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Research Article

Pain Outcomes and Selected Clinical Parameters Following Vertebroplasty for Multiple Myeloma A Multicentric Study

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Abstract: ***Background:*** Multiple myeloma frequently causes painful vertebral compression fractures that persist despite analgesics, systemic therapy, radiotherapy, and bisphosphonates. Percutaneous vertebroplasty offers rapid mechanical stabilization and analgesia, but data from low- and middle-income settings remain limited. ***Objective:*** To evaluate pain outcomes and selected clinical parameters following vertebroplasty for multiple myeloma in different private hospitas and Bangabandhu Sheikh Mujib Medical University.Dhaka, Bangladesh. ***Methods:*** We retrospectively reviewed all consecutive multiple myeloma patients undergoing fluoroscopy-guided transpedicular polymethyl methacrylate (PMMA) vertebroplasty between July 2010 and June 2019. Demographic data, number of vertebral levels treated, pre-procedure pain (three-point scale: mild/moderate/severe)? Prior systemic chemotherapy, bisphosphonate exposure, radiotherapy timing, and need for spine surgery were abstracted. Post-procedure pain response was categorized as improved vs not improved. Where direct follow-up was available, change in pain score was analyzed (Wilcoxon Signed-Rank; $p \leq 0.05$). ***Results:*** Twenty patients were included (62% male). Age distribution: 15% aged 40–49 years, 35% 50–59, 23% 60–69, and 27% ≥70. Multilevel disease was common: 50% had three vertebral sites treated, 19% two sites, and 31% one site. Pre-procedure pain was severe in 65% and moderate in 35%. Most patients had received systemic chemotherapy (89%) and bisphosphonates (81%). Radiotherapy had been given pre-procedure in 39%, post-procedure in 15%, both in 4%, and not at all in 42%. Following vertebroplasty, 77% reported meaningful pain relief; 23% reported no improvement. Only 15% underwent spinal surgery at any point during care. ***Conclusion:*** In this multicentric study in Bangladesh, vertebroplasty provided clinically meaningful pain relief for most patients with myeloma-related vertebral disease and was associated with a low subsequent need for spinal surgery. These findings support vertebroplasty as a useful adjunct to systemic myeloma therapy in patients with painful vertebral involvement; prospective studies using standardized pain and functional metrics are warranted.

Keywords: multiple myeloma; vertebroplasty; vertebral compression fracture; pain relief; bisphosphonate; Bangladesh.

INTRODUCTION

Multiple myeloma (MM) is a malignant plasma cell disorder characterized by the proliferation of abnormal plasma cells in the bone marrow, resulting in extensive bone destruction, osteolytic lesions, and skeletal complications. Spinal involvement is one of the most common clinical presentations of MM, often leading to vertebral compression fractures, severe pain, impaired mobility, and reduced quality of life. [1-3] Traditional treatment options such as analgesics, systemic chemotherapy, radiotherapy, and bisphosphonates have shown benefits in disease control and pain management but often fall short in providing rapid and sustained relief from spinal instability and mechanical pain.

Vertebroplasty, a minimally invasive percutaneous procedure, has emerged as a valuable therapeutic intervention for patients with multiple myeloma experiencing painful vertebral compression fractures. This technique involves the injection of polymethyl methacrylate (PMMA) bone cement into the collapsed vertebral body to provide mechanical stabilization and immediate pain relief. [4-6] Its ability to reduce pain quickly, improve mobility, and decrease dependence on analgesics has made vertebroplasty an important adjunct to standard therapy in MM-related spinal lesions.[7]

The clinical outcomes of vertebroplasty in MM patients have been widely studied, with several reports demonstrating significant improvement in pain scores, functional status, and overall quality of life. additionally, vertebroplasty may prevent progressive spinal deformity, which is a major concern in patients with multiple vertebral fractures. However, the efficacy and safety of the procedure can vary based on patient selection, number of vertebral levels treated, and the presence of comorbidities or prior spinal interventions.

Despite its promising outcomes, vertebroplasty is not without controversy. Potential complications such as cement leakage, embolism, or adjacent-level fractures remain concerns, particularly in patients with severely compromised bone integrity. Therefore, evaluating the risk-benefit profile of vertebroplasty in MM remains crucial, and outcome studies focusing on both pain relief and functional recovery are essential for clinical decision-making.

