

## EXTENDED REPORT

# Stable occurrence of knee and hip total joint replacement in Central Finland between 1986 and 2003: an indication of improved long-term outcomes of rheumatoid arthritis

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**Background:** Total joint replacement (TJR) surgery is an important severe long-term outcome of rheumatoid arthritis, but relatively little is known about changes of its incidence in patients with rheumatoid arthritis over the past two decades.

**Methods:** A population-based, retrospective, incidence case review was conducted to analyse the frequency of primary TJR surgery of the knee and hip in all patients, and specifically in patients with rheumatoid arthritis in Central Finland between 1986 and 2003. Patients with TJR surgery of the knee and hip were identified in hospital databases over the 18-year period. Age-standardised incidence rate ratios for the primary TJR of the knee and hip were calculated, stratified to sex and diagnosis, with 1986 as the reference value.

**Results:** In patients without rheumatoid arthritis the age-adjusted incidence rate ratios (with 95% CI) for TJR of the knee increased 9.8-fold from 1986 to 2003 in women and men, and for TJR of the hip 1.8-fold in women and 2-fold in men. By contrast, no meaningful change was seen over this period, in age-adjusted incidence rate ratios for TJR of the knee or hip in patients with rheumatoid arthritis, ranging from 0.7 to 1.2 in 2003 compared with 1986.

**Conclusion:** The prevalence of TJR surgery has increased 2–10-fold in patients without rheumatoid arthritis patients, associated with an ageing population, but has not increased in patients with rheumatoid arthritis between 1986 and 2003. These data are consistent with emerging evidence that long-term outcomes of rheumatoid arthritis have improved substantially, even before the availability of biological agents.

Total joint replacement (TJR) of the knee and hip is an important severe long-term outcome for patients with rheumatoid arthritis, which accounts for a substantial component of the costs of this disease.<sup>1</sup> Nonetheless, relatively little information is available about the prevalence of joint replacement surgery in patients with rheumatoid arthritis. Wolfe and Zwillich<sup>2</sup> estimated that 25% of all patients with rheumatoid arthritis who were under observation between the 1970s and 1990s needed a TJR surgery during the two decades.

Rates of TJR surgery of the knee and hip have increased substantially since the early 1980s,<sup>3–4</sup> associated with ageing of the population. However, several recent studies suggest that rates of TJR surgery have decreased in patients with rheumatoid arthritis in recent years.<sup>5–9</sup> A decline in TJR surgery in patients with rheumatoid arthritis is consistent with evidence of improved clinical status of patients with rheumatoid arthritis at this time compared with previous decades, according to disease activity,<sup>10–11</sup> functional capacity,<sup>11–14</sup> radiographic scores<sup>11–15–16</sup> and other clinical measures,<sup>11</sup> including lower mortality in patients who responded to methotrexate.<sup>17–18</sup>

These observations suggested that a study of the relative incidence of TJR in the hip and knee patients with rheumatoid arthritis in other patients would be of considerable value. The availability of population-based registries in Finland provided a unique opportunity to analyse TJR in the general population and in patients with rheumatoid arthritis. We present analyses of the occurrence of primary TJR of the knee and hip in patients with rheumatoid arthritis and in patients without rheumatoid arthritis seen in Central Finland between 1986 and 2003.

## PATIENTS AND METHODS

The Central Finland District has a population of 263 869 (in 2000), 5% of the total population of Finland. The study was

approved by the Ethics Committee of the Central Finland Health Care District.

Jyväskylä Central Hospital, Finland, performs most TJR surgeries in patients who live in the Central Finland District, but some patients are referred to Jokilaakso Hospital and the Heinola Rheumatism Foundation Hospital, Finland. Therefore, patients with primary or revision TJR surgery of the knee or hip were identified in the databases of all these hospitals in 1986, 1988, 1993, 1998, 2000, 2002 and 2003 according to the codes for these operations. The first plan was to analyse the rate of the TJR surgeries every 5 years between 1983 and 2003, but the data were not available in an electronic format before 1986, and therefore 1983 was replaced with 1986. Two additional years 2000 and 2002 were chosen to obtain more data from recent years. An event was defined as the first primary TJR of the knee (or hip) per patient each year.

