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Changes in the rates of joint surgery among patients with Rheumatoid Arthritis in California, 1983–2007

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Abstract

Objectives—Treatment of patients with rheumatoid arthritis (RA) has improved markedly over the past 25 years. We investigated if rates of joint surgery, a long-term consequence of poorly-controlled RA, have changed over this period.

Methods—In this population-based, serial cross-sectional study of patients aged ≥ 40 years with RA in California, we examined trends in annual rates of total knee arthroplasty, total hip arthroplasty, total ankle arthroplasty or arthrodesis, and total wrist arthroplasty or arthrodesis from 1983–2007.

Results—Rates of joint surgery peaked in the 1990s and since have decreased. Among patients aged 40–59 years, rates of knee surgery in 2003–2007 were 19% lower than in 1983–1987 (adjusted rate ratio 0.81; 95% confidence interval (CI) 0.74 – 0.87, $P < 0.0001$), while rates of hip surgery in 2003–2007 were 40% lower ($P < 0.0001$). Rates of knee and hip surgery did not decrease in patients aged ≥ 60 years but increased as observed in the general population. Compared with rates of ankle and wrist surgery in the mid-1980s, rates in the mid-2000s decreased significantly in both age groups.

Conclusions—Rates of joint surgery in RA peaked in the 1990s and have declined thereafter, suggesting that long-term outcomes of RA are improving.

Keywords

rheumatoid arthritis; joint surgery; orthopedic surgery; arthroplasty; arthrodesis

A long-term sequela of inadequately controlled chronic synovitis in patients with rheumatoid arthritis (RA) is joint damage severe enough to require surgery (1). Several studies have suggested that rates of arthroplasty among patients with RA have decreased in recent decades (2–7). Although the reasons for this finding are uncertain, these decreases mirror changes in other measures of RA severity and followed the shift to more aggressive anti-rheumatic treatment (8). We previously found that rates of total knee arthroplasty in

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COMPETING INTERESTS

None.

patients with RA in California declined in 1998–2001 after peaking in the mid-1990s (3). It is unknown if these rates have continued to decrease. In this population-based, serial cross-sectional study, we examined rates of total knee arthroplasty through 2007, and investigated if rates of total hip arthroplasty and ankle or wrist surgery among patients with RA in California decreased between 1983 and 2007.

METHODS

Source of Data

We used data on inpatient hospitalizations from the California Office of Statewide Health Planning and Development (9) from 1983 (the first year of the database) to 2007. This office receives discharge abstracts, which include a record of diagnoses and procedures, for all hospitalizations, and performs extensive reliability checks to ensure data accuracy. The study protocol was exempted from human subjects review by the institutional ethics committee.

Patients and Procedures

We tabulated the number of hospitalizations in which total knee arthroplasty, total hip arthroplasty, ankle arthrodesis or arthroplasty [hereafter “ankle surgery”], or wrist arthrodesis or arthroplasty [hereafter “wrist surgery”] were recorded. We limited the analyses to patients with RA aged 40 years or older because including younger patients at low risk for surgery would have decreased our ability to detect changes over time. Because unique patient identifiers were not available before 1991 or after 2000, analyses were based on the number of procedures, and not the number of patients.

Statistical Analysis

We computed the annual crude rate of each procedure by dividing the number of procedures in each year by the estimated number of patients with RA in California in each year. We estimated the number of patients with RA by applying age, sex, and race-specific prevalences of RA (based on data from the Third National Health and Nutrition Examination Survey (10)) to yearly estimates of the population of California (2,11). We standardized crude rates to the age, sex, and race distribution of the RA population in 2000. To provide more stable estimates, we pooled data in five equal 5-year periods, and used Poisson regression models to compare adjusted rates across time periods. Adjusted rate ratios were computed using both the first 5-year study period (1983–1987) or the peak time period as the referent group. We used a similar approach to calculate adjusted rates of procedures from 1998 to 2007 among patients aged 40 years or older in the general population. Data on hospitalizations not related to RA for years prior to 1998 were not available. Analyses were performed using SAS version 9.1.3 (SAS Institute, Cary, NC).

