

Appropriate Use of Lateral Vertebral Assessment

Kenneth G. Faulkner Ph.D., Chief Scientist, GE Lunar

Introduction

Osteoporosis is a disease characterized by low bone density leading to an increase in risk for fracture. Presence of the disease in its early phase is most easily detected by a bone density exam. However, severe osteoporosis will often present clinically as a low trauma fracture of the spine, hip, forearm, or ribs. When osteoporosis is left undetected (and untreated) until a fracture occurs, the opportunity to prevent the first clinical consequence of the disease is lost. Once an osteoporotic fracture occurs, the risk for subsequent fracture increases dramatically.

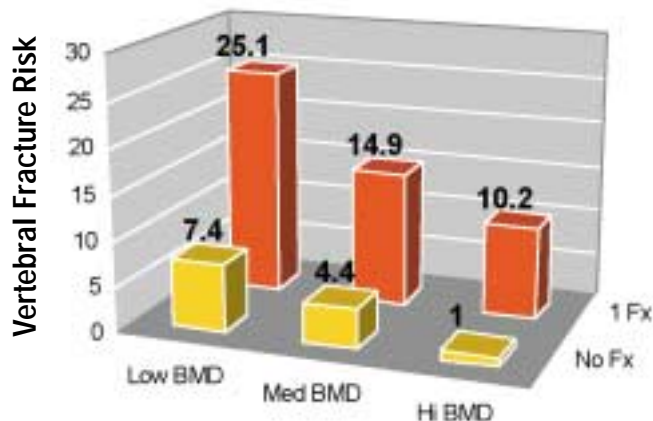


Fig. 2: Difference in vertebral fracture risk between subjects with and without an existing vertebral fracture (Ross et al, *Ann Intern Med* 114(11):919-923, 1991).

As with any disease prevention, early detection is important. For example, in the case of hypertension, blood pressure measurements are used to assess the presence of disease before a stroke occurs. In

many cases, a low trauma fracture in an elderly individual can be readily attributed to some form of osteoporosis, though the clinician still needs to determine if the disease is related to a secondary cause.

For vertebral fracture, data are clear that an existing fracture increases risk for subsequent fractures 3 to 10 times, independent of bone density [1-5]. Individuals with an existing fracture and low BMD are 25 times more likely to fracture than those with normal BMD and no fracture [1]. A patient with multiple vertebral fractures and low BMD has a 75-fold increase in risk for subsequent fractures [1]. Vertebral fracture also increases the risk for subsequent fracture of the hip [6].

Recent studies have shown that a postmenopausal woman who suffers a vertebral fracture has a 19% risk of a second vertebral fracture in the next year [7]. Therefore, knowing whether or not a patient has an existing vertebral fracture can have a profound influence on the clinical management of that patient. The National Osteoporosis Foundation recognizes that in the presence of a vertebral fracture alone, the risk for subsequent fracture in elderly woman is sufficient to warrant treatment even without a bone density test [8].

Identification of Vertebral Fractures

Many vertebral fractures are clinically undetected. The back pain of a vertebral fracture is often attributed to other causes and may not be severe enough to require a physician visit. Epidemiological studies have shown that as many as half of vertebral fractures are not diagnosed [2]. Today, the standard for the diagnosis of a vertebral fracture requires a set of lateral spine films. Separate thoracic and lumbar films are needed to account for the considerable differences in soft tissue attenuation between

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the two regions. Lateral spine films are commonly requested when a vertebral fracture is suspected based on history of back pain or height loss. However, spine films expose patients to moderate levels of radiation (approximately 100 times a bone density test). In addition, spine films cannot accurately measure bone density, nor do they easily allow for computer aided evaluation of vertebral heights. Fortunately, all of these features can be performed with newer dual x-ray absorptiometry (DXA) systems.

Lateral Vertebral Assessment (LVA)

The use of a bone densitometer for lateral imaging of the spine has been available for several years. Originally, lateral spine measurements were investigated as a BMD measurement tool, allowing for density assessment of the vertebral bodies without the influence of the non-weight bearing posterior elements. However, lateral BMD has not been shown to have value either for diagnosis or monitoring the skeleton.



