

EFFICACY OF CONSERVATIVE MANAGEMENT IN THE TREATMENT OF OSTEOPOROTIC VERTEBRAL COMPRESSION FRACTURES IN POST-MENOPAUSAL FEMALE

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Abstract

Background: Osteoporosis is an asymptomatic condition, and often, the first sign may be back discomfort caused by a painful vertebral compression fracture (VCF). If symptomatic vertebral compression fractures (VCF) are not treated or managed properly, they may lead to considerable illness and death. It may lead to persistent back discomfort, abnormal spinal shape, and lung conditions that limit breathing. Post-menopausal women are susceptible to developing osteoporotic vertebral compression fractures (VCF), which may be treated either by surgery or conservative methods. The aim is to assess the effectiveness of conservative management in treating osteoporotic vertebral compression fractures in post-menopausal women. **Materials and Methods:** A total of 50 post-menopausal ladies, aged between 50 and 80 years, who were diagnosed with acute vertebral compression fractures (VCF), were included in our research at our outside and emergency department. Obtained informed permission from all the patients. Every patient had bone mineral density measurement using dual-energy X-ray absorptiometry scan. The DXA scan was analyzed in relation to the T score, following the recommendations set by the World Health Organization. The evaluation of back pain was conducted using the visual analog scale (VAS), while disability was evaluated using the Oswestry Disability Index (ODI). **Result:** Every single patient (100%) reported experiencing back discomfort as the first symptom, whereas 56% of patients also saw a deformity in their back. Two patients (4%) had neurological impairment at the beginning of the study. The average visual analog scale (VAS) back pain score at the time of presentation was 6.65 ± 1.12 . There was a substantial improvement in the VAS score during the follow-up period (P value <0.001). During the first presentation, the majority of patients were classified as moderately impaired (42%) or severely disabled (48%). However, by the final assessment, most patients were categorized as minimally disabled (58%) or moderately disabled (38%). There was a substantial improvement in the ODI scores over the follow-up period, with a p-value of less than 0.001. The ODI decreased significantly ($p < 0.001$) from a baseline value of 59.37 to 25.96. With the exception of 7 patients, all others had a progressive decrease in both VAS score and ODI score during subsequent follow-up. **Conclusion:** We have found favorable outcomes with conservative treatment in osteoporotic vertebral compression fractures (VCF), which effectively relieve pain, decrease the likelihood of deformity, and thus contribute to enhancing quality of life. Our conservative treatment plan includes methods to alleviate pain, provide anti-osteoporotic drugs, use a hyperextension brace, provide therapy, and educate the patient.

INTRODUCTION

Osteoporotic vertebral compression fractures (OVCFs) are frequently observed in older adults with osteoporosis, affecting around 30% to 50% of individuals aged 50 and above. The prevalence of OVCFs is approximately 12% in both women and men aged 50 to 79 years worldwide, resulting in an estimated 1.4 million cases each year. The incidence rates of OVCFs increase significantly with age, particularly in women.^[1-3] Globally, almost 20% of individuals over the age of 70 and 16% of women who have gone through menopause suffer from osteoporotic vertebral compression fractures (OVCFs).^[4] The prevalence of osteoporotic vertebral compression fractures (OVCFs) is 10.7 per 1000 person years in women and 5.7 per 1000 person years in men.^[5] Nevertheless, a significant majority of vertebral fractures, ranging from two-thirds to three-quarters, go unnoticed during the first clinical event.^[1]

With the increasing number of older adults, osteoporotic vertebral compression fractures (OVCFs) are becoming a prominent cause of pain and impaired function,^[5] leading to higher rates of illness and death in industrialized nations.^[6,7] Nevertheless, current clinical guidelines lack uniform diagnostic and therapeutic recommendations for the management of osteoporotic vertebral compression fractures (OVCFs).^[8] The primary objective of this research was to address the key inquiries that doctors encounter while dealing with patients suffering from acute back pain and dysfunction, with the purpose of providing them with the necessary knowledge to effectively manage osteoporotic vertebral compression fractures (OVCFs) in their everyday medical practice.

