

Factors Affecting Bone Mineral Density Measurement after Fracture in South Korea

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Background: Prior osteoporotic fractures are strongly associated with the subsequent fractures. To prevent this, the diagnosis of osteoporosis following an osteoporotic fracture is important. The measurement of bone mineral density (BMD) is the first step for the diagnosis and management of osteoporosis. Therefore, the purposes of this study are 1) to evaluate the rate of BMD measurement after osteoporotic fracture in Korean population; and 2) determine the associated factors with BMD measurement after fractures among Korean patients. **Methods:** From database of Health Insurance Review & Assessment Service, we identified patients with osteoporotic fractures happened in 2010. The BMD examinations were evaluated by using procedure codes. We evaluated the rate of BMD measurement within 6 months after fracture according to gender, age group (10-year incremental), type of insurance, residency area (rural vs. urban), type of medical institute, department, history of depression, rheumatoid arthritis, medical history suggestive of secondary osteoporosis, osteoporosis-induced drug, and number of family members. **Results:** During study period, about a half (53.9%) of patients with osteoporotic fractures had BMD measurement. Men, younger age, urban residency, and depression history were associated with low rate of BMD measurement. However, increasing age, use of glucocorticoid use, osteoporosis-inducing comorbid disease including rheumatologic disease, and osteoporosis-induced drug user were associated with higher likelihood of BMD measurement. **Conclusions:** Our results showed that about a half of patients with osteoporotic fractures had BMD measurement in South Korea, and provided the basic information to encourage management after fracture by educating not only patient but also physician about post-fracture management.

Key Words: Bone density, Osteoporotic fractures, Risk factors

INTRODUCTION

Considering aging society, osteoporosis and its related fractures have become a growing health problem worldwide.[1,2] Osteoporosis occasionally results in osteoporotic fracture in hip, spine, humerus, and wrist.[3-5] In Korea, the annual incidences of osteoporotic fractures were 1,614 per 100,000 person-years in people aged 50 years or more in 2008.[6,7]

It is obvious that securing an appropriate level of post-fracture management for patients with osteoporosis may significantly reduce the risk of osteoporotic fracture. Especially, patients with previous osteoporotic fracture have higher risk of a

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subsequent fracture than those without previous fracture.[8]

Thus, post-fracture management for osteoporosis is highly recommended to prevent the occurrence of new fragility fractures.[9-11]

However, even high-risk patients with previous fracture often do not receive preventive management worldwide. [8,12-15] Korea is not an exception. Only 52.2% were aware of their diagnosis and 58.4% received pharmacological treatment among those with osteoporotic fractures.[16]

Bone mineral density (BMD) measurement is the first important step to investigate and manage patients with osteoporosis.[17] That is the important opportunity to initiate secondary prevention in patients with previous osteoporotic fracture.[18] In fact, a few empirical studies have already dealt with this issue in Korea.

There was lack of studies on the rate of BMD measurement after osteoporotic fracture in Korea, and what factors are associated with BMD measurement after fractures.

Therefore, our purposes were 1) to evaluate the rate of BMD measurement after osteoporotic fracture in Korean population; and 2) to determine associated factors with BMD measurement after fractures in Korea.

METHODS

We used data from the nationwide claims database of Health Insurance Review & Assessment Service (HIRA). Almost 97% of the Korean populations have been currently covered with this national insurance system. In other words, the medical claims data include demographic information (age and gender), diagnoses using the International Classification of Diseases, Tenth Revision (ICD-10) codes and procedures for diagnosis and treatment using codes in both of inpatients and outpatients care. Thus, it is firmly certain that all information about health care utilization is available from the HIRA database. Several epidemiologic studies have used this national claim database.[19-21] We analyzed patients aged over 50 years who were diagnosed with osteoporotic fracture by physician at 2010.

We identified patients with hip, spine, humerus and wrist fractures diagnosed in 2010. To identify patients with these fractures, we adopted the diagnostic codes using the ICD-10 (hip, S720 and S721; spine, M484, M485, S220, S221, and S320; humerus, S422 and S423; wrist fractures, S525 and S526) and the procedure codes according to each anatom-

ic site.[3,7,22,23]

If an individual with fracture had more than one outpatient visits or admissions within the time period of six months, the cases were not counted separately, as below.[24,25]

Double recording was avoided by counting only one record in the case that a person had more than one record in the HIRA database. If a patient had both spine and wrist fractures, only the first episode was counted.

The data based on the HIRA came from the patients who had experienced a hip, spine, humerus or wrist fracture and had undergone BMD examinations within 6 months before and after osteoporotic fractures. The procedure codes (HC 341-HC 344) for these examinations included dual x-ray absorptiometry scans (single site, HC 341; multiple sites, HC 342), quantitative computed tomography scans (HC 343), and other methods, including ultrasound (HC 344).

The rates of BMD examinations were estimated within 6 months after osteoporotic fractures.

We evaluated gender, age group (10-year incremental), type of insurance, residency area (rural vs. urban), type of medical institute, department, history of depression, rheumatoid arthritis, medical history suggestive of secondary osteoporosis, osteoporosis-induced drug, and number of family members as potential associated factors.

The significance of differences was determined with use of a χ^2 test. Statistical analyses were performed using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

We analyzed a total of 192,556 patients who were diagnosed of osteoporotic fracture in 2010. Of these patients, only 103,785 (53.9%) had been measured with BMD within 6-months post fracture (Table 1).

