ORIGINAL ARTICLE
Musculoskeletal Disorders

JKMS

http://dx.doi.org/10.3346/jkms.2011.26.11.1501 • J Korean Med Sci 2011; 26: 1501-1507

Orthopedic Surgeon's Awareness Can Improve Osteoporosis Treatment Following Hip Fracture: A Prospective Cohort Study

Sang-Rim Kim[1], Yong-Chan Ha[2], Yong-Geun Park[1], Sung-Rak Lee[3] and Kyung-Hoi Koo[4]

[1]Department of Orthopaedic Surgery, Jeju National University College of Medicine, Jeju; [2]Department of Orthopaedic Surgery, Chung-Ang University College of Medicine, Seoul; [3]Department of Orthopaedic Surgery, Cheju Halla General Hospital, Jeju; [4]Department of Orthopaedic Surgery, Seoul National University College of Medicine, Seoul, Korea

Received: 21 June 2011
Accepted: 6 September 2011

Address for Correspondence:
Yong-Chan Ha, MD
Department of Orthopaedic Surgery, Chung-Ang University College of Medicine, 29 Heukseok-ro, Dongjak-gu, Seoul 156-755, Korea
Tel: +82.2-6299-1577, Fax: +82.2-822-1710
E-mail: hayongch@naver.com

Financial support for this study was provided by Sanofi-Aventis, Korea.

Through retrospective Jeju-cohort study at 2005, we found low rates of detection of osteoporosis (20.1%) and medication for osteoporosis (15.5%) in those who experienced hip fracture. This study was to determine the orthopedic surgeons' awareness could increase the osteoporosis treatment rate after a hip fracture and the patient barriers to osteoporosis management. We prospectively followed 208 patients older than 50 yr who were enrolled for hip fractures during 2007 in Jeju-cohort. Thirty four fractures in men and 174 in women were treated at the eight hospitals. During the study period, orthopedic surgeons who worked at these hospitals attended two education sessions and were provided with posters and brochures. Patients were interviewed 6 months after discharge using an evaluation questionnaire regarding their perceptions of barriers to osteoporosis treatment. The patients were followed for a minimum of one year. Ninety-four patients (45.2%) underwent detection of osteoporosis by dual energy x-ray absorptiometry and 67 (32.2%) were prescribed medication for osteoporosis at the time of discharge. According to the questionnaire, the most common barrier to treatment for osteoporosis after a hip fracture was patients reluctance. The detection and medication rate for osteoporosis after hip fracture increased twofold after orthopedic surgeons had attended the intervention program. Nevertheless, the osteoporosis treatment rate remains inadequate.

Key Words: Hip Fractures; Orthopedic Surgeon; Osteoporosis; Treatment

INTRODUCTION

Osteoporosis is a common skeletal disease in elderly population, and osteoporosis-induced fractures are serious problems that pose considerable social and economic burdens in developed and developing countries (1-4). Osteoporosis is associated with low-energy fragility fractures which occur commonly in the hip, wrist, or vertebra. Of these, hip fractures are the most serious and have high rates of mortality and morbidity (3, 4). The history of hip fracture indicates a 5% risk of another hip fracture within a year, a 17 to 21% risk of any fracture within 16 to 21 months, and a 29% risk of another hip fracture in the following 20 yr (5, 6).

However, treatment for osteoporosis in patients older than 50 yr is not always instituted because of the asymptomatic and slowly progressive nature of the disease. Many patients will not be evaluated and/or treated until it is recognized in conjunction with a fragility fracture (7-9). However, even after hip fracture the rate of diagnosis and treatment of osteoporosis is still low at 5% to 25% (10-13).

Several studies have shown that osteoporosis treatment after a hip or any fragility fracture reduces the risks of subsequent fractures and mortality (14-16). It is known that a perioperative intervention program increased the percentage of patients in whom osteoporosis was addressed following a hip fracture. The role of orthopedic surgeons has been highlighted as part of the solution to recurrent fractures (17). Nonetheless, some orthopedic surgeons believe osteoporosis management after a hip fracture is not their responsibility (18-20). However, recent studies showed that active participation of orthopedic surgeons in the management of osteoporosis after a hip fracture improves treatment rates (21-23).