RESULTS

Joint Surgery in Patients with RA

The adjusted rate of total knee arthroplasty was 459 per 100,000 persons with RA in 1983, attained a maximum of 556 per 100,000 persons in 1997, and then decreased to 467 per 100,000 persons in 2007 (Figure 1A). The relative risk of total knee arthroplasty was 9% higher in 1993–1997 than in 1983–1987, but was significantly lower by 8% in 1998–2002 (Table 1).

The rate increased slightly in 2003–2007. The relative risk of total knee arthroplasty was 12% lower in 2003–2007 compared to the peak period of 1993–1997. The recent increase in rates was concentrated among patients aged 60 years and older. Among those aged 40–59

years, there was a progressive decrease in rates over time, with a relative risk of total knee arthroplasty that was 19% lower in 2003–2007 than in 1983–1987.

Rates of total hip arthroplasty steadily increased from 1983 to 1996, and then declined (Figure 1B). The risk of total hip arthroplasty was 32% higher in 1993–1997 than in 1983–1987, and nearly the same in 2003–2007 as in 1983–1987 (Table 1). Compared to the peak period of 1993–1997, the risk of total hip arthroplasty was 23% lower in 2003–2007. Similar to the findings for total knee arthroplasty, rates of total hip arthroplasty decreased progressively over time among those aged 40–59 years, with a relative risk that was 40% lower in 2003–2007 than in 1983–1987.

Rates of ankle surgery peaked in the mid-1990s (Figure 1C). The relative risk of ankle surgery was 21% higher in 1993–1997 than in 1983–1987 (Table 1). Thereafter, the risk decreased, such that the relative risk was 39% lower in 2003–2007 compared to 1983–1987.

Adjusted rates of wrist surgery in patients with RA increased from 1983 to 1990 before decreasing in the most recent periods (Figure 1D). The relative risk of wrist surgery was nearly 2-fold higher in 1988–1992 than in 1983–1987, but 59% lower in 2003–2007 than in 1983–1987 (Table 1). Trends in rates of ankle and wrist surgery were similar in younger and older patients. For all four procedures, trends were similar in men and women.

Joint Surgery in the California General Population

Between 1998 and 2007, annual adjusted rates of total knee arthroplasty among the general population increased steadily, from 260 per 100,000 persons in 1998 to 360 per 100,000 persons in 2007. Adjusted rates of total hip arthroplasty decreased slightly from 332 per 100,000 persons in 1998 to 290 per 100,000 persons in 2007, while adjusted rates of ankle surgery were stable (5.8 per 100,000 persons in 2000 to 5.1 per 100,000 persons in 2007). Adjusted rates of wrist surgery decreased slightly from 0.4 per 100,000 persons in 2000 to 0.2 per 100,000 persons in 2007.

DISCUSSION

Rates of joint surgery in patients with RA in California peaked in the 1990s and have since decreased. Rates of ankle and wrist surgery were markedly lower in the mid-2000s compared to the mid-1980s. Rates of total knee arthroplasty and total hip arthroplasty also decreased substantially (19% and 40%, respectively) among patients aged 40–59 years. Rates of total knee and hip arthroplasty did not decrease in older patients, and paralleled increases observed in the general population.

Our results are consistent with other recent reports of temporal trends in rates of orthopedic surgery among patients with RA (4–7). In a population-based retrospective study of patients with RA in Central Finland, rates of total hip or knee replacement from 1986–2003 were essentially stable (4). Rates of joint arthroplasty among patients with chronic inflammatory arthritides (86% with RA) in Norway from 1994–2004 either decreased (hip) or were stable (knee), while rates of ankle and wrist arthrodesis significantly decreased (5). A study of the Swedish National Hospital Discharge Register found declining rates for lower extremity surgeries from 1987–2001 (6) and upper extremity surgeries from 1998–2004 among hospitalized patients with RA (7).

Reasons frequently proposed to account for the recent declines in radiographic severity, functional impairment, and rates of joint surgery in RA are either that these represent responses to improvements in the way anti-rheumatic medications are used, or that RA is evolving to become milder (12–14). Both changes in treatment and changes in the natural

history may have an influence on the severity of RA, but the pattern of a gradual increase in rates of joint surgery through the 1990s, followed by a more recent decline, is more consistent with a treatment effect. A gradually progressive decline in rates might have been expected if a change in the natural history of RA was primarily responsible. The timing of the decline is also consistent with the time necessary for the new treatment strategy to be widely adopted, and for the first generation of patients treated under the new strategy to replace previous generations and reach the stage of RA when joint surgeries become more common (15). This may also account for the observation that decreases in rates of joint surgery were more pronounced among younger patients. This time lag also suggests that the effect of biologic agents on rates of joint surgery at the population level may not be evident for some time.