OBJECTIVE

This study aims to evaluate the outcomes of vertebroplasty in patients with multiple myeloma, with a particular focus on pain relief, functional improvement, and treatment-related complications.

METHODOLOGY

Study Design and Patients

This retrospective study was conducted at different private hospitals and Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, covering the period from July 2010 to June 2019. All patients who underwent vertebroplasty for multiple myeloma-related spinal compression fractures during this time were included. A total of 20 patients were identified, and their medical records were reviewed to collect baseline demographics, clinical history, pre- and post-procedure pain scores, analgesic use, mobility status, and any complications. Pain levels were recorded using a three-point scale (mild, moderate, severe).

Vertebroplasty Procedure

All patients underwent imaging studies, including plain radiographs and MRI, to identify the vertebral levels requiring intervention. Vertebroplasty was performed under short general anesthesia with the patient placed in the prone position. A transpedicular approach was used under continuous fluoroscopic X-ray guidance, with a bone-biopsy needle to inject 1–4 ml of polymethyl methacrylate (PMMA) cement into the targeted vertebral body. The PMMA cement mixture consisted of radio-opaque fluid combined with high-viscosity cement powder, ensuring optimal filling and stabilization. Post-procedure, all patients were evaluated for neurological function and pain relief before discharge.

Data Analysis

Collected data were entered into Microsoft Excel and analyzed using descriptive statistics. Pain score reduction was evaluated as “improved” or “not improved,” and for patients followed up directly, the mean reduction in pain score was calculated using the Wilcoxon Signed-Rank Test, with $p \leq 0.05$ considered statistically significant.

RESULTS

The demographic analysis of the study group showed that males constituted the majority at 62%, while females accounted for 38%. Regarding age distribution, 15% of patients were between 40–49 years, 35% were 50–59 years, 23% were 60–69 years, and 27% were aged 70 years or older.

Table-1: Demographic status of the study group

Variable	Percentage (%)
Gender	
Male	62%
Female	38%
Age Group (years)	
40–49	15%
50–59	35%
60–69	23%
≥70	27%

The clinical profile of the study group revealed that half of the patients (50%) had three vertebral sites treated, while 31% and 19% had one and two sites treated, respectively. Pain severity was predominantly high, with 65% reporting severe pain before the procedure. A large majority (89%) had received systemic chemotherapy, and 81% had a history of bisphosphonate use. Radiotherapy was administered pre-procedure in 39% of cases, post-procedure in 15%, and both pre- and post-procedure in 4%, while 42% did not receive any radiotherapy.

Table-2: Clinical status of the study group

Number of Vertebral Sites Treated	Percentage (%)
1 site	31%
2 sites	19%
3 sites	50%
Pre-procedure Pain Severity	
Moderate	35%
Severe	65%
Systemic Chemotherapy (Pre-procedure)	
Received	89%
Not Received	11%
Bisphosphonate Use	
Yes	81%
No	19%
Radiotherapy (Timing)	
Pre-only	39%
Post-only	15%
Both (Pre + Post)	4%
None	42%

The results revealed that 77% of patients experienced significant pain relief following vertebroplasty, while 23% reported no improvement in pain levels. This indicates that vertebroplasty was effective in providing pain relief for the majority of the study group.

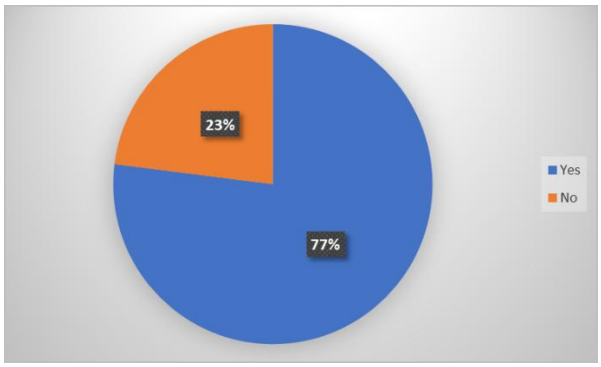

Figure-1: Pain Relief After Vertebroplasty

In this study, the majority of patients did not require any spinal surgery either prior to or following vertebroplasty, with 85% falling into this category. Only 15% of the patients had undergone spinal surgery during the treatment course.

