Knee arthroplasty in rheumatoid arthritis

A report from the Swedish Knee Arthroplasty Register on 4,381 primary operations 1985–1995

Otto Robertsson, Kaj Knutson, Stefan Lewold, Stuart Goodman[1] and Lars Lidgren

The Swedish Knee Arthroplasty Register has data on 4,381 primary operations performed 1985–1995 for rheumatoid arthritis. Of these, 192 were performed with unicompartmental prostheses and 4143 with tricompartmental. 77% were women and the mean age was 66 years. There were 126 first, 20 second, and 1 third revision in tricompartmental arthroplasties, mainly for loosening, infection and patellar problems. There were 38 first, 3 second, and 1 third revision in unicompartmental arthroplasties, mainly for progression of RA and loosening .

Cumulative revision rates (Kaplan-Meier) were calculated. Tricompartmental knees had a 10-year cumulative revision rate of 5% and uni-knees 25%. Patients treated before 1990, men and patients younger than 55 had higher revision rates than patients treated after 1990, women and older patients, respectively. Cemented tibial components resulted in lower revision rates than uncemented ones. There was no significant difference in revision rates between patellar replaced and unreplaced knees or between the 9 commonest implant types.

Department of Orthopedics, University Hospital, S-221 85 Lund, Sweden. Tel +46 46-171000. Fax -130732; [1]Stanford University Medical Center, CA, USA
Submitted 97-07-04. Accepted 97-11-07

In 1975, the Swedish Knee Arthroplasty Register was initiated by the Swedish Orthopedic Society to monitor prospectively the evolution of knee arthroplasty on a nationwide basis. Since then, primary knee arthroplasties and their revisions have been reported yearly by the participating departments to the project center at the Department of Orthopedics in Lund. Details of the design of the register have previously been reported (Knutson et al. 1994)

The Register is regularly updated on patient mortality against national census registers. The endpoint in the prosthetic survival analyses is revision, i.e., addition, exchange or removal of prosthetic components. Revisions are distinguished from other reoperations by checking the medical charts of failed cases.

In a previous report on survival of knee arthroplasties for rheumatoid arthritis (RA) from the Register, covering the period 1976–1983, the average yearly number of arthroplasties was 430 (Knutson et al. 1986). In the beginning of this period, half the number of arthroplasties were performed using unicompartmental prostheses with a poor prosthetic survival rate.

In a recent report from the Register covering three periods, 1976–1982, 1983–1987, and 1988–1992, the increasing use of tricompartmental prostheses for RA was described (Knutson et al. 1994). We also showed that the combined effect of improved implants and technique had gradually reduced the cumulative revision rates for tricompartmental arthroplasties.

We now present an updated report from the Register, comparing the results of a series of knee arthroplasties performed 1985–1989 and 1990–1995 for RA.

Patients and methods

During 1985–1995, 4,381 primary knee arthroplasties for RA were recorded. The yearly number averaged 400 (Figure 1). The commonest type of implant was tricompartmental and it was the only type used at the end of the period (Figure 2 and Table 1). There were 3,346 primary arthroplasties in women with a mean age of 66 years and 1,035 in men with a mean age of 65 years (Table 1). 24% of the arthroplasties were performed at university hospitals, 63% at county hospitals and 12% at local hospitals. Patients at local hospitals were older (Figure 3) and unicompartmental prostheses more often used (Figure 4). The use of unicompartmental prostheses at local hospitals, however, decreased from 21% in 1985–1989 to 8% in 1990–1995.

Tricompartmental prostheses were used with (n 1,925) or without (n 2,214) patellar components (Table 3). The county hospitals more frequently than oth-

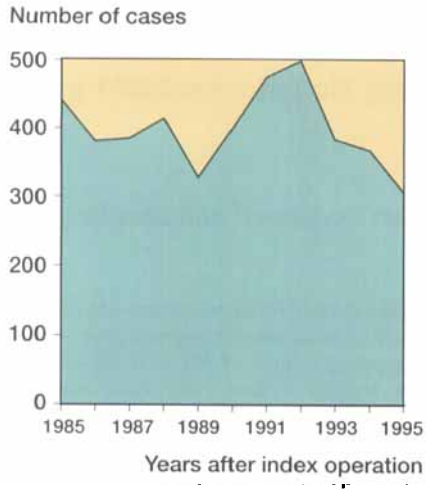


Figure 1. The yearly number of knee arthroplasties for RA was around 400, which was slightly lower than during the preceding 10-year period (430).