In 2007, we reported (24) a retrospective observational study of 174 patients with age of 50 yr or older who were admitted for a hip fracture between January 1 and December 31, 2005 from eight hospitals. One hundred seventy-four patients were enrolled and followed up for one year. Of these patients, only 35 (20.1%) underwent detection of osteoporosis by dual energy x-ray absorptiometry (DXA) and 27 (15.5%) received medication for osteoporosis at the time of discharge.

We performed a before and after study of educational program for orthopedic surgeons to determine whether this program is warranted or not. We wished to determine 1) whether an education program directed at orthopedic surgeons could increase the osteoporosis treatment rate after a hip fracture, 2) whether the difference of mortality between osteoporosis man-

pISSN 1011-8934
eISSN 1598-6357

agement group and none management group, and 3) the patient barriers to osteoporosis management after a hip fracture.

MATERIALS AND METHODS

Participants in the study were drawn from a cohort that has been monitored from 2002 to 2007 for whom the incidences of hip fractures and mortality and morbidity rates were determined after hip fracture. This large cohort was recruited on Jeju Island, the largest island in Korea, which is located southwest of the Korean peninsula. In 2007, its population was 559,258. There are 8 hospitals (one university hospital and seven general hospitals) on the island with an orthopedic department and emergency admission facilities. Jeju island is geographically isolated from Korean peninsula and patients with hip fracture usually require hospitalization, which makes ascertainment of patient follow-up easier and much reliable than other areas. This prospective cohort study was performed using the same patient database at the eight hospitals as used in our 2007 study and the same inclusion and exclusion criteria (24). Two hundred twenty seven patients older than 50 yr with hip fractures who were admitted to one of the 8 hospitals between January 1, and December 31, 2007 were candidates for the study. Nineteen patients were excluded for the following reasons: 14 for a high-energy injury resulting from a traffic accident or fall from height, 3 because they were nonresidents, and 2 because they had a pathologic fracture. A total of 208 patients with hip fractures (107 femoral neck fractures [51.4%] and 101 intertrochanteric fractures [48.6%] [34 men and 174 women]) was enrolled in this intervention study. The mean age of the patients at the time of diagnosis was 79.1 yr (men, 72.2 yr, range, 52-92 yr; women, 80.5 yr range, 52-97 yr). The most common coexisting medical conditions at admission were hypertension and heart disease, diabetes mellitus, depression and mental illness, previous stroke, and lung disease (Table 1). Of the 208 patients, 193 underwent surgery, but 15 did not. Five patents underwent nonoperative treatment for a nondisplaced fracture and 10 patients, confirmed to be high risks for surgery, were discharged without further treatment. Thirty-eight of the 208 patients died during the follow-up period, 8 who lived alone could not respond during the interview owing to dementia or deafness, and 25 could not be interviewed owing to change in contact information. Seventy-nine patients (38%) were followed for less than 6 months and 53 patients (25.5 %) were followed for less than 12 months during the 1-yr follow-up period. Of the 38 patients who died, 22 (10.6%) succumbed during the first 6 months of the follow-up, 30 (14.4%) died by 12 months, and 38 (18.3%) had died by the final follow-up of 19 months.

We calculated the required study sample size using the 2005 data, in which the initiation rate of osteoporosis treatment was 15.5%. Based on a power of 80%, significance level of 5%, and an estimated increasing rate of osteoporosis treatment of 10% in the patients who were diagnosed with hip fractures, the inclusion of 149 patients was estimated as an optimal sample size. As we expected a drop-out rate of 20% during follow-up owing to the high mortality rate after hip fracture, we included 180 patients in the intervention study.

Six of 8 hospitals used DXA to determine bone mineral densities. The other 2 hospitals treated fewer than 5 hip fractures per year, and referred patients to another hospital for DXA.

Twenty-two orthopedic surgeons who worked at the 8 hospitals were provided with 2 education sessions (in January and July 2007) and educational posters (March) and brochures (October) for increasing osteoporosis management. These education sessions involved providing information regarding the association between osteoporosis and hip fracture, the efficacy of DXA for diagnosis of osteoporosis, the effectiveness of antiosteoporotic drugs, and the importance of followup for management of osteoporosis and of routine orthopedic follow-up. All orthopedic surgeons who treated hip fractures in the cohort completed the educational programs.

