



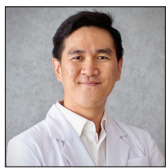
## Case Report

# Unilateral percutaneous balloon kyphoplasty for thoracic osteoporotic vertebral compression fractures: A case report and literature review

Marthinson Andrew Tombeng, Christopher Lauren, Tjokorda Gde Bagus Mahadewa

Division of Neurosurgery, Department of Surgery, Faculty of Medicine, Udayana University, Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Indonesia.

E-mail: \*Marthinson Andrew Tombeng - tombengma@gmail.com; Christopher Lauren - chrislauren11@gmail.com; Tjokorda Gde Bagus Mahadewa - tjokmahadewa@unud.ac.id



### \*Corresponding author:

Marthinson Andrew Tombeng,  
Division of Neurosurgery,  
Department of Surgery,  
Faculty of Medicine, Udayana  
University, Prof. Dr. I.G.N.G.  
Ngoerah General Hospital,  
Denpasar, Indonesia.

tombengma@gmail.com

Received: 30 June 2024

Accepted: 05 August 2024

Published: 30 August 2024

DOI

10.25259/SNI\_526\_2024

Quick Response Code:



## ABSTRACT

**Background:** Unilateral percutaneous balloon kyphoplasty (PBK) is increasingly utilized for the management of osteoporotic vertebral compression fractures (OVCFs). Its potential advantages include procedural simplicity, reduced tissue trauma, and minimal radiation exposure.

**Case Description:** A 59-year-old female with osteoporosis presented with back pain but was neurologically intact 2 weeks after a fall. The magnetic resonance imaging documented a thoracic 12 vertebral compression fracture that was successfully treated with a unilateral PBK.

**Conclusion:** Unilateral PBK appears promising for managing OVCFs in the aging population and offers rapid pain relief, vertebral height restoration, and functional improvement.

**Keywords:** Age-related osteoporosis, Kyphoplasty, Neurosurgical procedures, Vertebral column

## INTRODUCTION

Percutaneous balloon kyphoplasty (PBK) has emerged as a safe and effective minimally invasive procedure for addressing osteoporotic vertebral compression fractures (OVCFs).<sup>[1,2]</sup> Here, we successfully treated a 59-year-old female with a thoracic (Th) 12 vertebral compression fracture utilizing a unilateral PBK approach. We then chose to explore further whether unilateral approaches, in general, would offer the following advantages over bilateral procedures: greater simplicity, reduced tissue trauma, and less radiation exposure.<sup>[3,4,8]</sup>

## CASE DESCRIPTION

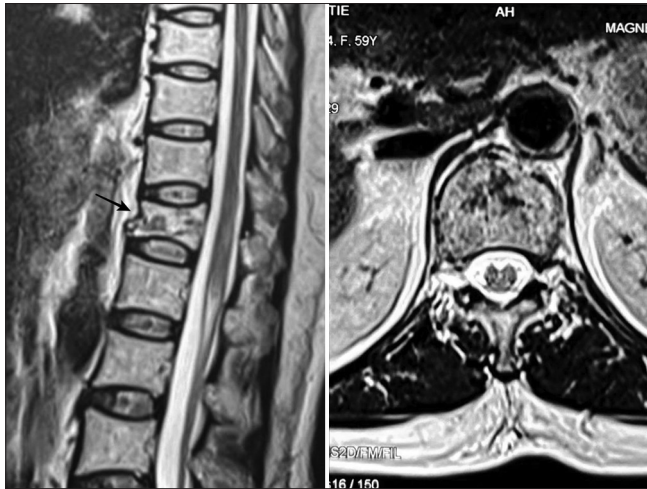
A 59-year-old female with osteoporosis presented 2 weeks following a fall with back pain but without a neurological deficit. The pain on the Visual Analog Scale (VAS) was 8/10, and the Oswestry Disability Index (ODI) score was 40%. The thoracic magnetic resonance imaging revealed a Th12 OVCF [Figure 1]. The bone mineral density examination confirmed a low osteoporotic bone (i.e., T-score of -3.0).