This literature review analyzes pertinent studies published from 1993 to 2023, providing a comprehensive discussion and addressing essential triage topics often addressed in routine clinical practice. We developed an algorithm for treating osteoporotic spine fractures that takes into account the patient's clinical symptoms, the kind of fracture shown on radiological imaging, and the structural characteristics of the fracture (as classified by an osteoporotic fracture classification system). Our objective was to emphasize the significance of medically treating osteoporosis, independent of the therapy for osteoporotic vertebral compression fractures (OVCF).

Given that 5% of adults aged 50 and above who have acute low back pain (aLBP) and exhibit certain risk factors (being over 50 years old, using anticoagulants, having a fever, being immunocompromised, engaging in intravenous drug abuse, having recently undergone surgery or epidural injection, experiencing neurological deficit, or having suffered trauma) are likely to have an osteoporotic vertebral compression fracture (OVCF), it is important to investigate the presence of these risk factors.^[9,10]

Following low-energy falls, it is recommended that older persons who may have spine fractures receive a radiographic evaluation using computed tomography (CT) followed by plain radiography.^[11] A CT scan offers higher sensitivity and specificity compared to conventional radiography, ensuring that no OVCF injuries are overlooked and reducing the need for needless radiological investigations.^[12] A negative CT scan is enough to rule out the majority of low-back pain (LBP) caused by low-energy fall injuries.^[12] If there are motor complaints or differences between the clinical and radiological findings, it is necessary to seek the counsel of a specialized spine surgeon. The regular use of magnetic resonance imaging (MRI) is not recommended, and its appropriateness should be deliberated with a spine surgeon. Among older persons, non-traumatic acute low back pain is linked to osteoporotic vertebral compression fractures (OVCF) in 5% of cases.^[10] Osteoporotic vertebral compression fractures (OVCFs) are considered severe due to their strong correlation with low bone mineral density (BMD) and their major contribution to the risk of future fractures. The incidence of subsequent fracture after an initial vertebral fracture is around 25% during a two-year period and 40% within a five-year period.^[13] Therefore, it is important to classify any patient with a vertebral fracture as being at immediate danger or in the high-risk category for future fractures in both the spine and other areas of the body. These patients should undergo examination and get appropriate treatment.^[14,15] Fracture liaison service programs may assist in the identification and involvement of secondary fracture prevention in individuals who have had index vertebral fractures. Untreated osteoporotic vertebral compression fractures (OVCFs) may lead to substantial discomfort and disability, and are increasingly contributing to illness and death in industrialized nations.^[5-7] It is crucial to have a more comprehensive knowledge of the correlation between the burden of lower back pain (LBP) and the advancement of vertebral collapse in osteoporotic vertebral compression fractures (OVCFs). Conservative therapy is often effective in treating them, but if conservative treatment fails, it may result in severe consequences, especially if additional risk factors are not addressed.^[16] Efficient patient care requires pre-established protocols for all procedures conducted in emergency departments (EDs) or general practice. However, current clinical guidelines provide conflicting recommendations for diagnosing and treating osteoporotic fractures.^[8] This research aimed to assess the effectiveness of conservative therapy for osteoporotic vertebral fractures in post-menopausal females. We selected post-menopausal females as research participants due to their susceptibility to fractures and related problems. This study aims to offer data supporting conservative therapy for acute vertebral compression fractures in post-menopausal females.

MATERIALS AND METHODS

A total of 50 post-menopausal ladies, aged between 50 and 80 years, who were diagnosed with acute vertebral compression fractures (VCF), were included in our research at our outside and emergency department. Obtained informed permission from all the patients. Every patient had bone mineral density measurement using dual-energy X-ray absorptiometry scan. The DXA scan was analyzed in relation to the T score, following the recommendations set by the World Health Organization.^[17] Our research excluded patients with chronic hepato-renal disease, endocrinal disorders, thyroidism, hyperparathyroidism, and malignancy. Patients who had already had surgery, experienced fractures caused by primary or metastatic malignancies, had infections, or had spinal deformities caused by arthritic hip or knee joints were not included in the study. The patients underwent clinical, hematological, and radiological evaluations. A neurological examination was conducted upon admission. All patients with a neurological disability were not included.

