The epidemiology of total knee replacement in South Korea: national registry data

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Objective. Knee osteoarthritis (OA) is prevalent among the elderly in Asian countries; however, the utilization of total knee replacement (TKR) is unknown. Using data from a national registry, we sought to estimate the incidence of TKR by age and sex, and the trend for TKR utilization from 2002 to 2005 in South Korea.

Methods. Reimbursement records from all hospitals in South Korea were extracted from the Health Insurance Review Agency (HIRA) database. Records with both the procedure code corresponding to a TKR and the diagnosis code of knee OA were selected. We estimated the age- and sex-specific rates of TKR. To compare the rate of TKR between men and women, we calculated age-standardized risk ratios. A TKR registry from a single centre containing more clinical information was analysed, and the differences in the clinical features between men and women were compared.

Results. From 2002 to 2005, 47,961 TKRs were performed in subjects over the age of 40 yrs due to OA. The rate of TKR has increased over the 4 yrs and was much higher in women than in men. Compared with men, the age-standardized rate ratios for TKR in women ranged from 7.4 to 8.0. The single-centre registry data revealed that there was no difference in age, disease duration and the Kellgren–Lawrence grade at the time of surgery between men and women.

Conclusion. Using a national database, we found that the rate of TKR increased steadily from 2002 to 2005 in South Korea. The TKR rate in women was much higher than that in men. Risk factors that account for such disparity in TKR utilization need to be further investigated.

KEY WORDS: Osteoarthritis, Total knee replacement, Sex difference, Epidemiology.

Introduction

Knee osteoarthritis (OA) is the most common joint disorder affecting the elderly throughout the world. It is a leading cause of disability and has a formidable societal and public health impact [1, 2]. Symptomatic knee OA occurs in ~12% of American adults 65 yrs of age or older [2]. The prevalence of knee OA in East Asian countries is as common for males as the prevalence reported in the US Caucasian population and is even higher for females [3, 4]. For example, among those aged 60 yrs or older in Beijing, China, the prevalence of symptomatic knee OA reaches 15% in women and 5.6% in men [3].

To date, there is no known cure for OA, and current management of patients with knee OA remains the control of pain. For most end-stage cases, total knee replacement (TKR) is the most effective medical intervention for control of pain and improvement of function. In the US, ~431 000 TKRs are performed yearly [5] and the utilization of TKR has increased over the last two decades, especially among younger patients [6]. TKR was 40% more likely to be performed in women than in men, and the rate of TKR increases with age for patients up to their late seventies; afterwards, the rate decreases [7].

To the best of our knowledge, epidemiological data on TKR have not been published for Asia, where over 60% of the world population lives. Furthermore, both population ageing and economic growth have taken place at a fast pace in many Asian countries such as South Korea. Thus, one would expect that knee OA is likely to become a major public health problem and that utilization of TKR will increase in many Asian countries. Using the national data collected by the Health Insurance Review Agency (HIRA) from South Korea, we estimated the incidence of TKR by age and sex, and described the trend of TKR utilization from 2002 to 2005.

Materials and methods

Data acquisition

The HIRA, established in 1989, is a non-profit agency sponsored by the Korean Ministry of Health and Welfare. The agency is responsible for the general administrative affairs of the Korean National Health Insurance covering all citizens of South Korea. The HIRA database contains reimbursement records from all medical facilities (~5–6 million inpatient-visits per year in about 1100 hospitals and 25 000 private clinics) in South Korea. From year 2002, hospitals have been required to file electronically the inpatient-visit records to the HIRA, and such data are publicly available. Information in the HIRA data set includes a unique identification number for each patient, age, sex, primary diagnosis (based on the International Classification of Disease, ICD-Tenth Edition), the date of surgery, the hospital where the surgery was performed and the duration of hospitalization. In the current analysis, we used data collected from 2002 to 2005.

