Vertebral compression fractures: Still an unpredictable aspect of osteoporosis

“The good physician treats the disease;
the great physician treats the patient who has the disease”.

Sir William Osler

ABSTRACT

Vertebral compression fracture is a hallmark of osteoporosis and by far and away the most prevalent fragility fracture. It is well proven that, patients who develop a vertebral compression fracture are at substantial risk for additional fractures. Diagnosis is based on adequate clinical evaluation, imaging and laboratory tests. Imaging of osteoporosis and fragility fractures includes conventional radiology to evaluate spinal fractures, bone mineral density testing by dual energy x ray densitometry, quantitative computerized tomography, magnetic resonance imaging, bone scintigraphy if necessary and ultrasound. Screening and treatment of individuals with high risk of osteoporotic fracture is cost-effective, but approximately two thirds of the vertebral compression fractures that occur each year are not accurately diagnosed and therefore not treated. Evaluation of the vertebral compression fractures, even though they may be asymptomatic, seems essential to health related and/or clinical researches on osteoporosis.

Key Words:
Osteoporosis, spine, spinal fractures, bone density

1.INTRODUCTION
Osteoporosis (OP) is one of the most frequent metabolic bone disorders worldwide. It has been defined as a skeletal disorder characterized by compromised bone strength, predisposing a person to increased risk of fracture. Osteoporosis is a silent problem without any evidence of disease until a fracture occurs. Health consequences from osteoporotic fractures not only have a negative impact on the quality of life but cause disability as well. Vertebral compression fracture (VCF) is by far and away the most prevalent fragility fracture and is a hallmark of OP. It has been proven that, patients who already have a VCF are at substantial risk for additional fractures [1-3]. One can say that, the VCF status is a powerful and independent risk factor for all new osteoporotic fractures, which is a major health care problem in the aging population, since the incidence of these fractures increases with age [4].

Independently of bone mineral density (BMD) measurements the prevalence and severity of VCF’s have been shown to be predictive for the risk of new osteoporotic fractures [5].

If a VCF exists the focus shifts to rehabilitation and prevention of the next fracture. These fractures can be linked with various problems, such as back pain, sleeping problems, decreased activity, more bone loss and increased fracture risk, spinal deformity, decreased lung capacity, impaired function, increased co-morbidities and mortality eventually [6]. Although the concept of risk factor evaluation is gaining ground, the current clinical practice of OP assessment is still largely based on the evaluation of BMD. That is the main reason why most patients with VCF are not clinically recognized. Additional imaging studies of the spine have not become routine for some reasons, including lack of awareness of the VCF status as independent risk factor and possibly because OP is a disease secondary to many other health problems and also it is not the “core” expertise of many physicians [7].

2. EPIDEMIOLOGY
A diagnosis of OP or previous fragility fracture was reported in around one-third of patients by Ong et al. Most patients (75% men and 78% women) had five or more co-pathologies and many of them were more dependent with activities of daily living on discharge compared to their pre-admission level [8]. The incidence of new VCF in female and male aged 50 years and over was 10.7/1000 person years and 5.7/1000 person years respectively, and the prevalence increased from 3% in females under 60 years of age to 20% in females aged over 70 years, and from 7.5 to 20% in males over the same age range [9].

Epidemiologic data related to osteoporotic fractures is limited in Turkey. In a retrospective chart review of 934 osteoporotic women, it was aimed to; 1-Explore the frequency of osteoporotic fractures in osteoporotic women on the basis of an outpatient clinic data. 2- Define the relationship between osteoporotic fractures and age, menopause status, BMD, and body mass index (BMI). Osteoporotic fractures were observed in 194 patients (20.8%). Vertebral compression fractures were the most common form of osteoporotic fracture (107 patients). The authors stated that, there was no significant difference in terms of BMI between the patients with or without any fractures [10].