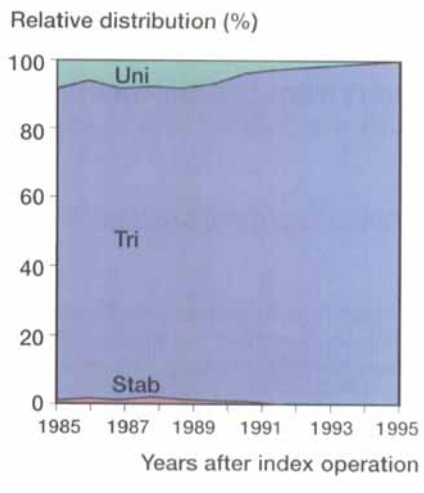


Figure 2. Unicompartmental prostheses, medially, laterally or combined, were used in 5%, tricompartmental in 94% and stabilized in 1%.

er hospitals used patellar components, but overall the use decreased from 36% to 30% at university hospitals, from 72%, to 37% at county hospitals and from 73% to 24% at local hospitals.

Data on cementation of components were recorded in only 3,054 of 4,143 tricompartmental arthroplasties. Registration of cementation status for each component was introduced during the study: 273 tibial components had noncemented fixation and the remaining 2,781 were cemented. Of the 2,781 with cemented tibial component, 2,252 had all their components cemented and the rest were hybrids, with at least one uncemented component.

Table 1. Type of prosthesis and mean ages in 4,381 knee arthroplasties for RA in Sweden 1985–1995

Type	N	n	Mean age
Linked [a]	44		
Tricompartmental	4143		
Women		3176	66
Men		964	66
Unicompartmental	192		
Women		133	66
Men		59	65
Medial/Lateral/Bilateral		99/23/70	
Patellar	2		

[a] Today, mainly rotating hinges. Posterior stabilized prostheses are included in the tricompartmental group.

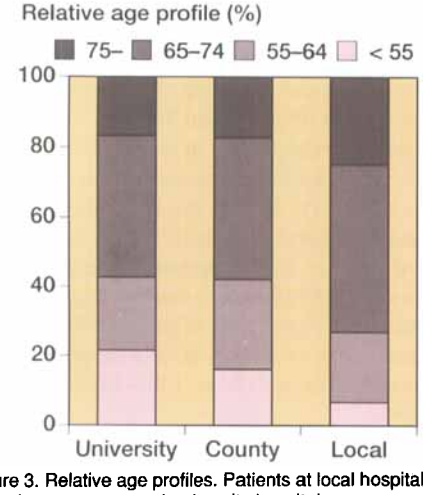


Figure 3. Relative age profiles. Patients at local hospitals were older than at county and university hospitals.

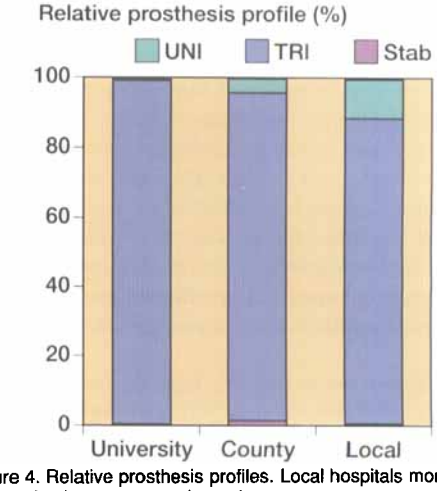


Figure 4. Relative prosthesis profiles. Local hospitals more often used unicompartmental prostheses.

Table 2. Prostheses in 4,381 knee arthroplasties for RA in Sweden 1985–1995

Tricompartmental prosthesis	n	Tricompartmental prosthesis	n	Unicompartmental prosthesis	n
AGC	919	Richards Tricon	129	Marmor	65
Freeman-Samuelson	659	Miller-Galante	106	St Georg sledge/Link	54
Scan	499	Synatomic	97	PCA	41
PCA	446	Townley	91	Various	32
F/S modular	179	Kinematic standard	91		
Kinemax	168	RMC	90		
PFC	150	Duracon	86		
TCCK	140	Freeman, early models	43		
PCA modular	131	Various	121		

Table 3. Use of patellar component in tricompartmental knee arthroplasties for RA in Sweden 1985–1995

	Patellar component		
	No (n 2214) [a]	Yes (n 1925) [a]	% of all
Women	1695	1480	
Men	519	445	
Mean age (years)	66	65	
University hospital [b]	687	334	33
County hospital [b]	1219	1365	53
Local hospital [b]	292	177	38
1985–1989	664	1118	63
1990–1995	1550	802	34

[a] 3 cases had missing value and 1 patellectomy
[b] 70 not classified because of changed status of hospital

Table 4. Indication for first revision in tricompartmental (TRI) and unicompartmental (UNI) knee arthroplasties for RA in Sweden 1985–1995

	TRI			UNI
Period	1st	2nd	Total	Total
Index cases	1783	2360	4143	192
Infection	22	13	35	2
Loosening	35	7	42	12
Other mechanical	9	1	10	3
Instability	5	6	11	4
Fracture	2	0	2	1
Patellar	12	8	20	1
Progress of RA	2	0	2	13
Other	2	2	4	2

Statistics

The cumulative revision rates and the associated 95% confidence intervals have been calculated, using Kaplan-Meier survival statistics (SPSS software). The proportional hazards model and Cox regression analysis were used to test the curves, with a significance level of 0.05. Only uni- and tricompartmental prostheses were analyzed and the cutoff point was 40 remaining cases.

