Association between osteoporotic fractures and quality of life based on the Korean Community Health Survey of 2010

HYUN-JU JUN, PT, PhD1), KI-JONG KIM, PT, PhD1*)*, JIN-SU LEE, PT, PhD2), SUENG-HOON YANG, PT, PhD3)

1) Department of Physical Therapy, Cheongam College: 1641 Noksaek-ro, Suncheon-si, Jeollanam-do, Republic of Korea
2) Department of Physical Therapy, Graduate School of Dongshin University, Republic of Korea
3) Department of Physical Therapy, Jeonju Vision University, Republic of Korea

Abstract. [Purpose] To assess the relationship between fractures and quality of life (QOL) of osteoporosis patients as well as the treatment methods and locations of fractures following osteoporosis diagnosis. [Subjects and Methods] Participants were selected from a cohort consisting of 229,229 subjects who participated in the Korean Community Health Survey. Those who were not diagnosed with osteoporosis by a doctor were excluded from the study (326) and the final analysis included 17,387 previously diagnosed participants with osteoporosis. Multiple linear regression analysis was conducted. [Results] The QOL was significantly lower for subjects receiving treatment for osteoporosis compared to those who had not previously received treatment. Subjects who experienced a fracture similarly had a lower QOL compared to those who did not have a fracture. In addition, the QOL of subjects who experienced a fracture in the pelvis, spine, or wrists was significantly lower compared to those without fractures in these areas. [Conclusion] Better knowledge of osteoporosis leads to early recognition of symptoms and timely treatment. This results in better treatment outcomes and improved QOL for patients. Therefore, the need for physical therapy that is based on research evidence of osteoporosis treatment methods should be presented.

Key words: Korean Community Healthy Survey, Osteoporotic fracture, Quality of life

INTRODUCTION

The number of patients with osteoporosis across the world is estimated to be over 0.2 billion. According to a recent Korean study, it is a prevalent disease affecting 2,510,000 patients in South Korea alone1, 2). Osteoporosis is a disease in which bone quantity and quality decrease, leading to the weakening of bones and increasing the risk of breakage. Fractures can occur in bones in all parts of the body. These injuries result in increases to both individual and national medical expenditures and can restrict the activities, reduce the quality of life (QOL), and shorten the life spans of patients3, 4).

Osteoporosis is one of the most common metabolic bone diseases. Fractures within the musculoskeletal system occur most commonly in the spine, femurs, and wrists. When a fracture occurs, the risk of refracture increases, as does the likelihood of death related to the fracture. According to the Korean Society for Bone and Mineral Research, treatment of osteoporosis is necessary in order to prevent osteoporotic fracture and lower the risk of refracture5). Direct causes of fracture include slip and fall accidents (78.9%), unknown causes (11.3%), falls (8.0%), and natural occurrences (1.8%)6). The predominant causes of fractures around the hip joint in those aged 50 years and older are slip and falls (75%) and falls (9.2%)7). Because accidental falls are a decisive causative element of osteoporotic fracture, the reduction of such falls has become a core strategy in preventing osteoporotic fracture8).

Osteoporosis does not occur suddenly; it progresses gradually without obvious, subjective symptoms. Once osteoporosis has occurred, significant time, cost, and management are required in order to repair reduced bone quantity even in cases of early diagnosis. Although abnormal findings are discovered radiographically through x-rays in 30% to 50% of patients after the loss of bone quantity, most visit a hospital only after a fracture. Early discovery and appropriate management of risk factors can prevent osteoporotic fracture, and are considered the treatment goals for the disease9). Thus, it is very important to provide a variety of opportunities to prevent, manage, and improve osteoporosis10–12).

Previous studies on the relationship between osteoporosis and fractures have been confined to elderly people and menopausal women. Research on the relationship between
fractures and the QOL resulting from osteoporosis is lacking. Therefore, this study aims to investigate the relationship between osteoporotic fracture and the resulting QOL of patients, thereby providing knowledge on treatment timing and the prevention of osteoporosis advancement after diagnosis.