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

©2024 Published by Scientific Scholar on behalf of Surgical Neurology International

### Operative procedure

Under general anesthesia, a unilateral PBK was performed with the patient prone [Figure 2a]. An inflatable balloon was positioned in the center of the fractured vertebral body and gradually inflated to a pressure of 150 psi, which successfully reduced the patient's kyphotic angle [Figures 2b and c]. Next, 4 cc of cement was injected. After deflation and removal of



**Figure 1:** MRI images showing a vertebral compression fracture at thoracic 12 (black arrow) in sagittal (left) and axial (right) views. MRI: Magnetic resonance imaging.

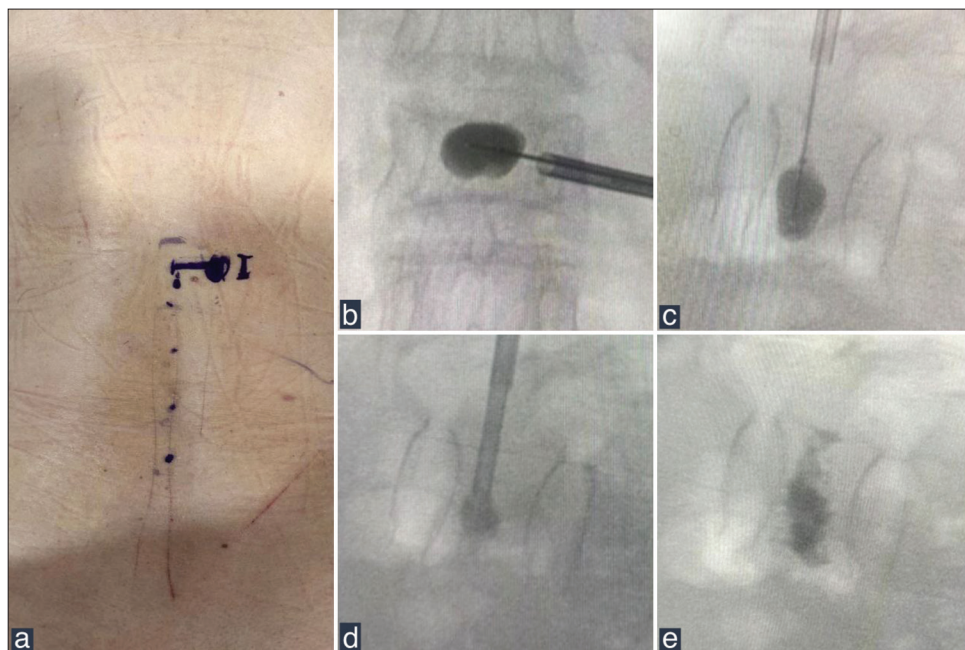
the balloon, the residual intravertebral cavity was filled with polymethyl methacrylate (PMMA) cement [Figure 2d and e].

### Follow-up and outcome

Postoperatively, back pain significantly improved, i.e., the VAS score improved to 2/10. X-rays showed restoration of both the vertebral height and alignment [Figure 3]. The patient was discharged 2 days later with improved mobility. Activities of daily living markedly improved within the 1<sup>st</sup> postoperative week (i.e., ODI score of approximately 5%). No perioperative complications occurred. Six months later, the patient had no residual back pain or neurological deficits.

