Osteoporosis and importance of vertebral fractures

Osteoporosis is a serious public health problem. As life expectancy increases for the majority of the world’s population, the financial and human costs associated with osteoporotic fractures will increase exponentially. Vertebral fractures due to osteoporosis are common – with one occurring every 22 seconds worldwide in men and women over age 50 [1]. The incidence of vertebral fractures increases with age in both sexes although more so in women [2]. Vertebral fractures generally occur at a younger age than hip fractures [3], and thus are an important early indicator of disease status. However, it is difficult to determine the exact incidence of osteoporotic vertebral fractures, as a substantial proportion does not come to clinical attention [2, 4].

Vertebral fractures are powerful predictors of future spine and hip fractures, so accurate diagnosis and clear, unambiguous reporting of these fractures is essential. There is considerable evidence that vertebral fractures are under-reported, and when they are reported, appropriate intervention is often not initiated. Large-scale clinical trials have demonstrated that osteoporosis therapies can increase spine bone mineral density (BMD) by 4-12% and reduce vertebral fracture rates by 40-70% [5, 6]. These benefits are most pronounced in patients with low BMD and prevalent vertebral fractures. Clinical guidelines developed by the International Osteoporosis Foundation and other osteoporosis societies around the world recognize the importance of vertebral fractures, along with low BMD, as key risk factors for use in patient evaluation [7, 8]. However, whereas BMD measured by dual-energy X-ray absorptiometry (DXA) is widely used in patient evaluation, radiologic assessment of vertebral fractures is not commonly performed, or if performed, is inadequately standardized and interpreted.

Identification and reporting of vertebral fractures

The purpose of this updated document is to raise awareness of the relevance and importance of identification of vertebral fractures, be it on spinal radiographs, lateral DXA scans, or fortuitously from other images. In particular, this update includes new information on the clinical utility of vertebral fracture assessment (VFA) by DXA imaging. In addition to a review of osteoporosis, the document includes a detailed description of methods to differentiate vertebral fractures from other causes of vertebral deformities. In providing this information, we aim to improve the diagnosis and management of osteoporosis and thus reduce fractures and suffering. Whereas radiographic diagnosis is considered to be the best way to identify and confirm the presence of osteoporotic vertebral fractures in clinical practice, improved image resolution now allows use of DXA images to assess these fractures [9]. In general, the presence and severity of vertebral fractures may be determined using the semi-quantitative (SQ) assessment criteria developed by Genant [10]. In visual SQ assessment (see Figure 1), each vertebra receives a score of either 0, 1, 2, or 3, corresponding to no fracture, or a mild, moderate, or
severe fracture, respectively, based upon the visually apparent degree of vertebral height loss and magnitude of associated vertebral deformities. By understanding the clinical principles of osteoporosis diagnosis and management provided in this document, by adopting the radiologic guidelines for assessing vertebral fractures provided herein and by clearly indicating ‘vertebral fracture’ in the patient’s report, clinicians worldwide can contribute substantially to reducing the consequences of this neglected disease.

Figure 1. Semi-quantitative visual grading of vertebral fractures

Dual-energy X-ray absorptiometry-based vertebral fracture assessment (DXA-based VFA)
Recent advances in DXA technology allow for vertebral fracture assessment (VFA) at the time of a bone densitometry exam (Figure 2). Although DXA-based lateral spine images do not have the spatial resolution of lateral spine radiographs, DXA-based VFA detects moderate to severe radiographic vertebral fractures with high accuracy and reproducibility, and detects mild fractures with modest reliability. VFA at the time of bone densitometry is warranted if the results of the test would reasonably influence therapeutic choices to reduce fracture risk. Follow-up imaging with radiography or computed tomography is advisable if substantial numbers of vertebrae are not evaluable,
if the presence of deformity is uncertain, if abnormalities cannot be ascribed to benign causes, or if deformities are noted in a person with a history of malignancy with potential to metastasize to the spine.

**Figure 2.** Severe vertebral fracture of T12 on VFA thoraco-limbar spine image (center) and radiographs of thoracic spine (left) and lumbar spine (right) [11].

**Key Messages**

- Most vertebral fractures are a complication of low bone mass or osteoporosis and the presence of a vertebral fracture increases the likelihood of subsequent fractures.
- Currently mild and moderate vertebral fractures are often not being recognised and reported, leading to under-diagnosis and under-treatment.
- Radiographic diagnosis is considered the best way to identify and confirm the presence of vertebral fractures in clinical practice.
- State-of-the-art DXA-based Vertebral Fracture Assessment (VFA) is nearly as accurate as radiographs in detecting fractured vertebra.
- DXA-BMD can be performed to diagnose osteoporosis and DXA-VFA can be performed to detect vertebral fractures at the same clinical visit.
- All vertebral fractures identified should be reported as **FRACTURED** to avoid ambiguity caused by other terminology.
- Early radiographic diagnosis followed by appropriate therapy will help prevent subsequent fractures.
Action is needed by radiologists & clinicians to ensure

- Recognition of vertebral fractures using radiography, DXA-based VFA and other spinal imaging techniques
- Reporting as FRACTURED to avoid ambiguity
- These actions will help patients receive effective treatment and prevent subsequent fractures

References

About the International Osteoporosis Foundation (IOF)
The International Osteoporosis Foundation is a not-for-profit, non-governmental organization dedicated to the worldwide fight against osteoporosis, the disease known as "the silent epidemic". IOF was founded in 1998 following a merger of the European Foundation for Osteoporosis and the International Federation of Societies for Skeletal Diseases. IOF’s members - scientific researchers (CSA), patient, medical and research societies and industry representatives from around the world - share a common vision of a world without osteoporotic fractures. With headquarters in Switzerland, IOF currently includes 196 member societies in 92 countries, regions and territories. The Foundation works with its members to advance the understanding of osteoporosis and to promote prevention, diagnosis and treatment of the disease worldwide. Among its numerous programs and activities, IOF mobilizes the global osteoporosis movement on World Osteoporosis Day every year and organizes the IOF World Congress on Osteoporosis and the IOF World Wide Conference of Osteoporosis Patient Societies every two years. Furthermore, IOF’s highly regarded educational programs and training courses make an important contribution to health professional awareness of osteoporosis and its management.

For more information about IOF visit [www.iofbonehealth.org](http://www.iofbonehealth.org)

*Members of the IOF CSA Bone Imaging Working Group:
Judith Adams
Claude Arnaud
Neil Binkley
Mary L Bouxsein
Daniel Chappard
Roland Chapurlat
Juliet E Compston
Adolfo Diez-Perez
CSA Chair: Cyrus Cooper; CSA Coordinator: Denys Wahl

Jean-Pierre Devogelaer
Hans Peter Dimai
Dieter Felsenberg
Harry K Genant
Claus C Glüer
Didier Hans
Sarah Lekamwasam
Leon Lenchik
Paul D Miller
Osvaldo Daniel Messina
Nick Pocock
Christian Roux
Philip Sambrook
John Schousboe
Pawel Szulc
Tamara Vokes