SUBJECTS AND METHODS

Subjects
This study was conducted under the supervision of the Korea Centers for Disease Control and Prevention (KCDC). The survey period was from August 16, 2010 to October 31, 2010. Trained examiners conducted a one-on-one electronic survey called the Korean Community Health Survey (KCHS) using a survey software program. The sample selected for the KCHS represented an average populations of 900 people from each public health center, based on the national address data provided by the Ministry of Government Administration and Home Affairs, house types, and the number of households as determined by the Ministry of Land, Infrastructure, and Transport prior to the annual survey. In total, 229,229 subjects participated in the survey. Those who were not diagnosed with osteoporosis by a doctor were excluded from the study (326) and the final analysis included 17,387 previously diagnosed participants with osteoporosis. The KCDC, 253 public health centers in 16 cities and provinces, and 36 university organizations collaborated on this study. A steering committee, sub-committees, and a management office were formed in order to conduct the investigation.

The KCHS protocol was reviewed and approved by the institutional review board of KCDC (2010-02CON-22-P). Written informed consent was obtained from all participants in the KCHS. The general characteristics of the subjects are presented in Table 1.

Methods
In order to assess the relationship between fractures and QOL of osteoporosis patients, treatment methods, and locations of fractures (pelvis, spine, or wrists) following osteoporosis diagnosis, were examined. The QOL was evaluated using the EQ-5D, an evaluation tool of the EuroQol Group, which was established in 1987. EQ-5D evaluates mobility, self-care, usual activity, pain/discomfort, and anxiety/depression on a three-tiered Likert scale. The levels of the scale—having no problem, having a slight problem, having a severe problem—were applied to both questions and answers. The formula below was used to calculate the survey results.

\[ EQ-5D = 1 - \left(0.05 + 0.096 \times M2 + 0.418 \times M3 + 0.046 \times SC2 + 0.136 \times SC3 + 0.051 \times UA2 + 0.208 \times UA3 + 0.037 \times PD2 + 0.151 \times PD3 + 0.043 \times AD2 + 0.158 \times AD3 + 0.05 \times N3\)  

Data from a complex sampling design were analyzed using the IBM SPSS Statistics 21.0 software. The population was estimated using individual weights, and frequency analysis was applied to assess the distribution of subjects. Multiple linear regression analysis was conducted with the controlled categories of sex, age, educational level, household members, monthly household income, residential area, and physical activity. A significance level was set at \(\alpha=0.05\).

Table 1. Characteristics of the KCHS participants with osteoporosis

| Total osteoporosis | n* | %† | %SE |
|--------------------|----|----|-----|
| Yes                | 17,387 | 5.0 | 0.1 |
| No                 | 211,516 | 95.0 | 0.1 |

| Gender             |        |    |    |
|--------------------|--------|----|----|
| Male               | 1,238  | 7.2 | 0.2 |
| Female             | 16,149 | 92.8| 0.2 |

| Age (years)        |        |    |    |
|--------------------|--------|----|----|
| 19–64              | 5,693  | 40.1| 0.4 |
| 65≤                | 11,694 | 59.9| 0.4 |

| Educational level   |        |    |    |
|--------------------|--------|----|----|
| Elementary school or less | 12,988 | 62.9| 0.4 |
| Middle school       | 1,830  | 13.4| 0.3 |
| High school and over| 2,532  | 23.7| 0.4 |

| Living with family  |        |    |    |
|--------------------|--------|----|----|
| No (alone)         | 4,127  | 17.9| 0.3 |
| Yes                | 13,260 | 82.1| 0.3 |

| Monthly household income (10,000 won) |        |    |    |
|--------------------------------------|--------|----|----|
| ≤100                                 | 9,273  | 47.4| 0.5 |
| 101–200                              | 2,934  | 19.7| 0.4 |
| 201–300                              | 1,662  | 13.5| 0.3 |
| 301≤                                 | 2,079  | 19.4| 0.4 |

