Vertebral Fracture Assessment

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DESCRIPTION

Vertebral fracture assessment (VFA) with densitometry is a technique to assess vertebral fractures (e.g., thoracic and lumbar spine) at the same time as bone mineral density (BMD), using additional software with dual-energy x-ray absorptiometry (DXA). Screening for vertebral fractures can be done at the same time a subject is undergoing assessment of BMD The addition of VFA to BMD may augment diagnostic information on fracture risk.

Vertebral fractures are highly prevalent in the elderly population. Most vertebral fractures are asymptomatic when they first occur and often go undiagnosed for many years. Only 20-30% of vertebral fractures are recognized clinically, the rest are discovered incidentally on lateral spine radiographs.

Lateral spine radiographs have not been recommended as a component of risk assessment for osteoporosis because of the cost, radiation exposure, and the fact that the radiograph would require a separate procedure in addition to the bone mineral density (BMD) study

using dual-energy x-ray absorptiometry (DXA). However, several densitometers with specialized software can perform vertebral fracture assessment (VFA) in conjunction with DXA. The lateral spine scan is performed by using a rotating arm. Depending on the densitometer used, the patient can either stay in the supine position after the bone density study or is required to move to the left decubitus position.

Vertebral fracture assessment differs from radiologic detection of fractures because VFA uses a lower radiation exposure and can detect only fractures, while traditional radiograph images can detect other bone and soft tissue abnormalities in addition to spinal fractures. Manufacturers have also referred to this procedure as instant vertebral assessment, radiographic vertebral assessment, dual-energy vertebral assessment, or lateral vertebral assessment.

For both lateral spine radiographs and images with densitometry, vertebral fractures are assessed visually. A number of grading systems have been proposed, and the Genant semiquantitative method is commonly used. This system grades deformities from I to III, with grade I (mild) representing a 20% to 24% reduction in vertebral height, grade II (moderate) representing a 25% to 39% reduction in height, and grade III (severe) representing a 40% or greater reduction in height. The location of the deformity within the vertebrae may also be noted. For example, if only the mid-height of the vertebrae is affected, the deformity is defined as an endplate deformity; if both the anterior and mid-heights are deformed, it is a wedge deformity; and if the entire vertebrae is deformed, it is classed as a crush deformity. A vertebral deformity of at least 20% loss in height is typically considered a fracture. Accurate interpretation of both lateral spine radiographs and VFA imaging depends on radiologic training. Thus, device location and availability of appropriately trained personnel may influence diagnostic accuracy.

Vertebral Fracture Assessment

Clinical Context and Test Purpose

Vertebral fractures are highly prevalent in the elderly population, and epidemiologic studies have found that these fractures are associated with an increased risk of future spine or hip fractures independent of bone mineral density (BMD).

The purpose of performing vertebral fracture assessment (VFA) using densitometry by dual-energy x-ray absorptiometry (DXA) is to diagnose whether the patient has a vertebral fracture.

The question addressed in this evidence review is whether there is sufficient evidence that screening for VFA using DXA improves the net health outcome in patients at risk of having vertebral fractures compared with alternative approaches.

The following PICO was used to select literature to inform this review.

Populations
The relevant population of interest is individuals at risk of vertebral fractures who are not known to have a fracture at the time of assessment.

Interventions
The relevant intervention of interest is VFA with densitometry using DXA.

Comparators
The following tools and tests are currently being used to make decisions about managing patients at risk for vertebral fracture: Dual-energy x-ray absorptiometry alone for the assessment of BMD as well as spine radiography. Radiography is used to confirm the occurrence of vertebral fractures but is not recommended as a routine component of osteoporosis assessment because of radiation exposure.

Outcomes
Outcomes of interest for diagnostic accuracy include test accuracy and test validity (eg, sensitivity, specificity). The primary outcome of interest for clinical utility is morbid events, specifically the incidence of future clinical fractures.

Vertebral fracture assessment with densitometry by DXA would occur at the time of osteoporosis screening. The recommended age at which to start screening with DXA and the frequency of screening is addressed in national guidelines.

