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36

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INCIDENCE AND MORTALITY OF OSTEOPOROTIC SACRAL INSUFFICIENCY FRACTURES: A RETROSPECTIVE SINGLE-CENTRE STUDY

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ABSTRACT

Objective: The incidence of osteoporosis increases with the ageing of the world population. In recent years, sacral insufficiency fractures (SIF) have become more prevalent due to the increase in life expectancy of the elderly population. The aim of this study was to investigate the incidence and the mortality rates of SIF in elderly patients with osteoporosis.

Materials and Methods: The records of patients admitted to our hospital between January 2011 and May 2018 were examined. Medical records, radiological images and reports of 245 patients over 65 years of age who had undergone pelvic computed tomography (CT) or magnetic resonance imaging (MRI) for any reason were retrospectively reviewed. Twenty-six patients (three male, 23 female) over 65 years of age who were proven to have osteoporosis with bone mineral densitometry (BMD) values at the time of diagnosis were included in the study.

Results: The mean age at the time of diagnosis was 80,5. MRI was used for diagnosis in 20 patients and CT in six patients. The mean value of BMD was found to be-3.62. The most common type of fracture was B1. Surgery was performed in four patients and conservative treatment in 22 patients.

Conclusion: Increased risk of fractures due to osteoporosis also increases the risk of SIF. In our study, the incidence of fractures of sacral insufficiency was found to be 12.44% and 5-year mortality was 26.9%.

Keywords: Osteoporosis, sacral insufficiency fractures, mortality

INTRODUCTION

The incidence of osteoporosis increases with the lengthening of the average lifetime of the world population. Uncoupling of osteoclast-osteoblast activity leads to a decrease in the bone mass and the deterioration of bone microstructure. All of these changes in the structure of the bone, which are seen both in the senile osteoporosis and post-menopausal osteoporosis, cause an increase in the fracture risk even during the regular activity and these fractures are defined as insufficiency fractures. The fracture risks directly related to the degree of bone loss. The most common fractures are seen in the vertebral body, hip and wrist, respectively. In recent years, sacral insufficiency fractures (SIF) have become more prevalent due to the increase in the life expectancy of the elderly population[1-3].

SIF were firstly described by Lourie in 1982. Although osteopenia, rheumatoid arthritis, corticosteroid use, radiotherapy, renal osteodystrophy, osteomalacia, Paget's disease, hyperparathyroidism, joint arthroplasties and lumbosacral fusion are risk factors for SIF, osteoporosis is the most common risk factor[4]. SIF presents itself with non-specific symptoms like low dorsal pain, buttock and hip pain, which resemble symptoms of various pathologies. These pathologies include lumbar spinal canal stenosis, vertebral fractures and metastatic disease. On the other hand, it is difficult to visualize sacrum with X-rays. Also, sacrum was not considered as a reason of symptoms at the first step of evaluation. Therefore, the diagnosis of the SIF is difficult and often delayed. In non-displaced SIF, the first line of treatment is conservative treatment. This treatment consists of analgesics and mobilization that is regulated according to the degree of the patient's pain. However, if the patient complains about long-standing pain or the fracture is displaced, surgical stabilization should be considered. Because the patients suffering from the SIF could easily deteriorate with surgical trauma, the least possible invasive treatment is recommended[5].

Although the exact incidence of SIF is still unknown, it is reported as between 1% and 1.8% in various studies[1,5]. Studies have shown that almost all osteoporotic fractures, especially osteoporotic vertebrae and hip fractures, are associated with

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increased mortality risk. However, in the literature, there are very few studies on the mortality rates of the patients with the SIF. One of the studies reported mortality within the three years after the occurrence of sacral insufficiency fracture as 25.5%[6]. The aim of this study is to investigate the incidence and mortality rates of SIF in elderly patients with osteoporosis.

