Osteoporotic vertebral compression fracture

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Epidemiology

Generalized osteoporosis and “osteoporotic vertebral body compression fractures” are interrelated geriatric problems.

Vertebral compression fractures (VCFs) are the most common type of fracture secondary to osteoporosis.

It is found most commonly in post-menopausal white females, and is rare prior to menopause.

The age-standardised annual incidence of vertebral compression fractures (VCF) in osteoporosis is 10.7/1000 in women and 5.7/1000 in men, increasing markedly with age [1)].

With the prevalence of an aging American population on the rise, osteoporotic vertebral fractures are becoming a common occurrence, resulting in an increase in vertebral augmentation procedures and associated complications such as cement leakage, vertebral compressions, and pulmonary embolism.

Risk factors

1. weight<58kg

2. cigarette smoking [2].

3. low-trauma vertebral body fracture in the patient or a first degree relative

4. drugs

a) heavy alcohol consumption

b) AEDs (especially phenytoin)

c) warfarin

d) steroid use:

● bone changes can be seen with 7.5 mg/d of prednisone for >6 months

● VB fractures occur in 30–50%of patients on prolonged glucocorticoids

5. postmenopausal female

6. males undergoing androgen deprivation therapy (e.g. for prostate Ca). Orchiectomy or ≥9 doses of gonadotropin-releasing hormone agonists had a 1.5 fold increase in risk of all fractures [3].

7. physical inactivity

8. low calcium intake

9. low serum levels of vitamin D (which decreases calcium absorption). Lab: serum 25-hydroxyvitamin D [25(OH)D], AKAcalcidiol is the best indicator of vitamin D status.

Factors that protect against osteoporosis include impact exercise and excess body fat.

The causes of thoracolumbar spine fracture are different depending on the patient's age. In younger patients, the fracture is more likely to occur due to high-energy trauma, such as motor vehicle accidents, motorcycle accidents, and falling injuries. However, in the elderly, even falls from a standing position to the ground can cause fractures due to osteoporosis and decreased cognition.

The Osteoporotic Fracture Treatment Score is a tool that helps healthcare professionals assess the risk of future fractures in patients who have already suffered an osteoporotic fracture. The score takes into account several factors that can affect fracture risk, including age, sex, body mass index (BMI), history of prior fractures, and bone mineral density (BMD) measurements.

The OFT Score is used to help guide treatment decisions for patients with osteoporotic fractures,

particularly in determining whether medication therapy is necessary to reduce the risk of future fractures. Patients with a higher OFT Score are considered to be at higher risk for future fractures and may benefit from more aggressive treatment to prevent further bone loss and fractures.

The OFT Score is calculated using a formula that takes into account the patient's age, sex, BMI, BMD T-score, and history of prior fractures. The resulting score ranges from 0 to 100, with higher scores indicating a greater risk of future fractures.

It is important to note that the OFT Score is just one tool used in assessing fracture risk and making treatment decisions for osteoporosis. Other factors, such as comorbidities and medication use, may also need to be considered when determining the best course of treatment for a particular patient.

Classification

The main types of low lumbar OVC were flat-type and concave type, which resulted in neurological symptoms by retropulsed bony fragments generating foraminal stenosis and/or canal stenosis. For patients with low lumbar OVC, decompression of the foraminal and canal stenosis with short fusion surgery via posterior approach can improve neurological symptoms. Since these patients are elderly with poor bone quality and other complications, treatments for both OVC and osteoporosis should be provided to achieve good clinical outcome [4)].

Scales

Vertebral compression fractures, which are commonly associated with older age and osteoporotic fractures, have an increased risk of re-fracture. Therefore, improving balance function is important to prevent falls. The minimal important change (MIC) has been recommended for interpreting clinically meaningful changes in rating scales. The MIC of the Berg Balance Scale for use in older women with a vertebral compression fracture has not been established.

Objective: To identify the MIC of the Berg Balance Scale that can be used in older women with vertebral compression fractures using predictive modeling methods and the receiver operating characteristic (ROC-based) method.