Clinically Valid
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

Clinically Useful
A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, more effective therapy, or avoid unnecessary therapy or testing.

(2017) Malgo et al. compared VFA with DXA to conventional spine radiography and published evidence comparing VFA with DXA to conventional spine radiography from a fracture liaison service (FLS) and meta-analysis of comparative studies. The FLS retrospective diagnostic study included 542 consecutive subjects (25% male) aged 50 years or older assessed for vertebral fractures and osteoporosis between 2012 and 2014 with both VFA and conventional radiography. The diagnostic accuracy of VFA was calculated using conventional radiography as a reference, and observers were blinded to the VFA findings. Normal BMD was reported in 11% of subjects. The sensitivity of VFA with DXA to detect a vertebral fracture greater or equal to Genant grade 2 was 77% and its specificity was 80%. A meta-analysis of 16 studies including 3238 subjects (19% male) with low to intermediate risk of bias revealed a pooled sensitivity of 84% (95% confidence interval [CI], 72% to 92%) and specificity of 90% (95% CI, 84% to 94%).

Reviewers did not report separate analyses for the diagnostic accuracy of VFA with DXA in patients at low- versus high-risk of osteoporosis. While the meta-analysis suggests adequate diagnostic performance of VFA with DXA for the detection of vertebral fractures, the study authors caution that these findings could not be replicated in their FLS center.

(2016) Lee et al. published a systematic review of studies and they included studies with postmenopausal women and/or men 50 years and older that compared the diagnostic accuracy of VFA with DXA with spinal radiography. Seventeen studies met selection criteria; 5 were excluded because of an inadequate description of methods or results. Of the remaining 12 studies, 4 examined postmenopausal women, 5 included osteoporotic patients (men and women), and 2 included both populations. Studies were heterogeneous, and thus reviewers did not pool study findings. Among the 8 studies that reported findings on a per-vertebral level, the sensitivity of VFA with DXA ranged from 70% to 93% and the specificity ranged from 95% to 100%. Nine studies reported findings on a per-patient level. Sensitivity ranged from 65% to 100% and specificity from 74% to 100%. Reviewers did not report separate analyses for the diagnostic accuracy of VFA with DXA in osteoporotic versus non-osteoporotic patients. The author's concluded VFA had moderate sensitivity and high specificity for detecting VF when compared with spinal radiography. However, the present findings are insufficient to assess whether spinal radiography should be replaced by VFA.

(2013) Domiciano et al. completed a systematic review and judged to have a low risk of bias was published by the authors reported on 429 adults at least 65 years old who had VFA with densitometry and spine radiography on the same day. On VFA, vertebral fractures were identified in 77 (29.7%) of 259 women and in 48 (28.2%) of 170 men. Comparable numbers on spine radiographs were 74 (28.6%) of 259 women and 52 (30.6%) of 170 men. Compared with spine radiography, the sensitivity of VFA was 81.7% (95% CI, 73.9% to 88.1%) and the specificity was 92.7% (95% CI, 9.2% to 95.4%). In conclusion, for community-dwelling older adults, VFA and radiographs had comparable performances in identifying vertebral fractures, particularly if mild deformities are excluded. Therefore, this methodology is a feasible and promising alternative to improve the management of patients with a high risk of osteoporotic fractures. The authors confirmed, vertebral visibility in the upper thoracic spine (above T7) is the main limitation of VFA due to the restricted image resolution of the DXA device in this region. This was also true for radiographic assessment, although to a lesser extent. This limitation does not seem to a significant disadvantage since most vertebral fractures were located at the mid-lower thoracic and lumbar spine, where there is good visibility reinforcing the notion that VFA by DXA remains an important tool for clinical practice based on the high positive predictive value.

(2008) The diagnostic performance of VFA with DXA has tended to be lower in older studies. For example, Ferrar et al. evaluated the performance of vertebral assessment using a visual algorithm-based approach. Subjects in the low-risk group were women ages 55 to 79 years who were randomly selected from their general practitioners' offices.

