



Trend in the Age-Adjusted Incidence of Hip Fractures in South Korea: Systematic Review

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Background: The incidence of hip fractures has been reported to vary geographically, and its trend has also varied widely. However, the trend in the age-adjusted incidence of hip fractures has not been well studied in Korea. After we identified eligible studies presenting multiple age-adjusted incidences of hip fractures in the Korean population in PubMed, we evaluated changes in the absolute number of occurrence and calculated the annual percentage change (APC) of age-adjusted incidences of hip fractures.

Methods: We have searched PubMed for the original and English-language literature on the incidence of hip fractures in the Korean population published since 2000. The studies presenting multiple age-adjusted incidences of hip fractures were selected. We evaluated the change in the absolute number of hip fractures and calculated the APC of age-adjusted incidences of hip fractures for each study.

Results: Three eligible articles were identified. The absolute number of hip fractures for both genders increased over time in all three studies although the operational definition of hip fracture differed from one another. The APC of the age-adjusted incidence of hip fractures was positive for women and negative for men. However, the change was not statistically significant in both genders during each study period (2001–2004, 2005–2008, and 2006–2010, respectively).

Conclusions: The age-adjusted incidence of hip fractures was stable among men and women, while the absolute number of hip fractures increased for both genders in Korea. Further studies with longer study periods on age-adjusted incidences are required to better determine the trend in the incidence of hip fractures in Korea.

Keywords: *Hip fracture, Incidence, Age groups, Korea*

Hip fracture is a serious health problem in elderly populations because it is associated with high morbidity and mortality.¹⁻⁴⁾ The risk of hip fractures has been reported to vary geographically.⁵⁾ Generally, the incidences of hip fractures in Western populations are higher than those in Asians.⁵⁾

The recent trends in the incidence of hip fractures

have also varied widely: increase, plateau, or decrease.⁶⁻⁸⁾ To predict the future health care burden of hip fractures, it is important to characterize the direction of temporal trend in incidence.

The change in demographic characteristics of the general population should be considered to determine the trend of hip fractures because the proportion of the elderly population at risk of hip fractures will increase or decrease with time. This means that the age-adjusted incidence estimated from a representative population sample should be used to evaluate the direction of temporal trend of hip fractures.^{7,9)}

Around 30% of the hip fractures occurring worldwide are thought to be found in Asian populations.⁷⁾ Although studies on the temporal trends of hip fractures including age-adjusted ones are available for several Asian

Received August 28, 2017; Accepted September 26, 2017

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countries including China, Singapore, and Japan,¹⁰⁻¹³⁾ there are lack of studies on the change of age-adjusted incidence of hip fractures in Korea. Therefore, the purpose of this study was to determine whether the age-adjusted incidence of hip fractures changed in Korea based on a systematic review.

METHODS

Study Inclusion Criteria

This systematic review included original articles that (1) were written in English and published since 2000, (2) addressed the incidence of hip fractures since 2000 in the general Korean population, (3) reported directly an age-adjusted incidence of hip fractures, and (4) provided multiple age-adjusted incidences of hip fractures.

Search Strategy

Studies were identified by searching PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>) in May 2016. The following search terms were used for literature search of the PubMed database: ("hip fractures"[MeSH Terms] and "Korea"[All Fields]). The studies identified were then filtered to limit the search to publications since 2000.

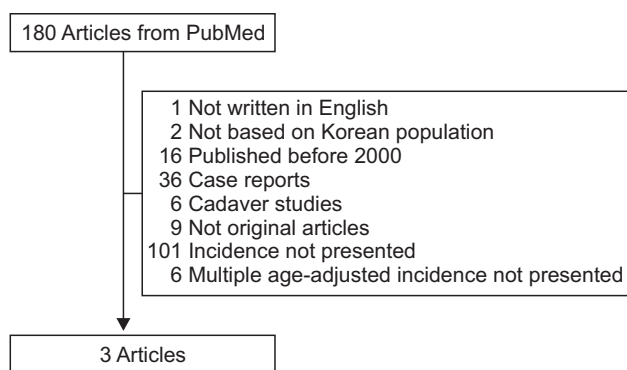


Fig. 1. Flowchart showing the search strategy to identify studies of age-adjusted incidence of hip fractures in Korea.

Selection of Studies

After screening the studies identified by the search, publications prior to 2000 were excluded. Then, the full manuscript of each article was retrieved to assess the eligibility for inclusion. One of the authors (YKL) reviewed the retrieved full manuscripts to determine whether an age-adjusted incidence of hip fractures had been reported. The reference lists of these articles were examined for identification of any other potentially relevant articles. Finally, only original studies with multiple age-adjusted incidences of hip fractures in the Korean population were selected. In all, three articles were included and reviewed to determine the changes in the incidence of hip fractures (Fig. 1).¹⁴⁻¹⁶⁾

Data Collection and Analysis

We compared the definition of hip fracture among the identified studies in terms of the used codes for diagnosis/procedure and possibility of duplication of the same single event. We plotted the absolute number of occurrences and the age-adjusted incidence of hip fractures in each study according to year. Annual age-adjusted incidences of hip fractures in both genders were also collected for each study period.

