

Ki Seong EOM  
Tae Young KIM



## CASE REPORT

# PROGRESSIVE SUBSEQUENT ADJACENT AND NONADJACENT VERTEBRAL COMPRESSION FRACTURES WITHIN A SHORT PERIOD AFTER MULTIPLE PERCUTANEOUS VERTEBROPLASTIES

### ABSTRACT

Percutaneous vertebroplasty (PV) is currently performed in patients with osteoporotic vertebral compression fractures (VCFs) who present with severe mechanical back pain, have restricted mobility, and require narcotic analgesics. However, sudden development of postoperative VCFs is not a rare complication, for which an additional PV is frequently performed. Here, we present a rare case of progressive subsequent adjacent and nonadjacent VCFs in many vertebral bodies that developed within a short period after multiple PVs were performed. We performed PV 6 times at 10 levels within an approximate 3.5-month period. Every time the patient visited us because of severe back pain, her vertebral condition was reassessed by repeated radiographs and MRI. PV was performed each time a newly developed VCF was detected. Fortunately, no complications occurred after PV. We also review previous reports and discuss the possible pathogenesis of this rare complication.

**Key Words:** Vertebroplasty; Osteoporosis; Fractures, Compression.



## OLGU SUNUMU

# MÜLTİPL PERKÜTAN VERTEBROPLASTİLERDEN KISA SÜRE SONRA BİTİŞİK OLAN VE OLMAYAN VERTEBRALARDA ORTAYA ÇIKAN PROGRESSİF KOMPRESYON KIRIKLARI

### Öz

Günümüzde şiddetli mekanik sırt ağrısı ve hareket kısıtlılığı ile gelen ve narkotik analjeziklere gereksinimi olan osteoporotik vertebra kompresyon kırıklarında (VKK) perkütan vertebroplastisi (PV) uygulanmaktadır. Ancak ek bir PV uygulaması gerektiren ani postoperatif VKK oluşması nadir bir komplikasyon değildir. Burada çok sayıda PV uygulamasından kısa bir süre sonra bitişik olan ve olmayan birçok vertebrada progressif kompresyon kırıkları ortaya çıkan bir olgu sunulmaktadır. Olguya yaklaşık 3.5 ay içinde altı kez 10 seviyede PV uygulandı. Şiddetli sırt ağrısı ile yeniden başvuran hastanın omurgası her defasında tekrarlanan grafiler ve MRG ile yeniden değerlendirildi. Yeni gelişen her VKK saptandığında PV uygulandı. PV'yi herhangi bir komplikasyon izlemedi. Daha önce yayınlanmış olgu bildirimleri gözden geçirilerek bu nadir komplikasyonun olası patogenezi tartışıldı.

**Anahtar Sözcükler:** Vertebroplastisi; Osteoporoz; Kırıklar, Kompresyon.

### İletişim (Correspondance)

Tae Young KIM  
Wonkwang University School of Medicine,  
Neurosurgery, Iksan, KORE (Kuzey)

Tlf: 82638591467  
e-posta: tykim@wonkwang.ac.kr

Geliş Tarihi: 11/04/2010  
(Received)

Kabul Tarihi: 04/07/2010  
(Accepted)

Wonkwang University School of Medicine,  
Neurosurgery, Iksan, KORE (Kuzey)



## INTRODUCTION

Vertebral compression fractures (VCFs) are the most common complications in osteoporosis. Percutaneous vertebroplasty (PV) is a therapeutic, interventional radiological procedure that involves injection of bone cement into a vertebral body lesion to relieve pain and strengthen bone. However, sudden development of postoperative VCFs is not a rare complication, for which an additional PV is frequently performed (1-3). Here, we present a rare case of progressive subsequent adjacent and nonadjacent VCFs in many vertebral bodies that developed within a short period after multiple PVs were performed. In addition, we also review previous reports and discuss the possible pathogenesis of this rare complication.

