ORIGINAL PAPER

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Sociodemographic factors and failure of hip arthroplasty

Accepted: 30 August 1999

Abstract To identify the sociodemographic and lifestyle factors related to development of aseptic loosening after a cemented total hip arthroplasty (THA), 151 consecutive primary THAs performed at a single hospital in a rural district of Japan, at a mean follow-up of 7.5 years, were reviewed. Based on the medical records collected during hospital admission for THA, in which sociodemographic and lifestyle backgrounds had been recorded by the nurse, answers regarding residence, education, employment, engagement in agricultural work, marital status, family members living together, religion, recreational activity, smoking, and alcohol intake were analyzed in relation to the development of loosening, using a multivariate Cox proportional hazards model. With adjustment for cementing technique, diagnosis, age, and sex, agricultural work had a significant relation with prosthetic loosening (relative risk =2.85, $P=0.03$). Restriction of physical work in agriculture for patients undergoing THA should be considered.

Résumé Afin d'identifier les habitudes de vie et les facteurs sociodémographiques reliés au développement d'un descellement aseptique après une arthroplastie totale scellée de la hanche (THA), ont été recensées 151 THA primaires consécutives réalisées dans un hôpital de région rurale au Japon, avec observation moyenne de 7.5 années. Sur la base des dossiers médicaux des patients admis pour une THA, dans lesquels des données avaient été recueillies en entrevue par les infirmières sur les facteurs sociodémographiques et sur les habitudes de vie (type de résidence, éducation, emploi, activités agricoles, état civil, cohabitation des membres de la famille, religion, activités récréatives, consommation de tabac et d'alcool), ces données furent analysées en relation avec

le développement d'un descellement, à l'aide du Modèle de régression à effet proportionnel et à variantes multiples de Cox. Après ajustements en fonction de la technique de scellement, du diagnostic, de l'âge et du sexe, une relation significative entre le descellement et l'engagement dans des activités agricoles a été trouvée (risque relatif=2.85, $P=0.03$). Des restrictions au niveau du travail physique agricole devraient être envisagées pour les personnes ayant subi une THA.

Introduction

Total hip arthroplasty (THA) still has some problems that can result in revision surgery. The major reason for failure is aseptic loosening of the femoral or acetabular component. As problems with loosening have become apparent, mechanical and biological factors are believed to play significant etiologic roles, promoting an increased interest in the development of alternative forms of prosthetic fixation, materials, or implant design.

The postoperative lifestyle of a patient may possibly also relate to loosening. Although it is recognized that aseptic loosening results from the complex and time-dependent interrelationship between patient variables and surgical variables, there have been only a few studies describing the relation between the gross activity level of patients and prosthetic loosening [12,20].

In our hospital, the sociodemographic and lifestyle background of all admitted patients has been routinely recorded by the nursing staff for the purpose of nursing care. Using these records, we analyzed the relation between sociodemographic factors and failure of primary cemented THA.

Patients and methods

All primary cemented THAs performed at the authors' institution between October 1978, when the hospital first opened, until August 1988 were included. One operation resulting in deep infection was eliminated from this study, as was one that resulted in early

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failure due to recurrent dislocations. This inclusion criteria resulted in a group of 151 THAs in 130 patients. There were 130 THA in a group of 111 women and 21 in 19 men. The mean age at surgery was 61.5 (32–84) years. The types of implant used were Müller (54), Trapezoid (10), Kyocera (9), and Harris (78). Sixty-three THAs with Harris and nine with Kyocera were inserted using an intramedullary plug and cement gun. One hundred and eight THAs were inserted by 4 different surgeons, each performing between 39 and 15 operations. The remaining 43 THAs were performed by 16 other surgeons. In 103 hips the indication was osteoarthritis and in 35 rheumatoid arthritis.

Between October 1993 and March 1994, those patients who had not been seen in the previous 2 years were questioned about hip pain over the telephone and invited to a radiographic examination. As a result, 72 THAs in 60 patients were radiographically evaluated between October 1991 and March 1994. Thirty-nine patients with 41 THAs were contacted by telephone, but did not respond to the invitation. None of these non-responders reported pain in the operated hip(s). Sixteen patients with 21 THAs died during the follow-up period. The remaining 15 patients with 17 THAs were lost to follow-up. Our latest follow-up was completed in March 1994, and the analyses in the present study are based on data up to that time.