Dual Energy LVA images from a normal subject and a patient with a T12 fracture

While BMD measurement of the lateral spine is not recommended for clinical use, an extended lateral view scan can be useful for assessing

vertebral fracture status. This technique, called Lateral Vertebral Assessment (LVA), uses the DXA system as a digital x-ray imaging device, but with the advantages of parallel beam geometry. Conventional spine films suffer from distortions at the film edges, where the x-ray beam strikes the vertebral body at an angle due to the cone beam geometry of the system. With the fan-beam scanning geometry of the DXA system, the x-ray beam and detector are parallel to the disc space at all vertebral levels. This facilitates both visual fracture assessment and measurement of vertebral heights.

Using a DXA system for assessing vertebral fracture status has several advantages. The evaluation of spine fractures can be performed without a conventional lateral spine x-ray. This can be done at the same time and at the same place as the BMD measurement, with much less radiation than a conventional spine x-ray. The scanner acquires a single image from the upper thoracic to the lower lumbar spine. By using dual energy techniques, the system compensates for soft tissue differences between the lungs and abdomen so the entire spine can be visualized in a single image. The images themselves are digital, so they can be stored on a computer for display and analysis.

Despite the advantages, there are still several questions regarding the use of DXA systems for vertebral fracture assessment. These include:

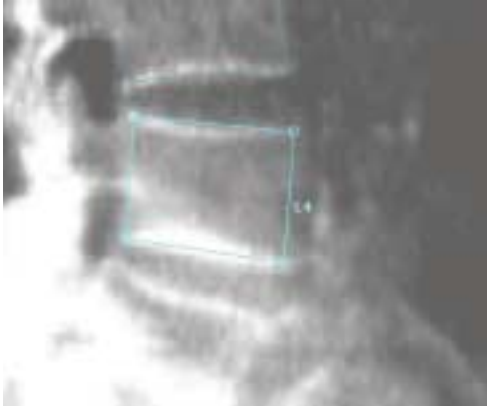
- How does vertebral assessment with a DXA system compare to spine radiographs for fracture detection?
- Which patients should be considered for an LVA exam?
- Can LVA procedures be reimbursed?

Appropriate use of vertebral assessment requires an understanding of the answers to these important questions.

How does Lateral Vertebral Assessment compare to spine radiographs?

LVA has several important advantages compared to spinal radiographs for assessing vertebral fractures. These include:

- A single digital image of the entire spine. Conventional radiographs require separate thoracic and lumbar films to adjust for differences in soft tissue density in each region.



Dual Energy LVA images from a normal subject and a patient with a T12 fracture

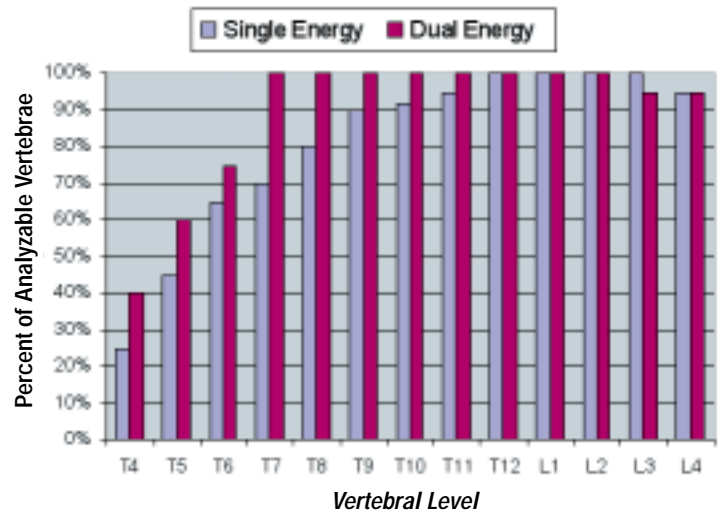
- Parallax effects are limited with DXA beam geometry. With limited angle fan beam densitometers, the parallax effects seen in standard spine x-rays are virtually eliminated, as the beam is kept perpendicular to the spine throughout the image acquisition.
- Digital acquisition and storage. LVA is a fully digital image, allowing complete control for viewing and analysis. Vertebral heights can be measured using morphometry software available on DXA systems, allowing precise quantitation of vertebral deformations. Images are DICOM compatible for easy electronic storage and access.
- Point of care availability. LVA exams can be performed together with bone density measurements, eliminating the need for x-ray referrals.
- Low radiation dose. LVA scans give only a small fraction (1/100th) of the dose for standard radiographs.
- Combined dual and single energy images. Optimal results for vertebral fracture assessment are obtained by the acquisition of both single energy and dual energy scans.