## CASE

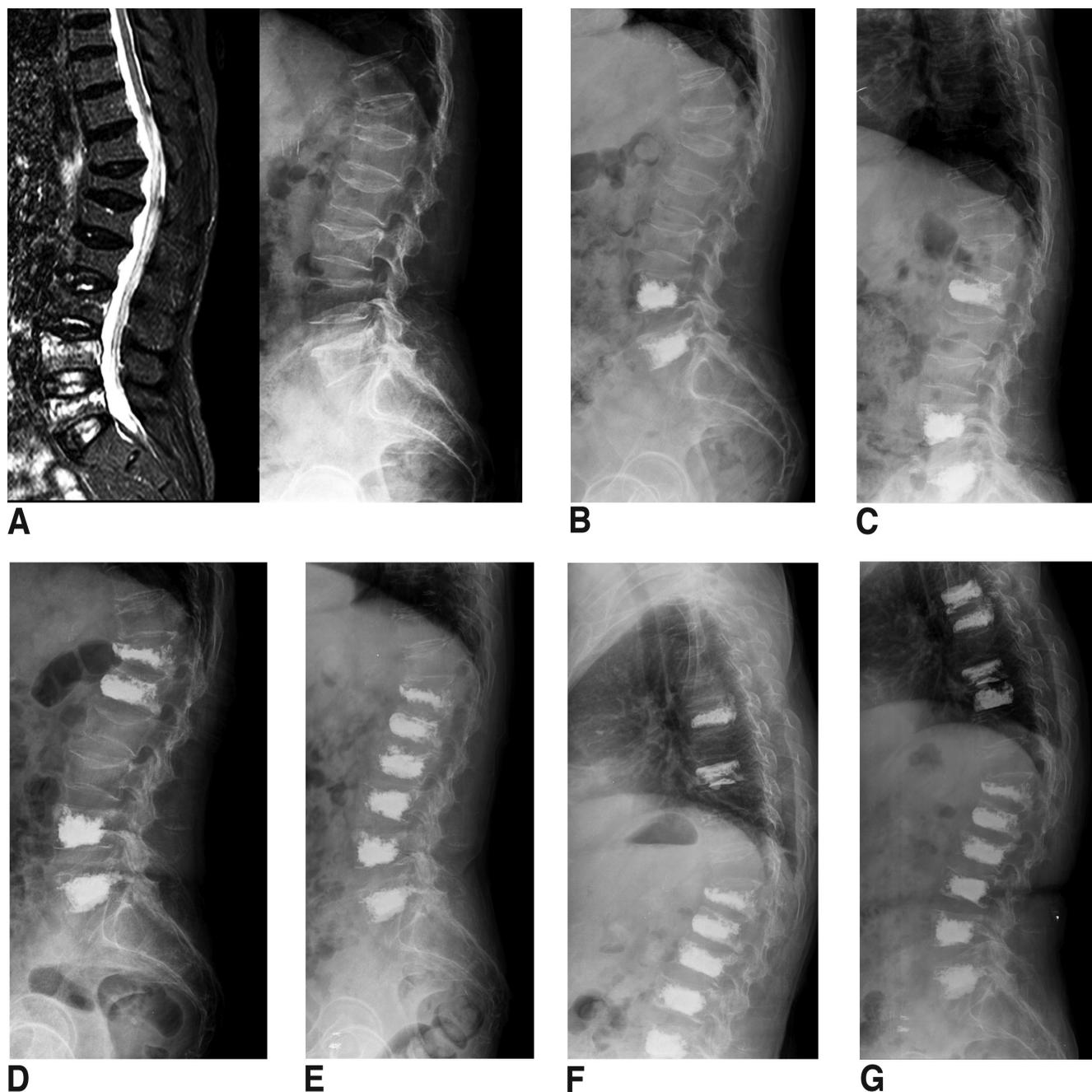
A 68-year-old woman presented with a 2-month history of severe pain in the lower back, which had started after lifting a heavy jar at her home. Her medical and surgical history was unremarkable. Her T-score for bone mineral density (BMD) was -3.7 and visual analogue scale (VAS) score was 9.8. A radiograph and magnetic resonance imaging (MRI) scan of the lumbar spine revealed acute VCFs in L4 and L5 (Figure 1A). PVs with polymethylmethacrylate (PMMA) at L4 and L5 were performed (Figure 1B). After the PVs, the pain resolved and she was discharged on the 3rd postoperative day. However, 2 weeks later, she returned to our hospital because she experienced back pain since the time immediately after her discharge. Her trauma history was unremarkable. Repeated radiograph and MRI scan revealed a nonadjacent VCF in L1. We performed a PV at L1 (Figure 1C) and the patient was discharged on the 4th postoperative day. Three weeks later, she was admitted again to our hospital with a 2-week history of severe back pain similar to what she had experienced after the 1st PV. Her trauma history was still unremarkable. Repeated radiograph and MRI revealed an adjacent VCF in T12. After performing a PV at T12 (Figure 1D), the pain resolved and she was discharged 1 week after the operation. As before, 3 weeks later, she was again admitted because of a 2-week history of severe lower back pain. Her trauma history was still unremarkable. Repeated radiograph and MRI scan revealed adjacent VCFs in L2 and L3. She was given conservative treatment, including facet joint and medial branch blocks and medication, and bed rest was advised. Despite the conservative treatment, the pain did not subside; therefore,

