

Incidence and Mortality after Proximal Humerus Fractures Over 50 Years of Age in South Korea: National Claim Data from 2008 to 2012

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Background: There has been lack of epidemiology of proximal humerus fracture using nationwide database in Asia. The purpose of this study was to investigate the incidence of proximal humerus fracture and its mortality following proximal humerus fracture in Korean over 50 years of age. **Methods:** The Korean National Health Insurance data were evaluated to determine the incidence and mortality of proximal humerus fracture aged 50 years or older from 2008 through 2012. **Results:** Proximal humerus fracture increased by 40.5% over 5 year of study. The incidence of fracture increased from 104.7/100,000 in 2008 to 124.7/100,000 in 2012 in women and from 45.3/100,000 in 2008 to 52.0/100,000 in 2012 in men, respectively. One year mortality rate after proximal humerus fracture was 8.0% in 2008 and 7.0% in 2012. One year mortality rate were 10.8% for men and 7.0% for women in 2008 and 8.5% for men and 6.4% for women in 2012. **Conclusions:** Our study showed that the proximal humerus fracture in elderly was recently increasing and associated with high mortality in Korea. Considering proximal humerus fracture was associated with an increased risk of associated fractures and an increased mortality risk, public health strategy to prevent the proximal humerus fracture in elderly will be mandatory.

Key Words: Humeral fractures, Incidence, Mortality, Osteoporotic fractures

INTRODUCTION

The number of osteoporosis and osteoporotic fracture has increased with life expectancy which is a major public health problem. Proximal humerus fractures are the third most frequent fractures in the elderly and reported that they were associated with the poor outcome such as persistent pain and limited activities.[1] Several studies reported that the patients with proximal humerus fracture tend to have additional fractures at the fragile bone which can lead to the excessive mortality.[2,3] However, previous studies for the epidemiology of proximal humerus fractures have had limitation that may influence their results of the studies, in-

cluding small sample size, the inclusion for all ages of humerus fracture and the enrollment from specific areas residents.[4-6] Although several studies have used nationwide claim or registered database to overcome these limitation of studies from limited regional database, the most studies have been performed only in western country.[7-10]

The purpose of this study was to investigate the incidence of proximal humerus fracture and its mortality following a proximal humerus fracture in Korean people over 50 years of age using recent five year national claim data.

METHODS

The Korean National Health Insurance (KNHI) data covers 100% of the population including 97% health insurance and 3% medical aid. All clinics and hospitals submit data on inpatients and outpatients, including data on diagnosis and medical costs, for claims.

One or more claims listing an International Classification of Disease (ICD), tenth revision diagnosis code of S42.2 (fracture of upper end of humerus), S42.3 (fracture of shaft of humerus) was required for inclusion in this study. No distinction was made between high energy and low energy injury.

The data were evaluated to determine the incidence of proximal humerus fracture and mortality associated with proximal humerus fracture, in men and women aged 50 years or older from 2008 through 2012.

All data of Korean men and women over the age of 50 years was based on the web site of the Korean Statistical Information Service.[11] Age standardized incidence rates of people in the corresponding of the age specific incidence rates of people in the corresponding age groups in a standard population, which was estimated for the Caucasian population in the United States (US) on July 1, 2008.[12]

Table 1. Incidence of proximal humerus fractures among patients 50 years or older from 2008 to 2012

Year	Number of proximal humerus fracture			Incidence of proximal humerus fracture (per 100,000)		
	Total	Men	Women	Total	Men	Women
2008	10,135	2,736	7,399	77.3	45.3	104.7
2009	11,037	2,944	8,093	80.5	46.5	109.7
2010	12,468	3,319	9,149	87.0	50.1	118.8
2011	12,967	3,434	9,533	86.4	49.3	118.5
2012	14,238	3,784	10,454	90.9	52.0	124.7

Unique personal identifier permitted the tracking of individuals for multiple visit or admissions. Where an individual had more than three outpatient visit or one admission for proximal humerus fracture, the patient was followed from the first event and recounted if a further event occurred 6 months or longer after the original visit or admission. [13] We followed each patient by code to identify death date of eligible file using the KNHI Program.