Hospital data evaluations were performed 6 and 12 months after discharge from the hospital, and every 6 months thereafter. From the medical records we determined diagnosis at admis-

Table 1. Patient's demographic data

Parameters	Findings
Number of patients	208
Man:Woman	34 (16.3%):174 (83.7%)
Age (yr) (mean ± SD)	79.1 ± 9.1 (range, 52-99)
Mean period of hospital follow-up (months)	8.8 (range, 1-24)
Diagnosis of hip fracture	
Neck	107 (51.4%)
Intertrochanter	101 (48.6%)
Management	
Conservative	15 (7.2%)
Operation	193 (92.8%)
Coexisting medical disease	
Hypertension and heart problem	84 (40.4%)
Diabetes mellitus	35 (16.8%)
Depression and dementia	32 (15.4%)
Previous stroke	27 (13%)
Pneumonia and COPD	18 (8.7%)
Cancer	6 (2.9%)
Others	18 (8.7%)
DXA	
Prior to hip fracture	7 (3.4%)
After hip fracture	94 (45.2%)
Osteoporosis (-2.5 ≥ T-score)	93 (44.7%)
Osteopenia (-1 > T-score > 2.5)	1 (0.5%)
Bisphosphonate medication	
Prior to hip fracture	2 (1%)
After hip fracture	67 (32.2%)
Duration of bisphosphonate medication	
< 6 months	25 (12%)
≥ 6 months	42 (20.2%)
Mean period of medication (months)	9.5 (range, 1-24)

SD, standard deviation; COPD, chronic obstructive pulmonary disease; DXA, dual energy x-ray absorptiometry.

http://dx.doi.org/10.3346/jkms.2011.26.11.1501

sion, mechanism of injury, DXA, procedures performed during hospitalization, and discharge medications. Regardless of follow-up compliance, patients were asked 6 questions using a questionnaire format that addressed information provided by clinicians regarding osteoporosis, diagnosis of osteoporosis, osteoporosis medication, name of antiosteoporotic medication, activity after hip fracture, and personal barriers to management of osteoporosis. Osteoporosis treatment was defined as medication including a selective estrogen receptor modulator, bisphosphonate, calcitonin therapy or hormone replacement. Seven of the 208 patients had a diagnosis of osteoporosis before hip fracture, but only 3 of these 7 were taking prescribed osteoporosis medications at the time of admission. Treatment initiation and duration were confirmed by reviewing medical records at 6 months and 12 months after discharge from hospital. Mortality status of the patients was identified from hospital records and/or interviews with patients' families. Also, death certificates at the Statistics Korea were searched for information for patients lost to follow-up. For subgroup analysis, we analyzed demographic data between osteoporosis treatment group and nonosteoporosis treatment group.

The chi-square test was used to analyze mortality rate of osteoporosis management group and none management group, rate of osteoporosis detection, and initiation rate of osteoporosis treatment between 2005 cohort and 2007 cohort. SPSS, version 15.0 (Chicago, IL, USA), was used for the analysis.

Ethics statement

The design and protocol of this study were approved by the institutional review board at the Cheju National University Hospital (CNUH-IRB No 2008-19). Patients were informed that their medical data might be used in a scientific study and they provided consent.

RESULTS

In 2007 the rate of osteoporosis detection was greater ($P < 0.001$) than that in 2005 (45% vs 20.1%) and the initiation rate of osteoporosis treatment also had increased (32.2% vs 15.1%) (Table 2). Among the 22 orthopedic surgeons, who participated in this study, the physician's detection rate and treatment rate increased in 15. Ninety-four patients (45.2%) underwent DXA during admission; hip and spine in 90, hip in 3, and spine in 1. Ninety-three of these 94 patients (99%) had osteoporosis (T score ≤ -2.5) and one had osteopenia (-2.5 < T score < -1. No patient received a DXA scan after hospital discharge during the study period. Of these 94 patients, 67 (71.3%) were prescribed only oral bisphosphonates (risedronate, 30/67 [43.5%], or alendronate, 39/67 [56.5%]) at the time of discharge. Other antiosteoporotic drugs such as, selective estrogen receptor modulator, calcitonin, and hormone replacement therapy were not prescribed. Fourteen patients received once-a-day bisphosphonate and 53 received once-a-week bisphosphonate. The mean duration of time these patients were taking osteoporosis medication, was 9.5 months (range, 1-24 months), and 25 patients (37.3%) received medication for less than 6 months.