we decided to perform PVs at L2 and L3 (Figure 1E). After performing the PVs, she was relieved of pain and was discharged 1 week after the operation; with an advice to wear a thoracolumbosacral orthosis (TLSO) brace. However, 1 month later, she presented with a 2-week history of severe back and chest pain when breathing or moving and she reported that she had fallen. Radiograph and MRI revealed nonadjacent VCFs in T6 and T8. A bone scan revealed increased uptake in the 4th, 5th, 7th, and 9th left and 4th and 6th right ribs, suggesting acute multiple rib fractures. We performed PVs at T6 and T8 (Figure 1F) and multiple intercostal nerve blocks. She was not discharged from our hospital this time. However, 2 weeks later, she again developed severe back pain in absence of any history of trauma. Radiograph and MRI scan revealed nonadjacent VCFs in T5 and T9, and PVs were performed (Figure 1G). She was relieved of the pain (VAS score, 3.8) and was discharged. Six months after this operation, the patient is doing well, and no complications in relation to the PVs have been observed.

## DISCUSSION

PV is currently performed in patients with osteoporotic VCFs who present with severe mechanical back pain, have restricted mobility, and require narcotic analgesics. The risks of PV are low, and patients show a marked improvement and rapidly return to normal activities (4,5). Biomechanical tests have indicated that PV generally restores or increases vertebral body strength and stiffness, relative to corresponding prefracture values, and most likely serves as an internal splint that immobilizes the fracture-site (6,7). The overall complication rate associated with PV for the treatment of osteoporotic VCFs is reported to be 1–3% (5). In addition to the frequently discussed PV complications that include cement extravasation, infection, nerve root compression, and cement embolism, the collapse of the vertebral body that is adjacent to the one injected with PMMA has also been proposed by Deramond et al (1).

The incidence of subsequent VCF has been reported to vary from 12% to 52% (2). It is uncertain whether PV itself is the cause of subsequent VCFs. Some authors have reported that the occurrence of a subsequent fracture is indicative of a progression of the underlying disease, whereas others have suggested that cement augmentation and increased physical activity after PV may play a role in subsequent VCFs (2,8,9). Ahn et al. postulate that the mechanisms underlying the development of subsequent fractures differ for adjacent and



**Figure 1—** (A) Radiograph and magnetic resonance imaging (MRI) scan showing acute vertebral compression fractures in L4 and L5. (B) Radiograph obtained after 1st percutaneous vertebroplasties (PVs) showing cement within the L4 and L5. (C) Radiograph obtained after 2nd PV showing additional cement within the L1. (D) Radiograph obtained after 3rd PV showing additional cement within the T12. (E) Radiograph obtained after 4th PVs showing additional cement within the L2 and L3. (F) Radiograph obtained after 5th PVs showing additional cement within the T6 and T8. (G) Radiograph obtained after 6th PVs showing additional cement within the T5 and T9.



