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A nationwide seven-year trend of hip fractures in the elderly population of Taiwan

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ABSTRACT

To investigate the recent longitudinal trend of hip fractures (including cervical and trochanteric fractures) in Taiwan's elderly population (≥65 years), a nationwide descriptive epidemiological study was conducted using the database of the Bureau of National Health Insurance from 1996 through 2002. Frequencies and incidences of hip fracture by gender, fracture site, and age group were estimated, and the 7-year incidence trend was further evaluated. The results showed that a total of 75,482 hip fractures occurred during the study period with an incidence rate of 57.54 per 10,000 per year. Overall incidence significantly increased by 30% ($p<0.0001$), from 49.56 to 64.37 per 10,000 per year during the 7-year study period. The increase in rates was greater in males (36%) than in females (22%). The average female-to-male ratio was 1.76, lower than those in many countries. In females, the annual incidence of cervical fracture was higher than that of trochanteric fractures throughout the 7 years, while the incidence of trochanteric fractures was higher than cervical fractures each year in males ($p<0.0001$). The average annual incidence of patients older than 85 years was 9.9 times higher than that of aged 65 to 69 years in females and 7.9 times in males. Development and implementation of public health strategies for hip fractures should more focus on these subgroups in Taiwan's rapidly aging society.

Introduction

Hip fracture is a major public health problem in the elderly. The devastating complications associated with hip fractures create medical and financial burdens for society. Hip fractures lead to an overall 12% to 20% reduction in expected survival with 5% to 20% excess mortality within the first year after the fracture [1,2]. Previous epidemiological studies [3–6] reported that the incidence of fractures of the proximal femur varies with geographic locations and ethnic groups. It has been found that the incidence of fractures of the proximal femur is lower in Asian countries compared to countries in the West [7–14]. The age-adjusted incidence rates of hip fracture among Asian populations were found to be around 60% to 70% of those observed among Caucasians [15].

Taiwan, a country of approximately 23 million people, is facing the challenge of an aging population, as developed countries have. The elderly population, defined as 65 years of age and older in Taiwan, will increase from 7.6% of the total population in 1995 to more than 15% in the next decade [16]. With an increasingly aging population, the occurrence of hip fractures will predictably rapidly increase and will represent a major and growing health care problem [17,18]. Chie et al. used the inpatient database of the National Health Insurance Program to investigate the incidence rate of hip fracture in Taiwan from 1996 to 2000 and found a higher incidence than in other reports of ethnic Chinese populations, and similar to that of Western countries [19]. The similar incidence of hip fracture was also found to depict hip fracture epidemiology in Taiwan [20,21]. However, the different characteristics between cervical and trochanteric fractures are worthy of detailed evaluation. Therefore, we extended the nationwide descriptive epidemiologic study to elucidate the incidence and trends of hip fracture from 1996 and 2002 in Taiwan by analyzing a National Health Insurance database, to compare the difference between cervical and trochanteric fractures in different genders and age groups in the elderly population, and with other countries, and to determine whether the incidence of hip fracture has increased further in Taiwan's elderly population.

Materials and methods

A nationwide survey of hip fractures in Taiwan from 1996 to 2002 based on the National Health Insurance Research Database was conducted. The National Health Insurance program, a single-pipeline public insurance system for the entire population of Taiwan, was established in March 1995. Up to 96% of the 23 million residents in Taiwan are enrolled in the National Health Insurance program. The hospitalization health care database makes the epidemiological

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analysis of hip fractures possible, because almost all patients with hip fractures in Taiwan are hospitalized to receive treatment.

The inclusion criteria were all patients ≥65 years of age with the International Classification of Disease-Clinical Modification, ninth revision (ICD-9-CM) code 820.X (hip fracture) who had received surgical treatment with the treatment code (79.1, 79.3, 81.5, and 81.6). Cervical fractures (femoral neck fractures) were indicated by codes 820.0, 820.1, 820.8, 820.9, or their five-digit subclassification, whereas trochanteric fractures were identified by codes 820.2, 820.20, 820.21, 820.3, 820.30, or 820.31. Additional information such as gender, age, and overall mortality during the hospital stay were also recorded. The exclusion criteria included (1) repeated admission with the same diagnostic codes within 30 days, to prevent repeating the calculation, and (2) patients with pathological fractures (codes 733.14 and 733.15).

The annual mid-year gender-specific and age group-specific adult populations ≥65 years old in Taiwan from 1996 to 2002 were obtained from the census data of the Taiwan Ministry of the Interior. The annual age- and gender-specific incidence rates were calculated as the number of cases in the specific subgroup divided by the specific subgroup census population for that particular year. The total mortality rates during hospital stay were calculated as the mortality number of cases during hospitalization divided by the total number of hip fractures annually. The relative frequency of hip fractures in gender, and the subtypes of fractures were calculated for each age group in order to understand the need for orthopedic medical services. The cervical/trochanteric fracture incidence ratio, an index of relative incidence for a subtype of hip fracture, was expressed as the annual incidence of trochanteric fractures divided by the annual incidence of cervical fractures. A ratio above 1 indicated that a higher incidence of cervical fracture was observed, and a ratio below 1 indicated that a higher incidence of trochanteric fracture was observed.