At last follow-up, the mortality rate was higher ($P = 0.044$) in the nonmedicated groups (31/141) than in the medicated group

Table 3. Subgroup analysis between osteoporosis treatment group and nonosteoporosis treatment group

	Treatment group (n = 68)	Nontreatment group (n = 139)	*P* value
Gender (man/woman)	5/63	29/111	0.015
Age (mean ± SD) (yr)	78.4 ± 7.45	79.5 ± 9.75	0.384
Diagnosis			0.008
Neck	26	81	
Intertrochanter	42	59	
Operation			0.277
Yes	65	128	
No	3	12	
Comorbidity			0.325
Hypertension and heart problem	29	55	
Diabetes mellitus	10	25	
Depression and dementia	14	18	
Previous stroke	12	15	
Pneumonia and COPD	6	12	
Cancer	2	4	
Others	6	12	

SD, standard deviation; COPD, chronic obstructive pulmonary disease.

Table 2. Comparison data of osteoporosis treatment after hip fracture or fragility fracture

Author	Study design	Trial subject	Intervention	Outcomes (control)	Outcomes (intervention)
Cranney et al. [26] 2008	Prospective RCT	PCPs and patients	Education	BMD scan 26% (36/141) Osteoporosis Tx 10% (15/145)	BMD scan 53% (64/120) Osteoporosis Tx 28% (35/125)
Gardner et al. [21] 2005	Prospective RCT	PCPs and patients	Education	BMD scan 17% (6/36) Osteoporosis Tx 17% (6/36)	BMD scan 33% (12/36) Osteoporosis Tx 28% (10/36)
Majumdar et al. [27] 2007	Prospective RCT	Physician and patients	Education	BMD scan 29% (32/110) Osteoporosis Tx 22% (24/110)	BMD scan 80% (88/111) Osteoporosis Tx 51% (56/110)
Miki et al. [22] 2008	Prospective RCT	Orthopedic surgeon and patients	Education	BMD scan 29% (7/24) Osteoporosis Tx 29% (7/24)	BMD scan 100% (26/26) Osteoporosis Tx 58% (15/26)
Streeten et al. [23] 2006	Prospective design and retrospective review	Orthopedic team	Osteoporosis consultation	Osteoporosis Tx 3.2% (1/31)	Osteoporosis Tx 52.8% (28/53)
Current study	Prospective before and after study	Orthopedic surgeon	Education	BMD scan 20.1% (35/174) Osteoporosis Tx 15.5% (27/174)	BMD scan 45% (94/208) Osteoporosis Tx 32.2% (67/208)

RCT, randomized control trial; BMD, bone mineral density; Tx, treatment; PCPs, primary care physician.

Table 4. Survey questionnaire and response rates

Question	Response	Number (%) of patients with medication (n = 56)	Number (%) of patients without medication (n = 81)	Number (%) of questionnaires (n = 137)
Have you heard the diagnosis of osteoporosis from your doctor?	Yes	26 (46.4)	29 (35.8)	55 (40.1)
	No	30 (53.6)	52 (64.2)	82 (59.9)
Was bone mineral density examined at the hospital?	Yes	25 (44.6)	24 (29.6)	49 (35.8)
	No	27 (48.2)	50 (61.7)	77 (56.2)
Have you received an antiosteoporosis drug?	Yes	40 (71.4)	0	40 (29.2)
	No	16 (28.6)	73 (90.1)	89 (65)
Why do not you start osteoporosis treatment?	Do not think it is a necessity to treat osteoporosis	0	47 (58)	47 (34.3)
	Economic reason(s)	0	4 (4.9)	4 (2.9)
	Transportation problem(s)	0	4 (4.9)	4 (2.9)
	Medical insurance problem(s)	0	1 (1.2)	1 (0.7)
	Other(s)	0	14 (17.3)	14 (10.2)

(7/67). Age (P = 0.384), comorbidity (P = 0.325), and operation (P = 0.277) in osteoporosis treatment group was not different with nonosteoporosis treatment group. However, gender (P = 0.015) and diagnosis (P = 0.008) in osteoporosis treatment group was significant with nonosteoporosis treatment group (Table 3).