The data were linked with the population registry according to the unique personal code to identify patients who were living in the Central Finland District at the time of surgery. To identify patients with rheumatoid arthritis, the data were linked with the Central Finland Rheumatoid Arthritis Database that captures most patients in the district who have been diagnosed with rheumatoid arthritis since 1980.<sup>19</sup> Medical records of patients who were not included in the RA database were checked for diagnosis of rheumatoid arthritis. Other diagnoses comprised >95% of primary osteoarthritis and were called “non-rheumatoid arthritis patients”.

## Statistical methods

Results for continuous variables were computed as mean standard deviation (SD), and for dichotomous variables as

**Abbreviations:** TJR, total joint replacement

percentages. Differences between the groups were tested using Student's *t* test and analysis of variance, when appropriate.

Unadjusted occurrences with 95% Poisson confidence intervals (CIs) for primary TJR surgery of the knee and hip were calculated per 100 000 adults (>15 years old) each year, stratified to sex and diagnosis (rheumatoid arthritis vs. non-rheumatoid arthritis). This analysis was performed to recognise robust rates of TJR in the population over time.

Age-standardised incidence rate ratios were calculated for primary TJR of the knee and hip using Poisson regression models, with 1986 as the reference value. The denominator was the mid-year number of female or male adult population of the Central Finland district for each year. These numbers are available at the Official Statistics of Finland and at the government website <http://www.stat.fi> for every year since 1980.

## RESULTS

The unadjusted occurrence of primary TJR of the knee increased from 17 to 187 per 100 000 in non-rheumatoid arthritis women and from 6 to 76 in men between 1986 and 2003 (table 1). The unadjusted occurrence of primary TJR of the hip increased over this period from 70 to 142 in non-rheumatoid arthritis women and from 39 to 98 in men (table 1).

In patients with rheumatoid arthritis, the unadjusted occurrence of primary TJR of the knee and hip increased until the 1990s and declined during the most recent years (table 1). No statistically significant changes were seen in the age-standardised incidence rate ratios of primary TJR of the knee or hip in patients with rheumatoid arthritis between 1986 and 2003 (fig 1A–D) except for TJR of the knee in women in 1998. In 2003, the age-adjusted incidence rate ratios (95% CI) were 1.2 (0.6 to 2.3) for TJR of the knee in female and 0.7 (0.2 to 3.6) in male patients with rheumatoid arthritis, and 0.7 (0.3 to 1.3) for TJR of the hip in female and 0.7 (0.2 to 3.7) in male patients with rheumatoid arthritis (fig 1 A–D). In non-rheumatoid arthritis patients, the age-adjusted incidence rate ratios (95% CI) were 9.8 (6 to 15.8) for TJR of the knee in female and 9.8 (4.3 to 22.5) in male patients, and 1.8 (1.4 to 2.4) for TJR of the hip in females and 2 (1.4 to 3) in males in 2003 (fig 1 A–D).

Patients with rheumatoid arthritis were a few years younger than patients with other diagnoses, 67 versus 71 years, when

they had TJR of the knee ( $p < 0.001$ ), and 66 versus 69 years when they had TJR of the hip ( $p = 0.005$ ). The age of patients with rheumatoid arthritis who had TJR increased over the 18 years, but this increase was not statistically significant (table 2). The mean duration of rheumatoid arthritis was between 13 and 20 years at the time of TJR surgery during 1986–2003, with no statistically significant trend over the years (table 2).