The strengths of our study include the investigation of rates of four types of joint surgery over a 25-year study period in a large population-based sample. Potential limitations of our study include possible coding errors in the database which could have misclassified some patients. However, validation studies showed major diagnoses to be accurately coded (3). We also could not determine whether the same patient underwent multiple surgeries (e.g. bilateral joints or revisions). Therefore, our rates were likely higher than rates based on the number of patients with joint surgery.

Our results demonstrate that rates of joint surgery in patients with RA peaked in the 1990s and since have decreased. Wrist and ankle surgery declined markedly, while progressive decreases in rates of total knee arthroplasty and total hip arthroplasty occurred in younger patients. Collectively these findings suggest that long-term health outcomes of RA are improving.

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Figure 1.

Annual adjusted rates of (A) total knee arthroplasty, (B) total hip arthroplasty, (C) total ankle arthroplasty or arthrodesis, and (D) total wrist arthroplasty or arthrodesis per 100,000 persons with rheumatoid arthritis from 1983–2007. Values provided for total sample as well as 2 stratified age groups (40 – 59 years; ≥ 60 years). Adjusted rates in the graphs represent 3-year weighted moving averages.

Table 1

Adjusted rates and rate ratios of joint surgery among patients with rheumatoid arthritis from 1983–2007*

	1983–1987	1988–1992	1993–1997	1998–2002	2003–2007
Total knee arthroplasty					
Total no.	3529	4083	4788	4472	5183
Adjusted rate (95% CI)	478.3 (461.5–495.0)	486.9 (471.6–502.1)	524.1 (509.2–539.0)	444.3 (431.3–457.3)	460.4 (447.8–473.0)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.02 (0.98–1.07)	1.09 (1.04–1.14)	0.92 (0.88–0.96)	0.96 (0.92–1.01)
P	-	0.36	<0.0001	0.0004	0.10
Total hip arthroplasty					
Total no.	2324	3171	3825	3658	3551
Adjusted rate (95% CI)	311.6 (298.2–325.0)	377.3 (363.9–390.7)	417.4 (404.1–430.6)	363.4 (351.7–375.2)	323.5 (312.8–334.2)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.21 (1.14–1.27)	1.32 (1.26–1.39)	1.15 (1.09–1.21)	1.02 (0.97–1.08)
P	-	<0.0001	<0.0001	<0.0001	0.39
Total ankle arthroplasty / Ankle arthrodesis					
Total no.	296	401	439	329	269
Adjusted rate (95% CI)	39.8 (35.0–44.5)	47.2 (42.5–52.0)	48.2 (43.7–52.7)	32.7 (29.2–36.2)	23.7 (20.8–26.5)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.21 (1.04–1.40)	1.21 (1.05–1.41)	0.82 (0.70–0.96)	0.61 (0.52–0.72)
P	-	0.02	0.01	0.02	<0.0001
Total wrist arthroplasty / Wrist arthrodesis					
Total no.	59	130	118	83	35
Adjusted rate (95% CI)	7.8 (5.7–9.8)	15.1 (12.5–17.8)	12.8 (10.5–15.1)	8.2 (6.5–10.0)	3.1 (2.0–4.1)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.98 (1.45–2.69)	1.66 (1.21–2.27)	1.07 (0.76–1.49)	0.41 (0.27–0.63)
P	-	<0.0001	0.002	0.71	<0.0001
Total knee arthroplasty					
Total no.	1006	1149	1410	1333	1562
Adjusted rate (95% CI)	381.6 (357.4–405.7)	366.6 (345.2–387.9)	381.2 (361.3–401.1)	301.9 (285.7–318.1)	309.3 (293.9–324.8)
Adjusted rate ratio (95% CI)	1.00 (reference)	0.96 (0.88–1.05)	0.99 (0.91–1.07)	0.78 (0.72–0.85)	0.81 (0.74–0.87)
P	-	0.38	0.78	<0.0001	<0.0001
Total hip arthroplasty					
Total no.	756	868	988	987	874
Adjusted rate (95% CI)	286.4 (265.5–307.4)	276.9 (258.3–295.5)	268.1 (251.4–284.8)	223.6 (209.6–237.5)	172.0 (160.5–183.4)