Outcome

Revisions

A first revision was recorded in 126 of 4,143 tricompartmental arthroplasties and 38 of 192 unicompartmental. A second revision was recorded in 22 in the former and 3 in the latter group. One third revision was recorded in each group. In first-exchange procedures performed in tricompartmental arthroplasties, a patellar component was removed in 22 and a patellar component was added in 17 instances.

The end result in the 126 revised tricompartmental arthroplasties was a linked prosthesis in 14, a new tricompartmental prosthesis in 92, arthrodesis in 11, resection arthroplasty in 7 and amputation in 2.

First revision after unicompartmental arthroplasties included 3 linked, 25 tricompartmental, 9 unicompartmental prostheses and 1 arthrodesis.

The main indications for first revision in tricompartmental arthroplasties were loosening in 42, infection in 35 and patellar problems in 20. Tricompartmental arthroplasties performed 1990–1995 were more often revised for infection than for loosening. Unicompartmental arthroplasties were revised mainly because of progression of arthritic destruction in the remaining compartment or because of component loosening (Table 4).

In the 35 infected primary tricompartmental arthroplasties, the first revision was performed within 2 years in 24. In 15 of the infected cases, the first revision step was removal of the implant. A new prosthesis was implanted within 6 weeks in 6 and one of these was later revised to a rotating hinge. Another 5 had a new prosthesis 6–13 weeks after explantation. One case had an amputation after 1 year and 3 were still without a new implant at 3 years. 11 infected tricompartmental arthroplasties had a one-stage exchange procedure and one of these later underwent an arthrodesis. 9 infected primary tricompartmental ar-

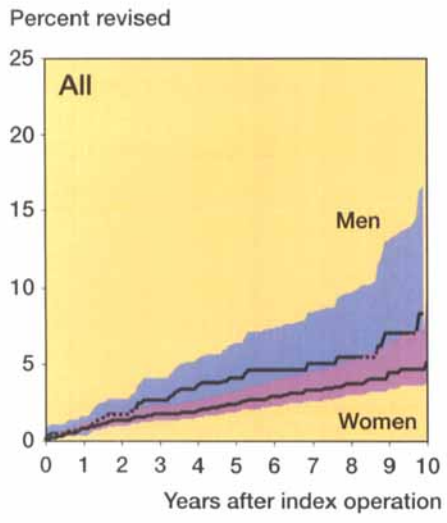


Figure 5. One fourth of the tricompartmental arthroplasties were performed on men and they had a higher revision rate than women (p = 0.04).

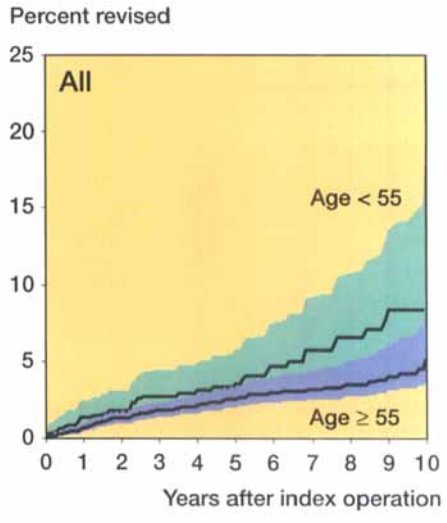


Figure 6. 1 patient in 6 with tricompartmental arthroplasty was below age 55 and they had a higher revision rate than older patients (p = 0.05).

throplasties were treated with arthrodesis and one of these had a re-arthrodesis.

Sex and age

Among patients treated with tricompartmental arthroplasty, men had a higher cumulative revision rate than women (Figure 5). Patients younger than age 55 also had a higher revision rate than older patients (Figure 6). In fact, every further year of age reduced the risk of revision by 2%.

Year of operation

In tricompartmental arthroplasty, the year of operation had a significant influence on the cumulative revision rate. For each year since 1985, the risk was reduced by 15%. This was also evident when comparing the period 1985–1989 with 1990–1995 (Figure 7). Infection, loosening and patellar problems account for three fourths of the failures. When comparing tricompartmental arthroplasties during the period 1985–1989 with 1990–1995, a reduction in cumulative revision rate was seen both in cases revised for loosening and other mechanical problems such as instability or malposition. The same trend was seen in cases revised for infection and cases that ended with a removed implant indicating a knee fusion, resection arthroplasty or amputation (Figure 8).

Uni- versus tricompartmental prostheses

Medial, lateral and double unicompartmental arthroplasties combined, all had poorer survival rates than tricompartmental arthroplasties (Figure 9).

Type of hospital

Local hospitals had significantly higher revision rates than university and county hospitals ($p < 0.001$; Cox regression; age, sex, index year, type of hospital). This difference was mainly caused by their use of unicompartmental prostheses.