To determine whether the incidence of hip fractures

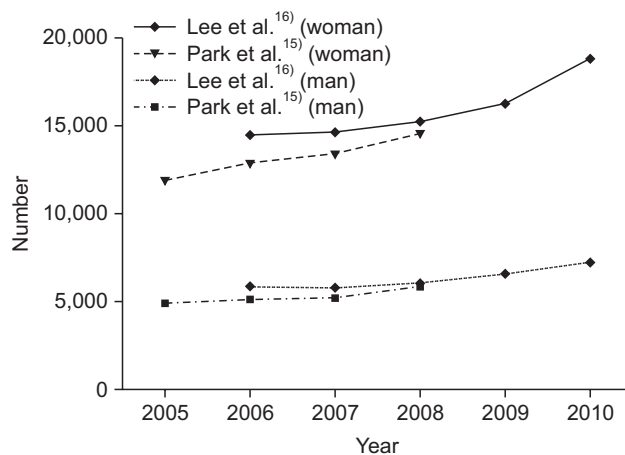


Fig. 2. Absolute number of hip fractures in Korea.

Table 1. Operational Definition of Hip Fracture in Each Study

Study	Study period	Age criteria	ICD-10 code	Procedure code	Duplication	Trend test
Lim et al. ¹⁴⁾	2001–2004	> 50 yr	S720, S721	NA	Not excluded	Percentage change
Park et al. ¹⁵⁾	2005–2008	> 50 yr	S720, S721	7 Codes	Excluded	Cochran-Armitage test
Lee et al. ¹⁶⁾	2006–2010	> 50 yr	S720, S721	7 Codes	Not excluded	Annual percentage change

ICD: International Classification of Diseases, NA: not available.

Table 2. Annual Percentage Change of Both Genders in Each Study

Study	Study period	Annual percentage change		
		Total	Woman	Man
Lim et al. ¹⁴⁾	2001–2004	NA	1.45 (–0.2 to 3.2)	–5.25 (–13.7 to 4.1)
Park et al. ¹⁵⁾	2005–2008	0.33 (–3.5 to 4.3)	0.98 (–1.1 to 3.1)	–0.75 (–6.9 to 5.8)
Lee et al. ¹⁶⁾	2006–2010	0.71 (–3.7 to 5.3)	1.11 (–3.6 to 6.1)	–0.16 (–4.1 to 4.0)

Values are presented as annual percentage change (95% confidence interval).
NA: not available.

in each study changed during each study period, annual percentage change (APC) for trends was used (Joinpoint Regression Program, ver. 3.5.2, Statistical Research and Applications Branch; National Cancer Institute, Bethesda, MD, USA). Statistical significance was determined at 95% confidence interval. If the confidence interval contained 0%, no significant change was considered present.

RESULTS

The operational definition of hip fractures differed with one another (Table 1). The absolute number of hip fractures for both genders increased in all three studies (Fig. 2).

The APC in the age-adjusted incidence of hip fractures was positive for women and negative for men. However, all 95% CI of APC in the trend test included 0%, which means that the change was not statistically significant in both genders (Table 2).

DISCUSSION

This systematic review showed that the age-adjusted incidence of hip fractures was stable among men and women, while the absolute number of hip fractures increased for both genders in Korea during the study period.

Korea has one of the fastest-aging populations as in Japan, Australia, and USA. In several Western countries, the age-adjusted incidences of hip fractures decreased or reached a plateau over the last decade.^{7,17,18)} The use of bisphosphonate, improved nutritional status such as vitamin D level, and decreased tobacco and alcohol consumption have been reported to be associated.⁷⁾

The most recent studies from Hong Kong and Singapore suggest that temporal trends of hip fractures may have reached a plateau.⁷⁾ Studies from Japan, one of the countries with a similar risk of osteoporotic fractures, showed significant increases in the age-adjusted incidence of hip fractures in both men and women during the last

decade.^{12,13)} Changes in the demographic structure in the Korean population are a possible explanation for the increase in the absolute number of hip fractures in the last decade, considering that the age-adjusted incidence of hip fractures was stable. Actually, the proportion of population over 50 years increased from 20.6% in 2000 to 29.5% in 2010 in Korea.¹⁹⁾

Baseline data on trends were necessary before estimating the projection of osteoporotic hip fractures. To determine the exact trend in the occurrence of hip fractures in a population at risk, the cumulative incidence of hip fractures in each year should be adjusted to the age characteristics of the standard population because the population at risk varies with time.⁷⁾ This means that the trend in the occurrence of hip fractures should be analyzed by using the age-adjusted incidence instead of the cumulative incidence.⁷⁾ By using the age-adjusted incidence, we could evaluate the trend in the occurrence of hip fractures and compare the incidence in Korea with that in other countries.

There were limitations of our study. First, the number of reviewed studies was relatively small. Multiple age-adjusted incidences of hip fractures were used as one of the inclusion criteria for this systematic review because calculation of age-adjusted incidences was necessary to test the trend of incidence. Unfortunately, we could not find further epidemiologic studies with age-adjusted incidences needed to determine the trend. Ha et al.²⁰⁾ presented that the annual incidence of hip fractures increased from 2002 to 2011 in a Jeju Island regional cohort study. Although they reported the incidence was standardized to the general Korean population according to age, it did not include the age-adjusted incidence of hip fractures. Second, the study periods of the included studies were too short (4 to 5 years) to determine the trend of hip fractures with time. Therefore, further studies with longer study periods as well as age-adjusted incidences are warranted to determine the trend in the incidence of hip fractures in

Korea.

Despite these limitations, this review shows that there was no substantial change in the age-adjusted incidence of hip fractures during each study period, while the absolute number of hip fractures increased in Korea.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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