Most had a normal BMD or were osteopenic. Subjects in the high-risk group were recruited after a low-trauma fracture to the hip, forearm, or humerus. Most high-risk patients had osteopenia or osteoporosis. In the per-patient analysis and including all poor or unreadable images, the sensitivity of VFA was 60% in the low-risk group and 81% in the high-risk group; specificity was 97% in both groups.

(2005) Binkley et al. compared VFA (GE Lunar densitometer) with radiography in 27 osteoporotic, 38 osteopenic, and 15 normal women. Blinded analysis correctly identified 17 of 18 radiographically evident grade 2 to 3 fractures (false-negative rate, 6%). The study did not describe whether the grade 2 or 3 fractures were found in women with osteoporosis, osteopenia, or normal BMD. Also, only 11 (50%) of 22 grade 1 fractures were identified. Thirty vertebrae were classified as fractured when no fractures were present (38% false-positive), 29 of these were grade 1 fractures by VFA with normal radiography. Also, VFA identified 40 grade 1 fractures, but only 11 (28%) were true-positive results. Also problematic is that results were compared only in vertebrae evaluable by VFA; 1 patient could not be evaluated due to poor image quality, and 66% of T4 to T6 vertebrae in other subjects could not be adequately visualized.

Section Summary: Clinically Valid
Several studies have compared VFA with radiography, and they were evaluated in a 2016 systematic review. The sensitivity of VFA compared with standard radiography reported in these studies varied. More recent studies have also reported higher diagnostic accuracy than older studies (i.e., sensitivities in the 80% to 99% range and specificities over 90%). No RCTs comparing health outcomes in individuals screened with VFA plus bone densitometry using DXA with those screened with bone densitometry using DXA alone were identified.

Chain of Evidence
Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

A chain of evidence for the clinical utility of VFA screening is based on evidence that VFA identifies appropriate candidates for treatment who would not otherwise be identified, and there is evidence that treatment in this population is beneficial. The chain involves evaluating:

(1) evidence that VFA is accurate,
(2) evidence that VFA identifies appropriate candidates for treatment who would not otherwise be identified
(3) evidence that treatment in this population is beneficial.

The National Osteoporosis Foundation (NOF; 2014) guidelines have recommended considering the U.S. Food and Drug Administration (FDA) approved medical treatment for the following groups of patients:

- "In those with hip or vertebral (clinical or asymptomatic) fractures

- In those with T-scores ≤ -2.5 at the femoral neck, total hip or lumbar spine by DXA
- In postmenopausal women and men aged 50 and older with low bone mass (T-score between -1.0 and -2.5, osteopenia) at the femoral neck, total hip, or lumbar spine by DXA and a 10-year hip fracture probability ≥ 3% or a 10-year major osteoporosis-related fracture probability of ≥ 20% based on the USA-adapted WHO [World Health Organization] absolute fracture risk model (Fracture Risk Algorithm [FRAX]...)"
  (*The World Health Organization algorithm is available online.)*

Because individuals with osteoporosis (T score, ≤ -2.5) diagnosed by DXA and individuals with low bone mass and other risk factors for fracture would be treated regardless of vertebral fractures, any incremental benefit using a VFA-inclusive strategy would accrue in the population without osteoporosis.

Vertebral Fracture Assessment to Identify Candidates Who Would Not Otherwise Be Identified

Vertebral fracture assessment has been used to identify candidates for treatment when patients with vertebral fractures do not fall into one of the other established categories. Few studies were identified that specifically dealt with whether VFA could identify candidates for medication treatment who would not otherwise have been identified but several studies are somewhat informative. Representative studies with larger sample sizes are described next.

(2020) Yang et al. conducted a systematic review and meta-analysis of 28 studies evaluating detection of vertebral fractures via VFA with DXA in asymptomatic postmenopausal women. Study sample sizes ranged from 63 to 5156 and mean age ranged from 59.5 to 86.2 years. Among women who had prevalent vertebral fractures, 11.1% to 43% had osteopenia and 3.6% to 32% had normal BMD. The weighted pooled prevalence of VFA-detected vertebral fractures was 28% (95% CI, 23% to 32%) with a high degree of heterogeneity (I^2=98.89%; p<.001). The authors concluded, VFA is able to identify prevalent VF in asymptomatic postmenopausal women. The use of VFA identified an average of 28% of asymptomatic women with VFs, many of whom did not have a diagnosis of osteoporosis. Implementation of VFA as a routine screening tool may detect high risk women. Detection of VF might lead to pharmacological treatment in individuals who may not otherwise be treated. A separate subgroup analysis for women with normal bone density was not conducted.