MATERIALS AND METHODS

After obtaining approval from the Başkent University Medical and Health Sciences Research Review Board (no: KA 19/444, date: 02.01.2020), the recordings of patients referred to our hospital between January 2011 and May 2018 were examined. Medical records, radiological images and reports of 245 patients who were over 65 years of age and underwent pelvic computed tomography (CT) or magnetic resonance imaging (MRI) for any reason were retrospectively reviewed.

Thirty-two of the 62 patients with the diagnosis of sacrum fracture were excluded from the study for the following reasons: high-energy sacrum fractures (14 patients), patients with other SIF risk factors (renal osteodystrophy, 10 patients; pathological fractures, eight patients). Bone mineral density (BMD) values of four of the remaining 30 patients could not be reached and they were excluded from the study. As a result, 26 patients (three male, 23 female) over 65 years of age who were proven to have osteoporosis with BMD values at the time of the diagnosis were included in the study.

Patients' demographics and radiological features were examined. Besides, the fractures of the patients were classified according to the classification systems previously described by Bakker et al.[7] in the literature (Table 1).

Statistical Analysis

The incidence was calculated according to the obtained data and statistically compared with the findings in the literature. Mortality data were obtained from the "Ministry of Health, Death Notification System". Mean values and standard deviations were calculated and statistical analyses were done by using SPSS (Statistical Package for the Social Sciences) for Windows v24.0.

RESULTS

Data of 26 patients (three male, 23 female) with SIF, who met the study criteria, were examined. The demographic data of each patient are shown in Table 2. The mean age at the time of diagnosis was 80.5±9.02 years [mean ± standard deviation (SD)] and the age distribution of the patients is shown in Graphic 1.

MRI was used for the diagnosis of 20 patients (76.9%) and CT was used in six patients (23.1%) (Figure 1). When the results of bone mineral densitometry (BMD) that was measured by dual-energy X-ray absorptiometry method were evaluated, the mean value was found to be -3.62 ±0.46 (mean ± SD). According to the classification system of Bakker et al.[7] of SIFs, the most common fracture type was B1. Numerical and percentage distribution of fracture types are shown in Graphic 2.

The treatment of patients with SIF was examined. Four of the patients had a surgical operation and 22 of them received conservative treatment. Iliosacral screw fixation was performed in patients who underwent surgical treatment. After the patients were placed in the supine position, screws were bilaterally placed percutaneously using secure corridors of the S1 and S2 vertebrae under scope control. In retrospective mortality screening, it was revealed that seven of 26 patients (26.9%) died during the follow-up period after the diagnosis. The 3-month mortality rate after fracture diagnosis was 7.7%, the 1-year mortality rate was 11.5%, the 2-year mortality rate was 19.2%, and the 5-year mortality rate was 26.9%. According to the results, the incidence of osteoporotic SIF was calculated as 12.44% in the study population.

Table 1. Classification of sacral insufficiency fractures according to Bakker et al.[7]

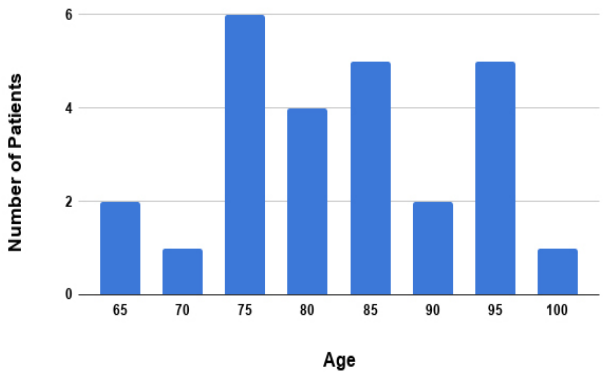
Type A: Fractures of the sacral ala	
A1	Bone bruise (MRI) without a visible fracture line in the CT-Scan
A2	Deformation of the anterior cortical bone without a cortical disruption
A3	Anterolateral rim fracture of the ala with up to 1 cm distance in the direction of the medial sacroiliac joint
Type B: Fractures of the sacral ala	
B1	Fracture parallel to the sacroiliac joint
B2	Fracture involving the sacroiliac joint
B3	Fracture with an involvement of the neural foramina or the spinal canal
Type C: Corpus fractures	
C1	Fracture moves from anterior cortex dorsally or into the sacroiliac joint
C2	Fracture with an unilateral involvement of the neural foramina or the spinal canal
C3	Unstable and represents bilaterally sagittal fractures combined with a transverse lesion.