	1983-1987	1988-1992	1993-1997	1998-2002	2003-2007
Adjusted rate ratio (95% CI)	1.00 (reference)	0.97 (0.88-1.07)	0.92 (0.84-1.01)	0.77 (0.70-0.85)	0.60 (0.54-0.66)
<i>P</i>	-	0.50	0.09	<0.0001	<0.0001
Total ankle arthroplasty / Ankle arthrodesis					
Total no.	145	181	197	146	104
Adjusted rate (95% CI)	52.3 (43.6-61.0)	56.9 (48.5-65.3)	52.5 (45.2-59.9)	33.1 (27.7-38.4)	20.8 (16.8-24.8)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.06 (0.85-1.32)	0.98 (0.79-1.22)	0.62 (0.49-0.78)	0.39 (0.31-0.51)
<i>P</i>	-	0.59	0.86	<0.0001	<0.0001
Total wrist arthroplasty / Wrist arthrodesis					
Total no.	23	51	39	35	17
Adjusted rate (95% CI)	8.3 (4.8-11.7)	15.4 (11.2-19.6)	10.4 (7.1-13.7)	8.0 (5.3-10.6)	3.5 (1.8-5.2)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.91 (1.17-3.12)	1.25 (0.74-2.09)	0.96 (0.57-1.63)	0.43 (0.23-0.80)
<i>P</i>	-	0.02	0.41	0.89	0.008
Total knee arthroplasty					
Total no.	2523	2934	3378	3139	3621
Adjusted rate (95% CI)	553.9 (530.8-577.0)	581.2 (559.7-602.7)	636.0 (614.5-657.4)	555.2 (535.8-574.6)	577.8 (558.9-596.7)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.05 (0.99-1.10)	1.13 (1.08-1.19)	0.99 (0.94-1.04)	1.04 (0.98-1.09)
<i>P</i>	-	0.10	<0.0001	0.59	0.19
Total hip arthroplasty					
Total no.	1568	2303	2837	2671	2677
Adjusted rate (95% CI)	331.5 (314.2-348.8)	456.2 (437.1-475.2)	534.0 (514.3-553.7)	472.4 (454.6-490.3)	441.3 (424.5-458.1)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.32 (1.24-1.41)	1.53 (1.44-1.62)	1.35 (1.27-1.44)	1.26 (1.19-1.34)
<i>P</i>	-	<0.0001	<0.0001	<0.0001	<0.0001
Total ankle arthroplasty / Ankle arthrodesis					
Total no.	151	220	242	183	165
Adjusted rate (95% CI)	30.2 (25.1-35.2)	39.8 (34.4-45.2)	44.9 (39.2-50.6)	32.4 (27.7-37.1)	25.9 (21.9-29.9)
Adjusted rate ratio (95% CI)	1.00 (reference)	1.34 (1.09-1.65)	1.45 (1.18-1.78)	1.04 (0.84-1.30)	0.86 (0.69-1.07)
<i>P</i>	-	0.006	0.0004	0.70	0.19
Total wrist arthroplasty / Wrist arthrodesis					
Total no.	36	79	79	48	18
Adjusted rate (95% CI)	7.4 (4.9-9.9)	15.0 (11.6-18.4)	14.6 (11.4-17.9)	8.5 (6.1-10.9)	2.7 (1.4-4.0)
Adjusted rate ratio (95% CI)	1.00 (reference)	2.02 (1.36-2.99)	1.96 (1.32-2.91)	1.13 (0.73-1.75)	0.39 (0.22-0.69)
Age ≥ 60 years					

	1983–1987	1988–1992	1993–1997	1998–2002	2003–2007
<i>P</i>	-	0.0005	0.0009	0.58	0.0012

* Adjusted rates per 100,000 persons. 95% CI = 95% confidence interval.