| Residential area   |        |    |    |
|--------------------|--------|----|----|
| Urban               | 7,251  | 71.6| 0.2 |
| Rural               | 10,136 | 28.4| 0.2 |

| Physical activity§ |        |    |    |
|--------------------|--------|----|----|
| Yes                | 8,389  | 48.9| 0.4 |
| No                 | 8,998  | 51.1| 0.4 |

| Receiving treatment for osteoporosis |        |    |    |
|-------------------------------------|--------|----|----|
| Yes                                 | 9,419  | 49.1| 0.4 |
| No                                  | 7,958  | 50.9| 0.4 |

| Fracture occurrence                |        |    |    |
|------------------------------------|--------|----|----|
| Yes                                | 5,287  | 29.4| 0.4 |
| No                                 | 11,665 | 70.6| 0.4 |

| Fracture site                      |        |    |    |
|------------------------------------|--------|----|----|
| Hip                                | 2,289  | 11.8| 0.3 |
| Vertebral                          | 3,370  | 17.6| 0.3 |
| Wrist                              | 1,691  | 9.5 | 0.3 |

* n: sample size; †%: estimated percent of the population; §Be-reaved, divorced, separation, etc.
§Physical activity: moderate levels of physical activities (strenuous physical activity > 3x/week, strenuous physical activity for > 20 min / day or moderate levels of physical activity > 5x/week, strenuous physical activity for more than 30 min per time), or walking activities for > 30 min per time; or over 30 minutes 5x/week or over 30 min per time
RESULTS

Multiple linear regression analysis was utilized to examine the occurrence of fracture QOL in osteoporosis patients. The QOL was significantly lower for subjects receiving treatment for osteoporosis ($B = -0.028, p < 0.001$) compared to those who were not receiving treatment, and lower for subjects who experienced a fracture ($B = -0.045, p < 0.001$) compared to those who did not. In addition, the QOL of subjects who experienced a fracture in the pelvis ($B = -0.067, p < 0.001$), spine ($B = -0.049, p < 0.001$), or wrists ($B = -0.027, p < 0.001$) was significantly lower compared to those who did not experience a fracture in these areas (Table 2).

DISCUSSION

This study sought to provide basic data regarding the relationship between osteoporosis-related fractures and patient QOL in order to improve the current knowledge on osteoporosis prevention, thereby lowering the risk of fractures, and heighten patient QOL.

The QOL of the surveyed osteoporosis patients who were receiving treatment was significantly lower compared to those who did not receive treatment. The reason for the absence of treatment in some patients was that they had been previously diagnosed with osteoporosis and completed treatment prior to enrollment in the study. Since early treatment results in better treatment outcomes, early treatment of osteoporosis and knowledge of prevention methods are of utmost importance.

Knowledge of prevention methods differed between participants. Women aged 20 to 65 years old who were living in large cities, for example, exhibited varying levels of osteoporosis awareness depending on whether they had listened to an explanation of osteoporosis and received a bone densitometry test. Previous studies recommend the development of systematic education on factors of osteoporosis, diagnosis of its symptoms, treatment, and bone health improvement. These studies also identified the need for a customized health education program that considers osteoporosis awareness levels. Female osteoporosis patients aged 40 to 65 years old were observed to have a middle level of knowledge of osteoporosis, health belief, and self-efficacy, and scored below average in the evaluation of the sensitivity to and severity of osteoporosis. The correlations between the previously reported low knowledge of osteoporosis and the present study, and score treatment effects on patient QOL after the onset of osteoporosis, revealed opportunities for treatment. Patients who recognized the symptoms of osteoporosis and initiated treatment were only able to do so after the disease had progressed to a serious state. Those that did not receive treatment failed to recognize the symptoms of osteoporosis. Thus, investigations into the correlations between the timing of symptom recognition, treatment, and QOL are needed. When general knowledge of osteoporosis is heightened, the subjective symptoms of disease onset may be recognized earlier, raising the expected QOL after treatment.