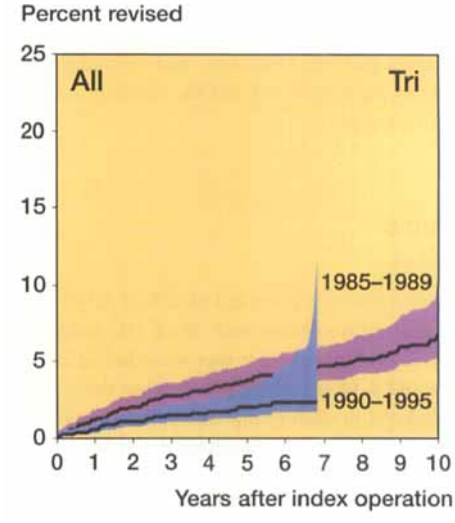
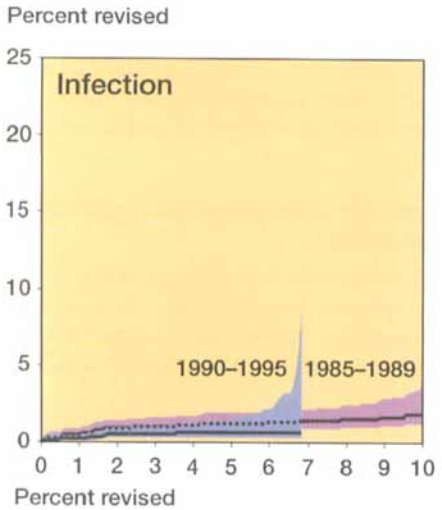
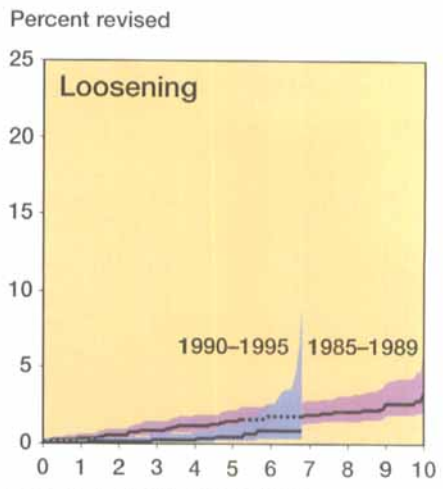
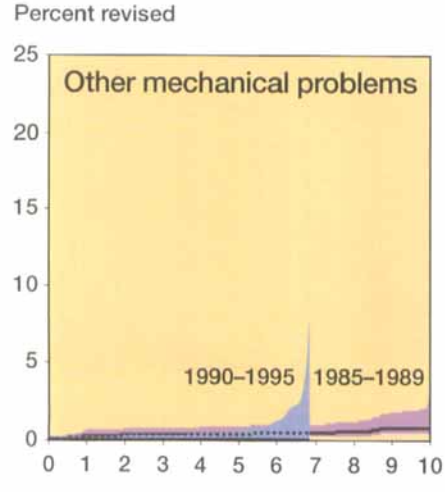


Figure 7. Tricompartmental knee replacement with or without patellar component had a low and improving cumulative revision rate (p = 0.002).







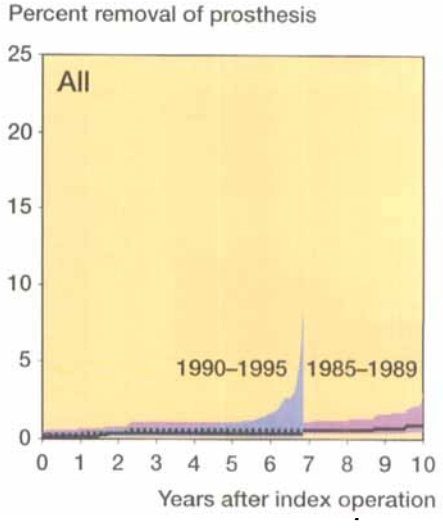


Figure 8. Comparison of the cumulative revision with the endpoints infection ($p = 0.09$), loosening ($p = 0.004$), other mechanical problems ($p = 0.03$) and prosthetic removal ($p = 0.2$) for period 1985–1989 with 1990–1995.