Records with a procedure code [Ja-71-(2)] corresponding to TKR were selected from the HIRA data sets. In addition, the database adapted the International Classification of Diseases, Tenth Edition, Clinical Modification (ICD-10-CM) to code the disease diagnosis. Unilateral or bilateral knee OA was coded as M17. Each record in the data set represented a single patient admission and had a unique identification number. Revision knee arthroplasty is assigned a separate procedure code and was excluded from the current analysis. Knee joint replacements performed for other diagnostic codes, i.e. rheumatoid arthritis, polyarthritis, avascular necrosis and unclassified arthritis, were also excluded.
From 2002 to 2005, 103,601 TKR surgeries were performed in South Korea. Of these, 38,125 (36.8%) cases were counted more than once, mostly due to a bilateral TKR performed on separate occasions and were excluded from the analysis. In addition, 17,396 medical charts, two patients had features suggestive of inflammatory arthropathy (one patient with polyarthritis with increased ESR and one patient with RF positivity), and were excluded from the study. In accordance with the HIRA data, female patients accounted for the majority of TKRs (94.2%). The duration of disease, the age at surgery, the body mass index, the level of education and the proportion of bilateral TKRs were available from all the patients. A single rheumatologist read the radiographs using the Kellgren–Lawrence (K–L) grading system [8]. The weighted kappa on the K–L grade for intra-reader reliability was 0.84 [95% confidence interval (CI) 0.68–0.99].

Extraction of the TKR data from a single institution

To compare the HIRA data with the data obtained from a real-world practice, the TKR registry for OA patients spanning the years 2002–2003 from a single institution was obtained. This was a university-affiliated specialist referral centre, in which more than 100 TKRs are performed annually. The data contained the information on patient body weight, height and disease duration in addition to the information available from the HIRA database. Information on the level of patient education and on comorbidity was available for 64 and 66% of the patients, respectively. Weight-bearing extension anterior–posterior radiographs of both knees were available from all the patients. A single rheumatologist read the radiographs using the Kellgren–Lawrence (K–L) grading system [8]. The weighted kappa on the K–L grade for intra-reader reliability was 0.84 [95% confidence interval (CI) 0.68–0.99].

Statistical analysis

We divided the age of the subjects into 5-yr age categories. For each calendar year, we estimated the age- and sex-specific rates of TKR by dividing the total number of TKR cases that occurred in that year by the total size of the South Korean population of that particular age and sex based on year 2000 Korean National Census data [9]. To compare the rate of TKR between men and women, we applied the age-specific rate of TKR in men to the age-distribution of the women as a standard, and calculated age-standardized risk ratios and 95%CIs. For a comparison between men and women, according to data from the Korean Census 2000, and then standardized according to the age distribution in women.

Results

From 2002 to 2005, 103,601 TKR surgeries were performed in South Korea. Of these, 38,125 (36.8%) cases were counted more than once, mostly due to a bilateral TKR performed on separate occasions and were excluded from the analysis. In addition, 17,396 TKR operations performed for persons with rheumatoid arthritis (M06), polyarthritis (M15), avascular necrosis (M87) and unclassified arthritis (M13 or M19) were excluded. Of the remaining 48,080 TKR cases, 47,961 were performed in subjects over 40 yrs old (4448 in men and 43,513 in women).
were not significantly different between male and female patients. The K–L grade of the operated knee was mostly 4 (96%), reflecting the advanced stage of OA at the time of the TKR. The proportion of K–L grade 4 was not significantly different between both sexes (96.1% in women and 93.8% in men, respectively; \( P = 0.49 \)).

Discussion

Using the national database for health care reimbursement in South Korea, we found that the rate of TKR increased over the years 2002–2005 and that it was much higher in women than in men. To the best of our knowledge, no epidemiological study has examined the rate of TKR utilization among an Asian population.

In a community study covering 983 participants with a mean age of 49.9 yrs residing in a rural area in South Korea, the prevalence of symptomatic knee OA was 8.4% for men and 21.2% for women (our unpublished data). Whereas the prevalence of knee OA in South Korea may be higher than that in Western countries, the rate of TKR is much lower [6, 10]. Several explanations may account for such a discrepancy, including the differences in the health care system, access to care, physician and patient preferences and socio-cultural beliefs on surgery. Nevertheless, as in Western countries, the rate of TKR utilization has been increasing steadily. For example, in the present study, we found that the TKR rate has increased almost 2-fold over a 4-yr period.