(2014) Kanterewicz et al. in Spain collected data on a population-based cohort of 2968 postmenopausal women between the ages of 59 and 70 years. A total of 127 (4.3%) women had a vertebral fracture according to VFA. Among them, 48.0% had osteoporosis, and 42.5% had osteopenia. Moreover, 42.5% had previous fragility fractures, and 34.6% had a first-degree family history of fractures. Thus, VFA could identify women who would be eligible for fracture prevention therapy according to NOF guidelines (i.e., women who did not have osteoporosis, osteopenia plus a 10-year fracture risk, or other

risk factors). The authors did not attempt to define this subgroup of women with normal BMD and other risk factors. The authors concluded, although the VFA approach showed a lower-than-expected prevalence of VF in our cohort, its association with clinical and densitometric parameters may be useful to identify women at risk for developing fragility fractures and may therefore justify its use in longitudinal studies. The high prevalence of minor vertebral deformities detected in patients with VF indicates the need to evaluate this type of deformity as a risk factor for further skeletal fractures.

(2013) Mrgan et al. in Denmark published a retrospective study evaluating VFA with BMD in 3275 patients presenting for osteoporosis screening or evaluation of anti-osteoporotic medication; 85% were women. Vertebral fractures were found using VFA in 260 (7.9%) patients. Of them, 156 patients (4.8% of the total sample) had osteoporosis (ie, BMD at least -2.5) and 104 (3.2% of the total sample) did not, according to BMD. The data suggested that up to 40% (104/250) of patients with vertebral fractures identified would be eligible for treatment by NOF guidelines and might not have been identified were DXA alone used. Some patients, however, might have had osteopenia and other risk factors that would have led to their eligibility for treatment.

(2013) El Maghraoui et al. in 908 asymptomatic postmenopausal women aged between 50 and 91 years identified vertebral fractures in 63 (28.3%) women with normal BMD (8.5% grade 2 to 3).12, Stepwise regression analysis indicated that the presence of vertebral fractures was independently related to age, low body mass index, multiparity, history of peripheral fracture, and low BMD. It is unclear whether patients were consecutively enrolled in the El Maghraoui studies.

(2012) El Maghraoui et al, published a prospective study evaluating VFA with BMD in 791 asymptomatic men aged between 45 and 89 years with no prior osteoporotic fracture or known diagnosis of osteoporosis in Morocco. In men with normal BMD, a grade 1 to 3 vertebral fracture was identified in 85/262 (32.4%) men. Grade 2 to 3 vertebral fractures were identified in 6.9% of these subjects. Vertebral fractures were also identified in 144/402 (35.8%) men with osteopenia (11.7% grade 2 to 3) and 89/124 (71.8%) men with osteoporosis (37.9% grade 2 to 3). Stepwise regression analysis indicated that prevalence of vertebral fractures was independently related to osteoporotic (OR = 4.761; 95% CI, 2.956 to 7.668) and smoking status (OR = 1.717; 95% CI, 1.268 to 2.323). It is unclear whether patients were consecutively enrolled in the El Maghraoui studies.

(2011) Jager et al. reported on 2424 consecutive patients (65% female) referred for BMD for a variety of reasons at a single center in the Netherlands. Participants underwent VFA with BMD during the same session. Vertebral fractures (reduction in the height of at least 20%) were detected in 541 (22%) patients. The prevalence of vertebral fractures was 14% (97/678) in patients with normal BMD and 21% (229/1100) in patients with osteopenia. Thus, 60.5% (326/541) of the patients with vertebral fracture did not have osteoporosis and would have been eligible for treatment based on NOF guidelines if they did not fall into another eligibility category (e.g., osteopenia with other risk factors). Most fractures had not been identified in the past. The vertebral fractures were previously unknown in

74% of patients with normal BMD and 71% of patients with osteopenia. The authors concluded, VFA is a patient friendly new tool with a high diagnostic yield, as it detected unknown VF in one out of each six patients, with significant impact on management. We believe these findings justify considering VFA in all new patients referred for osteoporosis assessment in similar populations. It was noted limiting the data was moderate and severe fractures only, the prevalence in men was 15% (131/851) and 12% in women (191/1,573).

