

# Immediate Adjacent Level Vertebral Fracture Following Percutaneous Kyphoplasty: Case Report

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## Abstract

**Introduction** :- Adjacent segment vertebral fracture after kyphoplasty is a known phenomenon. The incidence is low and probably an inherent risk exists in osteoporotic patients due difference in stiffness of bone and injected cement. Most of these fractures do occur in early follow up period, however we did not come across any description of a case within few days of the procedure. We present our case of 84 year old lady with osteoporotic fracture at T12 level which was treated with kyphoplasty. She had reduced pain after the procedure for few days after which she started complaining of pain again. A diagnosis of adjacent level fracture at T11 was confirmed by radiographic studies. This was treated conservatively with good outcome at final follow up. The case highlights the point that adjacent level fractures can happen even in immediate post-operative period and a high index of suspicion is needed.

**Key words:** Kyphoplasty, adjacent level fracture.

## Introduction

Most painful vertebral compression fractures (VCFs) are treated palliative, with bed rest, narcotic analgesics, orthotics, and time [1]. However, bed rest accelerates bone loss [2,3] and leads to muscle deconditioning, [2] resulting in increased pain from both of these mechanisms. Long-term treatments of this disease do not provide short-term pain relief. New minimally invasive techniques have been developed to help stabilize the fractured vertebra and give pain relief. They help to improve the function of individuals debilitated by painful osteoporotic VCFs. "Kyphoplasty" was developed by Dr. Mark Reiley (Berkley, CA) and has seen a lot of success in treatment of VCF [8]. Kyphoplasty helps realign the fractured vertebra, thereby decreasing the kyphosis and creating a void that theoretically allows safer introduction of polymethylmethacrylate (PMMA) into the fracture vertebra [1] Prospective studies have shown significant improvement in mobility and function after treatment [5,6,8] and pain relief of approximately 70–90% [4,5–6,7,9]. A risk of collapse of a vertebral body adjacent to one injected with PMMA also was proposed by some authors. It is low and probably an inherent risk for any patient with osteoporosis of the spine [11]. Variable time duration has been noted and patients, who were initially pain free following treatment, returned with new

symptoms that prompted clinical evaluation. The results of repeat MR imaging or bone scintigraphy, as compared with those of pretreatment repeat MR imaging and bone scintigraphy studies, confirmed the presence of new vertebral fractures. Anita A et al found that this phenomenon occurred in 22 (12.4%) of 177 treated patients [11]. Our case differs in terms of presentation of an adjacent level fracture immediately post kyphoplasty.

## Case History

Our case reports an 84 year old Chinese lady with independent activities of daily living (ADL) and community ambulation. She had established osteoporosis before fall (BMD lumbar spine 0.793g/cm<sup>3</sup>) and was on ossifying therapy for same. She was also treated for Sigmoid colon tumour (Histo: tubulovillous adenoma with high grade dysplasia) with laparoscopic high anterior resection in past. She sustained trivial fall, after which she started complaining of back pain. Pain was aggravated on turning and on getting up from lying. There was tenderness over the T12 region. Pain VAS on sitting on straight backed chair was 2-3/10 and same on standing was 5/10.

Radiological evaluation revealed severe compression fracture of T12 with bulging of the posterior cortex and indentation into the central spinal canal. There is some peripheral enhancement but no definite paravertebral mass is seen (Fig. 1). At this level, the canal space is slightly narrowed but there is no cord compression. The exit neural foraminae are slightly narrowed at this level. The overall findings were in favor of osteoporotic compression fracture, rather than a metastasis lesion

Initially she was managed by conservative means. She was advised bed rest with supportive therapy in form of pain

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Figure1: Lateral radiograph(a) and T2 sagittal (b) and STIR image(c) of thoracic-lumbar spine showing compression fracture of T12

medication, brace and mobilization within pain limits. Pain was persistent in spite of conservative measures. Eventually she was offered percutaneous kyphoplasty of T12 vertebrae. There was relief of pain after procedure except some pain on movement (pain VAS 1-2). Pain physicals were involved for co-management and future pain relief: Gabapentin 300mg bd, Mist morphine 5mg Q4H, morphine SR 500mg BD

Following a period of pain relief of few days she started complaining increased persistent pain, especially on movement. Repeat MRI showed status post kyphoplasty at T12 with minimal increase in the retropulsed segment of T12 into the canal. There is however no raised signal intensity in the cord or overt features of cord compression. There was mild marrow edema noted at antero-inferior endplate of T11 vertebra which also shows enhancement following intravenous Gadolinium at this level. This change was not evident on MRI scan performed 10 days ago.