MRI: Magnetic resonance imaging, CT: Computed tomography

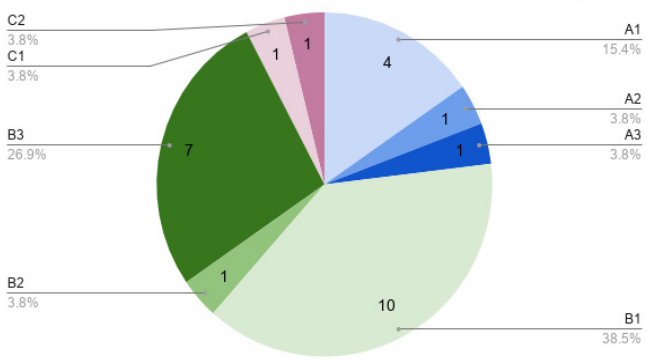
Table 2. The demographic data of each patient

Case	Age (year)	Gender	Imaging modality	BMD L1-L4 t-score	Fracture type	Treatment
1	81	F	MRI	-3.1	B1	C
2	65	F	MRI	-3.5	B3	C
3	65	F	MRI	-3.7	B1	C
4	91	F	MRI	-4.0	A3	C
5	75	F	MRI	-3.6	C1	C
6	76	F	MRI	-3.5	B1	C
7	82	F	MRI	-3.3	B2	C
8	89	M	CT	-4.3	A1	C
9	92	M	CT	-3.6	B3	C
10	95	F	CT	-3.0	A2	C
11	73	M	CT	-3.2	C2	C
12	75	F	MRI	-3.6	B1	C
13	96	F	MRI	-4.8	B1	C
14	81	F	MRI	-4.1	B1	C
15	86	F	MRI	-4.3	B3	C
16	93	F	CT	-3.2	B3	C
17	76	F	MRI	-3.5	B1	C
18	92	F	MRI	-4.0	B3	C
19	73	F	MRI	-3.0	A1	C
20	77	F	MRI	-3.2	B3	C
21	72	F	CT	-3.8	A1	C
22	81	F	MRI	-3.2	A1	C
23	74	F	MRI	-3.1	B1	S
24	85	F	MRI	-4.1	B1	S
25	70	F	MRI	-3.6	B3	S
26	80	F	MRI	-3.9	B1	S

M: Male, F: Female, CT: Computed tomography, MRI: Magnetic resonance imaging, BMD: Bone mineral density, C: Conservative, S: Surgical



Graphic 1. Distribution of patient numbers by age



Graphic 2. Numerical and percentage distribution of fracture types

DISCUSSION

The number of patients with osteoporosis increases and osteoporosis is more common in the elderly and female population. In the systematic review performed by Yoder et al.[4], risk factors causing SIF were investigated and these fractures were shown to be highly associated with old age, female gender and osteoporosis. In the literature; it has been suggested that the greater pelvic deflection angle of women causes biomechanical disadvantage and therefore, SIF are more common in the female population than in the male population. As consistent with other studies in the literature, our study also found a higher rate of SIF in women over 65 years of age.

It has been shown in many studies that plain radiographs are inadequate to detect SIF[1,4,8]. Tamaki et al.[1] found that the diagnosis of SIF was delayed on average 29.3 days after the referral to the emergency department and they suggested that this delay was caused by the use of plain radiographic examination. SIF are often located in the sagittal plane and parallel to the sacroiliac joint; therefore, scintigraphy also gives non-specific results. CT can only detect the changes that appear weeks after the fracture. Bone edema after a fracture occurs within hours and can be detected by MRI[8]. Therefore, MRI seems to be the most effective method for early diagnosis and also the most valuable diagnostic method in patients with vague low back pain that are suspected to have SIFs.