Pharmacologic Treatment for Vertebral Fracture and Low Bone Mass
Bisphosphonates decrease bone resorption and are the major class of drugs now used to treat osteoporosis.

Several subgroup analyses of large RCTs evaluating the efficacy of bisphosphonates in individuals with low bone mass and/or baseline vertebral fractures have been published. The trials were not designed a priori to assess efficacy according to baseline vertebral fracture status or BMD categories.

(2005) Kanis et al. reanalyzed data on 1802 women at least 5 years postmenopausal from the Vertebral Efficacy with Risedronate Therapy (VERT) trials who were identified on the basis of a prior radiographically detected vertebral fracture regardless of BMD and had radiographs available at baseline and 3 years. Overall, there was a significantly lower rate of a new vertebral fracture in women with prior vertebral fracture randomized to treatment with risedronate (14.5%) than to placebo (22.3%; $p<.001$). In the group with a T score greater than -2.5, the rate of new femoral neck fractures was 50 (11%) of 519 in the risedronate group and 71 (15.5%) of 537 in the placebo group ($p=.049$). In the osteoporotic group, for those with a T score of -2.5 or lower, the rate of new femoral neck fracture was 53 (18.7%) of 355 in the risedronate group and 92 (33.4%) of 318 in the placebo group ($p<.001$). In conclusion, the findings of this study suggest that risedronate is effective in patients identified solely on the basis of a prior fragility fracture and that the efficacy of risedronate in the reduction of vertebral fractures is largely independent of the presence of clinical risk factors for osteoporotic fracture.

(2005) Quandt et al. reanalyzed FIT study data for the outcome of clinical vertebral fractures (symptomatic and diagnosed by a physician) and radiographically detected (assessed at surveillance intervals) vertebral fractures. A total of 3737 women at least 2 years postmenopausal with low bone mass (T score between -1.6 and -2.5) were included in the analysis. Among the women with low bone mass and existing radiographically detected vertebral fractures (n=940), the rate of subsequent clinical vertebral fractures was 6 (a rate of 43/10000 person-years of risk) in the alendronate group and 16 (124/10000 person-years of risk) in the placebo group. Alendronate treatment compared with placebo was accompanied by an RR of 0.3 (95% CI, 0.1 to 0.8) for clinical vertebral fractures and an RR of 0.5 (95% CI, 0.3 to 0.8) for radiographically detected fractures. Similar risk estimates were found for women having low bone mass without vertebral fractures, but absolute risks were lower (12 vs. 81 fractures per 10000 person-years for

those without and with baseline fractures, respectively). Severe skeletal site (femoral neck or lumbar spine) was used for stratification.

No RCTs were identified that evaluated the efficacy of bisphosphonate treatment in men with vertebral fractures and low bone density. Several trials have evaluated whether bisphosphonate treatment increases BMD in men at risk for bone loss (e.g., on androgen deprivation therapy). However, vertebral fractures were not assessed and, therefore, conclusions cannot be drawn about the potential benefit of VFA added to densitometry in at-risk men.

Section Summary: Pharmacologic Treatment for Vertebral Fracture and Low Bone
Mass routine use of VFA with DXA will identify substantial numbers of individuals with previously unrecognized vertebral fractures. Many of these vertebral fractures are found in individuals without osteoporosis. Data are limited on how many of the vertebral fractures in non-osteoporotic individuals were in individuals who would not otherwise be eligible for treatment (i.e., those with osteopenia and other risk factors for fracture).