Figure2:T2 sagittal (b) and STIR image(c) of thoracic-lumbar spine after kyphoplasty showing post kyphoplasty status at T12 and adjacent fracture at inferior endplate of T11

Infectious disease physician had involved to rule out possibility of infection and a battery of blood test were done. The blood reports came to be within normal limits. Bone scan revealed increased radiotracer uptake right 11th costovertebral junction, T12 and L5/S1 vertebra consistent with secondary to post-surgical changes. Diagnosis of adjacent vertebrae fracture following kyphoplasty made based on clinical-radiological assessment. After possibility of spinal infection was ruled out she is treated aggressively for osteoporosis with subcutaneous teriperitide and given period of bed rest and adequate pain relief. She had responded well to conservative line of management at 3 month. She had again gone back to her permorbid ambulatory status and self-independency.



Figure: 3 months f/u showing (a) T1 sagittal (b) T2 sagittal and STIR image(c) of thoracic-lumbar spine after kyphoplasty showing post kyphoplasty status at T12 and healed adjacent fracture at inferior endplate of T11

## Discussion

Advances in minimally invasive spinal surgery have opened new avenues for the treatment of these fractures. One option for treatment of persistently painful fractures is percutaneous reduction via an inflatable balloon tamp (kyphoplasty) followed by stabilization with polymethylmethacrylate cement (PMMA). An initial report demonstrated this to be an effective method for both pain relief and restoration of vertebral height [12]. However, vertebra treated with PMMA are stiffer than fractured vertebra [13-15]. In biomechanical testing, this increased stiffness can decrease the ultimate load to failure of adjacent vertebra by 8 to 30% and provoke subsequent fractures [16]. Finite-element analysis of cement augmentation confirms these findings, showing clear alterations in load transfer to adjacent levels [17]. Garfin presented results from among the first 1439 patients treated in the United States at 2194 levels with kyphoplasty and found that only 46 patients (3%) returned for additional treatment of compression fractures [18].

Belkoff et al also demonstrated a significant increase in stiffness and strength of the vertebral body after cement

augmentation with vertebroplasty and kyphoplasty [13]. Using an average of 9.4 mL of cement per level for both techniques, stiffness was restored (kyphoplasty) or nearly restored (vertebroplasty) to prefracture levels. Since fractured vertebra have been shown to be significantly less stiff than normal vertebra or those injected with cement [10], this represents an acute change in stiffness from the fractured vertebra back to near-normal levels. This acute change in stiffness may provoke fractures at adjacent levels. Grados et al reported series of 25 patients treated at 34 levels with vertebroplasty, with mean follow-up period of 48 months [19]. Three to six milliliters of PMMA were injected into each vertebral body. During the follow-up period [13], patients (52%) developed 34 subsequent fractures. The authors report that the odds ratio of a vertebral fracture “in the vicinity of” a cemented vertebra was 2.27 (confidence interval, 1.11– 4.56) compared with 1.44 (confidence interval, 0.82– 2.55) for a vertebral fracture “in the vicinity of” an uncemented fractured vertebra. The average length of follow-up period is not mentioned, but 24 of these 36 fractures (67%) occurred within 30 days after treatment of the initial fractures. Our case is unique in terms of immediate presentation within few days of vertebroplasty.

### Conclusion

Risk of adjacent level vertebral compression is well documented in literature especially in advanced osteoporosis cases. There should be high index of suspicion when there is failure in improvement of symptoms and new onset pain after period of significant pain improvement. This can happen even in immediate post operative period, within few days of the procedure and a high index of suspicion should be maintained. MRI imaging can be helpful in early detection of this pathology.

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