Indeed, the number of female showed higher frequency to have BMD measurement as compared with men (57.9% vs. 37.9%). And, older patients were more likely to have BMD measurement, especially in population aged from 70 to 79 (66.7%). Patients in medical benefit system indicating almost free-ride medical aid program in Korea tended to have BMD measurement more frequently than those with medical care insurance (61.7% vs. 53.1%). Patients living in urban area were less likely to have BMD measurement than those living in rural area (51.6% vs. 97.6%). Patients who utilized public health care center showed high-

Table 1. Baseline characteristics of fracture patients who receive post-fracture therapy

Variables	No. of patients	BMD measurement, n (%)	P-value
No. of patients	192,556	103,785 (53.9)	
Gender			<0.001
Male	38,716	14,656 (37.9)	
Female	153,840	89,129 (57.9)	
Age (year)			<0.001
50-59	36,327	8,493 (23.4)	
60-69	44,967	21,859 (43.6)	
70-79	69,264	46,170 (66.7)	
≥80	41,998	27,263 (64.9)	
Type of health insurance			<0.001
Medical care insurance	174,784	92,820 (53.1)	
Medical benefit system	17,772	10,965 (61.7)	
Residential area			<0.001
Urban	117,824	60,817 (51.6)	
Rural	74,732	72,968 (97.6)	
Type of medical institute			<0.001
Tertiary hospital	12,365	7,978 (64.5)	
General hospital	50,605	29,574 (58.4)	
Hospital	63,089	36,847 (58.4)	
Clinic	65,878	28,889 (43.9)	
Public health care center	619	497 (80.3)	
Department			<0.001
Orthopedic surgery	122,357	55,872 (45.7)	
Internal medicine	21,300	13,951 (65.5)	
Neurosurgery	29,364	23,285 (79.3)	
Gynecology	311	191 (61.4)	
Family medicine	2,545	1,509 (59.3)	
Glucocorticoids			<0.001
User	5,030	3,618 (71.9)	
Non-user	187,526	100,167 (53.4)	
Depression			<0.001
Yes	599	187 (31.2)	
No	191,957	103,598 (54.0)	
Rheumatologic disease			<0.001
Yes	4,289	3,016 (70.3)	
No	188,267	100,769 (53.5)	
History of secondary osteoporosis			<0.001
With history	30,454	18,880 (62.0)	
Without history	162,102	84,905 (52.4)	
Osteoporosis-induced drug			<0.001
User	128,082	75,911 (59.3)	
Non-user	64,474	27,874 (43.2)	
No. of family members			<0.001
1	39,179	20,374 (52.0)	
2	40,350	20,609 (51.1)	
3	32,314	15,683 (48.5)	
≥4	80,713	47,119 (58.4)	

BMD, bone mineral density.

est likelihood (80.3%) of being taken BMD measurement than those who utilized another type of medical institute. When patients visited at neurosurgery department after fracture, BMD was measured in the most proportion (79.3%). As compared with those who had no medications during the baseline period, patients who took glucocorticoids, were taken BMD measurement more frequently (53.4% vs. 71.9%). Patients who had depression history were less likely to have BMD measurement than those with no depression history (31.2% vs. 54.0%). Patients who had rheumatoid arthritis were more likely to have BMD measurement than those with no rheumatoid arthritis (70.3% vs. 53.5%). Patients who had medical history suggestive of secondary osteoporosis were more likely to have BMD measurement than those with no medical history osteoporosis (62.0% vs. 52.4%). Patients who took osteoporosis-induced drug were more likely to have BMD measurement than those with no medical history osteoporosis (59.3% vs. 43.2%). Patients who had family members of more than four were more likely to have BMD measurement than those with less than four (58.4% vs. 50.7%).

DISCUSSION

This study examined BMD measurement in patients after the first fracture in Korea by using nationwide retrospective data. We found that only 37.9% of men and 57.9% of women underwent BMD measurement within 6 months after a fracture.

The low rate of BMD measurement was associated with men, younger age, urban residency, and depression history, in terms of patients' factor. Our results show that post-fracture management including BMD measurement is particularly poor among younger men, which was evidently in the line with the previous studies.[26,27]

In addition, physician in orthopedic department made the lowest level of BMD measurement after fracture (45.7%). Given that the most of fractures have been treated in orthopedic department, it is important that orthopedic surgeon have awareness of necessity of BMD measurement. [4] In our analysis, patients who utilized larger hospital showed less likelihood of being taken BMD measurement than those who utilized another smaller medical institute, which is likely to be related to the possibility of more coordinated care between the different departments in small

hospital than in large hospital. Our findings indicate that more coordinated service model is required in Korea to reduce the care gap for secondary fracture prevention.

According to our results, many of the factors affected the BMD measurement significantly. Increasing age, use of glucocorticoid use, osteoporosis-inducing comorbid disease including rheumatologic disease, and osteoporosis-induced drug user were associated with higher likelihood of BMD measurement, which is in line with prior studies. [8,28] Patients who utilized public health care center showed highest likelihood (80.3%) of being taken BMD measurement than those who utilized another type of medical institute. This means that public health care center play an important role to manage osteoporosis in Korea.

There were several limitations. First, we assumed that all patients with osteoporotic-fracture were eligible for BMD measurement. Second, we could not include patients who had BMD measurement after fracture, when patients with fracture took routine health care examination, because it was not included claim database. Therefore, there is possibility for us to under estimate the real gap in the post-fracture BMD measurement. Third, we could not evaluate whether the patients with BMD measurement took anti-osteoporosis treatment after BMD measurement. Finally, we could not perform multivariable analysis, because we could not link age, gender, disease or procedure code, type of insurance and so on using joint key of each individual.

CONCLUSION

Given the drawbacks raised above, our findings indicate that lack of BMD measurement after fracture remains a problem in Korea, especially among young men with osteoporotic fracture. Besides, this study provided the basic information to optimize management after fracture, such as giving education patient and physicians about the importance of post-fracture management.

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