Numerous studies have shown that knee OA is more common in women than in men [11–14]. Several studies have also reported that the rate of TKR is higher in women than in men. In Sweden, the rate of TKR is 1.93 times higher in women than in men, and a gender difference of similar magnitude to Sweden in TKR rate was also found in the US [6, 10]. To our surprise, the rate of TKR in women was almost 8-fold higher than that for men in South Korea, and the difference was persistent over the 4-yr period of the study.

Such a striking gender difference in the TKR rate is of interest, and there are a number of potential explanations for this difference. First, could the sex difference in the prevalence of symptomatic knee OA account for an 8-fold increase of the TKR in women? A few studies have shown that the magnitude of the sex difference in the prevalence of symptomatic knee OA was greater in Asia than that in the US. For instance, in the Beijing OA study, the age-standardized prevalence of symptomatic knee OA in Chinese women was 2.9 times higher than that of men in Beijing, whereas the corresponding prevalence ratio was 2.0 in the Framingham study [3]. In our aforementioned community study, the sex difference in the prevalence of symptomatic knee OA was similar to that observed in Beijing. In different ethnic groups, genetic polymorphisms may be underlying these sex differences. For example, the W200/G324 haplotype of FRZB, the gene coding for Frizzled-related protein 3 is significantly associated with both hip and knee OA in Caucasian women but not in men [15]. Whether such a genetic factor plays an even more significant role among Asian women is an interesting subject to pursue. Nevertheless, the sex difference in the prevalence of OA does not seem to account fully for an 8-fold increased rate of TKR utilization.

Second, both kneeling and squatting are strong risk factors for knee OA, and this life style factor might account for greater functional disability as well as the prevalence of knee OA in Koreans [16–18]. Korean women tend to use the squatting posture more often than men in daily activities, such as for the toilet and house chores. Compared with Western countries in which stability for walking is important, in Asian countries, knee flexion for squatting and kneeling may be more important in the decision to undergo surgery. Other risk factors for knee OA, such as the body mass index, knee injuries, sports activities and smoking might affect the sex difference, but we do not have evidence that these factors account for the increase of OA and/or TKR among Korean women.

Third, among the subjects that had a TKR in South Korea, women might have surgery at an earlier stage of the disease than men. To address this question, we reviewed registry data for TKRs performed in a single tertiary hospital including weight-bearing bilateral anterior–posterior knee radiographs. The proportion of knees with K–L grade 4 in women was similar to that in men. In fact, the duration of disease was slightly longer and the age was older at the time of the TKR operation in women than that in men though not statistically significant, thus excluding the possibility that TKR is performed at an earlier stage in women (Table 1). Other factors such as the body mass index, the level of education and the proportion of bilateral TKR were not significantly different between male and female patients, although the information on education level was not available from a third of the subjects.

It is unknown at present whether the sex difference in the TKR rate is the same in other Asian countries as in South Korea. Some surgical series have revealed that female patients accounted for >80% of TKRs in China and Japan [19, 20]. Although these studies were small and the data not derived from national registries, the sex difference might be present in other East Asian countries.

This study has some limitations. First, disease misclassifications or coding errors could have occurred in the large-scale administrative databases. We attempted to validate the finding by verifying the diagnostic/procedure code with the medical records of the more detailed 2-yr TKR clinical database from a single institution and the results were consistent with what we found for the national database. Although, we found that there were no major discrepancies in the coding and medical records, we cannot rule out the possibility of a coding error in a nation-wide database obtained from various types of institutions. In addition, detailed analysis regarding regional differences, income level or other risk factors was not possible because of the utilization characteristics of the South Korean health care system (no restrictions on access to health care facilities regardless of residence or health plan) and the limited contents of the database. This study includes only subjects having TKR and not subjects with knee OA; thus, the results cannot be extrapolated for knee OA.

In conclusion, the TKR rate increased steadily from 2002 to 2005 in South Korea. The rate of TKR in women was much higher than that in men, as compared with Western countries. In addition to the higher risk of knee OA in women, studies on risk factors that account for this disparity in TKR utilization need to be conducted.

Rheumatology key messages

- Although the rate of TKR is lower compared with Western countries, it steadily increased in South Korea.
- The rate of TKR was much higher in women than in men in South Korea.

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