However, vertebral assessment with a DXA system has important limitations. First, a densitometry image has lower resolution than a standard x-ray. Also, the field of view with LVA is somewhat narrower than with an x-ray. As a result, it is possible that an LVA image may not reveal other pathology (such as an abdominal aneurysm or tumor) that would be apparent on an x-ray.

LVA has limitations for measuring the upper thoracic spine [9-14]. Standard radiographs

typically visualize all vertebral bodies up to T4. With dual energy vertebral scans, 97% of vertebral bodies are analyzable to T7, with an average of 1.5 of 13 not analyzable scan [11-13]. Single energy images are more susceptible to 'lost' vertebrae than dual energy images [11]. The combination of single and dual energy images provides the best performance, decreasing the number of unanalyzable vertebrae per image to less than 1 [11]. Individuals with high body mass index (above 30 kg/m²) are more likely to have unanalyzable images.

For identifying vertebral fractures, vertebral assessment has been shown to have an overall sensitivity of 68% compared to a radiologist's read of a spine film [11]. Of the 32% of vertebral fractures that were missed, 12% were unanalyzable on the DXA image while 20%



Performance of dual and single energy DXA images for vertebral assessment. From Rea et al, Osteoporosis Int 8:177-183, 1998

were classified as normal on the scan but fractured on the x-ray. The majority of missed fractures were classified as mild (grade 1) on the films. For moderate to severe fractures (grades 2 and 3), sensitivity has been reported as 79.0%. In other words, LVA can be expected to capture 4 out of 5 moderate to severe vertebral fractures. It is rare that a fracture identified by vertebral assessment is not confirmed by spinal x-ray. Only 1.5% of vertebrae identified as normal by x-ray were misclassified as fractured by the DXA image [11].

Based on these data, it is clear that the lateral spine x-rays will remain the standard for vertebral fracture detection [14]. Yet in

situations where a spine x-ray is not available, an LVA image has sufficient utility to serve as a quick screening tool, particularly for moderate to severe fractures [14]. Although there is a potential for missing some fractures with LVA, the fracture would usually not have been detected anyway. Today, spine films are not routinely ordered unless there is a clinical indication, and many of these fractures are asymptomatic. If LVA does detect a fracture, the specificity is very high. A vertebral body classified as deformed by vertebral assessment will be confirmed to be fractured by x-ray the vast majority (>98%) of the time. In the case of equivocal LVA results, or if a large number of vertebrae are not analyzable, spine films should be performed for an accurate assessment of vertebral fracture status.

Which patients should have an LVA exam?

The National Osteoporosis Foundation treatment guidelines use the presence of a vertebral fracture as the first step in making treatment decisions [8]. In populations where osteoporosis treatment is a possibility, knowledge of vertebral fracture status is therefore important. When deciding who should have an LVA exam, consider both men and women at high risk for fracture based on clinical history. This includes:

- Patients over 65 years of age
- Patients on long-term corticosteroid therapy
- Those with 1.5 inches of height loss

LVA should also be considered for patients with a history of vertebral fracture when confirmatory spine films are not available.

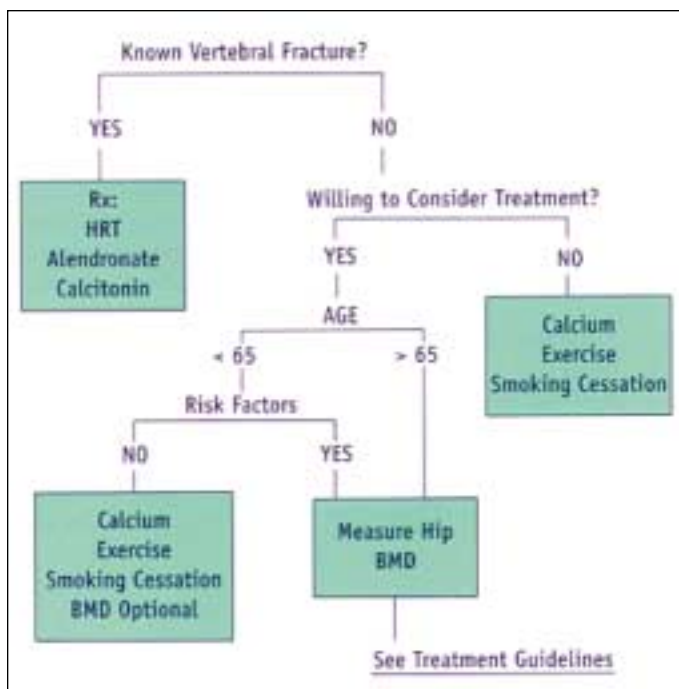
For these high-risk patients, the presence of a vertebral fracture might be expected to affect treatment decisions, even if the BMD is normal. Age is the most important determinant when deciding who to measure, as the prevalence of vertebral fracture increases dramatically after age 65.

