

Five-Year Relative Survival of Patients With Osteoporotic Hip Fracture

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Context: Osteoporotic hip fracture is known to be associated with excess mortality. The 1-year mortality rate after hip fracture is known to reach up to ~20%, similar to that of cancer. However, there was no study that compared cancer survival. Recently, relative survival has been used to present a prognosis for a particular disease.

Objective: The purpose of this study was to compare the 5-year relative survival after osteoporotic hip fracture with those of general population and cancer patients.

Design, Setting, and Patients: We retrospectively reviewed the medical records of 727 patients who were treated for osteoporotic hip fractures from 2003 to 2009.

Intervention: Intervention was hip fracture surgery.

Main Outcome Measure: Five-year relative survival after fracture was estimated and was compared with survival in the general population and in cancer patients. Relative survival of 100% would reflect no excess mortality associated with the hip fracture compared with the general population.

Results: Cumulative mortality was 32.3% at 5 years, and 5-year absolute survival rate was 63.0% (95% confidence interval, 59.0%–66.9%). Five-year relative survival of hip fracture was 93.9% (95% confidence interval 87.5%–99.7%), which was comparable with those of thyroid or breast cancer (99.8% and 91.0%, respectively).

Conclusions: Our results showed that 5-year relative survival after osteoporotic hip fracture was below those of the general populations and was comparable with some cancers such as thyroid and breast cancer. Therefore, osteoporotic hip fracture should not be overlooked. (*J Clin Endocrinol Metab* 99: 97–100, 2014)

A hip fracture is a serious complication associated with osteoporosis, and a major health concern, affecting a growing number of individuals worldwide (1–4). Several studies suggested that osteoporotic hip fracture is associated with adverse effects, such as decreased mobility and diminished quality of life (5, 6). In addition, excess mortality has also been described in patients who sustained osteoporotic hip fracture (7, 8). In a few previous studies, excess mortality after osteoporotic hip fracture

has been reported by comparing mortality of the general population but has not been compared with other diseases, especially cancer, which is a recent major cause of mortality in the elderly population (9–11).

Relative survival was introduced to provide an objective measure of survival probability from cancer eliminating the effect of other causes for mortality, and it has been used to estimate the prognosis of cancer patients (12–17). Relative survival can also allow researchers to compare

the survival rates of specific disease with those of the general populations or patients with certain diseases such as cancer, because the formulation of relative survival is based on the assumption of independent competing causes of death (12, 13). However, relative survival has not been previously applied to patients with benign diseases, including osteoporotic hip fracture with high excess mortality, although it has been applied to major cancer patients (14–17).

The purposes of this study were to investigate the 5-year mortality after osteoporotic hip fracture and to compare 5-year relative survival rates after osteoporotic hip fracture with those of major cancer.

Subjects and Methods

Study participants

We retrospectively reviewed the medical records of all 852 hip fracture surgeries for a femoral neck fracture or an intertrochanteric fracture in patients older than 50 years from May 2003 to December 2009. The inclusion criteria were patients older than 50 years of age who had a first-time low-energy trauma fracture with surgical treatment. A low-energy trauma fracture was defined as a fracture caused by an injury equal to or less than a fall at the standing height. Fourteen hip fracture surgeries in 12 patients were excluded because they had pathologic fractures. Seventy-four hip fracture surgeries were excluded because they were not first-time surgeries. During the follow-up period, 35 patients were lost to follow-up before 1 year, and thus, the remaining 727 patients were finally analyzed in this study.

There were 532 women and 195 men with a mean age of 77.3 (range, 50–101) years at the time of the operation. Their mean body mass index was 21.5 kg/m² (range, 12.1–35.8 kg/m²). There were 320 femoral neck fractures and 407 intertrochanteric fractures.

Cannulated screws (6.5 mm diameter), sliding hip screws, and intramedullary nails were used for internal fixation. Bipolar hemiarthroplasty and total hip arthroplasty were used for hip arthroplasty.

One to 3 days after surgery, closed suction drainage was removed and patients were mobilized with wheelchairs. Patients walked with protected weight-bearing and used assistive devices (wheelchair, walker, crutches, or cane) 3 to 10 days after the operation. As their walking ability improved, their assistive devices were changed appropriately by a physical therapist.

Clinical follow-up

Follow-up evaluations were performed at 6 weeks and at 3, 6, 9, and 12 months and every year thereafter. Some patients, who had not returned on regularly scheduled visits, were contacted by telephone.