In the study of Na et al.[9], 15 patients with osteoporotic pelvic insufficiency fractures were examined. It was reported that only four of the patients had sacral and nine had both sacral and pubic fractures. In this study, the mean BMD value was found to be -3.9. In our study, the mean BMD value was found to be -3.6 in accordance with these data. Wagner et al.[2] examined patients with osteoporosis-related SIF and calculated the bone mass of different parts of the sacrum by using special software with CT. According to this study, the bone mass of the sacrum body is generally decreased. However, the greatest loss of bone mass was shown to be in the alar regions. According to Bakker et al.'s[7] sacral insufficiency fracture classification, type B fractures are located in the alar region. The fracture line extends along with the sagittal plane and parallel to the sacroiliac joint. In addition, they reported the most frequent fracture as type B fractures in their study. Also, in our study, the most common fracture type was type B fractures. When all these data were examined together, it was found that the data of our study were consistent with the literature.

Conservative treatment is the first-line treatment for sacrum insufficiency fractures[5]. In the study performed by Park et al.[6], only 21 (6.5%) of 325 patients with sacral insufficiency were treated with surgery. In our study, this rate was 15.38% (4/26). The higher rate of surgical treatment may be due to the variability in the severity of osteoporosis and persistent symptoms associated with it.

In the literature, there are few studies reporting the mortality of SIF. In the study performed by Park et al.[6], 3-month, 6-month, 1-year, 2-year, and 3-year mortality after SIF were evaluated and were found as 5.8%, 9.8%, 17.5%, 23.7% and 25.5, respectively. In our study, mortality rates were found to be 7.7%, 7.7%, 11.5%, 19.2%, and 23%, respectively. In addition, 5-year mortality was %26.9 in our study. When both studies were evaluated together, it can be said that the obtained mortality data were proportionally similar.

The true incidence of SIF is unknown. The first study was done in 1993 by Weber et al.[10] In this study, the incidence was reported as 1.8% for the whole study group (n=20). While all patients were included in the calculation, only 12 patients with osteoporosis were included in the study. In the study performed by Tamaki et al.[1] in 2017, they investigated the sacral CT images of the patients who were referred to the emergency department and the incidence was calculated as 4.4%. On the other hand, there are no data available for BMD in both studies. In our hospital, the incidence of osteoporosis-associated sacral insufficiency fracture is 12.44%. Our study includes patients with osteoporosis-related SIF, which have been diagnosed by BMD values. Developing imaging technologies may have led to a higher incidence rate in our study.

Study Limitations

The present study has some limitations. Firstly, this is a single-centered and retrospective study; so, the sample of the study was lower compared to other studies. Secondly, other factors affecting insufficiency fractures were not included in the evaluation. Finally, the treatment of osteoporosis and their possible effect of the treatment were not considered in the study.

CONCLUSION

Symptoms of SIF are non-specific and similar to the symptoms of some other pathologies. Due to the difficulty in the visualization of the fracture, the diagnosis of the SIF cannot be made on time. Increased risk of fractures due to osteoporosis also increases the risk of SIF. In our study, the incidence of fractures of sacral insufficiency was found to be 12.44% and 5-year mortality was 26.9%. Therefore, if plain radiographs are negative in osteoporotic elderly patients with low back, hip and thigh pain, SIF should always be kept in mind. Further studies would increase our awareness and knowledge about these fractures.

Ethics

Ethics Committee Approval: Ethics committee approval was obtained from the Başkent University Medical and Health Sciences Research Review Board (no: KA 19/444, date: 02.01.2020).

Informed Consent: No informed consent was obtained because of the retrospective study design.

Authorship Contributions

Concept: B.H., E.K.Ş., Design: B.H., Data Collection or Processing: E.K.Ş., M.I., Analysis or Interpretation: B.H., Literature Search: M.I., Writing: B.H., E.K.Ş., M.I.

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