As a matter of fact, most of the men with OP and osteoporotic fractures are not diagnosed and do not receive treatment. A cross-sectional study included 2 groups of male patients: 1-A total of 71 nursing home residents with a mean age of 76.0 years (nursing home group), 2- And 44 men living in their homes with a mean age of 74.4 years (control group). Bone mineral density measurement was performed in all subjects, and Spinal Deformity Index, and Fracture Risk Assessment Tool were also used. Osteoporosis was detected in 25.3% of nursing home group and 8.8% of control group. The authors stated that, silent VCF was present in 27.8% of males older than 65 years. Vertebral compression fracture rate was higher in nursing home residents (42.2%) than the control group (17.6%), male nursing home residents seemed at a
higher risk for both OP and VCF. Results also showed that, 5.6% of nursing home group and 8.9% of control group males were aware of their VCF’s [11].

3. CLINICAL MANIFESTATIONS

Vertebral compression fracture is defined as a decrease at least 15% to 20% in height of the vertebra. These fractures can occur anywhere in the spine, most commonly in the lower thoracic spine, with a minor activity, such as coughing or getting in or out of the bathtub (for people with advanced OP). The majority of compressive damage is limited to the front of the vertebral column, and the fracture is usually stable, so it can be rarely associated with nerve root irritation or spinal cord damage [8].

It is difficult to determine the cause and the exact time of fragility fractures of the vertebral body, which often go undiagnosed. During evaluation of the patient, there are some clinical history details that can suggest a possible VCF. These are: 1- Recent direct or indirect trauma, 2- Age, 3- Prolonged usage of glucocorticoids, 4- Structural spinal deformity, 5- Loss of height > 6 cm. It is, therefore, strongly advised to carefully evaluate the presence of dorso-lumbar pain, progressive loss of height, or dorsal kyphosis. Multiple VCF’s may result in alterations of some system functions, mainly pulmonary or gastrointestinal [12].

3.1. Symptomatology- Basic symptoms of VCF are; sudden onset of back pain, which gets worse by standing or walking. Lying on one's back makes the pain less intense. Followed by; limited spinal mobility, height loss, deformity and disability. Some patients with VCF report that they felt no back pain or other symptoms. Even if there is not back pain, middle age or elderly persons (especially women) need to be concerned about potential fractures if there is; 1- Height loss, 2- Limited ability to twist and bend the back, 3- Deformity that develops in the spine. The pain from an osteoporotic VCF typically lasts about 4 to 6 weeks as the bone heals. Some patients report that the more severe pain has subsided and has turned into more of a chronic, achy pain concentrated in the area of the back where the fracture occurred. This is
because of the ligament problems due to the postural changes. Musculoskeletal pain is common in elderly people and clinical or subclinical VCF are common causes. Giving rise to functional and psychological impairments. Thorough physical examination is important to reveal the underlying cause of “pain” [6,13].

To identify individuals who have asymptomatic VCF’s, some clinical thresholds for height loss have been proposed. A 15° increase in kyphosis is associated with the presence of a VCF, but an adjustment for age should be done. Also clinicians should keep in mind that, it is important to demonstrate whether simple self-reported kyphosis is associated with the presence of VCF’s determined by lateral radiographs, since it is likely that patients with undiagnosed VCF’s may feel kyphosis themselves. A cross-sectional survey aimed to clarify the associations of self-reported height loss and kyphosis with VCF’s enrolled 407 women aged 60–92 years who visited orthopaedic clinic in Japan. Kamimura et al, stated that both self-reported kyphosis and height loss were significantly associated with the presence and number of VCF’s. So these simple self-reports may be useful tools for identifying undetected VCF’s [3].

3.2. Impact on Quality of Life- Physical, emotional, and psychological incapacity, combined with the pain that results from hip, spine, or wrist fractures, can alter quality of life (QoL). Quality of life in men and women with OP should be thoroughly investigated even prior to the occurrence of fracture, to develop appropriate interventions that would empower patients to effectively manage all stages of the disease [14,15]. It is reported that, VCF have a negative impact on the QoL and their presence is linked with cardiopulmonary morbidities, depression and death [6].

A sizeable body of literature has documented the detrimental effect of fragility fractures on the health related QoL (HRQOL) of those with OP [16,17]. And researchers agreed that, an important marker of the clinical evolution of patients with OP and fractures is assessment of
health related QoL. Not only the fragility fractures, but physical, emotional, and psychological incapacity can alter QoL as well [18-20].