One hundred thirty-seven patients completed the face-to-face questionnaire-based interview. These included 56 patients who received osteoporosis medication and 81 patients who did not. Of these 137 patients, 82 (59.9%) were not informed of their diagnosis of osteoporosis by their surgeons and 49 (35.8%) were acknowledged having DXA examination during hospital admission. Forty (71.4%) of the 56 patients who received osteoporosis medication were aware of their diagnoses. Because of the 56 (69%) of the 81 patients with osteoporosis did not receive osteoporosis medication following reasons: 47 (84%) thought that treatment was unnecessary, four had economic reasons, four had a transportation problem, and one had a medical insurance problem (Table 4).

DISCUSSION

Treatment of osteoporosis after hip fracture is important to prevent secondary fracture and to decrease mortality rate. However, many studies have reported low rates of osteoporosis treatment after hip fracture. Improvement of the awareness of orthopedic surgeons concerning the importance of identifying patients with osteoporosis has shown definite benefit to overcome this issue (25). This prospective intervention study was performed to determine 1) whether an education program directed at orthopedic surgeons could increase the osteoporosis treatment rate after a hip fracture, 2) whether the difference of mortality between osteoporosis management group and none management group, and 3) the patient barriers to osteoporosis management after a hip fracture.

Our observations suggest the rate of detection and treatment of osteoporosis after a hip fracture among patients treated in 2007 was more than twofold greater than that in 2005. We used a simple, yet effective and easily applied intervention method in this study. Our study also highlights the importance of the orthopedic surgeon's role as a first-line healthcare provider for patients with osteoporosis who have a fracture, because these patients regularly attend scheduled visits for radiologic and clinical evaluations after surgery. Interventions targeting clinicians with a view toward increasing treatment rates have been studied (22, 26, 27) (Table 2). Comparative studies conducted on orthopedic surgeon and physician-based interventions for improving osteoporosis management after hip fracture show awareness of orthopedic surgeon has a greater effect on osteoporosis management rates after hip fracture (20, 23). In particular, Miki et al. (22) reported the effects of osteoporosis management initiated by an orthopedic team and by primary care physicians (22). The osteoporosis treatment rate 6 months after hip fracture was higher for the orthopedic team (58%) than for the primary care physicians (29%) (22). Our study also showed an improved medication rate of osteoporosis from 15% to 32%. However, the osteoporosis treatment rate 6 months after hip fracture was still lower than those reported in other intervention studies (22, 23, 27). In addition, even after the educational program, the physician's detection rate and treatment rate of osteoporosis did not increase in seven (32%) out of the 22 orthopedic surgeons, who participated in this study. More effective educational campaign and reminiscence of osteoporosis treatment are warranted. This may have been attributable to the high mortality rate (10.6%) within the first 6 months and the high lost-to-follow-up rate (40%) in our study. However, of the 129 patients who were followed for more than 6 months, 32.6% (42/129) remained on osteoporosis medication. The other possible reason concerns differences between intervention modalities. In the current study, orthopedic surgeons only underwent education sessions, whereas previous studies have involved multimodal approaches, including nurse management programs, standardized algorithms, and monitoring of adherence to treatment (20, 22, 23). Finally, the propor-

http://dx.doi.org/10.3346/jkms.2011.26.11.1501

tion of patients in whom antiresorptive therapy is contraindicated also could have affected results (28). This shows that improving the awareness of orthopedic surgeons concerning the importance of identifying patients with osteoporosis is beneficial (25). Two intervention studies after hip fracture have reported improved osteoporosis treatment rates (17, 23). Intervention methods can be classified as a nationwide medical system, patient education, and doctor awareness. Patient education programs or systemic approaches generally are considered more effective. However, doctor's awareness should be changed before performing studies of education programs or systemic changes for patients.

