


# The (a)-Symptomatic Vertebral Fracture: A Frequently Discovered Entity With Clinical Relevance in Fracture Patients Screened on Osteoporosis

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## Abstract

**Objective.** Description of the prevalence of vertebral fractures in a fracture and osteoporosis outpatient clinic (FO-Clinic) and evaluation of the value of spinal radiographs by screening on osteoporosis. **Design.** Retrospective data collection, description, and analysis. **Methods.** All patients admitted to the FO-Clinic during the period of December 2005 until October 2006 were enrolled in this study. At the FO-Clinic spinal radiographs were obtained and bone mineral density (BMD) was measured by Dual energy X-ray-Absorptiometry (DXA). **Results.** During the study period, a total of 176 patients were screened at our FO-Clinic. In 41.5% of these patients, a vertebral fracture was diagnosed. There appeared to be an indication for anti-osteoporotic medication in 95 of the 176 patients. Of these 95 patients, 77% could be identified by spinal radiographs. Moreover, only 36% of all patients with a vertebral fracture did suffer from osteoporosis. **Conclusion.** The prevalence of vertebral fractures in patients screened at an FO-Clinic is high and spinal radiographs can identify up to 77% of patients in which anti-osteoporotic medication should be considered. However, fracture risk is not only dependent on bone quality but also on bone density. Therefore, the preferred method of screening on osteoporosis is DXA with vertebral fracture assessment and, if necessary, spinal radiographs. If DXA is not available, spinal radiographs might be used as a first step in osteoporosis screening.

## Keywords

osteoporosis, dual energy x-ray absorptiometry, bone mineral density, vertebral fracture, spinal radiograph

## Introduction

Osteoporosis is a major health problem of which the clinical manifestation is a fragility fracture.<sup>1-3</sup> Fragility fractures result in a significant impact on quality of life, morbidity, and mortality.<sup>4</sup> When patients with a fragility fracture are treated with anti-osteoporotic medication, it is possible to achieve a 40% reduction in subsequent fragility fractures.<sup>5,6</sup> Most subsequent fragility fractures (up to 60%) occur in the first year after the initial fracture.<sup>7,8</sup> Therefore, treatment should be started as soon as possible after the initial fracture.

The main indication for initiating anti-osteoporotic medication is osteoporosis. Patients older than 50 years who present with a low energy fracture to the emergency room are at increased risk of osteoporosis and should be screened on osteoporosis.<sup>9</sup> At our hospital, this is done at the Fracture and Osteoporosis outpatient Clinic (FO-Clinic). At this FO-Clinic, among other things, bone mineral density (BMD) is measured with dual energy x-ray absorptiometry (DXA) of the hip and spine. The advantage of DXA in screening on osteoporosis is that treatment thresholds are established and follow-up

measurements by repeated DXA are possible to evaluate the effect of anti-osteoporotic therapy.<sup>10-12</sup> A general disadvantage of DXA is that it is still not available in every clinic and interpretation of DXA can be difficult in patients with arthrosis or other skeletal deformities, which happens to occur especially in the older aged patient group.<sup>13</sup>

Another reason for initiating anti-osteoporotic treatment, independent on the BMD, is an (a)-symptomatic vertebral fracture, which increases the risk of a subsequent fragility fracture

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**Table 1.** Distribution of vertebral fractures and bone mineral density among patients screened at the FO-Clinic.

Vertebral Fracture on X-ray	73 patients	Group 1: Osteoporosis	26 patients
		Group 2: No osteoporosis	47 patients
No Vertebral Fracture on x-ray	103 patients	Group 3: Osteoporosis	22 patients
		Group 4: No osteoporosis	81 patients

at least 4-fold.<sup>4,14-19</sup> Vertebral fractures are the most common fragility fractures in patients  $\geq 50$  years with a prevalence of up to 50%.<sup>20,21</sup> But, although the prevalence of vertebral fractures is high, only one third of these fractures is clinically recognized.<sup>19,20</sup> Spinal radiographs might therefore be helpful in deciding whether or not anti-osteoporotic medication should be initiated.

