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Patient survival after total knee arthroplasty.*

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Abstract

The authors analyzed the 5-year and 9-year survival in 134 of 165 patients who underwent total knee arthroplasties from 1989 to 1996 in our department. Patients were followed until December 31, 1998, or until the time of death. Diagnoses were rheumatoid arthritis in 81 patients (132 knees) and osteoarthritis in 53 patients (79 knees). The survival of the patients was compared to that of the age- and sex-adjusted general population. Kaplan-Meier survival curves were constructed. Twenty-two patients in the study died before the end of the follow-up. The cumulative 5-year patient survival was 88.7%, and 9-year patient survival was 64.4% for total knee arthroplasty patients. The standardized mortality ratio was 0.11 (95% confidence interval: 0.02-0.40) for the patients with osteoarthritis, and 0.81 (95% confidence interval: 0.52-1.25) for the patients with rheumatoid arthritis. The Cox proportional hazards model showed that the factors of male sex and rheumatoid arthritis were related to a higher mortality rate in the total knee arthroplasty group.

KEYWORDS: total knee authroplasy, patient survival, rheumatoid arthritis

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Original Article

Patient Survival after Total Knee Arthroplasty

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The authors analyzed the 5-year and 9-year survival in 134 of 165 patients who underwent total knee arthroplasties from 1989 to 1996 in our department. Patients were followed until December 31, 1998, or until the time of death. Diagnoses were rheumatoid arthritis in 81 patients (132 knees) and osteoarthritis in 53 patients (79 knees). The survival of the patients was compared to that of the age- and sex-adjusted general population. Kaplan-Meier survival curves were constructed. Twenty-two patients in the study died before the end of the follow-up. The cumulative 5-year patient survival was 88.7%, and 9-year patient survival was 64.4% for total knee arthroplasty patients. The standardized mortality ratio was 0.11 (95% confidence interval: 0.02-0.40) for the patients with osteoarthritis, and 0.81 (95% confidence interval: 0.52-1.25) for the patients with rheumatoid arthritis. The Cox proportional hazards model showed that the factors of male sex and rheumatoid arthritis were related to a higher mortality rate in the total knee arthroplasty group.

Key words: total knee arthroplasty, patient survival, rheumatoid arthritis

Relief of pain, range of motion, instability, and walking ability are the primary clinical outcome parameters for total knee arthroplasty (TKA), and the time to revision of the prosthesis is an essential outcome parameter in most large studies. The mortality of the patients is important as well. The life expectancy of a patient provides valuable knowledge in planning joint replacement surgery. There are some reports that patient survival after total hip arthroplasty (THA) is longer than that of the general population [1-4]. There are only a few reports about patient survival after TKA [5-8].

The authors investigated the survival of a large number of registered TKA patients, identified factors of importance for survival, and compared the survival rates with those of the age- and sex-adjusted general population.

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Patients and Methods

A total of 253 primary TKAs were performed in 165 patients treated from January 1989 through December 1996 in our department. Patients were followed until December 31, 1998, or until the time of death. Thirty-one patients were lost during the follow-up, and the remaining 134 patients (follow-up rate, 81.2%) were evaluated for this study. For statistical reasons, only the first operation was considered in 77 patients with bilateral implantation. The mean follow-up was 5.4 (range, 2-9) years. The mean age of the patients was 64.9 (range, 39-83) years old; 68.4 (range, 42-83) years old for osteoarthritis (OA) (n = 53); and 62.6 (range, 39-80) years old for rheumatoid arthritis (RA) (n = 81) at the time of operation. Bilateral implantation was performed in 77 patients; 26 had OA, and 51 had RA. None of the patients with RA received haemodialysis before or during the study.

Kaplan-Meier analysis was used to estimate the sur-

vival of these groups. The first surgical intervention was regarded as a starting point, and the follow-up ended on December 31, 1998. The expected rate of mortality was calculated based on the age- and sex-specific mortality rates in the Japanese population from 1989 to 1998 [9-20]. Results are expressed by standardized mortality ratio (SMR) with the associated 95% confidence intervals (CI).

The following factors of importance for survival were analyzed in the TKA group: age, sex, diagnosis, cemented *vs.* cementless TKA, and unilateral *vs.* bilateral operations. The Cox proportional hazards model was used for controlling the potential confounding factors (variable criteria: life and survival time, variable predictors: age, sex, diagnosis, cemented or cementless, unilateral or bilateral). StatView Statistical Software version 4.5 for Macintosh was used for the analyses.