A high mortality rate, low follow-up rate, and the presence of life threatening comorbidities add to the difficulties of commencing osteoporosis treatment after a hip fracture in the elderly. However, the mortality rate of patients with osteoporosis medication in our study was lower at final follow-up than that of osteoporosis patients who did not receive medication. The randomized controlled intervention trial by Lyles et al. (16) showed that intravenous bisphosphonate reduces fracture rates and mortality. Our study also showed that these are benefits of osteoporosis medication after hip fracture. However, we could not evaluate reduction of recurrent fracture rate after osteoporosis medication because of high patient mortality, relatively small cohort size, and short follow-up duration. Nevertheless, other intervention studies have shown that osteoporosis medication after hip fracture can reduce recurrent hip fracture rates (15, 16).

The results of the patient questionnaire showed that patient education is required to encourage osteoporosis treatment after a hip fracture, because most patients were not given enough appropriate information by physicians or hospital staff either in the hospital or during follow-up. Furthermore, of the patients given osteoporosis medication, 23% could not recall their medication history or the name of the medication administered. Patients who did not receive osteoporosis medication thought commonly that such medication was unnecessary. Bogoch et al. (17) described four categories of barriers to treatment, namely, those associated with patients, physicians, orthopedic surgeons, and medical care systems. However, Kaufman et al. (25) described 10 different barriers to osteoporotic treatment after a hip fracture. Both studies emphasized the importance of the orthopedic surgeon's role in overcoming these barriers.

Several limitations of this study should be considered. First, the medical care system in Korea is unique compared to that in other countries. All Korean nationals are legally obliged to enroll in the Korean National Health Insurance Program. Patients pay an average of 30% of all medical costs to clinics or hospitals that manage them for almost all diseases, except for those not covered by insurance, such as cosmetic surgery or some new unproven therapies, for which the patients themselves pay 100% of the total costs. All clinics and hospitals then submit data on inpatients and outpatients, including data on diagnosis and medical costs, to the Korean Health Insurance Review and Assessment Service to reimburse 70% of the total medical cost. In Korea, patients with fractures are routinely followed by orthopedic surgeons because there is no such primary-care-physician system in which patients can register with a physician who would be accountable for their continuing care and referral. Therefore, osteoporosis treatment for patients with a fragility fracture substantially depends on the responsible orthopedic surgeon (29). The findings of intervention studies regarding the effectiveness of intervention programs provided by orthopedic surgeons and primary care physicians are less likely applicable to Korean medical system (8, 22, 30). However, active participation of orthopedic surgeons in our study showed an increase of osteoporosis treatment after a hip fracture and improved outcome after that fracture. Second, this study was performed in various hospital settings in the same cohort, and two of the hospitals involved were not equipped with central DXA and referred their patients to another hospital for DXA study. Intervention studies that have investigated the treatment of osteoporosis after hip fracture involved one or two specific centers, and it is difficult to extrapolate results from other university and local hospitals. Third, 25 patients were lost in follow-up. For these patients, we were able to confirm only mortality at the Korea National Statistical office. Furthermore, these patients' osteoporosis medication histories could not be confirmed. Fourth, the interventional education program was not validated. However, it specifically targeted overcoming barriers to osteoporosis detection, as described previously (9, 20, 23, 25). Fifth, we did not assess patient's knowledge of osteoporosis prior to the intervention, which might have affected the rate of osteoporosis treatment after a hip fracture.

The straightforward, systematic approach described for the education of orthopedic surgeons increased osteoporosis diagnosis and treatment rates. Despite more than twofold increase in osteoporosis detection, observed between 2005 and 2007, additional intervention studies are required to further improvement of osteoporosis treatment rates after hip fracture.

ACKNOWLEDGMENTS

We thank In Im, president of the Cheju Orthopedic Association, and members of the Cheju Orthopedic Association for support of preparing the data.