This study was designed to establish the prevalence of vertebral fractures in patients screened at an FO-Clinic in the Netherlands. Our goal was to determine whether or not spinal radiographs can be used as a first step in screening on osteoporosis.

## Materials and Methods

### Study design

This study is a retrospective data collection study conducted in a nonacademic teaching hospital.

### Patient Selection

All patients admitted to the FO-Clinic during the period of December 2005 until October 2006 were enrolled in this study. Patients were screened at the FO-Clinic when they were  $\geq 50$  years and admitted to the hospital with a low energy fracture. Patients were excluded from further screening at the FO-Clinic when no informed consent was obtained or in the case of dementia or a pathologic fracture.

### Data Collection

At the FO-Clinic, a standard questionnaire and physical examination was done. Furthermore, patients were sent for an x-ray from the fourth thoracic vertebra down to the fourth lumbar vertebra. Vertebrae were graded using the semiquantitative method described by Genant, which is a visual inspection of the vertebral column without direct vertebral measurement.<sup>22</sup> This was done by 2 different radiologists, followed by a consensus reading. Genant described in his original article that from grade 1 (approximately a reduction in anterior, middle, and/or posterior height  $\geq 20\%$ ), a vertebra can be considered to be fractured.<sup>22</sup> In our study, in all vertebrae graded  $\geq 1$  using the method described by Genant, the anterior, middle, and posterior height were really measured. If the reduction was indeed  $\geq 20\%$ , this vertebra was considered to be fractured.

The BMD was measured in all patients using DXA (Hologic Discovery A; Hologic, Massachusetts, VS and GE Lunar, Madison, Wisconsin). The DXA was obtained from the left hip and from the first till fourth lumbar vertebra unless

contraindicated. The DXA was expressed as a T-score, which is the standard deviation (SD) in BMD compared with the peak BMD of young adults.<sup>23,24</sup> Both the T-score of hip and spine were stored in our database. As osteoporosis is considered to be a systemic disease, the lowest of these 2 T-scores was used for further analysis in this study. Therefore, a patient with a spine T-score of  $-1.9$  SD and a hip T-score of  $-2.6$  SD was considered to be osteoporotic. Scanning time on the DXA took about 20 minutes and the machine was calibrated automatically on a daily basis using a phantom.

### Classification of patients

Patients were classified into 4 groups. First patients were classified based on the existence of a vertebral fracture on the radiographs. Then patients were further classified based on their BMD (Table 1). In this study, the definition of manifest osteoporosis (T-score  $\leq -2$  SD) was used instead of the definition of osteoporosis recommended by the World Health Organization (WHO) because the WHO defines patients with a T-score  $\leq -2.5$  SD as osteoporotic and patients with a T-score  $\leq -2.5$  SD plus a fracture as severe osteoporotic.<sup>25</sup> As all patients at the FO-Clinic per definition had a fracture, the definition of manifest osteoporosis is more suitable to the patient group screened at an FO-Clinic and recommended by the most recent Dutch guideline on osteoporosis.<sup>9</sup>

