

Patient survival after total knee arthroplasty

5-year data in 926 patients

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We analyzed prospectively the 5-year survival in 926 patients undergoing 1,024 total knee arthroplasties (TKA) in the period February 1989–December 1990. The patients were compared to an age- and sex-matched general population and to 326 patients operated on in the same period with total hip arthroplasty.

Cox analysis showed that male sex, rheumatoid arthritis and complications within the first year in-

creased the mortality rate in the TKA group. When this group was compared to the general population, only rheumatoid patients aged 65–74 years had an increased mortality. Generally, the TKA patients had a longer survival than the general population, especially women > 75 years old with arthrosis. The cumulative 5-year patient survival was 89%, both after hip and knee arthroplasty and was 81% in the matched general population.

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Patient survival after total hip arthroplasty (THA) is longer than that of the general population (Lindberg et al. 1984, Holmberg 1992, Visuri et al. 1994), although Seagroatt et al. (1991) demonstrated a minor excess mortality during the first 90 days.

Patient survival after total knee arthroplasty (TKA) has not been reported previously. These operations represent a considerable cost and we consider the patient survival to be a significant outcome measure, as well as the usually reported prosthesis survival.

We investigated the survival of a large number of prospectively registered TKA patients, identified factors of importance for survival and compared them with the survival of a group of THA patients and with the age- and sex-matched general population.

Patients and methods

In the period February 1989–December 1990, a multicenter study of total knee arthroplasty (AGC 2000, Biomet, Warsaw IN) included 1024 TKAs in 926 patients. The operations were performed in 14 Danish departments of orthopedics and the patients were followed prospectively with clinical and radiographic evaluations 1, 3 and 5 years postoperatively.

The medical records of 326 patients with 344 consecutive primary total hip arthroplasties (THA) performed during the same period in Hillerød Hospital

were retrospectively studied. Age, sex and diagnosis were registered. For both groups of patients the time of death, if any, was obtained in December 1994 from the Danish Central Bureau of Statistics (DCBS). Cumulative 5-year survival was calculated using the Kaplan-Meier method. The expected mortality (standardized mortality rates) was calculated from life tables for the relevant years (DCBS 1994).

First, factors of importance for survival in the TKA group were analyzed: age, sex, diagnosis, preoperative job and level of activity, cemented vs. cementless TKA, complications within the first year, and survival after the first vs. second TKA (in case of bilateral operation). The survival rates of the THA and TKA patients were also compared after stratification for age and sex.

Finally, the survival of the TKA patients was compared to that of the general population. Subgroups of patients, identified by the analysis mentioned above as having a significantly different survival, were all compared to the survival of the general population.

A Cox multivariate regression analysis was used for the statistical analysis. P-values were calculated using the Likelihood ratio test. Rate ratios (RR) and their 95% confidence intervals (CI) were calculated for all significant parameters. BMDP Statistical Software was used for the computations (Dixon 1985).

Table 1. Data in 926 TKA patients at first and second (other side) operation

	Age at operation						Total	
	23-64		65-74		> 75			
Operation no.	1	2	1	2	1	2	1	2
Sex								
Men	84	7	90	11	72	7	246	25
Women	156	22	260	27	264	24	680	73
Diagnosis								
Arthrosis	158	15	291	28	312	31	761	74
RA	59	12	37	7	16		112	19
Revision	7		8		4		19	
Fract. seq.	12		4		1		17	
Others	4	2	10	3	3		17	5
Complications								
No	231	28	342	38	328	28	901	94
Yes	9	1	8		8	3	25	4
Total	240	29	350	38	336	31	926	98

Table 2. Cox analysis of factors related to survival of 926 TKA patients

Factors		RR	95% CI	p-value ^a
Age		1.07	1.05–1.10	<0.00005
Sex	Men	1	reference	
	Women	0.54	0.38–0.77	0.001
RA	No	1	reference	
	Yes	1.95	1.20–3.19	0.008
Complications	No	1	reference	
	Yes	2.34	1.13–4.83	0.02

^a Likelihood ratio test

Factors of no significance that are not listed above: superficial ($p = 0.7$) and deep ($p = 0.8$) infections, reoperation ($p = 0.4$), preop. job situation ($p = 0.8$), preop. level of activity ($p = 0.2$), cemented vs. noncemented TKA ($p = 0.4$), first vs. second TKA ($p = 0.3$), TKA vs. THA ($p = 0.6$).

