 3.1
Other fingers (MCP, PIP, DIP)	43, 7/36	16.2 ± 2.7	13.2 ± 6.5	17.3 ± 3.0	40, 6/34	15.1 ± 2.6	11.5 ± 6.2	16.4 ± 2.9
Feet, MTP 2–5*	36, 4/32	16.5 ± 3.2	10.7 ± 7.4	18.5 ± 3.5	33, 4/29	15.6 ± 3.2	10.7 ± 7.4	17.2 ± 3.5
Thumbs (base, MCP, IP)*	34, 3/31	12.9 ± 2.4	3.6 ± 2.0	15.5 ± 3.0	34, 3/31	12.9 ± 2.4	3.6 ± 2.0	15.5 ± 3.0
Toes 2–5 (PIP, DIP)*	25, 2/23	12.6 ± 2.7	2.1 ± 1.4	15.6 ± 3.4	23, 1/22	12.0 ± 2.7	1.0 ± 1.0	15.2 ± 3.4
Elbow	14, 4/10	4.9 ± 1.4	7.6 ± 4.3	4.4 ± 1.5	11, 1/10	3.9 ± 1.3	2.9 ± 2.7	4.4 ± 1.5
Ankle	8, 1/7	2.9 ± 1.2	1.2 ± 1.2	3.4 ± 1.5	4, 0/4	2.0 ± 1.1	0.0	2.6 ± 1.4
Shoulder	7, 1/6	3.8 ± 1.8	1.6 ± 1.6	4.4 ± 2.3	7, 1/6	3.8 ± 1.8	1.6 ± 1.6	4.4 ± 2.3
Cervical spine fusion	1, 0/1	0.4 ± 0.4	0.0	0.6 ± 0.6	1, 0/1	0.4 ± 0.4	0.0	0.6 ± 0.6
TMJ	0, 0/0	0.0	0.0	0.0	0, 0/0	0.0	0.0	0.0

* Number of surgeries. Patients may, for example, have had from 1 to 5 MCP joints operated on in a single surgery session, but each surgery session is counted only once for the respective joint group.

RA and joint surgery[8]. We found that the risk for any joint surgery was 2.3 times higher for women than for men. The risk for joint surgery for RA related joint disease was 1.4 times higher for women than for men. The risk for having joint surgery performed was 1.59 times for those with RF positivity and was 2.97 times higher in patients with subcutaneous nodules than those without (the presence of other extraarticular disease manifestations was not associated with increased risk for surgery). If the requirement for joint surgery can be viewed as a marker of severe disease and poor outcome (at least with respect to joint integrity), these findings would seem to confirm other epidemiologic observations of younger age at disease onset, female sex, and RF positivity as markers of disease severity[9].

Certainly the decision to undergo joint replacement surgery is complex and not simply a reflection of joint damage and attendant loss of function. Clearly, women had more surgeries than men in absolute and relative terms, with increased utilization of small joint (hand and foot) surgery in women accounting for the major part of this difference. We did not examine psychosocial factors including occupational, educational, or marital status or outcome of previous joint surgery as predictors of the need for joint surgery. Whether this increased use of surgery by women reflects functional, cosmetic, pain perception concerns, greater disease extent, or in the case of previous surgery, greater satisfaction with functional and cosmetic outcomes is uncertain, but it is clear that there are significant sex differences in the rates of utilization of joint surgery.

There are no directly comparable studies of joint surgery for patients with RA, but this and other studies confirm that such surgeries are common. In another study of 1600 patients with RA, 25% underwent TJA within 21.8 years of disease onset, while we found that 102/424 or 24% (76 patients with primary TJA, 26 with TJA due to trauma) had TJA[10]. A cross sectional epidemiological study of 1629 patients with RA seen in a private practice in France during a 6 month period in 1996 revealed that 24% of patients had had one or more surgical procedures for joint disease during their disease course (mean 8 years; mean number of procedures was 3), a figure somewhat lower than that of our study[11]. Referral and temporal trends in disease management may explain these differences. The question whether surgery will be performed less often in patients recently diagnosed with RA because of changes in treatment patterns with introduction of putatively more effective disease modifying drugs remains to be answered. We did not evaluate the influence of pharmacotherapy for RA including corticosteroids, nonsteroidal antiinflammatory agents, and disease modifying antirheumatic drugs used over time, but no differences in the number of surgeries performed in the 3 decades of the followup were noted. We also did not specifically evaluate the presence of risk factors for osteoporotic and other fractures necessitating joint surgery in these patients with RA; this has been the subject of other reports[12–14].

Our results suggest that survivorship among patients with RA undergoing surgery was similar to the RA population at large. There are no comparable studies, although in a case series of Japanese patients with RA undergoing total knee and/or hip arthroplasty, only 8 were alive after 10 years of followup.

From this and other studies it is evident that patients with RA have high rates of utilization for orthopedic services. That these rates are higher than expected from the general population is reflected in a study of total hip arthroplasties

done in Olmsted County, Minnesota, between 1969 and 1990: 63.2% of these procedures were for degenerative joint disease, 19.8% for fractures, and 19.8% for RA[15]. Our longitudinal population based assessment data support and extend these findings.

Because of the demographic makeup of the community (over 90% white), estimates of the need for joint surgery in nonwhites would be unstable; however, the majority of RA cases nationally are among whites. We cannot demonstrate that the medical and surgical practice in Olmsted County is "optimal," but most (98%) surgeries were performed at Mayo Clinic, where physicians are salaried and have no direct personal financial incentive for performing the procedures. While the generalizability of our findings is hence limited, utilization rates from the study of total hip arthroplasty in Olmsted County were consistent with European data and slightly higher than other studies from the United States[15].

Although it is uncertain how the needs of patients with RA for joint surgeries will be affected by changes in disease therapies, it is certain that the need for such services will remain high in the foreseeable future, with important effects on patient quality of life and health care resource utilization planning.

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