A population-based cross-sectional study which aimed to examine the association between prevalent VCF and back pain, neck pain, and HRQL in elderly women and men, and to study possible gender differences in the reported pain and HRQL, included a total of 2887 individuals (1681 of them are women) mean age 65.4. The study showed that prevalent VCF are associated with increased risk of back pain and reduced HRQL in postmenopausal women, but not in men [21]. According to Salaffi et al. HRQOL scores were lower in women with lumbar VCF’s compared with women with thoracic VCF’s only when the physical functioning and bodily pain dimensions approached statistical significance [22]. The number of VCF’s was shown to be a determinant of a low QoL. As VCF’s are usually asymptomatic and are associated with reduced QoL, increased morbidity and mortality, and increased risk of future vertebral and non-vertebral fractures, their detection remains an important challenge for clinicians [23].

4. DIAGNOSTIC APPROACH

According to the literature, often because of methodological problems as much as one third of all VCF are never clinically diagnosed. Vertebral compression fractures may also be asymptomatic but it has been documented in several studies that osteoporotic VCF may be associated with acute/chronic back pain [21]. The first step of the diagnosis is based on the risk assessment.

4.1. Assessments of Risks- Assessments of VCF risks are based not only on physical examination, but a complete case history, laboratory, and diagnostic imaging tests as well. Complete case histories need information related to patients’ medical histories (especially presence of comorbidities, any medication that may interfere with bone metabolism, previous
fragility fractures and family history of fractures, in women gynaecological history, and the age of the onset of menopause), lifestyle, and evaluation of personal and environmental risk factors. According to the “guidelines for the management of osteoporosis and fragility fractures”, evaluation of the patient’s posture is mandatory, especially if there is an increase in kyphosis or a height loss may indicate the presence of one or more VCF’s [12].

Fracture risk assessment tool-FRAX® can be used in clinical practice, which is a computer-based algorithm and permits the classification of risk. It is documented that, WHO FRAX® algorithms has facilitated the assessment of fracture risk on the basis of fracture probability [24].

Diagnosis is based on adequate clinical evaluation, imaging and laboratory tests and the accurate diagnosis of VCF is important for the treatment of OP and prevention of new fractures. Since many VCF are asymptomatic or cause mild pain, the majority of VCF are not diagnosed worldwide. Only one in three VCF is clinically diagnosed, and according to the records, the majority is either undetected or incidentally detected through radiographic testing.

Diagnostic imaging of osteoporosis and fragility fractures includes basically conventional radiology to evaluate spinal fractures, BMD testing by DXA, quantitative computerized tomography (QCT), magnetic resonance imaging (MRI), bone scintigraphy if necessary and ultrasound (QUS). Quantitative computerized tomography, MRI and bone scintigraphy are used for differential diagnosis. In symptomatic osteoporotic patients the bone scintigraphy can be helpful in elucidating the etiology of back pain. If central DXA is unavailable, QUS can be used to identify subjects at low or high risk of osteoporotic fracture.

In spite of the fact that, BMD assay is considered the best predictor of osteoporotic fragility fracture risks, it is always recommended to perform adequate clinical evaluation [12].
Jager et al showed that, combined vertebral fracture assessment (VFA) and BMD method detects previously unknown VCF’s in nearly one out of each six patients, with significant impact on management [7].

4.2. Radiology- Vertebral compression fractures need radiological confirmation (semi-quantitative method of Genant by the conventional spine radiography is traditionally used in the evaluation of VCF’s), but are often undiagnosed by radiologists, with a misdiagnosis rate up to 50% [9]. Reasons for this inadequacy are; 1- Vertebral compression fractures frequently do not present as a clinically recognizable event. 2-Many radiologically apparent VCF go unreported [25,26].