Table-3: Distribution of the study group according to Spinal Surgery

Spinal Surgery (Prior/Following)	
Yes	15%
No	85%

Figure 2: Bone Scan

DISCUSSION

Our cohort demonstrated a male predominance (62%) across a broad adult age spectrum, with more than one-third of patients in their 50s and just over one-quarter aged ≥70 years. This sex pattern is consistent with the slight male excess reported in many myeloma populations, while the age spread resembles other vertebroplasty series in which mean ages typically fall in the sixth decade but extend into older age groups. Comparable demographic variability was noted in a recent Spine Jack vertebroplasty series (Frontiers in Surgery), and in the Brazilian quality-of-life study comparing vertebroplasty with conservative care.[8]

Disease burden at presentation in our patients was substantial: half required treatment at three vertebral levels and nearly two-thirds reported severe pre-procedure pain. High pain burden and multi-level involvement are well described in the literature; one study inclusion to patients with severe, opioid-refractory pain, underscoring how symptomatic vertebral disease often drives referral for augmentation.[9] Broader reviews emphasize that up to 90% of patients with multiple myeloma experience significant osseous pain during their illness and that vertebral compression fractures are a major contributor to morbidity when not mechanically addressed. The International Myeloma Working Group (IMWG) similarly highlights the frequent, multi-level nature of myeloma spine disease and the need to intervene when pain persists despite medical therapy.

Pain outcomes in our series were favorable: 77% of patients reported clinically meaningful relief following vertebroplasty. This response rate falls within the improvement ranges documented across published studies, where rapid and often dramatic reductions in

pain scores have been observed after cement augmentation; Other study reported median VAS reductions from 9 pre-procedure to 1 by three months, and the IMWG consensus cites multiple series with sustained post-operative pain control. [10] Improved pain has translated into better function and quality of life in comparative work, including the Brazilian vertebroplasty versus conservative management study. Taken together, these data support vertebroplasty as an effective analgesic strategy in appropriately selected myeloma patients—consistent with our experience.

Most patients in our cohort had already received systemic anti-myeloma therapy (89%) and bisphosphonates (81%), reflecting current standards of multidisciplinary care. Contemporary guidance recommends integrating bone-modifying agents (e.g., pamidronate, zoledronic acid, clodronate) for myeloma bone disease to reduce skeletal-related events and pain, and to complement local measures. The IMWG advises that definitive systemic control remains paramount, with cement augmentation considered when significant fracture-related pain persists; Thalambedu et al. likewise argue that vertebral augmentation offers faster pain relief than non-operative care in the setting of treated but symptomatic vertebral disease. Patient-education resources from the International Myeloma Foundation note that appropriate bone-directed therapy can reduce the need for radiation and support the role of vertebroplasty or kyphoplasty when pain remains limiting. Our mix of pre-, post-, and no-radiotherapy use fits this tailored, needs-based approach. Only 15% of patients in our series underwent spinal surgery at any point, suggesting that percutaneous vertebroplasty was sufficient for symptom control in the great majority and may have helped avoid more invasive stabilization procedures. Minimally invasive cement augmentation is increasingly favored when neurological compromise or gross instability is absent, a position reflected in contemporary management reviews and IMWG recommendations. Improved mobility and functional independence following vertebroplasty, as documented in the other studies where further support its role as a surgery-sparing intervention in selected myeloma patients.[11-12] While encouraging, our findings should be interpreted in light of the study's retrospective design, modest sample size, and categorical pain scale; prospective studies with standardized pain and functional measures are warranted.

CONCLUSION

Our study demonstrates that vertebroplasty is an effective and minimally invasive intervention for pain management in patients with multiple myeloma-related vertebral lesions. With 77% of patients experiencing significant pain relief and minimal need for subsequent spinal surgery (15%), the procedure proved beneficial in improving quality of life and reducing the burden of severe pain. Most patients had received systemic chemotherapy and bisphosphonates, aligning with current multidisciplinary treatment strategies. These findings support vertebroplasty as a valuable adjunct to standard myeloma care, particularly for patients with multi-level vertebral involvement and persistent pain despite optimal medical therapy.

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