### DISCUSSION

The primary goals of PBK surgery for OVCF patients are to reduce back pain, restore vertebral height/alignment, and improve patient mobilization. Although several meta-analyses have documented significant short-term improvement in VAS scores for unilateral versus bilateral PBK, no significant differences were found for long-term follow-ups.<sup>[1-3,5-11]</sup> Other studies also demonstrated no significant differences between unilateral vs. bilateral PBK in frequencies and extent of postoperative radiological outcomes, postoperative kyphosis angle reduction, Cobb's angle improvement, vertebral height reduction, and short- and/or long-term restoration of

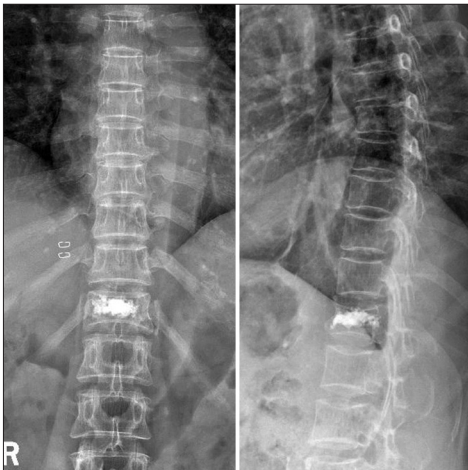


**Figure 2:** Intraoperative procedure. (a) Trocar insertion site is located approximately 4 cm to the right of the midline. (b and c) Balloon inflation to approximately 4 cc, as shown in the C-arm images in (b) anteroposterior (AP) and (c) lateral views. (d and e) C-Arm images (d) immediately and (e) after PMMA injection.

**Table 1:** Summary of bilateral vs. unilateral percutaneous kyphoplasty.

Author	Paper Title	Article Type	PBK Findings
Chang <i>et al.</i> (2017)	U vs. B PBK for OVCF	Meta	B PBK better VHR and KC
Chen <i>et al.</i> (2014)	U vs. B PBK for OVCF	Meta	B PBK better VHR and KC
Cheng <i>et al.</i> (2016)	U vs. B PBK for OVCF	Meta	U PBK reduces OR Time and RT exposure
Li <i>et al.</i> (2013)	U vs. B PBK for OVCF	Meta	U PBK is more efficient, but outcomes vary
Erkan <i>et al.</i> (2013)	Timing of PBK for Acute vs. Chronic Comp Fx	Cohort	Timing of PBK impacts outcomes and complication rates
Feng <i>et al.</i> (2015)	U vs. B PBK for OVCF	Meta and RCT	U PBK has a lower risk of cement leakage
Fu <i>et al.</i> (2013)	U vs. B PBK for OVCF	Meta and RCT	Review of RCT comparing U vs. B PBK
Huang <i>et al.</i> (2014)	U vs. B PBK for OVCF	Meta	U and B PBK have similar efficacy U PBK offers less cement leakage
Tan <i>et al.</i> (2018)	U vs. B PBK for OVCF	Meta	U PBK is efficient, but B PBK offers better structural outcomes
Yang <i>et al.</i> (2017)	U vs. B PBK for OVCF	Sys Rev	B PBK is preferred in severe cases
Yang <i>et al.</i> (2017)	U vs. B PBK for OVCF	Sys Rev	U and B PBK provide significant pain relief and functional improvement

U: Unilateral, B: Bilateral, PBK: Percutaneous balloon kyphoplasty, OVCF: Osteoporotic vertebral compression fracture, Meta: Meta-analysis, RCT: Randomized controlled trial, Sys Rev: Systematic review, VHR: Vertebral height restoration, KC: Kyphosis correction, OR: Operating room, RT: Radiation



**Figure 3:** Postoperative thoracolumbar X-ray in AP (left) and lateral (right) views showing polymethyl methacrylate within the thoracic 12 vertebrae.

anterior/middle vertebral heights [Table 1].<sup>[5]</sup> However, Feng *et al.* did demonstrate shorter surgery times and lower PMMA doses used for the unilateral versus bilateral PBK groups; the lower volume of PMMA likely reduced the incidence of symptomatic intra- and postprocedural cement leakage (i.e., higher for bilateral vs. unilateral PBK, which can result in new neurological deficits, cement emboli, etc.).<sup>[5]</sup> Our original hypothesis was that for patients with OVCF, unilateral PBK would offer greater simplicity, reduced tissue trauma, and less radiation exposure compared to those undergoing bilateral PBK.<sup>[9]</sup> We did confirm these original hypothetical findings while also documenting significant postprocedural improvement in VAS score (i.e., preoperative score 8/10 significantly reduced to 2/10) using the unilateral PBK.