Design: A retrospective longitudinal multicenter study.

Patients: Sixty older women (age 84.1 ± 7.0 years) with vertebral compression fractures who were unable to ambulate independently on a level surface.

Methods: A change of one point in the Functional Ambulation Categories (FAC) was used as an anchor to calculate the MIC of the Berg Balance Scale based on the change between admission and discharge. We calculated the MIC for the women whose FAC score improved by ≥1 point. We used three anchor-based methods to examine the MIC: the ROC-based method (MICROC), the predictive modeling method (MICpred), and the MICpred -based method adjusted by the rate of improvement and reliability of transition (MICadj).

Result: Thirty-nine women comprised the “important change” group based on their FAC score improvement. In this group, the MICROC (95% CI) value of the Berg Balance Scale was 10.0 points (5.5-15.5) with an area under the curve of 0.71. The MICpred (95% CI) value was 9.7 (8.1-11.0), and

the MICadj (95%CI) was 7.0 (5.5-8.5) points.

Conclusion: For women with vertebral compression fracture who are unable to ambulate independently, a 7.0-point improvement in the Berg Balance Scale score may be a useful indicator for reducing the amount of assistance required for walking [5].

Diagnosis

DEXA scan.

Differential diagnosis

Malignant compression fracture

Diffusion Weighted Imaging and standard spine magnetic resonance imaging to differentiate between acute osteoporotic and malignant compression fractures at 3.0 T.

In 62 patients with acute compression fractures. Three radiologists independently interpreted MR images for the presence of malignancy by using conventional MR images alone and in combination with axial DW images with qualitative and quantitative analysis. Apparent diffusion coefficients (ADCs) were measured within solid portion with careful use of a small region of interest (ROI). The Mann-Whitney U test was performed.

There were 30 malignant and 32 acute osteoporotic compression fractures. At qualitative analysis, hyperintensity relative to spinal cord was more frequent in malignant compression fractures than in acute osteoporotic compression fractures (87% vs 22%, respectively; $P < .001$). Median ADCs of malignant fractures were significantly lower than those of benign fractures ($P < .001$). With conventional MR imaging alone, sensitivity, specificity, and accuracy were 100%, 94%, and 97%, respectively, for reader 1; 97%, 78%, and 87% for reader 2; and 100%, 84%, and 92% for reader 3.

With conventional and DW MR imaging combined, sensitivity, specificity, and accuracy were 100%, 97%, and 98% for all three readers. The addition of DW imaging led to correct changes in diagnosis: Reader 1 improved by 1.6% (one of 62 fractures), reader 2 improved by 11% (seven of 62 fractures), and reader 3 improved by 6.5% (four of 62 fractures).

The addition of axial DW imaging to a conventional MR imaging protocol improved diagnostic accuracy in the differentiation of acute osteoporotic from malignant compression fractures by measuring ADCs in the solid portion with careful use of a small ROI [6].

Treatment

see Osteoporotic vertebral fracture treatment.

Outcome

These fractures are associated with significant rates of morbidity and mortality and annual direct medical expenditures of more than $1 billion in the United States. Although many patients will respond favorably to nonsurgical care of their VCF, contemporary natural history data suggest that more than 40% of patients may fail to achieve significant pain relief within 12 months of symptom onset. As a result, percutaneous vertebral augmentation is often used to hasten symptom resolution and return of function. However, controversy regarding the role of kyphoplasty and vertebroplasty in the treatment of symptomatic VCFs exists [7)].

Complications

These fractures can lead to a range of complications, some of which can significantly affect the patient's quality of life.

see Vertebral collapse.

1. **Pain and Disability**

1. **Chronic Pain**: The most common complication is severe back pain, which may become chronic. The pain often results from damage to the vertebral body and associated soft tissue, and can significantly limit movement and mobility.
2. **Decreased Quality of Life**: Ongoing pain may lead to a reduction in the ability to perform daily activities and may contribute to long-term disability.