4.3. Indications for Vertebral Radiographs-In a clinical practice guideline, Camacho PM et al stated that, especially if prevalent VCF’s would alter clinical management, for patients with unexplained height loss or back pain, thoracic and lumbar spine radiography or VFA by DXA is indicated. The sensitivity for detecting prevalent VCF’s seems low, but these height loss thresholds have >90% specificity. Also if there is a kyphosis or systemic glucocorticoid therapy vertebral radiographs are indicated [27].

4.4. Reporting Vertebral Fractures-When reporting VCF’s radiologists and clinicians should avoid using ambiguous terms “collapse”, “compression”, “loss of height”, “wedging” or “wedge deformity”, instead the terms “mild”, “moderate” or “severe” VCF are recommended [25,26].

Radiographic studies identify three types of VCF’s: 1-Wedging (anterior), 2-Biconcavity (middle), 3-Total collapse of vertebra. These definitions depend on the type and severity of spinal height reduction. For a more accurate identification, there are also 2 other methods: 1- Semi-quantitative visual method. Based on an initial phase of visual evaluation of images for differential diagnosis. This gradation of osteoporotic VCF’s are named as the Genant criteria, and classified as mild, moderate, or severe. 2-Quantitative morphometric methods. Performed
by the conventional radiology or with DXA, using VFA software by lower radiation doses in
a single image. The VFA technique is applied to assess the severity of VCF’s or a possible
worsening of preexisting VCF’s during follow-up [12].

4.5. Vertebral Fracture Assessment-Population based assessment of VCF’s can be carried
out by common DXA densitometers. This method is VFA, and has been used in many
population settings. According to Waterloo et al, its sensitivity and specificity are comparable
to vertebral radiographs in the ability to diagnose grade 2 (moderate) and grade 3 (severe)
VCF [21]. The VFA technique enables the acquisition of a patient-friendly alternative to
conventional radiographs (with lower radiation exposure and relatively lower costs) for the
assessment of VCF’s in a one-stop diagnostic test. However, Malgo et al stated that, the
advantage of lower-radiation doses used in certain BMD scanners can be associated with the
drawback of poor image quality, which could lead to misclassification of VCF’s for the
ascertaining of a vertebra as non-evaluable leading to an inaccurate estimation of fracture risk
[5].

Considering that most osteoporotic VCF’s are asymptomatic, it is difficult to identify the
symptomatic VCF’s, especially in patients with concomitant fractures. Concomitant acute
osteoporotic VCF’s and previous VCF’s are common and are often overlooked. Risk factors
for the occurrence of concomitant acute osteoporotic VCF’s are; 1- A low T-score in DXA, 2-
A number of previous VCF’s. Performing an MRI scan of the thoracic and lumbar spine with
STIR and T1w sequences in patients with multiple acute osteoporotic VCF’s, or suspicion of
concomitant acute osteoporotic VCF’s, can be useful in order to detect all acute concomitant
VCF’s and start adequate and effective fracture treatment [28].

5. PREVENTION AND TREATMENT
5.1. Fracture Prevention- There are a number of unmet needs when assessing OP and a number of strategies to prevent the continual increase of the disease. These are; 1- Optimizing peak bone mass in young adults, 2- Structural implementation of a four-step diagnostic procedure in patients with clinical risk factors for osteoporotic fractures: DXA, VFA, fall risk, secondary OP. 3- More adequate measurement of bone strength, 4- Reduction in the treatment gap, 5- New drugs with a better efficacy/safety profile, 6- Shared decision making with optimal nonmedical and medical treatment (Non pharmacological interventions include specific physical exercises for OP to improve muscle strength and balance, decrease pain, and improve QoL). 7- New strategies: treat to target and definition of high-risk patients [29]. Unfortunately fracture prevention is suboptimal and the reasons are: 1- Fractures do occur, mainly in the elderly, 2- Fear of severe side effects, 3- Lack of education in professionals and in the lay public, 4- Lack of engagement: OP is a low medical priority, 5- Lack of coordination between health care systems, 6- Inadequate access to diagnostics such as BMD measurement and VFA, 7- Suboptimal predictive value of diagnostic techniques, 8- The treatment gap, 9- Low adherence and compliance to anti-osteoporotic drugs, 10- Generic drugs, nocebo-effect (negative counterpart), 11- Lack of focus on muscle strength and fall prevention [29].