## CONCLUSION

Unilateral PBK is a promising technique for treating OVCFs. Potential benefits include more pain relief, better functional improvement, and reduced surgical complexity versus routine bilateral approaches.

## Ethical approval

Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

## REFERENCES

1. Chang W, Zhang X, Jiao N, Yuwen P, Zhu Y, Zhang F, *et al.* Unilateral versus bilateral percutaneous kyphoplasty for

- osteoporotic vertebral compression fractures: A meta-analysis. *Medicine* 2017;96:e6738.
2. Chen H, Tang P, Zhao Y, Gao Y, Wang Y. Unilateral versus bilateral balloon kyphoplasty in the treatment of osteoporotic vertebral compression fractures. *Orthopedics* 2014;37:e828-35.
  3. Cheng X, Long HQ, Xu JH, Huang YL, Li FB. Comparison of unilateral versus bilateral percutaneous kyphoplasty for the treatment of patients with osteoporosis vertebral compression fracture (OVCF): A systematic review and meta-analysis. *Eur Spine J* 2016;25:3439-49.
  4. Erkan S, Ozalp TR, Yercan HS, Okcu G. Does timing matter in performing kyphoplasty? Acute versus chronic compression fractures. *Acta Orthop Belg* 2009;75:396-404.
  5. Feng H, Huang P, Zhang X, Zheng G, Wang Y. Unilateral versus bilateral percutaneous kyphoplasty for osteoporotic vertebral compression fractures: A systematic review and meta-analysis of RCTs. *J Orthop Res* 2015;33:1713-23.
  6. Fu Q, Yang LY, Wang XL, Zhou L. Systematic review a systematic review and meta-analysis of randomized controlled trials of unilateral versus bilateral kyphoplasty for osteoporotic vertebral compression fractures. *Pain Physician* 2013;16:277-90.
  7. Huang Z, Wan S, Ning L, Han S. Is unilateral kyphoplasty as effective and safe as bilateral kyphoplasties for osteoporotic vertebral compression fractures? A Meta-analysis. *Clin Orthop Relat Res* 2014;472:2833.
  8. Li LH, Sun TS, Liu Z, Zhang JZ, Zhang Y, Cai YH, *et al.* Comparison of unipedicular and bipedicular percutaneous kyphoplasty for treating osteoporotic vertebral compression fractures: A meta-analysis. *Chin Med J (Engl)* 2013;126:3956-61.
  9. Tan G, Li F, Zhou D, Cai X, Huang Y, Liu F. Unilateral versus bilateral percutaneous balloon kyphoplasty for osteoporotic vertebral compression fractures a systematic review of overlapping meta-analyses. *Medicine (Baltimore)* 2018;97:e11968.
  10. Yang H, Lin J, Zhang L. Systematic review unilateral versus bilateral balloon kyphoplasty for osteoporotic vertebral compression fractures. *Pain Physician* 2019;22:15-28.
  11. Yang S, Chen C, Wang H, Wu Z, Liu L. A systematic review of unilateral versus bilateral percutaneous vertebroplasty/ percutaneous kyphoplasty for osteoporotic vertebral compression fractures. *Acta Orthop Traumatol Turc* 2017;51:290.

**How to cite this article:** Tombeng MA, Lauren C, Mahadewa T. Unilateral percutaneous balloon kyphoplasty for thoracic osteoporotic vertebral compression fractures: A case report and literature review. *Surg Neurol Int.* 2024;15:311. doi: 10.25259/SNI\_526\_2024

### Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Journal or its management. The information contained in this article should not be considered to be medical advice; patients should consult their own physicians for advice as to their specific medical needs.