

## Review Article

# Seasonal Variation of Osteoporotic Vertebral Fractures

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## Abstract

Fragility fracture is a clinical feature of osteoporosis and mainly occurs in the elderly. The most common sites of low trauma fractures are spine, hip, wrist, humerus and pelvis. Vertebral fractures are considered to be the most common ones and are related to acute and chronic pain, impairing the quality of patient's life. Seasonal variation of osteoporotic fractures is a subject of interest in multiple articles. Hip fractures seem to be more frequent in winter and this is closely related to variation in the level of serum vitamin-D as well as sarcopenia. On the other hand, there are less articles and surveys regarding vertebral fractures and their seasonal variation. The main cause is the difficulty in diagnosis, considering that a big amount of vertebral fractures are underdiagnosed. The majority of the articles referring to the seasonal variation of vertebral fractures indicate no significant quantitative difference throughout the months of the year. Further investigation should be conducted in the future and a precise timeline of patients' symptoms would be of vital importance in such cases.

**Keywords:** Fragility fractures, Osteoporosis, Seasonal variation, Vertebral fractures

## Introduction

Osteoporosis is a bone disease characterized by low bone mass and microarchitectural disruption<sup>1</sup>. This may lead to skeletal fragility and low trauma fractures. It is estimated that 9% of men and women over the age of 50 suffer from osteoporosis in the United States and 200 million women globally<sup>2</sup>. Vertebral fractures are the most common fragility fractures and their main clinical feature is sudden severe back pain worsened with movement. Patients are forced to limit their everyday activities due to pain and this can exacerbate other health issues and increase the rate of depression. It has been proved that mortality rate is higher after a vertebral fracture and hospitalization of the elderly may be prolonged. Therefore, it becomes clear that osteoporotic spinal fractures have a negative social impact in the health care system, as well. The main concern of the medical community is that spinal fractures can often be underdiagnosed or diagnosed in a great delay<sup>3</sup>. Patients, especially the elderly, often believe that back pain is due to chronic arthritis or other health conditions that they may suffer from and as a result they don't seek directly for medical support. Furthermore, radiologists frequently cannot diagnose vertebral fractures, especially on chest x-rays (1 out of 3 patients with vertebral

fracture were undiagnosed). This further delays the diagnosis and the treatment of the fracture and worsens patient's disability. Moreover, a vertebral fracture can be the first clinical feature of osteoporosis and thus a sign for initiation of appropriate drug therapy. If an osteoporotic vertebral fracture is underdiagnosed the risk of new fractures is increased. Genant's assessment for vertebral fractures and an adaptation of its semiquantitative criteria could be helpful for radiologists and generally medical community to detect earlier spinal fragility fractures<sup>2</sup>. For health care systems to be able to deal with fragility fractures more efficiently, the knowledge of their seasonal variation is of great importance. Unfortunately, there are only a few studies regarding

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seasonal fluctuation of vertebral fractures because of the difficulty in diagnosing them directly. Most of the studies about fragility fractures of the hip and forearm have shown that they are more frequent in winter and this has been linked to multiple causes. However, it is questionable if spinal fragility fractures follow the same pattern in seasonality and this is the aim of the article.

## Literature Search Method

The search was based on identified articles in English language that were published on the searching machines; pubmed, springer and google scholar until September 2022. The terms “Fragility fractures”, “vertebral fractures”, “seasonal variation” and “osteoporosis” were used as key words. Patients in case studies were men and women over the age of 55.

## Results

In most of the studies there was no significant seasonal variation in vertebral fractures. In an investigation in Lithuania between 1991-1993 the amount of hip and radial fragility fractures in winter was almost twice the amount in summer and they seemed to increase each year<sup>4</sup>. On the other hand, there was no difference in the number of vertebral fractures along the seasons of each year and it was relatively stable annually. In an analysis from the Global Longitudinal Study of Osteoporosis in women, data was selected from the United States of America, Canada, Australia and seven European countries<sup>5</sup>. There was noticed in fact, a seasonal variation solely in hip fractures, whilst for the spinal fractures no significant variability was found and they were closely related to falls (45%) in patients <85 years. Furthermore, in a study regarding the relationship between seasonality, vitamin D insufficiency and fragility fractures, hip and wrist fractures were increased in the late winter ( $p = 0.078$  and  $p = 0.002$ , respectively). Peaks in fracture frequency followed 1.5-3 months after the lowest level of serum 25(OH) vitamin D. In contrast, there was no evidence of monthly variation in spinal fractures<sup>6</sup>. A very interesting investigation took part in Poland between 2010-2015. The database was obtained from the National Health Fund of Poland and the aim was to compare fractures of the spine (thoracic and lumbar), femur, humerus and forearm<sup>7</sup>. The study proved that humerus and lumbar fractures had an increasing tendency through the years, while femoral and forearm fractures decreased. As for the seasonal variation, thoracic spinal fractures were consistent each year while lumbar fractures were slightly increased between April and October. Last but not least, in a study in Czech Republic that investigated osteoporotic fractures in geriatric patients there seemed to be an increase in all osteoporotic fractures between December – February<sup>8</sup>. Similarly, in an investigation conducted in Wuhan, China the amount of patients hospitalized because of osteoporotic fractures in winter was increased<sup>9</sup>. In most of the studies spinal fragility