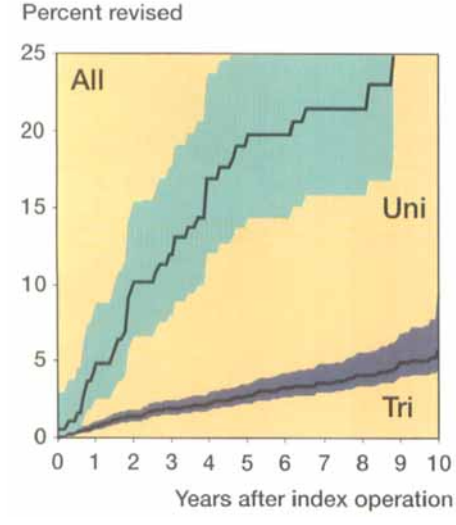


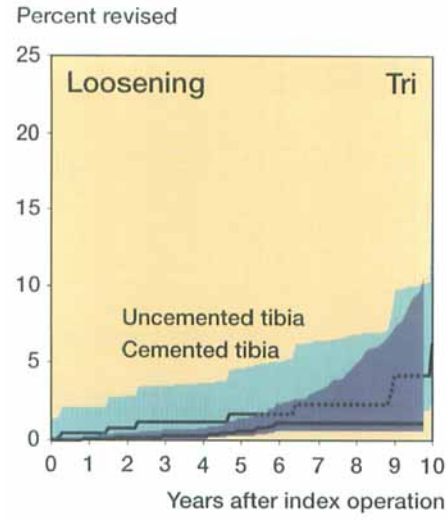
Figure 9. Medial, lateral and double unicompartmental arthroplasties combined had poorer survival rates than tricompartmental arthroplasties ($p < 0.001$).

Use of patellar component

There was no significant difference in cumulative revision rate between tricompartmental arthroplasties with or without a patellar component ($p = 0.6$). Cox regression analysis (age, sex, year of operation and patellar use) confirmed this, as also did isolated analyses of the commonest implants.

Mode of fixation

Tricompartmental prostheses with cemented tibial components had a lower cumulative revision rate than those with uncemented tibial components ($p = 0.02$). The same was found when only models designed for uncemented use—with or without cement—were compared and also when loosening alone was used as an endpoint (Figure 10).



Models compared

The 9 commonest tricompartmental models are listed in Table 2. The corresponding cumulative revision rates are compared in Figure 11 (not significant; p = 0.4–0.9).

Rerevision in noninfected tricompartmental arthroplasties

86 tricompartmental arthroplasties were revised with new components for noninfection failures, 6 with a linked prosthesis, 48 with a new tricompartmental implant, 15 with partial exchange and 17 with addition

Figure 10. Tricompartmental prostheses with cemented tibial component had a lower cumulative revision rate for loosening than those with an uncemented tibial component (p = 0.03).