## DISCUSSION

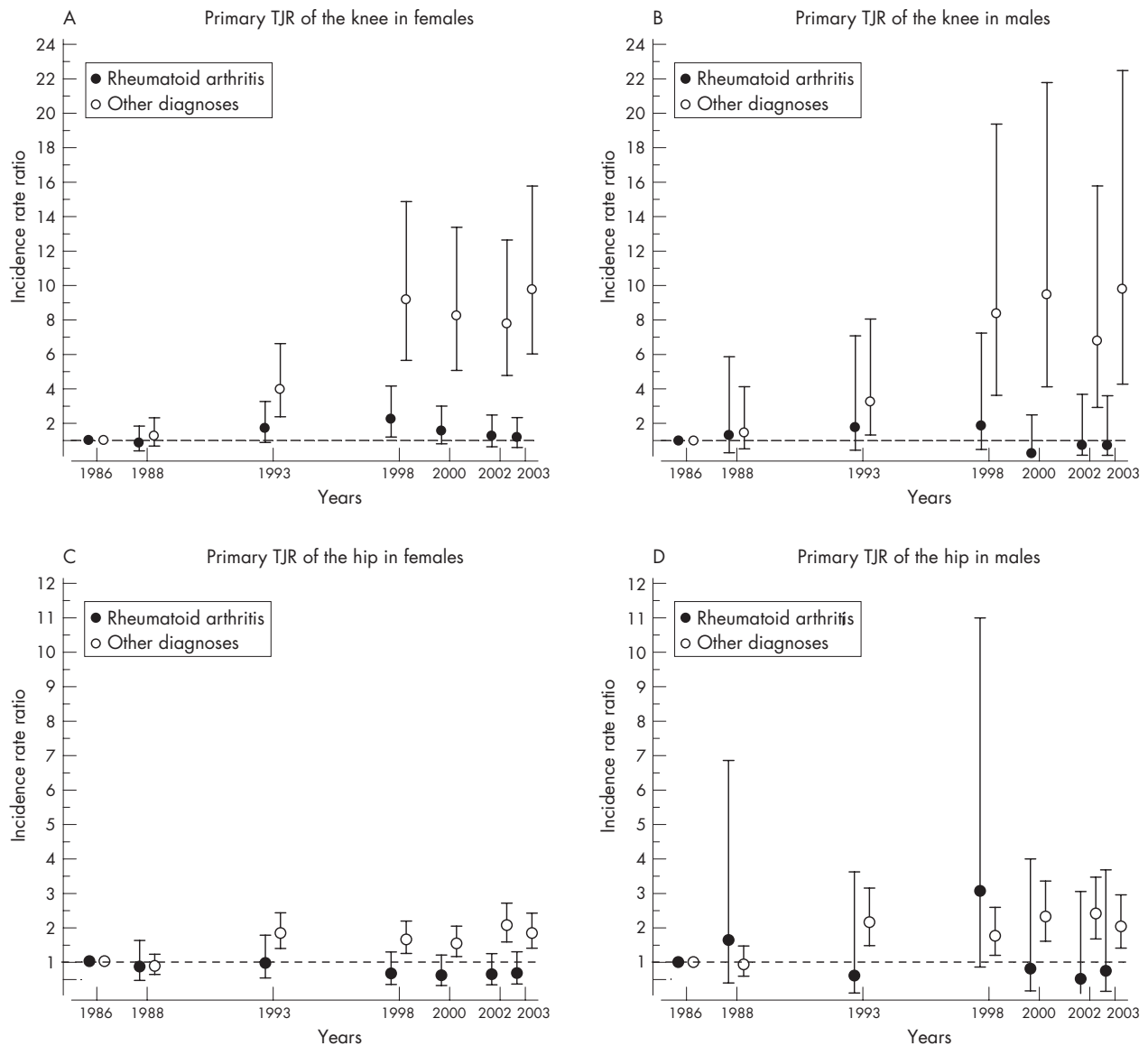
Over an 18-year period between 1986 and 2003, the age-standardised incidence rate ratio of TJR increased almost tenfold for the knee and twofold for the hip in patients without rheumatoid arthritis, but was virtually unchanged in patients with rheumatoid arthritis. These observations, obtained from the same population, are consistent with previous reports, indicating an increase in rates of knee and hip TJR surgery over the past two decades in the general population from many countries,<sup>3,4</sup> with a concomitant decrease of TJR surgery in patients with rheumatoid arthritis in other studies.<sup>5,6,8,9</sup>