The evaluation of back pain was conducted using the visual analog scale (VAS),^[18] while disability was evaluated using the Oswestry Disability Index (ODI).^[19] Upon admission, a comprehensive hematological examination was conducted, which included a full blood hemogram, liver function test, renal function test, serum calcium, serum PTH, serum alkaline phosphatase, serum 25(OH) Vitamin D level, and thyroid profile. In all instances, the radiological examination involves x-rays of the dorsal and lumbar spine. Computed tomography (CT) and magnetic resonance imaging (MRI) were performed selectively when necessary. The x-ray was used to evaluate the position, morphology, and deformity in the coronal and sagittal planes of the fracture. The patient's fracture was categorized according to the categorization system developed by Sugita et al.^[20]

Initially, all patients received treatment consisting of bed rest and pain-relieving medications. This was followed by the use of hyper-extension bracing. Afterward, they participated in a closely monitored physical therapy program and received information on how to manage and avoid fractures. Patients were prescribed bed rest for a duration of two to five days based on their particular pain tolerance. Additionally, patients were urged to begin moving and being active as soon as possible. Initially, patients were given NSAIDs. If there was no response, opioids were administered for a brief period of time. The use of a Hyper-extension Anterior Spinal Extension brace was recommended to prevent excessive bending forward at the site of the fracture. A brace was prescribed for a duration of four to six weeks. Every patient received supervised therapy to enhance the power of their core back muscles. A regimen of calcitonin nasal spray, with a metered-dose of 200 IU, was started at the beginning of pharmacotherapy

and continued for two months. The spray was administered daily, alternating between nostrils. Each patient received a weekly dose of alendronate (70mg), along with a daily dose of calcium (1000mg) and a weekly dose of Vitamin D (60000 units). Every patient was clinically monitored and the functional result was assessed using the Oswestry Disability Index (ODI). therapy failure was defined as the continued presence of a Visual Analog Scale (VAS) score of 5 or above after two months of conservative therapy. Patients were first monitored at four-week intervals for three months, and then at three-month intervals to assess long-term problems.

Statistical Analysis: The statistical analysis was conducted using the SPSS software for Windows computer, namely version 24.0. The dichotomous variables were expressed in terms of number or frequency and were analyzed using either the Chi-square test or Fisher's exact test, depending on the circumstances. The continuous variables were assessed using the mean (standard deviation) or range value. To compare the means between the two groups, we conducted a study using Student's t-test. A p-value less than 0.05 or 0.001 was considered statistically significant.

RESULTS

A total of 50 post-menopausal females, with a mean age of 63.46 ± 5.87 years and a mean bone mineral density (BMD) of the spine of 0.81 ± 0.07 gm/cm², were monitored for at least one year.

The average duration after menopause was 13.99 ± 2.48 years. The majority of patients suffered a fracture in the lumbar spine (62%), with the most often broken vertebrae being L1, followed by T12 in the thoracic spine (38%).

According to the categorization of Sugita et al., the majority of patients in our series (46%) exhibited a concave type fracture pattern, followed by a bow-shaped pattern (24%). There was a substantial rise in height collapse seen during the final follow-up, with a statistically significant correlation (<0.001) between this collapse and increasing age. Every single patient (100%) reported experiencing back discomfort as the first symptom, whereas 56% of patients also saw a deformity in their back. Two patients (4%) had neurological impairment at the beginning of the study. The average visual analog scale (VAS) back pain score at the time of presentation was 6.65 ± 1.12 . There was a substantial improvement in the VAS score during the follow-up period (P value <0.001). There was a steady increase of 20% in performance on each consecutive quarterly visit. After one year, the last follow-up showed a substantial improvement in the VAS score ($p < 0.001$), decreasing from 9.12 to 2.26.

The impact of osteoporotic vertebral fracture on disability was assessed using the Oswestry Disability Index (ODI). The average ODI score at the time of presentation was 41.84 ± 7.89 . The patients were

categorized into several levels of impairment based on their ODI scores: minimum disability (ODI 0-20%), moderate disability (ODI 20-40%), severe disability (ODI 40-60%), crippled (ODI 60-80%), and bedridden (ODI >80%). During the first presentation, the majority of patients were classified as moderately impaired (42%) or severely disabled (48%). However, by the final assessment, most patients were categorized as minimally disabled (58%) or moderately disabled (38%). There was a substantial improvement in the ODI scores over the follow-up period, with a p-value of less than 0.001. The ODI decreased significantly ($p < 0.001$) from a baseline value of 59.37 to 25.96. With the exception of 7 patients, all others had a progressive decrease in both VAS score and ODI score during subsequent follow-up. Out of the total number of patients, 7 individuals, which accounts for 14% of the sample, did not show any improvement when treated using