Failure of the femoral component was defined as subsidence of the stem, fracture of the cement or the stem, or a radiolucent line at the cement-prosthesis interface, as seen on serial radiographs [7,8]. Failure of the acetabular component was defined as migration of the component or any new fracture in the cement mantle [9]. The mean length of follow-up was 7.5 (0.2–15.3) years.

Sociodemographic and lifestyle backgrounds of all admitted patients had been routinely recorded in the patient's profile of a medical chart through nurse interviews. The records included manner of residence, educational background, occupation, marital status, number of family members living together, religion, recreational activity, smoking, alcohol intake, and others. The baseline sociodemographic and lifestyle factors of each patient were, therefore, available from the medical records taken on admission. Occupation and recreational activity was recorded in a descriptive manner.

The relative risk (RR) of development of failure was estimated using a Cox proportional hazards model, with the follow-up period as the dependent variable. To adjust for possible confounding variables, baseline characteristics such as implant, cementing technique, surgeon, diagnosis, age, sex, and body weight were examined as potential risk factors for the development of failure, using

univariate Cox proportional hazards models. Next some important confounders and variables such as age and sex that might interfere with the lifestyle of a patient were included as covariates, and the sociodemographic and lifestyle variables were examined as possible risk factors using multivariate Cox proportional hazards models. Statistical significance was inferred when the 95% confidence interval failed to include unity and/or the *P*-value was less than 0.05. Pearson's chi square test and Student's *t*-test were also used where appropriate. The software used for statistical analysis was SPSS (SPSS Inc., Chicago, USA).

Results

There were 28 radiographic failures. Failure of the socket was seen in 8 hips, of the stem in 14, and of both components in 6. All patients with these defined failures had varied degrees of hip pain. In 19 out of 28 failures revision surgery had already been performed.

For the 28 failures, the follow-up period was defined as the period of time until failure was diagnosed for the first time. For the patients not complaining of any hip pain over the telephone and not responding to a radiographic examination, the follow-up period was defined as the period until the telephone interview. For the remaining patients, it was defined as the period of time until the last radiographic assessment was performed.

The crude RR for possible confounders is shown in Table 1. However, none of the factors shown demonstrated any significant association with prosthetic failure.

Regarding sociodemographic and lifestyle variables, there were some defective data in our medical records. These defective data were treated as missing values in the subsequent analyses. The number of missing values of each factor ranged from 0 to 7, as shown in Table 2. In view of the possible importance of the cementing technique and the diagnosis on the outcome of THA, these two

Table 1 Crude relative risk (RR), 95% confidence interval (CI) and *P*-value of confounders

Factors	No. hips	RR	95% CI	<i>P</i> -value
Implant				
Charnley-Müller	54	1.00	—	—
Harris	78	0.74	0.40–1.40	0.36
Others	9	1.29	0.70–2.35	0.41
Cementing Technique				
Without plug and gun	79	1.00	—	—
With plug and gun	72	0.76	0.32–1.80	0.54
Surgeon				
A	39	1.00	—	—
B	38	1.46	0.75–2.85	0.27
C	16	1.28	0.54–3.04	0.57
D	15	1.63	0.69–3.87	0.27
Others	43	0.63	0.30–1.32	0.22
Diagnosis				
Osteoarthritis	103	1.00	—	—
Rheumatoid arthritis	35	1.19	0.66–2.16	0.55
Others	13	1.35	0.60–3.02	0.47
Age at operation	151	0.97/10 years	0.96–1.03	0.85
Sex				
Women	130	1.00	—	—
Men	21	1.32	0.81–2.14	0.27
Body weight	151	0.92/10 kg	0.95–1.03	0.70

Table 2 Adjusted relative risk (RR), 95% confidence interval (CI) and *P*-value of sociodemographic and lifestyle variables. (Adjusted for cementing technique, diagnosis, age, and sex)

