

Do osteoporosis-related vertebral fractures precede hip fractures?

Mir Sadat-Ali, Abid Hussain Gullenpet, Md Quamar Azam, Ammar K Al-Omran

Mir Sadat-Ali, Md Quamar Azam, Ammar K Al-Omran, Department of Orthopaedic Surgery, College of Medicine, University of Dammam and King Fahd Hospital of the University, Al Khobar 31952, Saudi Arabia

Abid Hussain Gullenpet, Department of Radiology, College of Medicine, University of Dammam and King Fahd Hospital of the University, Al Khobar 31952, Saudi Arabia

Author contributions: All the authors contributed to this article. Correspondence to: Mir Sadat-Ali, MBBS, MS, FRCS, Professor, Department of Orthopaedic Surgery, College of Medicine, PO box 40071, King Fahd University Hospital, AlKhobar 31952, Saudi Arabia. drsadat@hotmail.com

Telephone: +966-50-5848281 Fax: +966-3-8820887

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Abstract

AIM: To evaluate the relationship between a vertebral fracture and a hip fracture in Saudi Arabians with osteoporosis.

METHODS: In this retrospective study, 154 Saudi Arabian patients with osteoporosis-related hip fractures were analyzed for the presence of a vertebral fracture. Radiographs were retrieved from the IPAC (Image Picture Archiving and Computing) System, an imaging retrieval system, and were reviewed independently by two of the authors, Abid Hussain Gullenpet, and Mir Sadat-Ali, and later reviewed jointly. Patients admitted with proximal hip fracture who were ≥ 50 years and had undergone Thoraco-lumber imaging and a dual energy X-ray absorptiometry (DEXA) scan were included in the study. Patients with a history of significant trauma to the spine and those with a malignancy or connective tissue disorder were excluded from the analysis.

RESULTS: Out of 154 patients with hip fractures, 78 had a fracture of the femoral neck while 76 had an intertrochanteric hip fracture. Of the 111 patients who

were finally included in the study, after applying inclusion and exclusion criteria, 76 patients with an average age of 67.28 ± 12 years had no fractures of the spine. Thirty-five patients with an average age of 76.9 ± 14.5 years (31.53%) had a total of 49 vertebral fractures. Patients with vertebral fractures were significantly older than those without fractures $P < 0.001$. Overall, 24.7% of these patients had an asymptomatic vertebral fracture. Further analysis showed that 11 males (18.96%) and 24 females (45.28%) had suffered a previous asymptomatic vertebral fracture. Interestingly, all women who participated in this study and who presented with a femoral neck fracture had experienced a prior asymptomatic vertebral fracture.

CONCLUSION: We recommend that all elderly patients who go to the radiology department for a chest X-ray also have a DEXA scan and a lateral thoracic spine radiograph.

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Key words: Fragility fracture; Osteoporosis; Vertebral fractures; Hip fractures; Saudi Arabia

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INTRODUCTION

Osteoporosis is reported to be common among Saudi Arabians, and researchers report a prevalence of 30%-35%^[1-5].

Fragility fracture is a major health care concern because of its relationship to morbidity and mortality. The incidence of fragility fractures in Saudi Arabia jumped from 2.9/1000 in 1999^[6] to 6/1000 in 2007 at an annual cost of SR 4.27 billion^[7]. Only 30% of the patients who were still alive remained ambulatory^[8] and this put an extreme burden on the patient's family and caregivers^[9-11]. Prevention of fragility fractures, particularly those of the femur, is an important part of the management of osteoporosis. In a 2012 paper, Chan *et al*^[12] suggested that vertebral fractures are probably the most common fragility fractures and that they are often followed by a second fracture. In 2004, Johnell *et al*^[13] studied the risk of a second fracture, particularly of the femur, after a fracture of the spine or the proximal part of the humerus and concluded that the risk of a second fracture is highest immediately after the first one. Studies also showed that some who experiences a vertebral fracture have a five-fold increased risk of experiencing a subsequent hip fracture^[14-17].

The objective of this study was to evaluate the relationship between an asymptomatic vertebral fracture and a second hip fracture among patients living on the east coast of Saudi Arabia.