Table 3. Observed and expected number of deaths related to sex, diagnosis and complications (no/yes) within the first postoperative year in 926 TKA patients

	n	Obs.	Exp.	Ratio Obs/Exp	95% CI	P-value
Men	246	50	56	0.89	0.65–1.14	0.2
Women	680	89	120.6	0.74	0.58–0.89	0.002
Arthrosis	761	115	155.5	0.74	0.60–0.87	<0.0001
RA	112	20	13.9	1.43	0.81–2.07	0.07
Revision	19	3	3.3	0.91	0–1.94	0.7
Fract. seq.	17	0	1.2	0	0–1.57	1.00
Others	17	1	2.7	0.37	0–1.10	0.9
Complications						
No	901	131	172.1	0.76	0.63–0.89	<0.0001
Yes	25	8	4.5	1.78	0.55–3.01	0.09
Total	926	139	176.6	0.79	0.66–0.92	0.002

Results

The median age at operation of the TKA patients was 71 (23–88) years (Table 1). The diagnoses were arthrosis (82%), rheumatoid arthritis (12%), revision (2%), fracture sequelae (2%) and others (2%).

The cumulative 5-year patient survival was 89% for both the TKA and the THA patients. There was no postoperative excess mortality. The composition of the THA material was similar to that of the TKA with regard to age, sex and diagnosis. In the TKA material, old age, male sex, rheumatoid arthritis and complications within the first year increased the mortality (Table 2).

The observed and expected numbers of deaths were calculated regarding sex, diagnosis and complications (Table 3). Women had a significantly decreased mor-

tality. Stratification for age showed that the decreased mortality was found mainly among women > 75 years of age. Patients with arthrosis lived longer than expected, but statistically significantly only among those > 75 years of age. Patients with rheumatoid arthritis tended to have an increased mortality, this being significant only for those aged 65–74 years.

Finally, patients having no complications within the first year lived longer than expected, but only significantly when they were > 75 years of age.

Discussion

Our 5-year patient survival of 89% in both the THA and the TKA groups corresponds well with the figures reported by Holmberg (1992), Surin and Sundholm

(1983) and Visuri et al. (1994), who in THA patients found a survival of 85% after 5 years, 86% after 4–7 years, and 83% after 10 years, respectively. The median age of our patients was 71 years, the mean ages in the other reports were 67, 64 and 62 years, respectively. Our patients were operated on during 1989–1990, in contrast to the others, viz. 1978–1982, 1970–1977 and 1967–1985, respectively.

Two oppositely-directed effects can theoretically influence the survival over time—i.e., a continuously improving perioperative medical care and an increased selection of medically fragile patients for the operation. These effects seem to balance each other in our more recently operated patient population. In accordance with that, Seagroatt et al. (1991) reported unchanged mortality during the period 1976–1985.

We compared our multicenter group of TKA patients to a group of THA patients from one center, and consider this to be of interest (as only the survival of THA patients has been reported earlier from other countries) and appropriate, as the groups are similar with regard to age, sex and diagnosis. Moreover, the composition of the population in that particular area (Frederiksborg County) is similar to that of the average population in Denmark. As also noted by Boettcher (1992) and Holmberg (1992), we did not observe excess mortality postoperatively, which indicated little or no impact at all of the operation on life expectancy.

Old age means a higher mortality and more readmissions (Holmberg 1992, Seagroatt et al. 1991). Nevertheless, Boettcher (1992) considered THA a good socioeconomic investment in patients above 80 years of age. The relationship between age and mortality is not clear. Thus, we found that women aged 75 years or more had a relatively longer survival than the rest, compared to the general population. Lindberg et al. (1984) also noted a longer survival in women above 70 years of age, with arthrosis after primary THA. In contrast, the survival of female hip fracture patients has been shown to decrease with increasing age more than should be expected (Schröder and Erlandsen 1993).

Patients with RA are known to have an increased mortality compared to the general population (Pincus and Callahan 1989). Whether the slightly increased mortality in our study in the age group 65–74 years represents an excess mortality compared to what should be expected for RA patients is uncertain. Lindberg et al. (1984) and Surin and Sundholm (1983) found RA patients to have an increased mortality after THA, whereas Holmberg (1992) found the opposite. All reports consider patients having an arthroplasty because of primary arthrosis to have the best survival.

Danielsson (1964) showed that the mortality of unoperated patients with primary coxarthrosis was equal to that of the general population. Today, there is evidence that a TKA improves cardiovascular fitness in patients with gonarthrosis (Ries et al. 1996). Thus, the improvement in mobility due to a TKA might be the reason for the improvement in life expectancy.

Our analysis underlines the importance of avoiding complications. Surprisingly, we observed no significant differences between the various complications regarding impact on survival. Lindberg et al. (1984) found an increased mortality after revision in men, but not in women. In contrast, Surin and Sundholm (1983) noted a decreased mortality in patients who had had a revision and concluded that factors affecting survival of the patient and the arthroplasty are not identical.

Our findings, based on a large, consecutive and unselected series of TKA patients of a size equal to about two thirds of the annual Danish TKA production, indicate that a TKA with regard to life expectancy is not a risky operation and that patients not medically fit are generally not operated on.

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