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Original article

Sacral insufficiency fracture with compression fracture of the thoracolumbar spine: Analysis of coincidence rate and risk factors

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Abstract

Objectives: The purpose of present study was to investigate the coincidence rate and risk factors of sacral insufficiency fracture accompanied by compression fracture of thoracolumbar spine.
Material and methods: The candidates for this study were 945 patients who measured their bone mineral density (BMD) and showed spinal compression fracture on MRI or CT between January 2008 and December 2012. Sacral insufficiency fracture was diagnosed by MRI and the whole body bone scan. We assessed the risk factors of sacral insufficiency fracture which include sex, age, body mass index (BMI), underlying diseases (hypertension, diabetes mellitus, rheumatoid arthritis, and thyroid disease), the number of spinal compression fractures and the presence of osteoporosis.
Results: Among 945 patients with spinal compression fracture [76 (8%) males and 869 (92%) females], 36 (3.8%) had sacral insufficiency fractures (3 [8.3%] males and 33 [91.7%] females). Age and the presence of osteoporosis among risk factors were significant ($p < 0.05$). Logistic regression analysis indicated that age(odds ratio: 3.7, $p = 0.019$) and the presence of osteoporosis(odds ratio: 5.4, $p < 0.0001$) were associated with the coincidence rate of sacral insufficiency fracture.
Conclusions: The coincidence rate of sacral insufficiency fracture is about 3.8%. The clinicians should evaluate sacral insufficiency fractures more actively in patient with compression fracture of thoracolumbar spine accompanied by risk factors (age, the presence of osteoporosis).

Keywords: Thoracolumbar compression fracture; Sacral insufficiency fracture; Osteoporosis

1. Introduction

Sacral insufficiency fracture is one of the causes of low back pain that occurs in the absence of a distinct injury in elderly patients with osteoporosis [1,2]. It is often clinically or radiologically overlooked and not fully diagnosed and treated in elderly patients complaining of pain in the back, hip and inguinal region due to the accompanying lumbar degenerative changes [1,3,4]. We reviewed the charts of the patents who were hospitalized in our center for thoracolumbar compression fracture to investigate the coincidence rate of sacral insufficiency fracture accompanied in those patients, and compared the data with the patients who did not accompany sacral insufficiency fracture to determine the factors that may be helpful in making its diagnosis.

2. Materials and methods

2.1. Materials

Among the patients who received bone mineral densitometry (BMD) in our center between January 2008 and

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December 2012, 945 patients who had a thoracolumbar compression fracture on computed tomography or magnetic resonance image were included in the study. Subjects who had a history of a high-energy trauma such as fall or accident, an infection such as osteomyelitis, and a pathologic fracture from primary or metastatic bone tumor were excluded from the study. Among the subjects, 76 were male and 869 were female subjects. The age was 67.8 years old on average (range, 47–98).

2.2. Methods

Sacral insufficiency fracture was diagnosed when a fracture was present on one or more diagnostic tests among CT, MRI and whole body bone scan: a fracture line should have been visible in case of CT or a signal change due to fracture-mediated bone marrow edema in case of MRI. Technetium 99m medronate methylene diphosphonate (MDP) was used for bone scan, and sacral insufficiency fracture could be diagnosed when the characteristic sign of increased bone resorption (Honda sign) was observed in bilateral sacral alae and sacral vertebral body [5,6] (Fig. 1). Sex, age, body mass index (BMI), comorbidity (diabetes mellitus, hypertension, rheumatic arthritis), thyroid disease [hyperthyroidism, hypothyroidism, hyperparathyroidism and hypoparathyroidism], number of compression fracture, and presence or absence of osteoporosis were selected as patient factors, and the relationships between each factor and sacral insufficiency fracture were examined. Final approval of exemption from review by the Institutional Review Board was obtained for this study because this study was retrospective in nature. Odds ratio and 95% confidence interval were computed by logistic regression analysis to determine statistical significance between each clinical factor and sacral insufficiency fracture. Consistent with Hicks et al. [7] and Jellema et el [8], the level of significance for the univariate screening regressions was set at $P = 0.2$, assessed by likelihood ratio tests; more stringent significance levels can lead to the exclusion of potentially useful predictor variables. Predictor variables found to be significant according to this criterion were entered into a multiple logistic regression model. The level of significance for the multivariate logistic regression model was set at $p < 0.05$. All statistical analyses were performed by IBM SPSS Statistics, version 19.0.