Statistical analysis

Cumulative mortality rate was calculated according to time.

Five-year absolute survival rate was calculated to estimate the survival in patients including those who were followed up, by using Kaplan-Meier survival analysis. Patients who were lost to

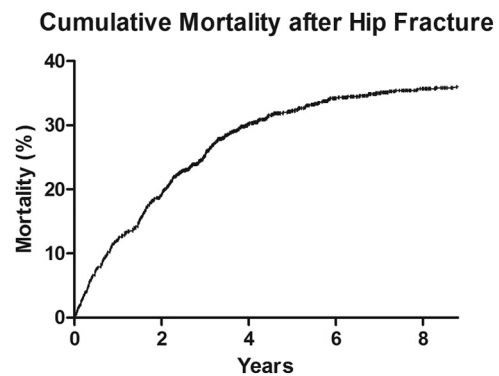


Figure 1. Cumulative mortality after osteoporotic hip fracture.

follow-up were considered as censored cases (18). Five-year absolute survival rate is defined as the percentage of patients who are alive 5 years after their disease is diagnosed.

To compare the survival probability after hip fracture with those of the general population and several cancer patients, 5-year relative survival were analyzed. Relative survival is defined as the ratio of the observed survival rate in patients with the disease of interest to the expected survival rate in disease-free individuals. The observed survival rate is the probability of surviving from all causes of death for hip fracture patients, and the expected survival rate is the survival probability of a general population similar to the patient group but free of hip fracture (12, 13). Because a cohort of disease-free individuals was difficult to obtain, the expected survival rate was estimated using a national life table representing survival rate of the general population, like elsewhere (12–14). The underlying assumption was that the deaths by hip fracture were a negligible proportion of all deaths (12). The national life table of the general population matched for age, sex, and calendar year of the hip fracture patients was obtained from the website of the Korean Statistical Information Service (<http://www.kosis.kr>), which is the central government organization for statistics. Relative survival of 100% means that the survival probability after hip fracture is same as those of the general population, and there is no excess mortality associated with hip fracture. We obtained the 5-year relative survival of several cancers (thyroid, breast, prostate, lung, and colorectal cancer) between 2006 and 2010 from the website of the Korean National Cancer Information Center (<http://www.cancer.go.kr>) and literature review (14).

Statistical analyses were conducted with STATA version 12 (StataCorp LP).

The design and protocol of this study were approved by the

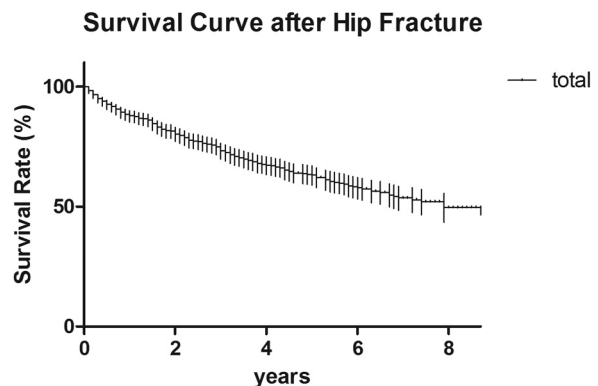


Figure 2. Kaplan-Meier survival curve.

5-year Relative Survival after Hip Fracture and Cancers

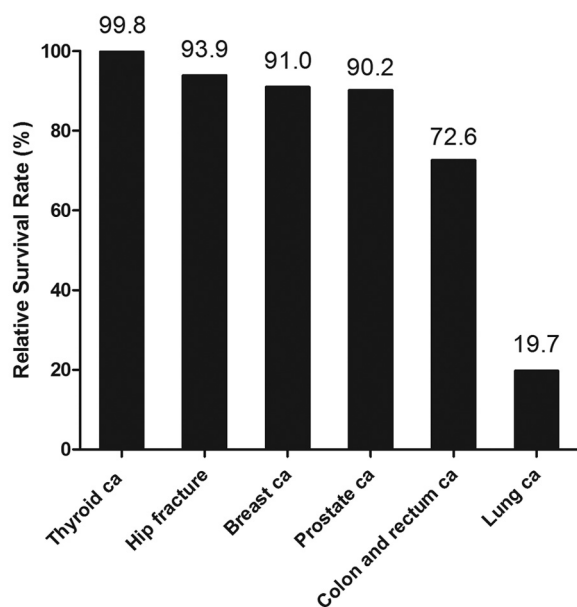


Figure 3. Five-year relative survival of patients with osteoporotic hip fracture and several cancers (ca) in South Korea.

institutional review board in our hospital, who waived informed consent.