2. **Spinal Deformity and Postural Changes**

1. **Kyphosis (Dowager's Hump)**: A common consequence of multiple vertebral fractures is the development of kyphosis, where the spine becomes abnormally curved, leading to a hunched or stooped posture. This can further exacerbate pain and limit mobility.
2. **Loss of Height**: Over time, VCFs can cause a loss of vertebral height, which may also lead to a shortening of the torso.

3. **Neurological Complications**

1. **Spinal Cord Compression**: If a vertebral fracture impinges on the spinal cord or nerve roots, it can cause neurological deficits such as numbness, weakness, or even paralysis. While this is relatively rare, it can be a life-threatening complication.
2. **Radiculopathy**: Compression of nerve roots from the fracture can lead to radiculopathy, causing pain, tingling, and weakness in the arms or legs.

4. **Increased Risk of Additional Fractures**

1. **New Fractures**: Patients with osteoporotic VCFs are at a higher risk of developing new fractures, particularly if they continue to have low bone density or fail to receive appropriate treatment. Multiple fractures can compound the deformity and pain.

5. **Pulmonary Complications**

1. **Pulmonary Embolism**: Though rare, bone fragments from a vertebral fracture may enter the

bloodstream and cause a pulmonary embolism, leading to respiratory distress or even death.
2. **Respiratory Issues**: Severe kyphosis can lead to decreased lung capacity and respiratory difficulties, particularly in older adults with other health conditions.

6. **Loss of Mobility and Independence**

1. **Decreased Mobility**: Pain and postural changes often lead to decreased mobility, making it more difficult for patients to walk, stand, or perform activities of daily living.
2. **Increased Risk of Falls**: The deformity and pain from VCFs can also make individuals more prone to falls, leading to additional fractures or complications.

7. **Increased Risk of Mortality**

1. **Long-Term Consequences**: Studies suggest that individuals with multiple osteoporotic fractures, including VCFs, have an increased risk of mortality, partly due to complications such as pneumonia, blood clots, and decreased mobility, which affects overall health.

8. **Psychological Impact**

1. **Depression and Anxiety**: The chronic pain, decreased mobility, and fear of additional fractures can contribute to psychological distress, including depression and anxiety, which can further worsen quality of life.
2. **Social Isolation**: Reduced mobility and fear of further injury can lead to social withdrawal, which may also contribute to depression.

Narrative reviews

To highlight important studies about osteoporotic spinal fractures (OF) that may be integrated into clinical practice based on the assessment of the AO Spine KF Trauma and Infection group key opinion leaders.

Methods: 4 important studies about OF that may affect current clinical practice of spinal surgeons were selected and reviewed with the aim of providing clinical recommendations to streamline the journey of research into clinical practice. Recommendations were graded as strong or conditional following the GRADE methodology.

Results: 4 studies were selected. Article 1: a validation of the Osteoporotic Fracture (OF)-score to treat OF fractures. Conditional recommendation to incorporate the OF score in the management of fractures to improve clinical results. Article 2: a randomized multicenter study comparing romosozumab/alendronate vs alendronate to decrease the incidence of new vertebral fractures. Strong recommendation that the group receiving romosozumab/alendronate had a decreased risk of new OF when compared with the alendronate only group only. Article 3: a systematic literature review of spinal orthoses in the management of. Conditional recommendation to prescribe a spinal orthosis to decrease pain and improve quality of life. Article 4: post-traumatic deformity after OF. A conditional recommendation that middle column injury and pre-injury use of steroids may lead to high risk of post-traumatic deformity after OF.

Conclusions: Management of patients with OF is still complex and challenging. This review provides some recommendations that may help surgeons to better manage these patients and improve their

clinical practice [8].

Case series

A prospective multicenter cohort study (EOFTT) in 17 spine centers. All consecutive patients with Osteoporotic vertebral compression fractures were included. The decision for conservative or surgical therapy was made by the treating physician independent of the OF score recommendation. Final decisions were compared to the recommendations given by the OF score. Outcome parameters were complications, Visual Analogue Scale, Oswestry Disability Index, Timed Up and Go test, EQ-5D-5L , and Barthel Index.