3. Results

3.1. Sex

Among 945 subjects who had a thoracolumbar compression fracture from October 2008 through 2012, the number of female subjects was approximately 11 times greater than that of male subjects (869 [92%] vs. 76 [8%]). Among the 945 subjects with compression fracture, 36 (3.8%) subjects had a sacral insufficiency fracture, 3 (3.9%) among 76 male subjects and 33 (3.8%) among 869 female subjects. In univariate logistic regression analysis, relative risk of sacral insufficiency fracture was 1.0 time higher in male subjects than in female subjects, and the difference was not statistically significant ($p = 0.948$) (Table 1).

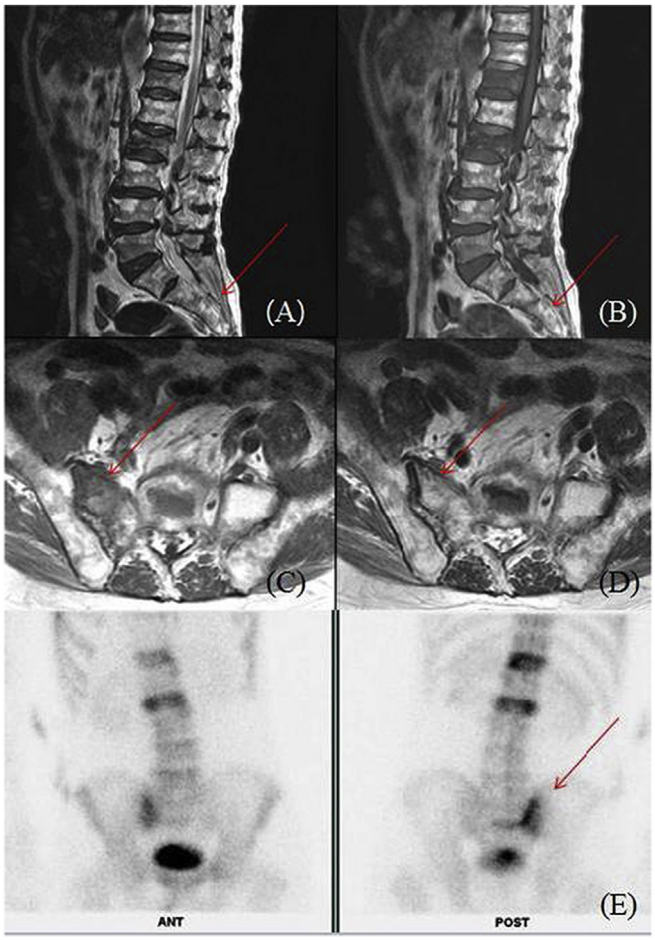

Fig. 1. A 59-year-old male with recent onset of increasingly severe pelvic pain. (A) Sagittal T1 weighted image shows abnormal low signal at S2 level (arrow). (B) Sagittal T2 weighted image shows slight high signal at the same level (arrow). (C,D) Axial T1,2 weighted image show signal change at Rt. sacral wing. (E) whole body bone scan images show increased uptake at S2 body level and Rt. sacral wing.

3.2. Age

The subjects with a thoracolumbar compression fracture were divided into 3 categorical variables according to their age: less than 60 in 255 subjects (27.0%), in their 60s in 321 subjects (34.0%), and 70 or older in 369 subjects (39.0%). The number of the subjects who had both thoracolumbar fracture and sacral insufficiency fracture was 4 (1.6%) among the subjects aged less than 60, 7 (2.2%) among the subjects in their 60s, and 25 (6.8%) among the subjects aged 70 or older. In univariate logistic regression analysis, relative risks of sacral insufficiency fracture among the subjects in their 60s, aged 70 or older were 1.4, 4.6 times higher, respectively, than that among the subjects aged less than 60, and the differences were statistically significant only in aged 70 or older ($p = 0.596$, $p = 0.005$) (Table 1).