Evidence from the FIT and VERT studies has suggested that treatment of individuals with low bone mass (but not osteoporosis) reduces further fractures. However, the FIT and VERT studies were post hoc subgroup analyses, which are considered to be exploratory. Also, vertebral fracture screening was done using radiography rather than VFA software. Advantages of the studies are that the 2 subgroup re-analyses had large sample sizes and used data from well-conducted randomized trials. Currently, this chain of evidence is insufficient to determine whether treatment of individuals with low bone density and vertebral fractures improves net health outcomes.

Summary of Evidence
For individuals who are at risk of having vertebral fractures but are not known to have them who receive vertebral fracture assessment (VFA) with densitometry by DXA, the evidence includes diagnostic accuracy studies and subgroup re-analyses of treatment studies. Relevant outcomes are test accuracy, test validity, and morbid events. This technique may help in screening individuals, but technological improvements are necessary to improve image quality. There is a lack of direct evidence from screening trials that use of densitometry with vertebral fracture assessment (VFA) improves health outcomes. Because direct evidence was not available, a chain of evidence was sought. Evidence was examined on the diagnostic accuracy of vertebral fracture assessment (VFA) in non-osteoporotic individuals (i.e., those not already eligible for treatment), the ability of vertebral fracture assessment (VFA) to identify individuals for treatment who would not otherwise be identified, and the effectiveness of treatment in this population. Studies tended to use radiography as the reference standard and did not evaluate potential false positives or false negatives associated with radiography. Diagnostic accuracy studies have reported variable findings; recent studies have suggested higher diagnostic accuracy of vertebral fracture assessment (VFA) overall compared with standard radiographs than older studies. Studies have found that vertebral fracture assessment (VFA) can identify individuals without osteoporosis who may be appropriate candidates

for treatment according to recommendations from the National Osteoporosis Foundation. None of these reported findings separately for osteoporotic and non-osteoporotic individuals, so conclusions cannot be drawn about diagnostic accuracy of VFA in individuals without osteoporosis. If a vertebral fracture is identified in an asymptomatic individual, studies do not report the impact of that finding on long-term health outcomes. There is limited evidence on the effectiveness of treatment in this population. There is no clear guidance for the treatment of asymptomatic vertebral fractures with normal BMD and whether or not anti-resorptive therapy would improve the fracture risk in individuals with normal or near normal bone mineral density. Additionally, no treatment data have been published on individuals whose vertebral fractures were identified using vertebral fracture assessment (VFA) software with densitometry. The evidence is insufficient to determine that the technology results in an improvement in the net health outcomes.

Practice Guidelines and Position Statements

American College of Physicians
(2017) The American College of Physicians' guidelines on the treatment of low bone density or osteoporosis include the following recommendations:

Recommendation	GOE	QOE
"ACP recommends that clinicians offer pharmacologic treatment with bisphosphonates to reduce the risk for vertebral fracture in men who have clinically recognized osteoporosis."	Weak	Low
"ACP recommends that clinicians should make the decision whether to treat osteopenic women 65 years of age or older who are at a high risk for fracture based on a discussion of patient preferences, fracture risk profile, and benefits, harms, and costs of medications."	Weak	Low

ACP: American College of Physicians; GOE: grade of evidence; QOE: quality of evidence. (*Accessed April 2022*)

Endocrine Society
(2019) The Endocrine Society Clinical Practice Guideline on pharmacological management of osteoporosis in postmenopausal women states four management principles:

- "(i) The risk of future fractures in postmenopausal women should be determined using country-specific assessment tools to guide decision-making.
- (ii) Patient preferences should be incorporated into treatment planning.
- (iii) Nutritional and lifestyle interventions and fall prevention should accompany all pharmacologic regimens to reduce fracture risk.
- (iv) Multiple pharmacologic therapies are capable of reducing fracture rates in postmenopausal women at risk with acceptable risk-benefit and safety profiles." (*Accessed April 2022*)

International Society for Clinical Densitometry (ISCD)
(2019) The International Society for Clinical Densitometry provided recommendations for selecting patients VFA:

- Lateral spine imaging with either standard radiography or densitometric VFA is indicated for patients with a T score of less than -1.0 when at least 1 of the following factors are present:
  - "Women age ≥70 years or men ≥80 years
  - Historical height loss > 4 cm (> 1.5 inches)
  - Self-reported but undocumented prior vertebral fracture
  - Glucocorticoid therapy equivalent to ≥5 mg of prednisone or equivalent per day for ≥3 months." (*Accessed April 2022*)

National Osteoporosis Foundation (NOF)
(2014) The National Osteoporosis Foundation's guide to the prevention and treatment of osteoporosis states:

- "Although the majority of vertebral fractures are initially clinically silent, these fractures are often associated with symptoms of pain, disability, deformity, and mortality. Postural changes associated with kyphosis may limit activity, including bending and reaching. Multiple thoracic fractures may result in restrictive lung disease, and lumbar fractures may alter abdominal anatomy, leading to constipation, abdominal pain, distention, reduced appetite, and premature satiety. Vertebral fractures, whether clinically apparent or silent, are major predictors of future fracture risk, up to 5-fold for subsequent vertebral fracture and 2- to 3-fold for fractures at other sites."
- The guide recommends that vertebral imaging tests be considered in the following patients:
  - "All women age 70 and older and all men age 80 and older if BMD T-score is ≤−1.0 at the spine, total hip, or femoral neck
  - Women age 65 to 69 and men age 75 to 79 when BMD [bone mineral density] T-score is -1.5 or below at the spine, total hip, or femoral neck.
  - Postmenopausal women age 50 and older with specific risk factors:
    - Low-trauma fracture during adulthood (age 50 and older)
    - Historical height loss (difference between the current height and peak height at age 20) of 1.5 in. or more (4 cm)
    - Prospective height loss (difference between the current height and a previously documented height imeasurement of 0.8 cm in. or more (2 cm)
    - Recent or ongoing long-term glucocorticoid treatment
      - If bone density testing is not available, vertebral imaging may be considered

  (*Accessed April 2022*)

North American Menopause Society (NAMS)
(2021) The North American Menopause Society's position statement on management of osteoporosis did not include a recommendation for or against VFA as part of the screening process.

- States a height loss of 1.5 in or more increases the likelihood that vertebral fracture is present calls for an evaluation by a lateral thoracolumbar radiograph or vertebral fracture assessment by DXA to identify asymptomatic compression vertebral fractures. (*Accessed April 2022*)

U.S. Preventative Services Task Force
(2018) The U.S. Preventive Services Task Force updated its recommendations on screening for osteoporosis to prevent fractures. The recommendations included:

- Screening for osteoporosis with bone measurement testing to prevent osteoporotic fractures in women 65 years and older. (Grade B)
- Screening for osteoporosis with bone measurement testing to prevent osteoporotic fractures in postmenopausal women younger than 65 years who are at increased risk of osteoporosis, as determined by a formal clinical risk assessment tool. (Grade B)
- Current evidence is insufficient to assess the balance of benefits and harms of screening for osteoporosis to prevent osteoporotic fractures in men. (Grade I)

The Clinical Summary: Screening for Osteoporosis to Prevent Fractures defines risk assessment and screening tests as follows:

- Risk Assessment: Risk factors for osteoporotic fractures include parental history of hip fracture, smoking, excess alcohol consumption, and low body w eight. In addition, menopausal status in w omen is also an important consideration. For postmenopausal w omen younger than 65 years w ho have at least 1 risk factor, a reasonable approach to determine w ho should be screened w ith bone measurement testing is to use a clinical risk assessment tool. Several tools are available to assess osteoporosis risk, such as OST, ORAI, OSIRIS, SCORE, and FRAX.
- Screening Tests: The most commonly used test is central dual-energy x-ray absorptiometry (DXA) of the hip and lumbar spine. While several bone measurement tests similarly predict risk of fractures, DXA provides measurement of bone mineral density (BMD), and most treatment guidelines use central DXA to define osteoporosis and the treatment threshold to prevent osteoporotic fractures. Other screening tests include peripheral DXA and quantitative ultrasound (QUS).