RESULTS

1. Incidence of proximal humerus fracture

Proximal humerus fracture increased by 40.5% over the 5 year of study (10,135 in 2008 and 14,238 in 2012) whereas the number of individuals 50 years or older in general population increased 19.5% (13,103,814 in 2008 and 15,657,674 in 2012) (Table 1). Although the annual incidence of proximal humerus fracture did not increase consistently, the incidence of proximal humerus fracture showed increasing tendency. The incidence of proximal humerus fracture increased from 104.7/100,000 in 2008 to 124.7/100,000 in 2012 in women and from 45.3/100,000 in 2008 to 52.0/100,000 in 2012 in men, respectively. In terms of the gender-specific distribution of proximal humerus fracture from 2008 to 2012, the incidence of proximal humerus fracture in women (19.1%) was more increased than that in men (14.8%) (Fig. 1). The mean age specific incidence by 10 year age groups increased in all age groups. In terms of age specific distribution of proximal humerus fracture from 2008 to 2012, the incidence of proximal humerus fracture increased

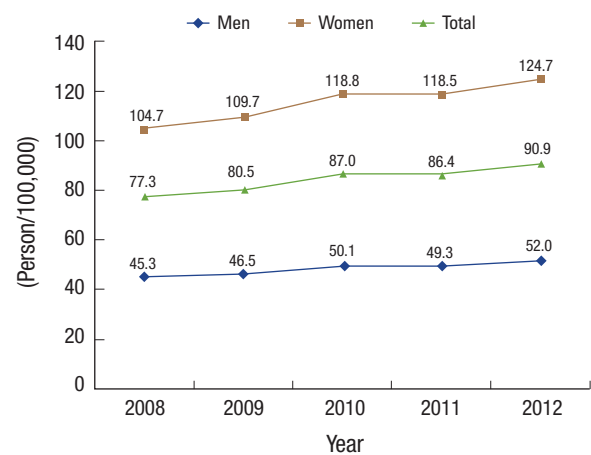


Fig. 1. Gender specific incidence of proximal humerus fractures in patients aged 50 years or older from 2008 through 2012.

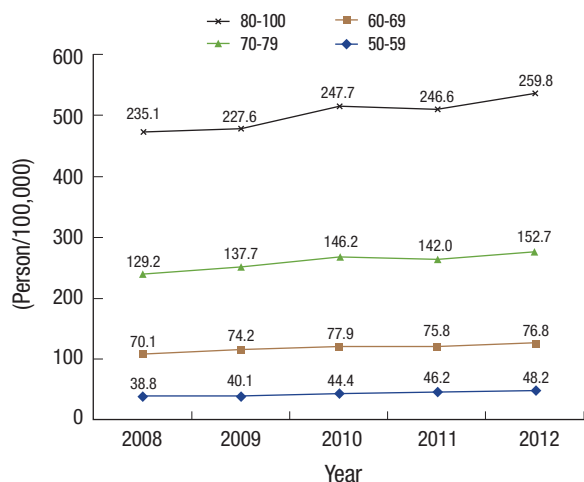


Fig. 2. Age specific incidence of proximal humerus fractures in patients aged 50 years or older from 2008 through 2012.

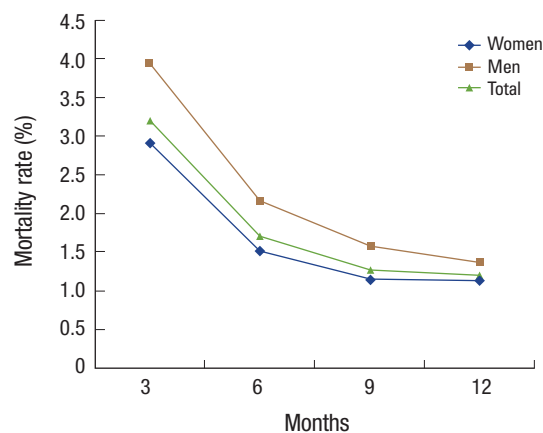


Fig. 3. Mortality rate after proximal humerus fracture in 2011.