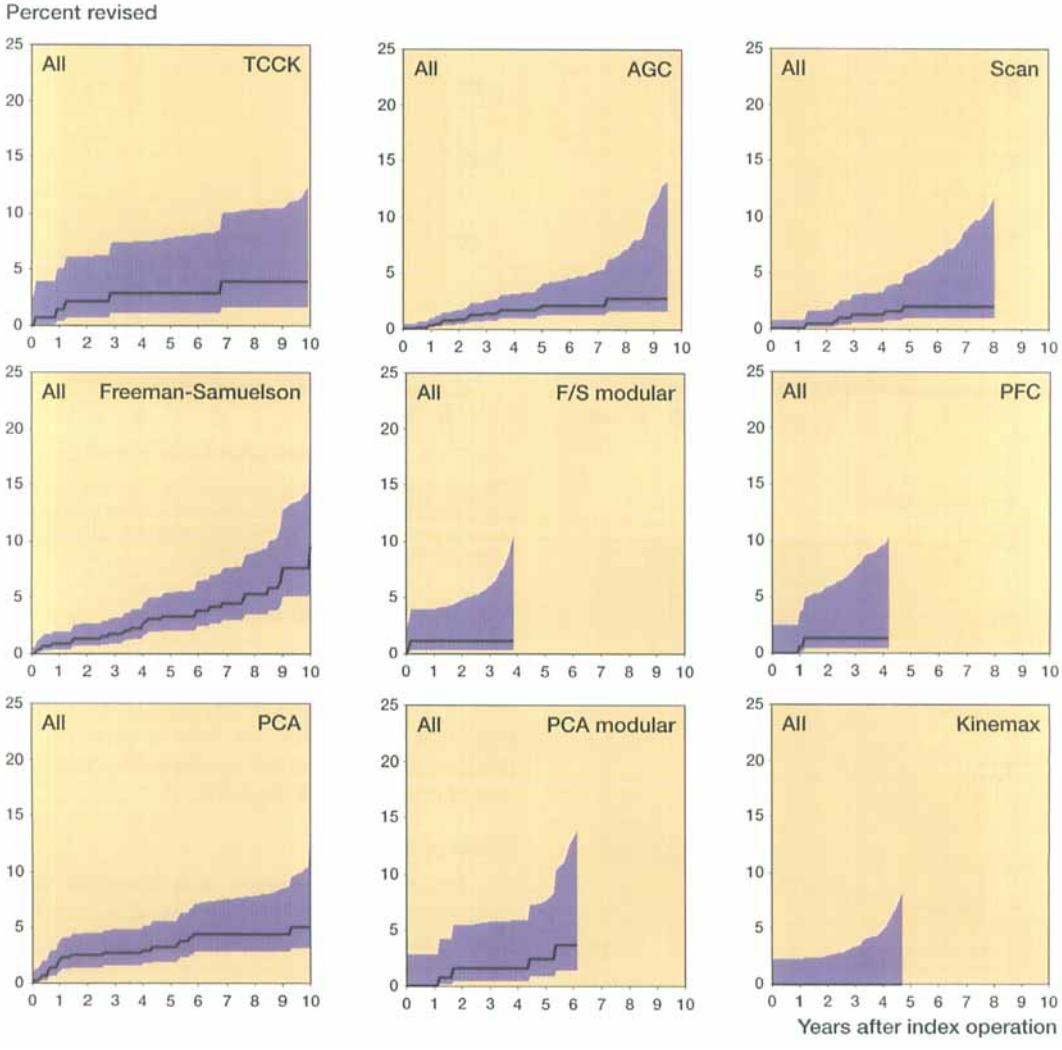


Figure 11. The cumulative revision rate in the 9 commonest tricompartmental models (no significant differences).

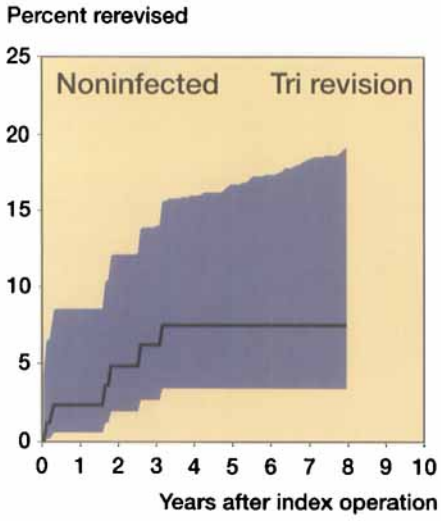


Figure 12. 86 revised tricompartmental arthroplasties with new components implanted for failures other than infection had 8% rerevision at 8 years.

of a patellar component. The 6 rerevisions were performed with a linked prosthesis in 2, partial exchange in 3 and removal of the implant in 1. The cumulative rerevision rate was 8% at 8 years (Figure 12).

Discussion

Tricompartmental knee arthroplasty for RA is a safe procedure with a steadily improving prosthetic survival. The almost constant yearly number of knee arthroplasties for RA in Sweden, the lack of need for constrained implants and the increasing mean age indicate that this surgery has no backlog and is in steady state. In other words, RA patients in the present series may have less severe joint destruction than those in previous series. However, in the present period there is no reason to believe that the indication for surgery has changed.

Although loosening and infection remain the commonest indications for revision, the rate is low and patellar problems are evolving as the new threat to successful arthroplasty. Our analyses could not show whether patellar replacement should be performed. The decision to replace the patella is based not only on estimates of revision risks but also on the effect of the procedure on clinical outcome. In one comparative 3-year follow-up study, no clinical benefit was seen in scoring or mobility (Shoji et al. 1989). Selective use of patellar replacement in cases with low-riding patella has been advocated (Fern et al. 1992). However, low-riding patella also occurs postoperatively through shrinkage of the patellar ligament (Koshino et al. 1990). Previous reports on patellar revision rates vary considerably. Hvid et al. (1987) had 1 revision in 100 Insall-Burstein knees, while Wright et al. (1990) had 10 in 96 Kinematic knees. Using the PCA prosthesis, Ebert et al. (1992) had 2 patellar revisions in 102 knees and Elke et al. (1995) 2 in 61. In several reports, patellar revision is not mentioned (Laskin 1990, Moran et al. 1991, Partio et al. 1993).

Loosening of the tibial component is the commonest mechanical problem. A revision rate of 3% has been reported for the PCA knee (Ebert et al. 1992, Elke et al. 1995) and Synatomic noncemented knee (Partio and von Bonsdorff 1994). Using the Insall-Burstein knee, Kristensen et al. (1992) observed a 4% revision rate while Hvid et al. (1987) and Aglietti et al. (1995) had none. Femoral component problems are rarely reported.

The infection rate was 2.2% in over 2,000 tricompartmental knee arthroplasties for RA (Wilson et al. 1990). This was higher than in arthrosis. In several of the above-mentioned reports, the revision rate for infection was approximately the same as the revision rate for loosening.

In the present report, the 10-year cumulative revision rate for tricompartmental prostheses was 5%. This was better than reported by Laskin (1990; 19%), Rand and Ilstrup (1991; 18%), and Elke et al. (1995; 19%) but not so good as reported by Ranawat et al. (1989; 0%) or Aglietti et al. (1995; 4%).

As a consequence of the low revision rate and the fairly large number of models used, we found no underperforming model. It is likely that RA patients are physically inactive because of the disease. Low joint forces are produced and thus do not really put the prostheses to the test (Brugioni et al. 1990). This may be one factor, and disease-related osteopenia another factor, explaining why the introduction of noncemented prosthetic fixation could not be shown to be advantageous. Further observation will, of course, reveal more, but by then the implants may have become obsolete.