MATERIALS AND METHODS

One hundred and fifty-four patients with osteoporosis-related hip fractures and no history of a previous fracture were analyzed for the presence of a vertebral fracture. Demographic data about the patients, including their age, co-morbidities, and ASA score, was retrieved from their medical records and the QuadruMed database. All radiographic images were retrieved from the IPAC imaging system. Patients admitted with proximal hip fracture who were ≥ 50 years and had undergone thoraco-lumbar imaging and a dual energy X-ray absorptiometry (DEXA) scan were included in the study. Patients with a history of significant trauma to the spine, a malignancy, or a connective tissue disorder were excluded from the analysis. After applying inclusion and exclusion criteria, 111 patients were finally included in the study. The fracture morphology was entered in a database, including the side, site, type, and operative implants used. Patients were divided into two groups: a non-elderly group (50-64 years old) and an elderly group ≥ 65 years old, following the accepted definition of elderly patients^[15]. Radiographs were reviewed independently by two authors, Abid Hussain Gullenpet (AHG), and Mir Sadat-Ali (MSA), and later they reviewed them jointly. The data was analyzed using SPSS software, version 14. Data were expressed as mean \pm SD. Statistically significant differences between the two groups were determined with the Student's *t*-test using a ratio of $P < 0.05$, which is considered to be significant, and precision was ascertained at a CI of 95%.

RESULTS

Of the 154 patients with proximal hip fracture, 78 of

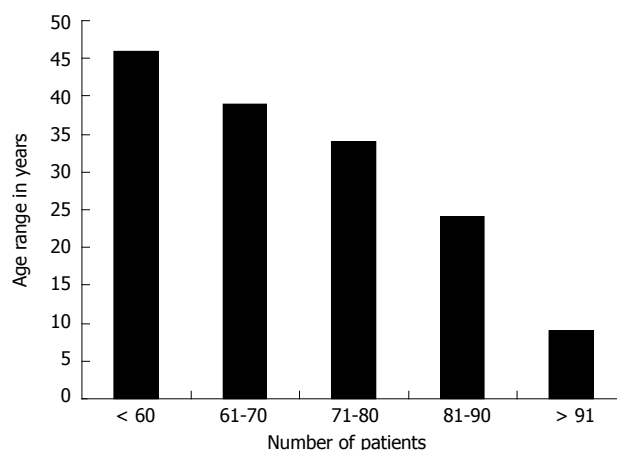


Figure 1 Shows the age range of patients with osteoporosis-related hip fractures.

them had a fracture of the neck and 76 had an intertrochanteric fracture. Of the 111 patients included in the study, 58 were male and 53 female with an average age of 70.6 ± 13.7 years (Figure 1). The demographic data and associated diseases of the patients are provided in Table 1. Sixty-five patients (58.55%) were classified as elderly patients (≥ 65 years). Seventy-six patients (68.47%), 47 males and 29 females, had no fractures of the spine and an average age of 67.28 ± 12 years. Thirty-five patients (31.53%), 11 males and 24 females, had a total of 49 vertebral fractures and an average age of 76.9 ± 14.5 years. [The odds ratio was calculated as 0.4605, 95%CI (0.2852 to 0.74) and $P = 0.0015$]. Patients with vertebral fractures were significantly older than those without fractures $P < 0.001$. The majority of the fractures (55%) occurred between thoracic 11 and lumbar 2nd vertebra (Figure 2). Women sustained a fractured neck of the femur more often than men $P < 0.001$. All women who had experienced such an injury had a vertebral fracture.

Overall, 24.7% of our patients had an asymptomatic vertebral fracture. Further analysis showed that 11 males (18.96%) and 24 females (45.28%) had a previous asymptomatic vertebral fracture. Interestingly, in our sample all women who presented with a fractured neck of the femur had a prior asymptomatic vertebral fracture.

DISCUSSION

In this study we found that 24.7% of patients who presented with a hip fracture also had an asymptomatic vertebral fracture, and the remaining 75.3% patients had never experienced spine fractures. This indicates that proximal femoral fracture may be the first presenting complaint that indicates underlying osteoporosis. It also underlines the fact that asymptomatic spine fracture remains undiagnosed in almost 25% of elderly patients until they experience a debilitating hip fracture. Further analysis showed that 45.28% of elderly females and 18.96% of the males had experienced an asymptomatic vertebral fracture.