REFERENCES

1. Cooper C, Campion G, Melton LJ 3rd. *Hip fractures in the elderly: a worldwide projection. Osteoporos Int 1992; 2: 285-9.*
2. Lippuner K, Golder M, Greiner R. *Epidemiology and direct medical costs of osteoporotic fractures in men and women in Switzerland. Osteoporos Int 2005; 16: S8-17.*

3. Mullen JO, Mullen NL. *Hip fracture mortality. A prospective, multifactorial study to predict and minimize death risk. Clin Orthop Relat Res 1992; 280: 214-22.*
4. Randell AG, Nguyen TV, Bhalerao N, Silverman SL, Sambrook PN, Eisman JA. *Deterioration in quality of life following hip fracture: a prospective study. Osteoporos Int 2000; 11: 460-6.*
5. Colón-Emeric CS, Sloane R, Hawkes WG, Magaziner J, Zimmerman SI, Pieper CF, Lyles KW. *The risk of subsequent fractures in community-dwelling men and male veterans with hip fracture. Am J Med 2000; 109: 324-6.*
6. Melton LJ 3rd, Ilstrup DM, Beckenbaugh RD, Riggs BL. *Hip fracture recurrence. A population-based study. Clin Orthop Relat Res 1982; 167: 131-8.*
7. Colón-Emeric C, Yballe L, Sloane R, Pieper CF, Lyles KW. *Expert physician recommendations and current practice patterns for evaluating and treating men with osteoporotic hip fracture. J Am Geriatr Soc 2000; 48: 1261-3.*
8. Gardner MJ, Flik KR, Mooar P, Lane JM. *Improvement in the undertreatment of osteoporosis following hip fracture. J Bone Joint Surg Am 2002; 84: 1342-8.*
9. Panneman MJ, Lips P, Sen SS, Herings RM. *Undertreatment with anti-osteoporotic drugs after hospitalization for fracture. Osteoporos Int 2004; 15: 120-4.*
10. Juby AG, De Geus-Wenceslau CM. *Evaluation of osteoporosis treatment in seniors after hip fracture. Osteoporos Int 2002; 13: 205-10.*
11. Kamel HK, Hussain MS, Tariq S, Perry HM, Morley JE. *Failure to diagnose and treat osteoporosis in elderly patients hospitalized with hip fracture. Am J Med 2000; 109: 326-8.*
12. Lüthje P, Nurmi-Lüthje I, Kaukonen JP, Kuurne S, Naboulsi H, Kataja M. *Undertreatment of osteoporosis following hip fracture in the elderly. Arch Gerontol Geriatr 2009; 49: 153-7.*
13. Siris ES, Bilezikian JP, Rubin MR, Black DM, Bockman RS, Bone HG, Hochberg MC, McClung MR, Schnitzer TJ. *Pins and plaster aren't enough: a call for the evaluation and treatment of patients with osteoporotic fractures. J Clin Endocrinol Metab 2003; 88: 3482-6.*
14. Black DM, Cummings SR, Karpf DB, Cauley JA, Thompson DE, Nevitt MC, Bauer DC, Genant HK, Haskell WL, Marcus R, Ott SM, Torner JC, Quandt SA, Reiss TF, Ensrud KE. *Randomised trial of effect of alendronate on risk of fracture in women with existing vertebral fractures. Fracture Intervention Trial Research Group. Lancet 1996; 348: 1535-41.*
15. Black DM, Thompson DE, Bauer DC, Ensrud K, Musliner T, Hochberg MC, Nevitt MC, Suryawanshi S, Cummings SR; Fracture Intervention Trial. *Fracture risk reduction with alendronate in women with osteoporosis: the Fracture Intervention Trial. FIT Research Group. J Clin Endocrinol Metab 2000; 85: 4118-24.*
16. Lyles KW, Colón-Emeric CS, Magaziner JS, Adachi JD, Pieper CF, Mautalen C, Hyldstrup L, Recknor C, Nordsletten L, Moore KA, Lavecchia C, Zhang J, Mesenbrink P, Hodgson PK, Abrams K, Orloff JJ, Horowitz Z, Eriksen EF, Boonen S; for the HORIZON Recurrent Fracture Trial. *Zoledronic acid in reducing clinical fracture and mortality after hip fracture. N Engl J Med 2007; 357: nihpa40967.*