Despite the dramatic increase in TJR operations between 1986 and 2003, the occurrence of TJR surgery in patients with rheumatoid arthritis did not increase, which is in line with the results of other recent reports.<sup>5,6,8</sup> In the Rochester Epidemiology Project, patients who were diagnosed with rheumatoid arthritis after 1985 were less likely to require joint replacement surgery compared with patients who had been diagnosed in earlier years.<sup>5</sup> A decrease in the rate of primary knee TJR in patients with rheumatoid arthritis was reported in the California State Hospitalisation Database in 1983–2001.<sup>6</sup> A decrease in both knee and hip TJR surgeries was seen in Sweden between 1987 and 2001 in patients with rheumatoid arthritis.<sup>8</sup> In Norway, a decrease in orthopaedic surgery was seen among patients with inflammatory arthritis between 1994 and 2004.<sup>9</sup> In a group of patients who started a tumour necrosis factor inhibitor, the annual rate of TJR surgery decreased from 22% to 10%.<sup>7</sup>

The most plausible explanation for the decline in TJR in patients with rheumatoid arthritis is that clinical status in these patients is improved from earlier decades, as indicated in a number of reports.<sup>5,6,8,11–18</sup> Possible reasons for improved clinical status of patients with rheumatoid arthritis include

**Table 1** Unadjusted occurrences (95% CI) of total joint replacements of the knee and hip in patients with rheumatoid arthritis and with other diagnoses, per 100 000 adult female and male population in Central Finland

Year	Knee				Hip			
	Rheumatoid arthritis		Other diagnoses		Rheumatoid arthritis		Other diagnoses	
	Patients with TJR (n)	Incidence (95% CI)	Patients with TJR (n)	Incidence (95% CI)	Patients with TJR	Incidence (95% CI)	Patients with TJR (n)	Incidence (95% CI)
<b>Women</b>								
1986	14	14 (7 to 23)	18	17 (10 to 27)	20	19 (12 to 30)	73	70 (55 to 89)
1988	12	12 (6 to 20)	23	22 (14 to 33)	17	16 (10 to 26)	64	62 (47 to 79)
1993	25	23 (15 to 34)	77	72 (57 to 90)	20	19 (11 to 29)	143	134 (113 to 157)
1998	34	31 (21 to 43)	186	170 (146 to 196)	14	13 (7 to 21)	135	123 (103 to 146)
2000	24	22 (14 to 32)	170	154 (131 to 178)	13	12 (6 to 20)	128	116 (96 to 137)
2002	20	18 (11 to 28)	165	148 (126 to 172)	14	13 (7 to 21)	178	160 (137 to 185)
2003	19	17 (10 to 26)	210	187 (163 to 214)	15	14 (5 to 22)	160	142 (121 to 166)
<b>Men</b>								
1986	3	3 (0 to 9)	6	6 (2 to 13)	3	3 (0 to 9)	38	39 (27 to 53)
1988	4	4 (0 to 10)	9	9 (4 to 17)	5	5 (2 to 12)	36	36 (26 to 51)
1993	6	6 (2 to 13)	22	22 (14 to 33)	2	2 (0 to 7)	91	89 (72 to 109)
1998	7	7 (3 to 14)	62	59 (54 to 87)	11	11 (5 to 19)	81	78 (62 to 96)
2000	1	1 (0 to 5)	73	69 (54 to 87)	3	3 (0 to 8)	111	105 (86 to 127)
2002	3	3 (0 to 8)	55	52 (39 to 67)	2	2 (0 to 7)	121	114 (94 to 136)
2003	3	3 (0 to 8)	83	76 (61 to 95)	3	3 (0 to 8)	105	98 (80 to 119)