conservative methods. Our observations revealed that advanced age, obesity, and failure to comply with medication and physiotherapy are linked to treatment failure. One patient was lost to follow-up, while two patients died owing to other related comorbidities. The hematological indices exhibited a notable alteration throughout conservative therapy, with blood calcium (p value < 0.001), phosphorus (p value < 0.001), and vitamin D3 (p value < 0.001) levels demonstrating substantial improvement over time. The improvement in the hematological indices was statistically significant at each subsequent trimonthly follow-up visit. The serum parathyroid hormone levels exhibited a substantial decline during the follow-up period (p value < 0.001), with the most pronounced fall occurring within the first three months. After this time, the levels reached a stable plateau. There were no notable alterations in the alkaline phosphatase levels.

Table 1: Basic parameter of the patients

	Number	Percentage	P value
Age			0.15
50-60	7	14	
60-70	32	64	
70-80	8	16	
Above 80	3	6	
Mean Age	63.46 ± 5.87		
BMD	0.81±0.07		0.13
Menopause time	13.99±2.48		0.18
Radiologically fracture			0.26
Lumbar spine	31	62	
Thoracic spine	19	38	
Types of fracture			0.33
Concave type fracture	23	46	
Bow-shaped	12	24	
Others	15	30	

Table 2: VSA Score

VSA Score	Mean	Sd	P Value
Base line	9.12	1.39	0.001
After 6 months	7.03	1.21	
After one year	2.26	0.87	
Mean VSA Score	6.65	1.12	

Table 3: ODI Score

ODI Score	Baseline	Afte one year	P value
0-20	0(0%)	29(58%)	0.001
20-40	21(42%)	19(38%)	
40-60	24(48%)	2(4%)	
60-80	3(6%)	2(0%)	
Above 80	2(4%)	2(0%)	
Mean Score	59.37±5.27	38.97±3.11	

DISCUSSION

The hematological indices showed significant changes throughout conservative treatment, with blood calcium (p value < 0.001), phosphorus (p value < 0.001), and vitamin D3 (p value < 0.001) levels showing significant improvement over time. The enhancement in the hematological measurements shown a statistically significant difference at each subsequent trimonthly follow-up visit. During the follow-up period, there was a significant decrease in the levels of parathyroid hormone in the blood (p

value < 0.001), with the most notable reduction happening within the first three months. Following this period, the levels achieved a consistent plateau. There were no significant changes seen in the levels of alkaline phosphatase.

The presence of back discomfort was seen in all patients, followed by the occurrence of back deformity. According to Francis RM et al., only one third of vertebral fractures are brought to the attention of medical professionals. These fractures usually manifest as sudden back discomfort, but may also appear as deformity due to loss of height and a

developing curvature of the spine, known as kyphosis.^[22] Lyritis et al. conducted a study on the progression of osteoporotic vertebral fractures in 210 women who had reached menopause. They categorized the participants into two groups.^[23] Individuals with type I fractures had radiographically visible osteoporotic vertebral fractures. These fractures were accompanied by a single episode of intense and acute pain that lasted for a duration of four to eight weeks. For type II fractures, the fracture was not clearly visible on X-rays, but a slow development of a wedge deformity occurred over the following months. The intensity and length of pain in type II fractures were comparatively milder and shorter than type I fractures. However, a subsequent episode of pain emerged between six to 16 weeks, and often reoccurred over a span of six to 18 months. Neurological complications resulting from the vertebral fracture were seen in just one patient. Spinal cord compression and myelopathy are not often seen in vertebral osteoporotic fractures because there is no structural disruption of the posterior wall or middle column of the vertebral body. Neurological involvement may occur in certain individuals with osteoporotic spinal compression fractures, but this is uncommon.^[24] This research is a prospective cohort study that focuses on post-menopausal females who had acute vertebral compression fractures (VCF). The study found that conservative care resulted in a success rate of 86%. Post-menopausal ladies have a higher likelihood of having osteoporotic vertebral compression fractures due to a lack of estrogen. The prevalence of osteoporotic vertebral compression fractures (VCF) is greater in women compared to men. However, other investigations have shown an equal distribution of osteoporotic vertebral fractures across males and females, or even a higher prevalence in males.^[25]