Results

During the follow-up period, 22 patients (OA, 2 patients; RA, 20 patients) died. The cumulative 5-year patient survival was 88.7%, and the 9-year patient survival was 64.4% for TKA patients (Fig. 1). The cumulative 5-year patient survival rate was 95.5% for OA patients and 84.7% for RA patients, and the 9-year rate was 95.5% for OA and 57.2% for RA patients (Fig. 2). The estimated SMRs are presented in Table 1. SMR in RA did not statistically differ from that for the general population (SMR = 0.81, 95% CI: 0.52-1.25). In contrast, SMR in OA was significantly decreased (SMR = 0.11, 95% CI: 0.02-0.40) (Table 1).

The Cox proportional hazard model showed that the factors of male sex and RA were related to a higher mortality rate in the TKA group (Hazards ratio: OA / RA = 0.207/1; Female/Male = 0.178/1). Cemented TKA and bilateral TKA did not appear to be related to mortality rate (Table 2).

Table 3 shows the stratification for age at operation and the number of deaths. The highest ratio of mortality was found mainly among RA patients aged 65-74 years

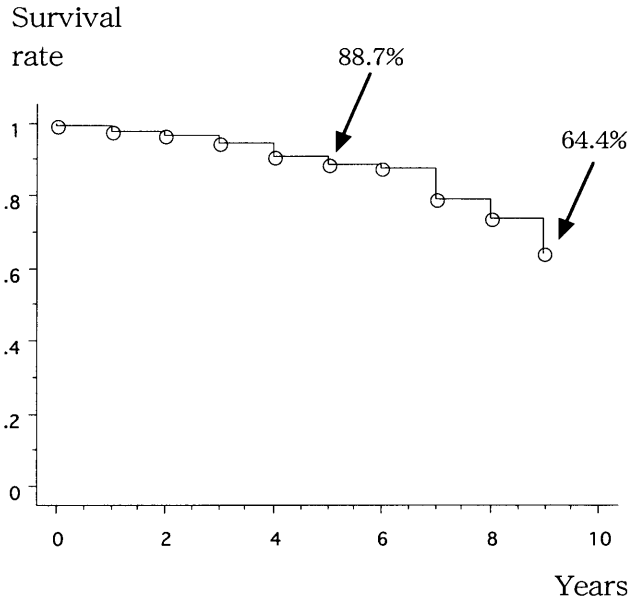

Fig. 1 Survival of patients after TKA at 5 years and 9 years

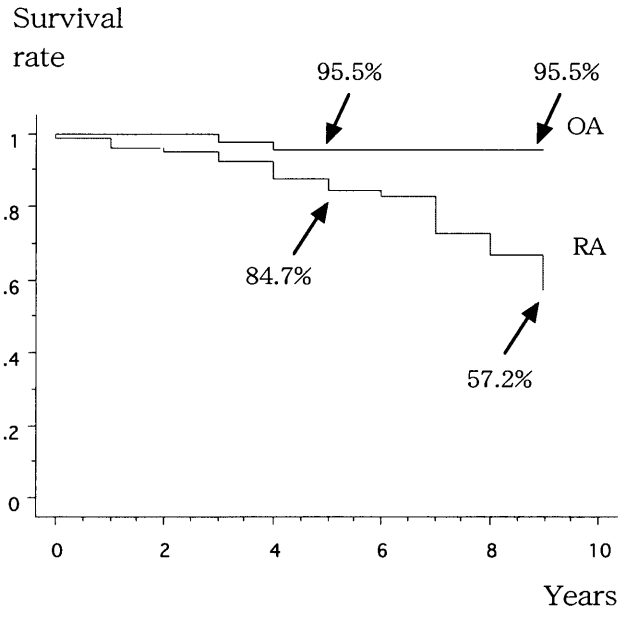

Fig. 2 Survival of 53 patients with OA and 81 patients with RA at 5 years and 9 years

Table 1 Mortality of patients after TKA

Diagnosis	n	Number of observed deaths	Number of expected deaths	SMR	95% CI
OA	53	2	18.3	0.11	0.02-0.40
RA	81	20	24.7	0.81	0.52-1.25
Total	134	22	43.0	0.51	0.33-0.78

SMR, standardized mortality ratio; CI, confidence interval.

(35.7% had died by the end of the follow-up) (Table 3).

The causes of death are presented in Table 4. The greatest number of deaths was found to be caused by cardiovascular diseases (1 patient in OA, and 6 patients in RA) (Table 4).

Discussion

Holmberg [1], Surin and Sundholm [3], and Visuri *et al.* [4] demonstrated a survival rate of 85% after 5 years, 86% after 4–7years, and 83% after 10 years, respectively, in THA patients. These 3 rates were higher than those of the respective referent populations.