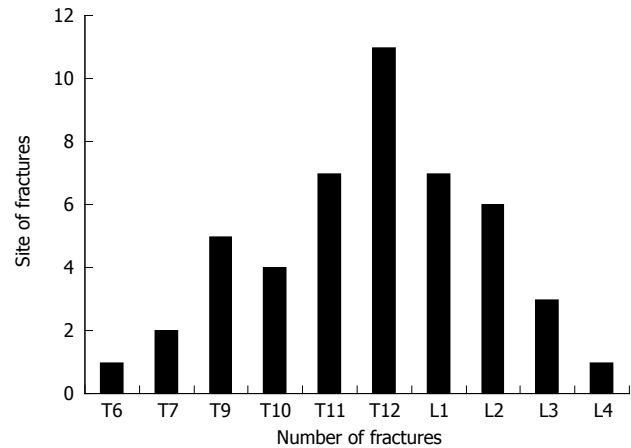
Table 1 Demographic details of patients (mean \pm SD)

	Hip fracture with vertebral fracture	Hip fracture without vertebral fracture	P value
Number of patients (n = 111)	35	76	
Mean age	76.9 \pm 14.5	67.28 \pm 12.2	0.001
BMD at hip (g/cm ²)	0.511 \pm 2.5	0.692 \pm 3.1	0.7
BMD at spine (g/cm ²) non fractured side	0.496 \pm 4.3	0.728 \pm 3.6	0.6
HTN/CAD (hypertension/coronary artery disease)	14	45	0.06
Diabetes mellitus	25	49	0.5
Endocrine diseases	2	2	0.4
Stroke	3	7	0.9
Family history of osteoporotic fracture	3	0	0.7
Chronic kidney disease	9	4	0.01
Dementia	1	5	0.01
Asthma	5	2	0.06
Drugs, steroids, anticoagulants	4	7	0.7

BMD: Bone mineral density.

The results of this study cause us to emphasize the issue of a second fracture, which has been raised by many other researchers. Lönnroos *et al*^[18] reported that this occurs at an incidence of 5.08%, but Berry *et al*^[19] found the incidence of a second fracture was 14.8% in a follow-up study after 4.2 years. Recently Kaukonen *et al*^[20] reported a second femoral fracture occurred in 12% of their patients. A recent study reported that in a cohort of 178 women, grade 1 vertebral fractures were identified in 33.1% and grade 2 and 3 fractures in 20.2%, and the researchers concluded that age, vitamin D levels, and osteoporosis as defined by DEXA were not factors influencing vertebral fractures^[21]. Clinton *et al*^[22] reported that the risk of a subsequent hip fracture after a proximal humeral fracture was highest within one year after the proximal humeral fracture, with a hazard ratio of 5.68 (95%CI = 3.70 to 8.73). We agree with Rouzi *et al*^[23] that various clinical factors, including elderly age and sex, are independent risk factors that predict osteoporotic fractures.

This study was limited because of its retrospective nature and the relatively small patient population, which may not adequately represent the whole country. However, in the absence of literature published by researchers in Saudi Arabia, the current study may stimulate more prospective studies on this subject. We conclude by repeating that proximal femur fracture may be the first presenting complaint of a patient with underlying osteoporosis. It is not, as a rule, necessarily preceded by a spine fracture. However, asymptomatic vertebral fracture is a harbinger of a subsequent hip fracture, especially in elderly females. A health care worker needs a high degree of aware-

**Figure 2** Shows the site and number of vertebral fractures seen in patients with hip fractures. T: Thoracic; L: Lumbar.

ness to diagnose the underlying osteoporosis before his or her patient ends up suffering a fragility fracture. We recommend a DEXA scan and a lateral thoracic spine radiograph for all elderly patients who go to the radiology department for a chest X-ray. This strategy has the potential to allow health care professionals to diagnose osteoporosis at an early stage and to detect at least 25% of asymptomatic vertebral fractures. If appropriate medical therapy is instituted for such patients, it is possible that the morbidity and mortality that result from a fragility fracture of the hip can be minimized significantly.

COMMENTS

Background

Fractures related to osteoporosis in men and women can cause high rates of morbidity and mortality. Others have reported that vertebral fractures precede a hip fracture. The objective of this study was to evaluate the relationship between a vertebral fracture and a hip fracture in Saudi Arabians with osteoporosis.

Research frontiers

A vertebral fracture does not precede hip fracture in all patients with osteoporosis. Other co-morbidities play an important role. Patients with vertebral fractures due to osteoporosis need to be closely monitored, particularly if they have other diseases, so that a femoral fracture may be prevented.

Innovations and breakthroughs

It is not essential to see a vertebral fracture in a patient with a proximal femoral fracture related to osteoporosis.

Applications

Patients with osteoporosis-related vertebral fractures and associated other diseases should be followed regularly to prevent other fragility fractures.

Peer review

This is a retrospective study to review the clinical data in Saudi Arabia and investigate the relationship between a vertebral fracture and a hip fracture in the population with osteoporosis. The study aims to look into whether vertebral fractures precede the occurrence of hip fractures. The study design is straightforward to review the X-ray retrospectively by two investigators independently and count the number of vertebral fracture cases.

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