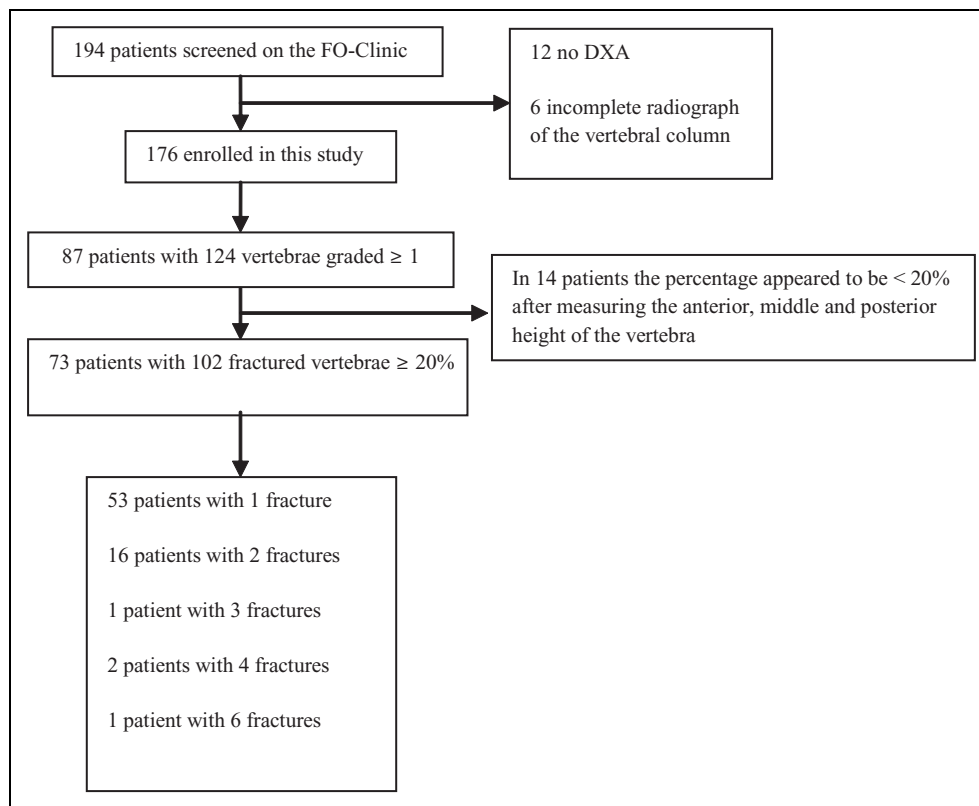
### Statistical Analysis

Statistical analysis was performed using SPSS software program (version 15.1 for Windows XP, SPSS, Chicago, Illinois). The normally distributed variables are expressed as mean and SD. For comparison of age, body mass index, and gender with the different groups of patients, crosstabulation were performed with chi-square test and analysis of variance as appropriate. The level of significance was set at  $P < .05$ .

### Results

In the 10-month study period, a total of 194 fracture patients were screened on osteoporosis at our FO-Clinic. For unknown reasons, in 12 patients, DXA was not performed and in 6 patients, spinal radiographs were not obtained. Thus, the final study population comprised 176 patients (Figure 1). The general patient characteristics of the 176 patients are expressed in Table 2.

In 87 patients, 124 vertebrae were graded  $\geq 1$  using the semiquantitative method described by Genant. In 73 patients, at least 1 vertebra was indeed fractured (reduction in height



**Figure 1.** Flowchart of the inclusion of patients in this study

**Table 2.** General patient characteristics of patients admitted to the FO-Clinic.

General patient characteristics	
Men:women	36:140
Height, mean (SD), cm	168 (8.7)
Weight, mean (SD), kg	79 (12.7)
Body mass index, mean (SD), kg/m <sup>2</sup>	28 (4.4)
Age, mean (SD), years	67 (9.5)
Fracture localization	
Tibia/fibula/patella	33
Radius/ulna	56
Hand/foot	36
Humerus	25
Femur/pelvis	8
vertebrae	13
Clavicula/scapula	2
Rib	3

Abbreviation: SD, standard deviation.

≥20%) after measuring the anterior, middle, and posterior height. Thus, a vertebral fracture was diagnosed in 41.5% of all patients (73 of 176). Only 13 of these 73 patients were referred to the FO-clinic because of a clinical symptomatic vertebral fracture (Table 2). The incidence of symptomatic vertebral fractures at our FO-Clinic is therefore 17.8% and the incidence of a-symptomatic vertebral fractures is 82.2%.

The BMD was in 48 patients (27%) in the osteoporotic range, in 67 patients (38%) in the osteopenic range, and 61 patients (35%) had a normal BMD. As can be seen in Table 1,

anti-osteoporotic medication can be considered in 95 of the 176 patients. In 47 (50%) patients, this is because of a vertebral fracture, in 22 (23%) patients because of osteoporosis, and in 26 (27%) patients because of both a vertebral fracture and osteoporosis. This means that it is possible to identify 77% of all patients in which anti-osteoporotic medication can be considered by obtaining a simple spinal radiograph. An interesting result of this study is that only 36% (26 of 73) of the patients with a vertebral fracture did suffer from osteoporosis (Table 1). Therefore, 47 patients did suffer from a vertebral fracture but no osteoporosis. It appeared that the age, body mass index, or gender in these 47 patients was not significantly different from the other patients.