The conservative approach for vertebral compression fractures (VCF) involves pain control, rehabilitation, and education to avoid further fractures. Analgesic medications may be used for a duration of 6 to 12 weeks to alleviate pain. Non-steroidal anti-inflammatory drugs (NSAIDs) and opioids may be used based on the patient's individual reaction. The results of our research indicate that a significant proportion of patients had positive responses to NSAIDs and Calcitonin. Additionally, the majority of patients saw a reduction in VAS ratings to below four after eight weeks of therapy, with 66% of patients achieving this outcome. During the later check-up, the patient shown an enhancement in the VAS score. Specifically, after four months of follow-up, 72% of patients had a VAS score that was lower than 3. In their research on 30 patients, Shah et al,^[26] noted a progressive improvement in the Visual Analog Scale (VAS) score across repeated follow-ups. They reported a 49% improvement in the VAS score from the baseline at the last follow-up. In a study conducted by Venmans et al,^[27] conservative therapy was used to treat 95 patients with vertebral compression fractures (VCF). The

researchers found that 60% of the patients had a Visual Analog Scale (VAS) score of 3 or below after one year of follow-up. Diamond HT et al,^[28] reported that after six weeks of conservative care of vertebral compression fractures (VCF), the Visual Analog Scale (VAS) score decreased to 61%. This improvement further increased to 71% between six to 12 months of treatment. The measurement of disability resulting from a spinal fracture was assessed using the Oswestry Disability Index (ODI). Through the implementation of conservative therapy, there was a notable improvement in the Visual Analog Scale (VAS) score for the back pain. Relieving pain led to a simultaneous reduction in the impairment caused by these fractures, resulting in improved functional results. In a study conducted by Diamond HT et al,^[29] it was shown that there was a 61% decrease in VAS pain levels after six weeks of starting conservative therapy. Furthermore, there was a 71% reduction in pain scores between six to 12 months. In addition, they observed a 31% enhancement in physical functioning as assessed by the Barthel index after six weeks, which further climbed to a 39% improvement between six and twelve months. Patients who have less than a 25% reduction in their pain score may suggest a shift towards chronic back pain caused by changes in the mechanics of the joints in the spine, collapse of the front part of the vertebrae, tiredness in the muscles surrounding the spine, and misalignment of the arthritic facet joints.

At the conclusion of our trial, the majority of our patients (96%) had little or moderate impairment, indicating a substantial improvement in their ODI score. The improvement in ODI performance may be attributed to the use of efficient rehabilitation techniques, such as closely monitored physiotherapy sessions and comprehensive patient education. All patients participated in a structured muscle strengthening program that included strengthening the muscles in their back extensors. The program was conducted by a certified physiotherapist. Initially, patients were provided with information on the normal progression of osteoporotic vertebral compression fractures (VCF), strategies to avoid falls and future fractures, and the significance of workouts in preventing deformities. In their study, Shah et al,^[26] found that there was a 47.23% improvement in the ODI score during the final follow-up. Additionally, 56.67% of the patients had minor impairment, while 36.67% had a moderate disability. Our investigation has a limited number of constraints. Because of the single-centered, prospective observational research, the findings cannot be extrapolated to a broader population. Unfortunately, we lack a control group to establish the superiority of conservative management. We have only focused on the female population, despite the fact that osteoporosis is more widespread among females. However, it is also extensively prevalent among men. Future multicentric studies that include both male and female individuals, and follow a consistent

conservative treatment procedure, may provide more substantial data to demonstrate the effectiveness of conservative management.

CONCLUSION

We have found favorable outcomes with conservative treatment in osteoporotic vertebral compression fractures (VCF), which effectively relieve pain, decrease the likelihood of deformity, and thus contribute to enhancing quality of life. Our conservative treatment plan includes methods to alleviate pain, provide anti-osteoporotic drugs, use a hyperextension brace, provide therapy, and educate the patient. This procedure is simple and efficient for the management of post-menopausal vertebral compression fractures (VCF). We suggest that a conservative approach should be attempted first and for a sufficient period of time before considering surgical treatments.

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