One limitation in using cumulative revision rates to describe the safety of implants is that they do not distinguish between the various types of revision. Addition of a patellar component cannot be compared to knee fusion. However, if subsets of revision were to be analyzed for different models, the sample size would be even larger.

Clinical safety, i.e., low revision rate, is only one aspect of prosthetic evaluation. Our study does not take clinical performance into consideration. A safe implant may score lower than a less safe one. However, in RA, functional scores are of limited value, since

they are vry much influenced by the general condition of the patient (Elke et al. 1995).

Acknowledgements

We thank all contributing colleagues for submitting their data and providing secretarial help (Table 5).

References

Aglietti P, Buzzi R, Segoni F, Zaccherotti G. Insall-Burstein posterior-stabilized knee prosthesis in rheumatoid arthritis. J Arthroplasty 1995; 10: 217-22.

Brugioni D J, Andriacchi T P, Galante J O. A functional and radiographic analysis of the total condylar knee arthroplasty. J Arthroplasty 1990; 5: 173-80.

Ebert F R, Krackow K A, Lennox D W, Hungerford D S. Minimum 4-year follow-up of the PCA total knee arthroplasty in rheumatoid patients. J Arthroplasty 1992; 7: 101-8.

Elke R, Meier G, Warnke K, Morscher E. Outcome analysis of total knee-replacements in patients with rheumatoid arthritis versus osteoarthrosis. Arch Orthop Trauma Surg 1995; 114: 330–4.

Fern E D, Winson I G, Getty C J. Anterior knee pain in rheumatoid patients after total knee replacement. Possible selection criteria for patellar resurfacing. J Bone Joint Surg (Br) 1992; 74: 745-8.

Hvid I, Kjaersgaard-Andersen P, Wethelund J O, Sneppen O. Knee arthroplasty in rheumatoid arthritis. Four- to six-year follow-up study. J Arthroplasty 1987; 2: 233-9.

Knutson K, Lindstrand A, Lidgren L. Survival of knee arthroplasties: a nation-wide multicentre investigation of 8000 cases. J Bone Joint Surg (Br) 1986: 68-: 795-803.

Knutson K, Lewold S, Robertsson O, Lidgren L. The Swedish knee arthroplasty register: a nation-wide study of 30,003 knees 1976–1992. Acta Orthop Scand 1994; 65 (4): 375-86.

Kristensen O, Nafei A, Kjaersgaard-Andersen P, Hvid I, Jensen J. Long-term results of total condylar knee arthroplasty in rheumatoid arthritis. J Bone Joint Surg (Br) 1992; 74: 803-6.

Koshino T, Ejima M, Okamoto R, Morii T. Gradual low riding of the patella during postoperative course after total knee arthroplasty in osteoarthritis and rheumatoid arthritis. J Arthroplasty 1990; 5: 323-7.

Laskin R S. Total condylar knee replacement in patients who have rheumatoid arthritis. A ten-year follow-up study. J Bone Joint Surg (Am) 1990; 72: 529-35.

Moran C G, Pinder I M, Lees T A, Midwinter M J. Survivorship analysis of the uncemented porous-coated anatomic knee replacement. J Bone Joint Surg (Am) 1991; 73: 848-57.

Partio E, von Bonsdorff H. Cementless Synatomic total knee arthroplasty in rheumatoid and osteoarthritic knees: a clinical and radiological review with follow-up from 4 to 7 years. J Orthop Rheumatol 1994; 7: 155-63.