fractures increase through the years but there is no strong evidence for any seasonal variation.

## Discussion

There seem to be no specific seasonal pattern in vertebral fractures. Although, there is a strong indication that spinal fractures increase annually. More research should be conducted for seasonal variation of vertebral fractures. Medical history could be the key to these studies as the two-thirds of vertebral compression fractures are in fact not diagnosed<sup>10</sup>. Most of these fractures are diagnosed during routine medical examinations when the patient is asymptomatic. This is the critical point where the doctor should be able to identify the possible onset of symptoms. Early diagnosis of vertebral fractures is of vital importance not only for better identification of their seasonal variation but also for the diagnosis of osteoporosis as well. A spinal fragility fracture is usually the first clinical sign of osteoporosis. According to some studies, only a small group of patients receive proper osteoporosis drug treatment after suffering a fragility fracture<sup>11</sup>. Patients not being treated for osteoporosis, have a substantially higher risk for additional fragility fractures (13,8%). Bisphosphonates and osteoporosis drug treatment in general reduce the risk of secondary vertebral fractures (RR 0,38 – 0,77)<sup>12</sup>. Hence, the diagnosis of fragility vertebral fractures shall be followed by proper medical examination of the patient making sure the diagnosis of osteoporosis is not missed. One more fact of great medical interest, is the prevalence of vitamin-D deficiency in patients with vertebral fragility fractures. Studies demonstrate a significant difference in vitamin-D levels between patients with vertebral fragility fractures and control group ( $p = 0,036$ )<sup>13</sup>. Nowadays, vitamin-D insufficiency is closely related to sarcopenia. It was found that about 22.85% of women with one spinal fragility fracture were sarcopenic and this number increased to 43.75% for those with multiple vertebral fractures<sup>14</sup>. As a result, vitamin-D supplements should be taken into consideration as a medication along with anti-osteoporosis drugs. Furthermore, Vitamin-D levels in many countries seem to have a seasonal variation. With respect to the close relationship between vitamin-D levels and vertebral fractures, it is quite contradictory that vitamin-D levels have a seasonal variation, while vertebral fractures do not. Future studies should take into consideration vitamin-D levels, vertebral fragility fractures and seasonal variation as parameters in order to enlighten this contradiction. Finally, it should be mentioned that in other fragility fractures such as hip fractures, a seasonal variation has been certainly proved.

## Conclusion

The incidence of vertebral fractures seems to increase globally in the age group 70 – 89<sup>15</sup> and is a quite demanding task that has to be managed by the medical community. This type of fracture affects not only the patients themselves

but also their families, as well as the governments and health care systems around the world. They often result in prolonged hospitalization and even surgical operations. In an investigation that had been made for spine fractures from standing height between 2011 – 2016, an increased mortality rate up to 18.7% was noticed in the patients and 24.5% of them had undergone surgery, mainly vertebroplasty and balloon kyphoplasty<sup>16</sup>. The treatment according to some studies is empirical and has to do with the type of fracture and patient's general health condition<sup>17</sup>. Conservative treatment has its own disadvantages, too. In the Nottingham spinal health study 37% of patients with vertebral fragility fracture were susceptible to persistent pain and disability and they needed high doses of analgesia. One other interesting fact is that 65% of these patients had fallen more than two times during the previous year<sup>18</sup>. The proper management of vertebral fragility fractures depends on many factors such as antiosteoporotic drugs, patients' daily care, weight management, nicotine abuse, serum glucose levels and possible surgical operation. Early diagnosis still remains the main problem in the management of spinal fragility fractures and directly affects the understanding of their seasonal variation.

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