In total, 518 patients (75.3% female, age 75 ± 10) years were included. 344 (66%) patients received surgical treatment. 71% of patients were treated following the score recommendations. For an OF score cut-off value of 6.5, the sensitivity and specificity to predict actual treatment were 60% and 68% (AUC .684, P < .001). During hospitalization overall 76 (14.7%) complications occurred. The mean follow-up rate and time were 92% and 5 ± 3.5 months, respectively. While all patients in the study cohort improved in clinical outcome parameters, the effect size was significantly less in the patients not treated in line with the OF score's recommendation. Eight (3%) patients needed revision surgery.

Patients treated according to the OF score's recommendations showed favorable short-term clinical results. Noncompliance with the score resulted in more pain and impaired functional outcome and quality of life. The OF score is a reliable and save tool to aid treatment decision in OVCF [9]

The aim of a study was to evaluate the efficacy and safety of modified posterior vertebral column resection (PVCR) combined with anterior column restoration in elderly patients presenting with thoracic or osteoporotic Thoracolumbar spine fractures with spinal cord compression and severe pain.

109 patients with one level thoracolumbar osteoporotic fracture and at least 5 years of follow-up were included. They underwent posterior instrumentation performed with PMMA augmented pedicle screws. A modified PVCR (unilateral costotransversectomy+hemilaminectomy) combined with the insertion of an expandable titanium cage for anterior column restoration was undertaken. Patients were evaluated clinically and radiographically.

Patients had a mean age of 74.1 and a follow-up duration of 92.3 months. Mean duration of operations, hospital stays, and mean loss of blood were detected as 172.3 minutes, 4.3 days, and 205.4mL. All of the patients were mobilized immediately after surgery. The mean pre-operative local kyphosis angle improved from 39.3° to 4.7° at the last follow-up (p=0.003). Patients' pre-operative mean VAS, JOA, and ODI scores improved from 7.7/8.6/76.3 to 1.6/26.1/17.4(p<0.001 for all), respectively. The average SF-36 MCS/PCS scores at the last follow-up were 55.1/56.8. A dural tear was detected intra-operatively in one patient and repaired immediately.

Subtotal PVCR combined with the insertion of an expandable titanium cage was detected as a safe and effective method for osteoporotic vertebrae fractures' sequelae in the elderly population involving spinal cord compression, by enabling the decompression of the spinal canal and reconstruction of the resected segment, resulting in significant improvement in clinical and radiographic outcomes [10]

In a multicenter study, Kallmes et al., randomly assigned 131 patients who had one to three painful osteoporotic vertebral compression fractures to undergo either vertebroplasty or a simulated procedure without cement (control group). The primary outcomes were scores on the modified Roland Morris Disability Questionnaire (RDQ) (on a scale of 0 to 23, with higher scores indicating greater disability) and patients' ratings of average pain intensity during the preceding 24 hours at 1 month (on a scale of 0 to 10, with higher scores indicating more severe pain). Patients were allowed to cross over to the other study group after 1 month.

All patients underwent the assigned intervention (68 vertebroplasties and 63 simulated procedures). The baseline characteristics were similar in the two groups. At 1 month, there was no significant difference between the vertebroplasty group and the control group in either the RDQ score (difference, 0.7; 95% confidence interval [CI], -1.3 to 2.8; P=0.49) or the pain rating (difference, 0.7; 95% CI, -0.3 to 1.7; P=0.19). Both groups had immediate improvement in disability and pain scores after the intervention. Although the two groups did not differ significantly on any secondary outcome measure at 1 month, there was a trend toward a higher rate of clinically meaningful improvement in pain (a 30% decrease from baseline) in the vertebroplasty group (64% vs. 48%, P=0.06). At 3 months, there was a higher crossover rate in the control group than in the vertebroplasty group (51% vs. 13%, P<0.001) [corrected]. There was one serious adverse event in each group.

Improvements in pain and pain-related disability associated with osteoporotic compression fractures in patients treated with vertebroplasty were similar to the improvements in a control group [11].

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