**Figure 1** A–D Age-standardised incidence rate ratios (95% CI) for primary total joint replacement of the knee and hip, with 1986 as the reference value. TJR, total joint replacement

**Table 2** Mean (SD) age and disease duration of patients with rheumatoid arthritis with primary total joint replacement of the knee and hip, according to year

Year	Primary TJR of the knee		Primary TJR of the hip	
	Age mean (SD)	Disease duration, mean (SD)	Age mean (SD)	Disease duration, mean (SD)
1986	64 (9)	17 (14)	62 (14)	15 (13)
1988	65 (14)	20 (7)	64 (8)	19 (14)
1993	63 (10)	16 (8)	66 (14)	15 (11)
1998	66 (9)	14 (11)	64 (10)	18 (13)
2000	68 (11)	15 (11)	66 (10)	13 (11)
2002	67 (9)	15 (12)	64 (14)	17 (12)
2003	66 (10)	17 (14)	69 (9)	18 (11)

TJR, total joint replacement.

patient selection towards milder cases seeking medical care, milder disease in general and improved treatment.<sup>16</sup> Although this study does not explore reasons for improved outcomes, our results reflect the history of rheumatoid arthritis 15–20 years before the occurrence of TJR (table 2), and in any case the era before tumour necrosis factor inhibitors were widely used. A local strategy has been to treat patients with rheumatoid arthritis early and aggressively, including increasing the early use of methotrexate.<sup>20</sup> However, this study provides only indirect evidence of improved long-term outcomes of rheumatoid arthritis, and generalisability of our observations need to be tested in further studies.

Several limitations are seen in this study. Firstly, there is a relatively low number of cases. However, the population-based sample consisted of >200 000 adults in a healthcare district over 18 years, including all three hospitals that perform TJR operations in patients who live in the Central Finland District. Our

study explores TJR rates in patients with and without rheumatoid arthritis in a population—that is, all members of the population form the denominator in the calculations, although most of these population members are not at risk for the procedures. Katz and Losina<sup>21</sup> dealt with this issue in a recent editorial, pointing out that the true at-risk population for an estimate of the utilisation rates of TJR consists of people with advanced arthritis who have no contraindications for TJR and are willing to undergo the procedure. Recognising this limitation that applies to this study, we believe that our results reflect the true occurrence of TJR as a phenomenon in a population.

A second possible limitation of this study is that criteria for TJR may have changed over time, and that TJR surgery has become more available to individuals with less severe diseases. However, this change would probably apply equally to patients with rheumatoid arthritis as to patients with other diseases.

A third possible limitation is that the pool of available cases has changed, as the number of people  $\geq 65$  years increased by 33% between 1986 and 2003 in the Central Finland District (<http://www.stat.fi>). However, this shift in the population seems to apply equally to people with osteoarthritis and other conditions as much as to people with rheumatoid arthritis.

A strength of our study includes epidemiological data from the entire district that were available to us over almost two decades. Unfavourable long-term outcomes or side-effects of rheumatoid arthritis, such as functional losses, work disability, early death, joint damage, and need for TJR surgery, cannot be studied in randomised controlled trials,<sup>22</sup> and data must be collected in longitudinal observational studies or epidemiological data may be analysed such as in this study.

Orthopaedic surgery has been considered as a failure of conservative rheumatology care in rheumatoid arthritis. Our results imply that resources for TJR surgery of the knee and hip can be directed to osteoarthritis rather than to rheumatoid arthritis, as the need for TJR surgery in patients with rheumatoid arthritis seems stable or even decreasing. We conclude that our observations might add to an increasing body of evidence that long-term outcomes of rheumatoid arthritis have improved over the past two decades.<sup>5 6 8 9 11–18</sup>

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