Table 2. One year mortality rate (%) after proximal humerus fracture among patients 50 years or older from 2008 to 2012

Year	Number of deaths after proximal humerus fracture			Mortality rate of proximal humerus fracture (%)		
	Total	Men	Women	Total	Men	Women
2008	813	294	519	8.02	10.75	7.01
2009	866	288	578	7.85	9.78	7.14
2010	934	311	623	7.49	9.37	6.81
2011	954	311	643	7.36	9.06	6.74
2012	995	323	672	6.99	8.54	6.43

as they grow older (Fig. 2). The fracture incidence in the population aged from 50 to 100 year, which is age adjusted to the United States' Caucasian population in 2008, increased from 49.5/100,000 for men and 11.92/100,000 for women in 2008 to 57.4/100,000 for men and 136.8/100,000 for women in 2012.

2. Mortality after proximal humerus fracture

One year mortality rate after proximal humerus fracture was 8.0% (813/10,135) in 2008 and 7.0% (995/14,238) in 2012. In terms of gender difference, 1 year mortality rate were 10.8% (294/2,736) for men and 7.0% (519/7,399) for women in 2008 and 8.5% (323/3,784) for men and 6.4% (672/10,454) for women in 2012 (Table 2). The mortality rate was 1.4 times higher for men than for women at 12 months follow up. Using the data from the year 2011, the mortality after proximal humerus fracture was the highest during the first 3 months and it gradually decreased (Fig. 3).

DISCUSSION

To our knowledge, this is the first nationwide study of proximal humerus fracture 50 year or older in South Korea in terms of its incidence and mortality. We reported that the proximal humerus fracture in elderly patient was recently increasing and was associated with the high mortality in South Korea although hip fracture is associated with the highest mortality in elderly population. Proximal humerus fractures are known for the third most frequent non-vertebral fractures in the elderly. In both Europe and United States, the incidence of this fractures was reported to have increased during the last 40 years.[9,14] The age-adjusted incidence in Finland increased between 1970 and 2002 in both genders.[9] In Iceland, the incidence increased until 2001, when it started to decline for women over the last decade, but not for men.[15] In Asia, Hagino et al. [16] reported that significant increases were observed from 1986 to 1995 among Japanese men and women. However, Sakuma et al.[17] recently reported that the incidence of proximal humerus fracture was not increased (37.3/100,000 in 2004 and 37/100,000 in 2010). The average age at the time of fracture increased from average 75.7 years old in 2004 to average 82.6 years old in 2010.[17,18] In this study, the incidence of proximal humerus fractures in Korea increased from 77.3/100,000 in 2008 to 90.9/100,000 in 2012. In terms of the different age, the incidence of proximal humerus fracture was higher in elderly patients (259.8 in over 80 year old and 48.2 in 50th year old in 2012). Other study also reported that the incidence of this fracture was the highest in nonagenarian in each year that was similar with

our study.[19] Maravic et al.[3] reported lower incidence of proximal humerus fractures that is, 16.3/100,000 for men and 47.7/100,000 for women in 2009 at 40 years old older in comparison with those of our study (52/100,000 for men and 124.7/100,000 for women in 2012, female to male ratio: 2.4:1). The reason for this difference from our study was that their study included only hospitalized patients in comparison with our study that include the in-patients and out-patients. Sakuma et al.[17] recently reported that the female to male ratio was 1.67:1 in Sado island, Japan in 2010.