5.2. Treatment- Approximately two thirds of the VCF’s that occur each year are not accurately diagnosed and therefore not treated. The patients’ pain is often just thought of as back pain resulting from “soft tissue injuries” or “spondylosis” or as a “common part of aging”. It should be kept in mind that, despite the absence of VCF’s, “bone resorption” due to OP may also cause back pain [6,13]. Since standardized and accepted treatment evidence-based concepts are missing for certain fracture types, the treatment of osteoporotic VCF’s is widely empirical. As in other
osteooporotic fractures in the elderly, the key for good outcome may be; a combination of interdisciplinary treatment approaches and adapted surgical procedures [30].

The basic treatment of vertebral fractures in the acute stage involves conservative measures that are bed rest, minor and major analgesic medications, physical therapy and bracing.

For all patients, optimizing vitamin D and calcium status, as well as recommendation of risk appropriate exercises and fall prevention strategies are mandatory. According to the latest treatment algorithm published by Kanis et al; in addition to the categories of low and high risk espoused in the current IOF-ESCEO guideline, very high risk can also be identified and is defined as a fracture probability that lies above the upper assessment threshold after a FRAX assessment. For women at high risk treatment usually starts with an antiresorptive drug, while patients with very high risk usually need an anabolic therapy followed by antiresorptive drugs [31].

In a recent clinical practice guideline 4 principles have been published for the management of osteoporosis and osteoporotic fractures: 1-Country-specific assessment tools should be used to identify possible fracture risk. 2-Patient preferences should be included in treatment plans.

3-All pharmacological treatments should be accompanied by nutritional and lifestyle changes and strategies for prevention of falls. 4-In postmenopausal women who are at risk, pharmacological treatments can reduce fracture rates with acceptable risk-benefit and safety profiles [32].

Pain due to vertebral fracture often lasts for 1-3 weeks and then begins to subside and disappears in a few months. But in some cases a biomechanical instability may develop and persist due to the severity and location of the VCF. Vertebroplasty or kyphoplasty may be considered in patients with intractable pain. Potential risks associated with these procedures and uncertain benefits over the long term should be considered in these practices and these interventions are not found to be suitable in patients with no symptoms or mild symptoms
It is well known that, in VCF’s, the primary goal of the surgical approach is to stabilize the spinal column and correct the deformity. For guiding clinical practice, some symptoms have been identified that are thought to be relatively specific indications for further investigations. This further examination is often reported to be MRI, because of being the most preferred diagnostic modality. Vertebral augmentation was recommended in patients with positive imaging results and also worsening of the symptoms (eg decreased vertebral heights, negative impacts on functioning, etc.) [33]. Nevertheless regarding the role of kyphoplasty and vertebroplasty interventions, no definitive consensus have been reached. Also no conclusions can be drawn about the superiority of cementoplasty techniques over conservative management according to Longo et al [34].

6. CONCLUSION

It is stated that, the huge burden caused by OP related fractures to individuals, healthcare systems and societies should provide a clear impetus for the progression of such approaches [35]. The cost of these fractures for societies is enormous and is forecast to steadily increase over the coming decades globally. Low BMD remains a key preventable risk factor for fractures. Screening and treatment of individuals with high risk of fracture is cost-effective. Predictive tools including “clinical risk factors”, “minimization of falls risk” and “public authorities’ support” to create Fracture Liaison Services are suggested as paramount strategies [36].

There is good evidence and consensus about the disease and its complications, but physicians still do not give enough effort for “identification and prevention of osteoporotic VCF’s”. Evaluation of the VCF’s, even though they may be asymptomatic, seems essential to health related and/or clinical researches on osteoporosis. It is suggested that physicians should give much more attention in their research efforts in increasing the awareness of not only the
clinicians but the public as well. Recommendations for primary screening are being developed to reduce mortality and morbidity caused by fragility fractures [37]. These practices, which are becoming increasingly important in terms of health policies of the countries, should be reviewed not only from the perspective of health but also social, psychological and economical perspective as well.

7. REFERENCES


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