In 137 patients, it was known which medication was prescribed prior to screening at the FO-Clinic. It appeared that 10% of these patients were already on anti-osteoporotic medication. The reason why these patients were already treated was not recorded.

## Discussion

Vertebral fractures are frequently diagnosed in patients screened at an FO-Clinic. We found a prevalence of vertebral fractures of over 40% in our study population. One fifth of these fractures appeared to be symptomatic, which is comparable to the literature.<sup>19-21</sup> Another important finding of this study is that only 36% of all patients with a vertebral fracture did suffer from osteoporosis. As vertebral fractures in patients older than 50 years can be considered a reason for initiating

anti-osteoporotic treatment irrespective of their BMD, assessment of the spinal column is important in order not to withhold patients adequate treatment.<sup>4,18-20</sup> When both vertebral fractures and osteoporosis are considered a reason to initiate anti-osteoporotic medication, spinal radiographs can already identify 77% of all patients who will benefit from this medication. On the other hand, 23% of the patients with an indication for anti-osteoporotic medication did not have a vertebral fracture and cannot be identified with spinal radiographs. Spinal radiographs might thus serve as a first step in screening on osteoporosis. Of all patients screened at the FO-Clinic, 10% were already on anti-osteoporotic medication. The value of obtaining spinal radiographs in patients who are already on osteoporotic medication is questionable, although the kind of medication might be changed in the presence of recurrent vertebral fractures.<sup>26</sup>

It is important to realize that bone strength and therefore fracture risk can be described as the integration of BMD and bone quality. In a previous study, it has been stated that DXA represents BMD and spinal radiographs can represent a test for bone quality.<sup>19</sup> Although a vertebral fracture is probably not the best test for bone quality, it is true that vertebral fractures should be considered a reason for initiating anti-osteoporotic therapy. However, BMD measurement remains also important in this decision. Both modalities do have their own advantages. The most important advantage of BMD measurements is that follow-up measurements are possible to evaluate the effect of medication. A great advantage of spinal radiographs is that it can be obtained very easily and will identify more than 40% of all patients in which treatment can already be initiated. This latter is important as most subsequent fragility fractures occur in the first months after the initial fracture.<sup>7,8</sup> In our opinion, a combination of BMD measurement and assessment of the spinal column is therefore the best way in screening patients at an FO-Clinic.

A relatively new aspect of DXA scanners is the possibility of morphometry or instant vertebral fracture assessment (VFA). This combines measurement of BMD and assessment of the spinal column at levels where vertebral fractures are most common (below the fourth thoracic vertebra).<sup>27</sup> The VFA allows manual or automatic placement of markers at the anterior, middle, and posterior height of the vertebra to calculate ratios.<sup>28</sup> The VFA has been compared with spinal radiographs in previous studies. The sensitivity and specificity in diagnosing  $\geq$  grade 2 deformity (according to the classification by Genant) with VFA is good, with a lower dose of ionizing irradiation and greater patient convenience.<sup>29-31</sup> The VFA is therefore suitable as a first step in screening the vertebral column.<sup>9</sup> If a  $\geq$  grade 2 vertebral deformity is detected, which happens to be the case in 57% of patients, conventional radiographs do not have to be obtained and these patients can be classified as having a vertebral fracture.<sup>9,32</sup> If a grade 1 deformity is detected on VFA, spinal radiographs should be obtained to exclude vertebral fractures.<sup>9,29</sup>

## Conclusion

At most FO-Clinics, the cornerstone in deciding whether or not anti-osteoporotic medication has to be prescribed is BMD

measurement using DXA. However, vertebral fractures should also be considered a reason to initiate anti-osteoporotic medication and the prevalence of vertebral fractures in patients screened at an FO-Clinic is high (41.5%). The ideal screening method at an FO-Clinic is probably DXA with VFA. However, if DXA is not available or the waiting list for DXA is long, spinal radiographs can be used as a first step in osteoporosis screening.

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