With aging, height loss can occur as the result of many factors, including vertebral fracture. Often height loss of an inch or less is the result of postural changes or disk space narrowing and is not indicative of vertebral collapse. Losses of 1.5 inches are more frequently associated with vertebral fracture.

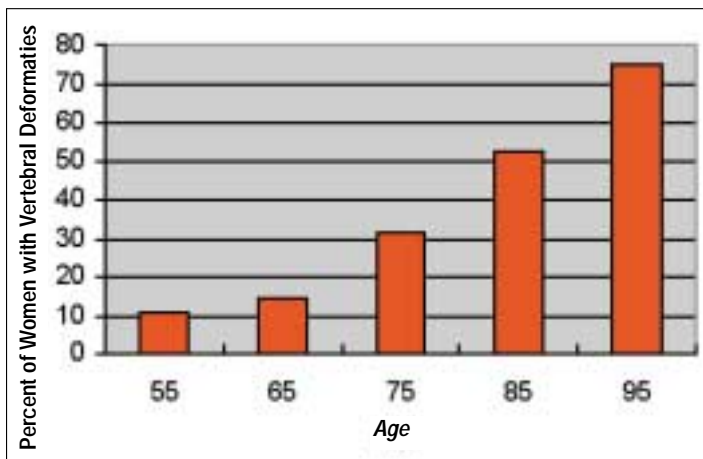
Long-term steroid use is an important risk factor for all osteoporotic fractures. The National Osteoporosis Foundation considers patients on doses of 7.5 mg/day of prednisone or equivalent for more than 3 months candidates for treatment. Knowledge of existing fractures can be extremely important for these individuals. Likewise, individuals starting long-term corticosteroid treatment can benefit both from a bone density test and an LVA exam before initiating therapy.

Can LVA be submitted for reimbursement?

Local insurance carriers determine reimbursement of medical procedures. If the procedure can be documented as safe (that is, FDA cleared), medically necessary, and have clinical utility for the patient, reimbursement will usually be made. Medicare and many private insurance carriers have reimbursed vertebral assessment procedures like a lateral spine x-ray, if the study can be shown to have clinical value and influences the decision pathway. However, other carriers may decline LVA claims if they are unfamiliar with the procedure. At that point, it is the responsibility of the physician to support the clinical utility of the procedure in order to establish a reimbursement policy.



NOF Guidelines for osteoporosis treatment.



Prevalence of Spine Fractures by Age (Melton, *Osteoporosis Int* 3:113-119)

When submitting for reimbursement for LVA, there are several possible CPT codes that describe the LVA procedure. Only one code should be used for billing; the best code to use should be determined together with the local insurer. The most common codes include:

72020 Radiologic examination, spine, single view, specify level

76075-22 Dual energy x-ray absorptiometry (DEXA), bone density study, one or more sites; axial skeleton (eg, hips, pelvis, spine). Note: The unusual procedure modifier (-22) indicates that the service provided is greater than that usually required for the listed procedure. A report may also be appropriate.

72080-52 Radiologic examination, spine; thoracolumbar, two views. Note: The reduced services modifier (-52) indicates only a single view was performed.

76499 Unlisted diagnostic radiologic procedure.

If a claim is only partially reimbursed or denied, the insurer will identify why the action was taken. If there is any missing or erroneous information, resubmit the claim with the requested corrections. The first time reimbursement for LVA is sought from a carrier, it may be required to prove medical necessity for the procedure. In this case, be sure to include information on why the LVA procedure is medically necessary, as well as information on the patient's medical history that support the use of LVA.

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