  VFA was not specifically mentioned.
  (*Accessed April 2022)*

Joint Guidelines
American Association of Clinical Endocrinologists and the American College of Endocrinology

(2020) The joint guidelines from the American Association of Clinical Endocrinologists and American College of Endocrinology on the diagnosis and treatment of postmenopausal osteoporosis included vertebral facture assessment in the assessment for fracture risk and osteoporosis in postmenopausal women:

- Lateral spine imaging with standard radiography or vertebral fracture assessment in patients with unexplained height loss, self-reported but undocumented prior spine fractures, or glucocorticoid therapy equivalent to ≥ 5 mg of prednisone per day for 3 months or more. (*Accessed April 2022*)

American College of Radiology (ACR), Society for Pediatric Radiology (SPR) & Society of Skeletal Radiology (SSR)

(2018) The ACR, SPR and SSR issued a practice guideline for the performance of dual energy x-ray absorptiometry (DXA) which noted the following information:

- Vertebral fracture assessment (VFA) is a low-dose lateral image of the thoracic and lumbar spine that may be added to a standard DXA to determine whether vertebral fractures are present. VFA should be considered in patients with height loss or back pain who have not been assessed by conventional radiographs, CT, or MRI. VFA is intended solely to identify whether spine compression is present and does not replace conventional diagnostic imaging for other purposes. (*Accessed April 2022*)

Regulatory Status

Vertebral fracture assessment application packages that have received 510(k) marketing clearance are the following devices: *This is not intended to be an all-inclusive list*:

- Instant Vertebral Assessment (IVA) (Hologic, Inc.)
- Dual Energy Vertebral Assessment (DVA) (previously known as Lateral Vertebral Assessment (LVA) (GE Lunar Medical Systems)

Additional software is needed to perform VFA with a densitometer, and it must be cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process. Products cleared for marketing are shown in the table below but the table is not intended to be an all-inclusive list.

Device	Manufacturer	Date Cleared	510(k) No.	Indication
Aria	GE Medical Systems Ultrasound & Primary Care Diagnostics LLC	4/20/2018	K180782	For use in vertebral fracture assessment
GE Lunar DXA Bone Densitometers with enCORE version 16	GE Medical Systems Ultrasound & Primary Care Diagnostics LLC	5/15/2014	K133664	For use in vertebral fracture assessment
GE Lunar DXA Bone Densitometers with enCORE version 17	GE Medical Systems Ultrasound & Primary Care Diagnostics LLC	12/2/2016	K161682	For use in vertebral fracture assessment
GEHC DXA Bone Densitometers with enCORE version 18	GE Medical Systems Ultrasound & Primary Care Diagnostics LLC	9/19/2019	K191112	For use in vertebral fracture assessment

QCT PRO ASYNCHRONOUS CALIBRATION MODULE CLINIQCT™	MINDWAYS SOFTWARE INC.	8/29/2014	K140342	For use in vertebral fracture assessment

PRIOR APPROVAL

Not applicable

POLICY

Screening for vertebral fractures using dual x-ray absorptiometry (DXA or DEXA) as an adjunct to bone mineral density measurement is considered **investigational** due to a lack of evidence demonstrating an impact on improved net health outcomes.

PROCEDURE CODES AND BILLING GUIDELINES

To report provider services, use appropriate CPT* codes, Alpha Numeric (HCPCS level 2) codes, Revenue codes, and/or ICD diagnosis codes.

- 77085 Axial skeleton (e.g, hips, pelvis, spine), including vertebral fracture assessment
- 77086 Vertebral fracture assessment via dual energy X-ray absorptiometry (DXA)

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POLICY HISTORY		
Date	**Reason**	**Action**
April 2022	Annual Review	Policy Revised
April 2021	Annual Review	Policy Renewed
April 2020	Annual Review	Policy Renewed
April 2019	Annual Review	Policy Renewed
April 2018	Annual Review	Policy Renewed
April 2017	Annual Review	Policy Renewed
April 2016	Annual Review	Policy Revised
May 2015	Annual Review	Policy Renewed
June 2014	Annual Review	Policy Revised
August 2013		New Policy

New information or technology that would be relevant for Wellmark to consider when this policy is next reviewed may be submitted to:

Wellmark Blue Cross and Blue Shield
Medical Policy Analyst
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