Data analysis

Fracture incidence was expressed as the number of fractures per 10,000 persons per year, and was computed for each gender and age group. Age was divided into 5 groups from 65 years to ≥85 years with 5-year intervals. The difference of cervical and trochanteric fracture incidence between females and males was compared using the chi-square test. We also evaluated the secular trend of fracture incidence, and the female-to-male ratio with age and mortality rate by linear regression analysis. *P* values less than 0.05 were considered to be statistically significant. The 95% confidence interval (95% CI) of incidence was estimated according to Poisson distribution. All statistical analyses were performed by using SAS 9.1 (SAS Institute, Inc., Cary, North Carolina).

Results

Overall incidence, mortality during hospital stay, and the 7-year trend

A total of 75,482 patients aged ≥65 years with hip fracture from1996 to 2002 were identified, with an incidence rate of 57.54 per 10,000 per year (Table 1). Of these patients, the majority (60.9%, 45,954/75,482) were females. The overall incidence increased 30%, from 49.56 to 64.37 per 10,000 during the 7-year study period ($p<0.0001$). The average 7-year overall mortality rate during the hospital stay was 0.97%, and the mortality rate showed a declining trend (1.34% in 1996 and 0.84% in 2002; $p=0.0082$) (Table 1).

Gender-specific incidence and the 7-year trend

The frequency and incidence of hip fractures significantly increased in both genders ($p<0.05$). Among those with hip fractures, the majority of them were females. Magnitude of increase in incidence was larger in males than that in females (males: 36%; females: 22%). The overall female/male incidence ratio over the entirety of the study was 1.76 and the ratio decreased from 1.87 in 1996 to 1.68 in 2002 ($p=0.0038$) (Table 1).

Age-, gender-specific incidences and the 7-year trend

Overall, the hip fracture incidence increased with age and females had higher incidence than males in each age group (Fig. 1). The average annual incidence of patients older than 85 years was 9.1 times higher than that of aged 65 to 69 years (9.9 times in females and 7.9 times in males). A much higher female to male incidence ratios were observed in the age group older than 75 years (65–69 years: 1.39, 69–74 years: 1.57, 75–79 years: 1.73, 80–84 years: 1.77, ≥85 years: 1.72).

There was a 39% increase in incidence in men and women over 85 years between 1996 and 2000, which was much higher than the 16% increase in those aged 65–84 years. Although the number of cases were still increasing, the incidence of hip fracture did not significantly increase in both males and females in all age groups from 2000 to 2002 ($p>0.05$) (see Appendix A).

Fracture site-specific incidence in patients

Among patients with hip fracture, 36,549 (48.4 %) cervical fractures and 38,933 (51.6 %) trochanteric fractures were identified, with an average incidence of 27.81 and 29.73 per 10,000 per year, respectively. The overall 7-year incidence of cervical and trochanteric fractures is shown in Table 2. The incidence of both types of hip fracture increased about 30% during the 7-year period (cervical: 32%; trochanteric: 27%). Interestingly, the magnitude of difference in

Table 1
Gender-specific numbers and incidence[a] of hip fracture in Taiwan from 1996 through 2002

Year	Total		Male		Female		Female/male ratio[b]	Mortality rate[c] %
	Number	Incidence[a]	Number	Incidence[a]	Number	Incidence[a]		
1996	8384	49.56 (48.50–50.62)	3280	35.53 (34.31–36.75)	5104	66.42 (64.60–68.24)	1.87	1.34
1997	8888	50.73 (49.67–51.78)	3427	36.08 (34.87–37.29)	5461	68.08 (66.27–69.88)	1.89	1.05
1998	9937	54.89 (53.81–55.97)	3899	40.05 (38.80–41.31)	6038	72.15 (70.34–73.98)	1.80	1.15
1999	11,024	59.09 (57.99–60.20)	4307	43.38 (42.08–44.68)	6717	76.98 (75.13–78.82)	1.77	0.95
2000	11,754	61.18 (60.07–62.28)	4568	45.18 (43.87–46.49)	7186	78.94 (77.12–80.77)	1.75	0.81
2001	12,420	62.94 (61.83–64.05)	4993	48.64 (47.29–49.99)	7427	78.45 (76.66–80.23)	1.61	0.67
2002	13,075	64.37 (63.26–65.47)	5054	48.36 (47.02–49.69)	8021	81.34 (79.56–83.12)	1.68	0.84
Total	75,482	57.54 (57.45–58.27)	29,528	42.46 (42.17–43.14)	45,954	74.62 (74.36–75.73)	1.76	0.97

95% CI: 95% confidence interval.
[a] Fracture incidence is expressed as the number of fractures per 10,000 persons per year and computed for each gender population.
[b] Female/male ratio is expressed as the fracture incidence for females divided by the incidence for males.
[c] Mortality rate is expressed as the patients that expired during this period of admission.