Results

Of the 727 patients, 89 patients died within 12 months after the operation, resulting in a 1-year mortality of 12.2%. Of the 195 men, 30 (15.4%) died, and 59 (11.1%) of the 532 women died within the first year after the fracture. The mean follow-up duration of 638 patients who survived over 12 months postoperatively was 3.7 (range, 1.0–9.4) years.

Cumulative mortality was 32.3% at 5 years (Figure 1), and the 5-year absolute survival rate was 63.0% (95% confidence interval [CI], 59.0%–66.9%) (Figure 2). Five-year relative survival was 84.9% (95% CI, 70.7%–97.5%) in men and 97.0% (95% CI, 89.8%–

100%) in women. Overall 5-year relative survival of hip fracture was 93.9% (95% CI 87.5%–99.7%), which was comparable to those of thyroid or breast cancer patients. (Figure 3)

Discussion

In this study, 5-year mortality rate after hip fracture was 32.3%. The 5-year relative survival after hip fracture was below those of the general population and was between those of thyroid and breast cancer in South Korea.

In previous epidemiologic studies of patients with hip fractures, the mortality rate at 5 years after hip fracture ranged from 41.2% to 61.3%, which was higher than our rate (Table 1) (6, 9, 10, 20–24). However, we could not directly compare the absolute mortality rate in our study with those of the previous studies, because we could not adjust comorbidities. So, we used the relative survival to help eliminate the effect of other comorbidities for mortality.

To explain the excess mortality after hip fracture, standardized mortality ratio (SMR) or relative risk has been used in previous epidemiologic studies. (8–11, 23) The SMR is calculated as the observed mortality divided by the expected mortality for each age and gender group (6, 25). The expected mortality rate for each group was determined from the total number in the age/gender-specific study population multiplied by each age/gender-specific mortality rate of the general population. An SMR >1.0 means excess mortality associated with the disease of interest (25).

Although SMR and relative risk can allow researchers to compare mortality between patients and the general population, they cannot allow a comparison with another disease. In this study, we can compare the effect to mortality of hip fracture with those of malignancy by analyzing the 5-year relative survival. Five-year relative survival

Table 1. Mortality After Hip Fracture

Ref.	Number of Patients With Hip Fracture	Age, y	1-Year Mortality, %	5-Year Mortality, %	Statistics for Excess Mortality
Borgquist et al (20)	103	≥ 50	NA	43.7	NA
Schroder et al (21)	3895	≥ 40	31.6	61.3	NA
Johnell et al (10)	1143	≥ 60	22	59	RR
Karagiannis et al (22)	499	≥ 60	15.7	44.1	RR
Tsuboi et al (6)	753	≥ 50	19	51	NA
Paksima et al (23)	1109	≥ 65	11.9	41.2	SMR
Friesendorff et al (24)	766	≥ 20	21	52	NA
Bliuc et al (9)	246	≥ 60	NA	52.8	SMR
Current study	727	≥ 50	12.2	32.2	5Y-RSR

Abbreviations: NA, not applicable; RR, relative risk; 5Y-RSR, 5-year relative survival rate.

after hip fracture was lower than that of thyroid cancer with good prognosis.

A recent study from Western countries reported that 5-year relative survival was 48% in men and 59% in women after hip fracture (19). They included a small number of patients (206 patients) and had a different cutoff value of age (>60 years). They demonstrated that the relative survival showed a gender difference and was reduced with age (19).

Our study has several limitations. First, the study design was retrospective. Second, there might be a selection bias because our hospital is a tertiary referral hospital. This may influence our results and the generalizability of the study. In addition, the subjects for relative survival of hip fracture were from one institute, whereas the subjects for relative survival of cancer included all cancer patients from a nationwide cancer registry. Third, relative survival might depend on other confounding factors such as timing of diagnosis, nontreatment, and stage at diagnosis, especially in cancer patients. Finally, relative survival, which excludes the chance of deaths from other causes, was theoretical in an artificial situation. However, this is the first study that demonstrated 5-year relative survival of osteoporotic hip fracture, making a comparison with those of general population and several cancers.

In conclusion, our study demonstrated that 5-year relative survival after osteoporotic hip fracture was comparable to those of patients with thyroid and breast cancer as well as the general population. Osteoporotic hip fracture should not be overlooked.

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