Factors	No. hips	RR	95% CI	<i>P</i> -value
Residence				
Detached house	129	1.00	–	–
Apartment	15	1.22	0.38–3.94	0.74
Missing value	7			
Employment				
Employed	84	1.00	–	–
Unemployed	67	0.95	0.42–2.16	0.91
Working in agriculture				
No	92	1.00	–	–
Yes	57	2.85	1.10–7.36	0.03
Education				
<10 years	87	1.00	–	–
≥10 years	60	0.88	0.40–1.96	0.75
Missing value	4			
Marital status				
Married	102	1.00	–	–
Unmarried ^a	49	0.56	0.21–1.54	0.26
Number of household members ^b				
≤2	36	1.00	–	–
≥3	115	2.75	0.79–9.61	0.11
Religion				
None	60	1.00	–	–
Buddhism/others	90	1.16	0.48–2.78	0.74
Missing value	1			
Recreational activity				
None	71	1.00	–	–
Some activity	79	0.89	0.40–1.98	0.77
Missing value	1			
Smoking				
Non-smoking	133	1.00	–	–
Smoking	18	0.30	0.06–1.52	0.15
Alcohol				
Rare/occasional drinking	138	1.00	–	–
Daily drinking	13	0.21	0.04–1.27	0.09

^a Single, divorced, or widowed

^b Including patient

factors plus two others: age (a continuous variable) and sex, were included as covariates for calculating the adjusted RR for each sociodemographic or lifestyle variable. As Table 2 shows, factors such as manner of residence, employment, educational level, marital status, number of household members, religion, recreational activity, smoking, and alcohol intake were not significantly associated with prosthetic failure. However, engagement in agricultural work had a significantly higher RR (RR=2.85, *P*=0.03).

Because the pattern of the relationship between sociodemographic factors and failure may be different for men and women, examination of the association of agricultural work was carried out for each sex separately, being adjusted for cementing technique, diagnosis, and age. In men, it had no more significant relation with failure, probably due to the decreased sample size (RR=2.37, *P*=0.40). However, in women, engagement in agriculture still had a significant relation with failure (RR=3.09, *P*=0.04).

Discussion

The present study shows that some patient sociodemographic factors could be predictors for cemented THA

loosening. Many factors have been indicated as predictors of early loosening after THA, namely, cementing without the use of a cement gun and intramedullary plug [1,7,10,13,15,17,22,23], rheumatoid arthritis [6,14,16], young age [20,21], and heavy weight [2,3,5,11,18–20] have been thought to be related to a worsened outcome of THA. In this study, however, the relation of these confounders with prosthetic failure did not reach a statistically significant level, probably due to the comparatively small sample size. Above all, crude RR for age and for body weight were nearly equal to unity, probably explained by the few young patients involved in this study and by the lower average body weight of Japanese people. We, therefore, included cementing technique and diagnosis in a multivariate analysis. We also included age and sex, because these factors may interfere with the lifestyle of a patient. With adjustment for these confounders, engagement in agriculture was detected as a significant predictor in the present study.

Because the sociodemographic and lifestyle data from each patient were based on medical records taken at admission, some of these variables might have fluctuated as time elapsed. However, in a separate series of patients who had undergone primary THA and then visited our

hospital for follow-up between April and October 1998, 21 out of 26 patients (81%) who had engaged in agricultural work before THA declared that they were more or less still doing some agricultural work after surgery. Therefore, there seems to be a relatively minor deviation from the baseline data at surgery.

We categorized the subjects without hip pain and who did not respond to the invitation for follow-up radiographic examination as "non-failure". As was previously described [4], not all patients with radiographically loose implants have clinical symptoms. However, asymptomatic patients are usually hard to radiographically follow up, and we considered it more practical to pick up symptoms than to ignore them. Thus, in the present study, the relationship between social background and symptomatic failure of THA was examined.

Agriculture involves exposure to a wide spectrum of physical labour, so that the exact responsible factor in the relation between agriculture and loosening is unclear. Possible explanations include lifting and carrying heavy objects, repetitive crouching, frequent falls when walking over rough ground, and vibration from agricultural machinery. In addition, the range of social organizations and services, such as transportation, available in the rural community is limited. However, we did not collect this kind of information systematically. Although the reasons for the excess of failure after THA in subjects engaged in agriculture are not exactly clear at present, it would be reasonable to limit physical labour involved in agriculture.

In view of the lack of proper postoperative guidelines for the social activities of patients who undergo THA, we consider that a number of important issues regarding sociodemographic factors and failure of THA remain to be addressed in future studies.

Acknowledgements We wish to express our appreciation to the nurses of our department for their devoted work in recording patient profiles in the medical charts, and to the doctors who performed the THAs.

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