In this study, 1 year mortality rate after proximal humerus fracture continued to decrease throughout the study period from 8.0% in 2008 to 6.99% in 2012. Clement et al. [4] reported the similar rate of 1 year mortality (10% in 65 year old older in 1992-1996). Barrett et al.[20] reported that the mortality within 90 days was 4.6% and the risk of death at 1 year after fracture was still high (relative risk: 1.4 [95% CI: 1.3-1.5]). Several studies in Europe and United States reported that the proximal humerus fracture was significantly associated with the excess mortality at 1 year after injury. Melton et al performed a 22 year follow up study on osteoporotic fracture mortality in 2,901 patients who lived in Olmsted County in United States during 3 years (1989-1991). Relative death rate following proximal humerus fracture due to no more than moderate trauma was not statistically significant at less than 5 years after injury but, statistically high at more than 5 years after injury (standardized mortality ratio [SMR]: 1.6 [1.1-2.2] for men and 3.0 [1.7-5.0] for women).[8] Shortt and Robinson[6] reported from their study between 1989-1999 on 2,983 patients older than 45 years that hazard rate was significantly high in less than 5 years but not in more than 5 years (hazard ratio [HR]: 1st year: 3.4 [3.1-3.9], 2nd-5th year: 1.9 [1.5-2.2], 6th-10th year: 1.2 [0.9-1.8]). Clement et al.[4] performed a retrospective review of the prospectively compiled database between 1992 and 1996 on 637 proximal humerus fracture patients older than 65 years and SMR at 1 year was 2.06 (1.47-2.80) and the rate of mortality at one year was 10%. Barrett et al.[20] reported that using the 5% US standard sample of the medicare population in 1986-1990 among beneficiaries aged 65 years or older, the relative risks of 3 month mortality was 3.1 (2.5-3.7) and the one year relative risks remained high for proximal humerus fracture (1.4 [1.3-1.5]). A population based prospective cohort study with 12 year follow up in south-western Finland reported that the prox-

imal humerus fractures were associated with excess mortality in men (HR: 5.4; 95% CI: 1.6-17.7), but not in women (HR: 1.0; 95% CI: 0.4-2.3).[10] In this study, the mortality rate after proximal humerus fracture was higher than that of general population even though the mortality rate decreased throughout the study period. The reason for higher mortality might be related with the older age and male gender which is similar to those of hip fracture. Shortt and Robinson[6] reported that older age, male gender and the use of walking aids predicted mortality after proximal humerus fracture. They also identified factors associated with social independence to be predictive of mortality, finding patients no longer living in their own home to have an increased risk of mortality. Other report confirmed that poor functional outcome after proximal humerus fractures was associated with social independence.

Another reason for higher mortality after proximal humerus fracture might be related with the associated fracture. Proximal humerus fracture was associated with an increased risk of sustaining associated fractures. Clinton et al.[2] reported that the humeral fractures are associated with a fivefold increased risk of subsequent hip fracture in the following year. Both hip and humerus fracture are shown to associate with several factors indicating poor health.[21] Clement et al.[22] reported that the SMR at one year was significantly greater after sustaining multiple fractures that included the proximal humerus fracture (2.06 SMR for single fracture and 4.95 SMR for multiple fractures including proximal humerus fracture). They suggested that the combined fractures of the proximal humerus and femur were associated with the highest mortality risk at one year.

There were several limitations in this study. First, bone mineral density (BMD) of patients was not available due to the study design based on National Claim Registry in this study. It was possible that proximal humerus fractures due to high-energy trauma were included in this study, because distinction between high and low-energy fractures could not be made by using ICD-10 coding system. However, we used additional criteria of "aged 50 years or more" to exclude high-energy fractures. Second, this study could not differentiate the pathologic fractures in the proximal humerus which could occur in the elderly. This can influence the incidence of fracture to be overestimated. Third, there was a lack of consideration for medical condition in mortality analysis, which can much influence the mortality in

old populations. Thus, we cannot avoid the confounding effect on results imposed by different medical condition in this study.

In conclusion, our study from nationwide database showed that the proximal humerus fracture in elderly was recently increasing and associated with excessive mortality in Korea. Considering proximal humerus fracture were associated with an increased risk of associated fractures which could increase the mortality risk more, public health strategy to prevent the proximal humerus fracture in elderly will be mandatory.

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