The present survey assessed the participants’ knowledge of osteoporosis (20 questions in the form of a quiz), health belief (6 questions each for exercise and calcium intake), self-efficacy (6 questions each for exercise and calcium intake), and prevention behaviors. Those who demonstrated a higher knowledge of osteoporosis, health beliefs, and self-efficacy also exhibited better osteoporosis prevention behaviors. In other words, there was a significant relationship between osteoporosis prevention behaviors and knowledge of osteoporosis. This demonstrates the need for education to improve osteoporosis awareness and for plans and measures to heighten health beliefs and self-efficacy for disease prevention.

In order to be truly effective, osteoporosis prevention education programs should be implemented across a wide range of stages from elementary school age, adolescence, pre-menopause, and menopause. Prevention education is important from youth to old age because bone mass forms over the entire growth period, increasing by 5 to 10% until a person reaches his or her thirties, at which point maximal bone mass has been reached. Before and after the age of 35, rapid bone loss subsequently takes place after menopause due to aging.

This study identified age as a determinant of osteoporosis, since only 32% of participants were younger than 65 years old, while 68% were aged 65 years old or older. In a previous study, the group aged 65 to 74 exhibited a higher risk of osteoporotic fractures compared to other age groups. The results of this survey indicated that the reduced sense of balance in older subjects increased their possibility of osteoporotic fractures.

According to a previous study, the lower the bone density, the higher the risk of a fracture. In previous research studies, bone density reduction was the most important factor affecting the risk of spine or femoral fracture. The bone density of elderly patients with hip joint fractures was 2.5 to 3 lower than normal maximal bone density. These results indicate that the influence of bone density on osteoporotic fracture is quite high. Therefore, osteoporosis patients with low bone density need to be thoroughly educated on how to prevent a fall, and continuing research on the effects of bone density and accidental falls on osteoporotic fracture is necessary.

Osteoporosis has no obvious symptoms and progresses slowly with age, making it more dangerous as it can occur

| Table 2. Results of multiple regression analysis for quality of life |
|---------------------------------------------------------------|
|                                      | R² | B   | SE   |
| Receiving treatment for osteoporosis (/No) |     |     |     |
| Yes                                      | 0.160 | -0.028 | 0.003 |
| Fracture occurrence (/No)                |     |     |     |
| Yes                                      | 0.166 | -0.045 | 0.004 |
| Fracture site (/No)                      |     |     |     |
| Hip                                      | 0.168 | -0.067 | 0.006 |
| Vertebral                                | 0.164 | -0.049 | 0.004 |
| Wrist                                    | 0.155 | -0.027 | 0.006 |

*aadjusted for gender, age, educational level, living with family, monthly household income, residential area, physical activity"
undetected. It lowers the QOL, disrupts the long-term ability to participate in social activities, and can cause economic burden. According to a previous study, the ultimate goal of osteoporosis treatment should be fracture prevention and the preservation of QOL. Similar studies have examined the associations between QOL and age, sex, education level, number of household members, monthly household income, residential area, and physical activity.

This study involved subjects between the ages of 19 and 65 years old who had been diagnosed with osteoporosis. Subjects were not categorized according to gender. Although not restricted to a specific age group or gender, diverse information was not obtained because the subjects were not stratified according to age distribution age distribution. In addition, the timing of treatment following osteoporosis diagnosis and treatment methods used was not mentioned.

In conclusion, better knowledge of osteoporosis leads to early recognition of symptoms and timely treatment. This results in better treatment outcomes and improved QOL in patients. In addition, when people understand the need to prevent osteoporosis, the risk of fracture due to osteoporosis will decrease. Therefore, the need for physical therapy that is based on research of osteoporosis treatment methods should be presented. Such findings will be conducive to the development of physical therapy methods for osteoporosis patients.

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