There have only been a few reports about patient survival after TKA [5–8]. Schrφder *et al.* [8] demonstrated, in a 5-year survival analysis of patients after TKA, that the ratio of observed to expected number of deaths was 0.74 (95% CI: 0.60–0.87) in patients with OA, and 1.43 (95% CI: 0.81–2.07) in patients with RA. Böhm *et al.* [5] demonstrated in patients with OA that the SMR was 1.03 (95% CI: 0.76–1.37) for women and 1.14 (95% CI: 0.68–1.80) for men, and in patients with RA that the SMR was 2.92 (95% CI: 2.17–3.85) for women and 3.09 (95% CI: 1.0–7.19) for men.

The SMR in TKA patients was 0.51 (95% CI: 0.33–0.78) in the current study. A significantly lower mortality was found in patients with OA than in the Japanese population (SMR was 0.11, 95% CI: 0.02–0.40). The SMR in patients with RA did not statistically differ from that of the general population (SMR was 0.81, 95% CI: 0.52–1.25) in the current study.

The higher survival rate for TKA patients in our study can be explained partly by the fact that all of the TKA patients underwent selective surgery. The preoperative medical assessment excluded from surgery high risk cardiac and cardiovascular patients, and those in generally bad medical condition. The remaining patients may be considered a selected group of medically fit persons who were qualified for surgery, had extended physical therapy, and underwent regular medical examinations. There is evidence that TKA improves cardiovascular fitness in patients with gonarthrosis [21]. Thus, improvement in mobility due to TKA might be another reason for the improvement in life expectancy of OA patients.

The short follow-up period (2–9 years) may explain the slightly lower mortality in RA patients (which was statistically insignificant) in our study. There are some indications that patients with RA have a substantially reduced life expectancy [22–27], and some reports have indicated that mortality in RA patients rises with increasing disease duration [23, 27].

Thirty-one patients could not be traced. If data on these patients had been included, our results might have differed. Assuming that in the worst case, all 31 patients died before the last follow-up, the SMR would be 0.53 (95% CI: 0.28–0.98) in patients with OA, and 1.70 (95% CI: 1.23–2.29) in patients with RA. The cumulative 5-year patient survival would be 72.3%, and the 9-year patient survival would be 50.9% for TKA patients. The cumulative 5-year patient survival would be 81.8% for OA patients and 66.8% for RA patients, and the 9-year patient survival would be 81.8% for OA and 43.6% for RA. Regardless, the OA patients in this

Table 2 Cox analysis of factors related to survival

Factors	Hazards ratio	95% CI
Diagnosis OA/RA	0.207/1	0.05–0.90
Sex Female/Male	0.178/1	0.07–0.44
Bilateral/Unilateral	1.305/1	0.53–3.22
Cemented/Non-cemented	1.956/1	0.65–5.92

Table 3 Stratification for age in 134 patients after TKA

Age at operation	OA Number of deaths /	RA Number of patients
< 65	0/10	9/49
65～74	2/36	10/28
75≦	0/7	1/4

Table 4 Causes of death after TKA

	OA	RA
Cardiovascular disease	1	6
Digestive disease	0	3
Musculoskeletal system insufficiency	0	3
Malignancy	0	2
Renal insufficiency	0	1
Other	0	3
Unclear	1	2
Total	2	20

series showed a higher survival rate. In contrast, RA patients had a higher mortality rate than that of the general population. The SMR findings for the RA patients in the current study are consistent with those of other mortality studies of RA patients (Kvalvik *et al.* 1.49 [22], Pincus *et al.* 1.62 [24], Symmons *et al.* 2.7 [26], Wolfe *et al.* 2.26 [27]).

The factors of male sex and RA were related to a higher mortality rate in the TKA group in our study by the Cox proportional hazard model. Schrǿder *et al.* [8] reported that in the TKA group, older age, male sex, RA, and complication within the first postoperative year were related to increased mortality by Cox analysis.

Stratification for age showed that an increased mortality rate was found mainly among patients aged 65–74 years in our study. Schrǿder *et al.* [8] showed that women aged 75 years or more had a relatively longer survival after TKA than that of the general population. Lindberg *et al.* [2] also noted a longer survival in women above 70 years of age with arthrosis after THA.

Patients with revision arthroplasty were excluded from our study. Lindberg *et al.* [2] noted an increased mortality rate after revision of THA in men. In contrast, Surin and Sundholm [3] noted a decreased mortality rate in patients who underwent a revision of THA, and concluded that factors affecting the survival of the patient and the arthroplasty are not identical. Patient survival after revision of TKA has not been reported previously. Whether revision of TKA is related to a change in mortality requires further study.

In conclusion, we found that patient survival after TKA due to OA was longer than that of the general population, and after TKA due to RA it was similar to or slightly shorter than that of the general population. Our findings may indicate that TKA is not a negative factor with regard to life expectancy.