Table 5. Present participants in the project

Hospital	Orthop. surgeon	Secretary
Akademiska	Jan Milbrink	Zerny Paulsson
Alingsås	Rolf Appelqvist	Ing-Britt Gustavsson
Arvika	Lars Enskog	Britt-Inger Karlsson
Avesta	Julius Ruszh	
Boden	Arne Henriksson	Ann-Britt Larsson
Bollnäs	Gunnar Onelius	Eva Blomberg
Borås	Krister Sundholm	Viveka Lindell
Danderyd	Ulf Jonsson	Pia Göransson
Eksjö-Nässjö	Bengt Hagstedt	Lena Lewenhaupt
Elisabethklin.	Hans Rahme	
Enköping	Sten Karlström	Elaine Skirgård
Eskilstuna	Lars-G. Brobäck	Monica Lindberg
Fagersta	Johan Vollsäter	Margareta Rigvald
Falköping	Krister Hjalmars	Britt-Inger Modig
Falun	Anders Henricson	Irené Gradén
Gällivare	Jan Minde	Barbro Smedberg
Gävle	Per-Åke Eriksson	Birgitta Hansson
Halmstad	Ulf Larsson	Lena Malkoff
Helsingborg	Leif Ceder	May-Chr. Friberg
Huddinge	Anders Herrlin	Ann-Chr. Eriksson
Hudiksvall	Sven-Erik Keisu	Bodil Gabrielsson
Hässleholm	Arne Sahlström	Ewa Tallroth
Jönköping	Bengt-Olof Olnäs	Gullan Persson
Kalmar	Carl-H. Hybbinette	Birgitta Eriksson
Karlshamn	Claus Olesen	Linda Rotsten
Karlskoga	Anders Lindbäck	Ulla Laursén
Karlskrona	Ronny Lövdahl	Ing Marie Stéen
Karlstad	Anders Tolagen	Carina Bååth
Karolinska	Johan Isacson	Eva Åhlander
Kullbergska	Thomas Hultén	
Kristinehamn	Rolf Andersson	Birgitta Häggroth
Kungälv	Michael Eriksson	Anita Bengtsson
Köping	Carl Linton	Anette Lindberg
Landskrona	Reiner Brümmer	Anita Sörensson
Lindesberg	Sune Hallberg	Birgitta Bergström
Linköping	Magnus Lundberg	Anna-B. Gustavsson
Ljungby	Mats Wilhelmsson	Christina Björklund
Ludvika	Wolfgang Gammer	Ann-Christin Jansson
Lund	Stefan Lewold	Mariann Hökmark
Löwenströmska	T Welin-Berger/I Gladh	
Malmö	Lennart Sanzén	Margit Kosztovics
Mora	Håkan Bjerneld	Margaretha Larsson
Motala	Christer Djerf	Annelie Gustavsson
Mölndal	Tord Röstlund	Jill Fallenius
Norrköping	Anders Svanström	Christina Johansson
Norrtälje	Christer Lindh	
Nyköping	Svend Dirksen	Victoria Neuman
Oskarshamn	Håkan Sterling	Helene Toots
Sahlgrenska	Lars Regnér	Eva Allen Frizell
Sala	Jan Vannfält	Birgitta Lethi
Sandviken	Lars Brolin	Margareta Petersson
Simrishamn	Sverker Kinnerup	
Skellefteå	Torbjörn Hedlund	Birgitta Forsman
Skene	Hans C Östgaard	Karin Jokisalo
Skövde	Björn Tjörnstrand	I Nilsson/ L Åberg
Sollefteå	Jörgen Kongsholm	L Mähler/ B Rahmén
S:t Görans	Lars Weidenhielm	
Södersjukhuset	Per Hamberg	Agneta Biström
Sundsvall	J. Lykke-Olesen	Birgitta Hellrup
Säffle	Hans Lyrholm	Monika Olsson
Söderhamn	Lennart Persson	Eva Blomberg
Södertälje	Stig Lindequist	Britt Marie Blomqvist
Torsby	Odd Kleppenes	
Trelleborg	Birger Bylander	Anita Dewár
Vänersborg-NÄL	Lennart Ahnfeldt	Anita Broberg
Uddevalla	Rhagnar Myrhage	
Umeå	Kjell G Nilsson	Margareta Hagström
Varberg	Sven Björkström	Karin Gerdemark
Visby	Åke Karlbom	Solveig Nygren
Värnamo	Torbjörn Persson	Yvonne Sjödell
Västervik	Leif Joneberg	Lotta Törngren
Västerås	Maria Hilding	Vanja Karlsson
Växjö	Sten Bengtsson	Inger Sjödahl
Ystad	Peter Abdon	Agnetha Wahlman
Ängelholm	Anders Nordqvist	Britt-Marie Tilling
Örebro	Urban James	Britt-Marie Nordin
Örnsköldsvik	Per Magnusson	Astrid Kallin
Östersund	Villum Christensen	Inger Nilsson
Östra	Björn Albrektsson	Maile Gröndahl

Partio E, von Bonsdorff H, Hatanpää S, Lehto M U K. Anatomic Total Knee (Townley) arthroplasty in the rheumatoid and osteoarthritic knee: a clinical and radiographical study with follow-up from 3.5 to 10 years. J Orthop Rheumatol 1993; 6: 915.

Ranawat C S, Padgett D E, Ohashi Y. Total knee arthroplasty for patients younger than 55 years. Clin Orthop 1989; 248: 28-33.

Rand J A, Ilstrup D M Survivorship analysis of total knee arthroplasty J Bone Joint Surg (Am) 1991; 73: 397-409.

Shoji H, Yoshino S, Kajin A. Patellar replacement in bilateral total knee arthroplasty: a study of patients who had rheumatoid arthritis and no gross deformity of the patella. J Bone Joint Surg (Am) 1989; 71: 853-6.

Wilson MG, Kelley K, Thornhill TS. Infection as a complication of total knee-replacement arthroplasty—risk factors and treatment in sixty-seven cases. J Bone Joint Surg (Am) 1990; 72: 878-83.

Wright J, Ewald F C, Walker P S, Thomas W H, Poss R, Sledge C B. Total knee arthroplasty with the kinematic prosthesis. Results after five to nine years: a follow-up note. J Bone Joint Surg (Am) 1990; 72A: 1003-9.