17. Bogoch ER, Elliot-Gibson V, Beaton DE, Jamal SA, Josse RG, Murray TM. *Effective initiation of osteoporosis diagnosis and treatment for patients with a fragility fracture in an orthopedic environment. J Bone Joint Surg Am 2006; 88: 25-34.*
18. Elliot-Gibson V, Bogoch ER, Jamal SA, Beaton DE. *Practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: a systematic review. Osteoporos Int 2004; 15: 767-78.*
19. Sheehan J, Mohamed F, Reilly M, Perry IJ. *Secondary prevention following fractured neck of femur: a survey of orthopedic surgeons practice. Ir Med J 2000; 93: 105-7.*
20. Simonelli C, Killeen K, Mehle S, Swanson L. *Barriers to osteoporosis identification and treatment among primary care physicians and orthopedic surgeons. Mayo Clin Proc 2002; 77: 334-8.*
21. Gardner MJ, Brophy RH, Demetrakopoulos D, Koob J, Hong R, Rana A, Lin JT, Lane JM. *Interventions to improve osteoporosis treatment following hip fracture. A prospective, randomized trial. J Bone Joint Surg Am 2005; 87: 3-7.*
22. Miki RA, Oetgen ME, Kirk J, Insogna KL, Lindskog DM. *Orthopedic management improves the rate of early osteoporosis treatment after hip fracture. A randomized clinical trial. J Bone Joint Surg Am 2008; 90: 2346-53.*
23. Streeten EA, Mohamed A, Gandhi A, Orwig D, Sack P, Sterling R, Pellegrini VD Jr. *The inpatient consultation approach to osteoporosis treatment in patients with a fracture. Is automatic consultation needed? J Bone Joint Surg Am 2006; 88: 1968-74.*
24. Kim TY, Ha YC, Kim YH, Lee SR, Kim SR, Kim JR, Kim SY, Koo KH. *Treatment of osteoporosis after hip fractures in patients older than 50 years. J Korean Hip Soc 2007; 19: 499-503.*
25. Kaufman JD, Bolander ME, Bunta AD, Edwards BJ, Fitzpatrick LA, Simonelli C. *Barriers and solutions to osteoporosis care in patients with a hip fracture. J Bone Joint Surg Am 2003; 85: 1837-43.*
26. Cranney A, Lam M, Ruhland L, Brison R, Godwin M, Harrison MM, Harrison MB, Anastassiades T, Grimshaw JM, Graham ID. *A multifaceted intervention to improve treatment of osteoporosis in postmenopausal women with wrist fractures: a cluster randomized trial. Osteoporos Int 2008; 19: 1733-40.*
27. Majumdar SR, Beaupre LA, Harley CH, Hanley DA, Lier DA, Juby AG, Maksymowych WP, Cinats JG, Bell NR, Morrish DW. *Use of a case manager to improve osteoporosis treatment after hip fracture: results of a randomized controlled trial. Arch Intern Med 2007; 167: 2110-5.*
28. Ettinger B, Pressman A, Schein J. *Clinic visits and hospital admissions for care of acid-related upper gastrointestinal disorders in women using alendronate for osteoporosis. Am J Manag Care 1998; 4: 1377-82.*
29. Gong HS, Oh WS, Chung MS, Oh JH, Lee YH, Baek GH. *Patients with wrist fractures are less likely to be evaluated and managed for osteoporosis. J Bone Joint Surg Am 2009; 91: 2376-80.*
30. Fisher AA, Davis MW, Rubenach SE, Sivakumaran S, Smith PN, Budge MM. *Outcomes for older patients with hip fractures: the impact of orthopedic and geriatric medicine cocare. J Orthop Trauma 2006; 20: 172-8.*

 http://dx.doi.org/10.3346/jkms.2011.26.11.1501

AUTHOR SUMMARY

Orthopedic Surgeon's Awareness Can Improve Osteoporosis Treatment Following Hip Fracture: A Prospective Cohort Study

Sang-Rim Kim, Yong-Chan Ha, Yong-Geun Park, Sung-Rak Lee and Kyung-Hoi Koo

The osteoporosis detection and medication rate after hip fracture increased two fold after orthopedic surgeons had attended the intervention program. Nevertheless, additional efforts are required to further increase the treatment rates.