References

1. Holmberg S: Life expectancy after total hip arthroplasty. J Arthroplasty (1992) **7**, 183–186.
2. Lindberg H, Carlsson AS, Lanke J and Horstmann V: The overall mortality rate in patients with total hip arthroplasty, with special reference to coxarthrosis. Clin Orthop (1984) **191**, 116–120.
3. Surin VV and Sundholm K: Survival of patients and prostheses after total hip arthroplasty. Clin Orthop (1983) **177**, 148–153.
4. Visuri T, Pulkkinen P, Turula KB, Paavolainen P and Koskenvuo M: Life expectancy after hip arthroplasty. Case-control study of 1018 cases of primary arthrosis. Acta Orthop Scand (1994) **65**, 9–11.
5. Böhm P, Holy T, Pietsch-Breitfeld B and Meisner C: Mortality after total knee arthroplasty in patients with osteoarthrosis and rheumatoid arthritis. Arch Orthop Trauma Surg (2000) **120**, 75–78.
6. Hanyu T, Murasawa A and Tojo T: Survivorship analysis of total knee arthroplasty with the kinematic prosthesis in patients who have rheumatoid arthritis. J Arthroplasty (1997) **12**, 913–919.
7. Kageyama Y, Miyamoto S, Ozeki T, Hiyoshi M, Kushida K and Inoue T: Outcomes for patients undergoing one or more total hip and knee arthroplasties. Clin Rheumatol (1998) **17**, 130–134.
8. Schrǿder HM, Kristensen PW, Petersen MB and Nielsen PT: Patient survival after total knee arthroplasty. 5-year data in 926 patients. Acta Orthop Scand (1998) **69**, 35–38.
9. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1998. Vol. 3, Health and Statistics Association, Tokyo (2000) pp458–459 (in Japanese).
10. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1998. Vol. 3, Health and Statistics Association, Tokyo (2000) pp116–117 (in Japanese).
11. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1997. Vol. 3, Health and Statistics Association, Tokyo (1999) pp116–117 (in Japanese).
12. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1996. Vol. 3, Health and Statistics Association, Tokyo (1998) pp116–117 (in Japanese).
13. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1995. Vol. 3, Health and Statistics Association, Tokyo (1997) pp116–117 (in Japanese).
14. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1994. Vol. 3, Health and Statistics Association, Tokyo (1996) pp80–81 (in Japanese).
15. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1993. Vol. 3, Health and Statistics Association, Tokyo (1995) pp424–425 (in Japanese).
16. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1993. Vol. 3, Health and Statistics Association, Tokyo (1995) pp80–81 (in Japanese).
17. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1992. Vol. 3, Health and Statistics Association, Tokyo (1994) pp78–79 (in Japanese).
18. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1991. Vol. 3, Health and Statistics Association, Tokyo (1993) pp78–79 (in Japanese).
19. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1990. Vol. 3, Health and Statistics Association, Tokyo (1992) pp78–79 (in Japanese).
20. Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare: Vital statistics of Japan 1989. Vol. 3, Health and Statistics Association, Tokyo (1991) pp78–79 (in Japanese).
21. Ries MD, Philbin EF, Groff GD, Sheesley KA, Richman JA and Lynch F Jr: Improvement in cardiovascular fitness after total knee arthroplasty. J Bone Joint Surg Am (1996) **78**, 1696–1701.
22. Kvalvik AG, Jones MA and Symmons DP: Mortality in a cohort of Norwegian patients with rheumatoid arthritis followed from 1977 to 1992. Scand J Rheumatol (2000) **29**, 29–37.
23. Myllykangas-Luosujärvi RA, Aho K and Isomäki HA: Mortality in rheumatoid arthritis. Semin Arthritis Rheum (1995) **25**, 193–202.
24. Pincus T and Callahan LF: What is the natural history of rheumatoid arthritis? Rheum Dis Clin North Am (1993) **19**, 123–151.
25. Pincus T, Brooks RH and Callahan LF: Prediction of long-term mortality in patients with rheumatoid arthritis according to simple questionnaire and joint count measures. Ann Intern Med (1994) **120**, 26–34.

26. Symmons DP, Jones MA, Scott DL and Prior P: Longterm mortality outcome in patients with rheumatoid arthritis: Early presenters continue to do well. J Rheumatol (1998) **25**, 1072–1077.
27. Wolfe F, Mitchell DM, Sibley JT, Fries JF, Bloch DA, Williams CA, Spitz PW, Haga M, Kleinheksel SM and Cathey MA: The mortality of rheumatoid arthritis. Arthritis Rheum (1994) **37**, 481–494.