nonadjacent VCFs (2). The development of adjacent fractures can be explained by the direct pillar effect. Cement augmentation due to intradiscal PMMA leakage may increase the strength gradient, leading to an adjacent fracture in a very weak bone. In contrast, the development of a nonadjacent fracture can be explained by the dynamic hammer effect. If the adjacent segment is already rigid, the pillar effect is not prominently observed; however, a mobile remote segment may be affected by the augmentation strength. A mobility gradient between the rigid adjacent segment and relatively mobile remote segment may cause a subsequent nonadjacent fracture. Patients usually experience rapid clinical improvement after PV; as a result, they may become more active and engage in activities that they were unable to perform previously. This axial load on the vertebra may increase stress and result in the compression of adjacent vertebrae. Further, patients resume their normal activities during which they may fall, resulting in the fracture of other vertebrae, or even fractures in the extremities and hip (10).

The long-term risk of subsequent fractures is increased after a VCF, and new compression fractures occur repeatedly after PV (3). Tseng et al (3). reported that the risk of new adjacent fractures is high after PV, and these fractures occur earlier than nonadjacent level fractures (adjacent fractures,  $71.9 \pm 71.8$  days; nonadjacent fractures,  $286.8 \pm 232.8$  days). In patients with 2 or more VCFs, the risk factors for multiple VCFs are old age, low baseline BMD, and other pre-existing VCFs (3). Kim et al (11). reported that repeated osteoporotic VCFs result in multi-level PVs, as observed in our case. They performed PV 12 times at 13 levels (from T5 to S1) within an approximately 35-month period. The mean interval between PVs was 86.1 days (22–363 days). We performed PV 6 times at 10 levels within an approximate 3.5-month period. Every time she visited us because of severe back pain, her vertebral condition was reassessed by repeated radiograph and MRI. PV was performed each time a newly developed VCF was detected. Fortunately, no complications occurred after PV.

## CONCLUSION

This is a rare case of progressive subsequent VCFs in many vertebral bodies that developed within a short period after multiple PVs were performed. Although the exact mechanism underlying this rare complication remains unclear, a repeated

PV may be an effective treatment for subsequent painful VCFs. Further biomechanical and clinical studies should be conducted to obtain more precise data. Effective and sustained treatment for osteoporosis should be introduced as early as possible.

## REFERENCES

1. Deramond H, Depriester C, Galibert P, Le Gars D. Percutaneous vertebroplasty with polymethylmethacrylate. Technique, indications, and results. *Radiol Clin North Am* 1998;36:533-46. (PMID:9597071).
2. Ahn Y, Lee JH, Lee HY, Lee SH, Keem SH. Predictive factors for subsequent vertebral fracture after percutaneous vertebroplasty. *J Neurosurg Spine* 2008;9:129-36. (PMID:18764744).
3. Tseng YY, Yang TC, Tu PH, Lo YL, Yang ST. Repeated and multiple new vertebral compression fractures after percutaneous transpedicular vertebroplasty. *Spine (Phila Pa 1976)* 2009;34:1917-22. (PMID:19652633).
4. Tohmeh AG, Mathis JM, Fenton DC, Levine AM, Belkoff SM. Biomechanical efficacy of unipedicular versus bipedicular vertebroplasty for the management of osteoporotic compression fractures. *Spine (Phila Pa 1976)* 1999;24:1772-6. (PMID:10488505).
5. Uppin AA, Hirsch JA, Centenera LV, Pfiefer BA, Pazianos AG, Choi IS. Occurrence of new vertebral body fracture after percutaneous vertebroplasty in patients with osteoporosis. *Radiology* 2003;226:119-24. (PMID:12511679).
6. Baroud G, Bohner M. Biomechanical impact of vertebroplasty. Postoperative biomechanics of vertebroplasty. *Joint Bone Spine* 2006;73:144-50. (PMID:16095945).
7. Dean JR, Ison KT, Gishen P. The strengthening effect of percutaneous vertebroplasty. *Clin Radiol* 2000;55:471-6. (PMID:10873694).
8. Lindsay R, Burge RT, Strauss DM. One year outcomes and costs following a vertebral fracture. *Osteoporos Int* 2005;16:78-85. (PMID:15167988).
9. Kim SH, Kang HS, Choi JA, Ahn JM. Risk factors of new compression fractures in adjacent vertebrae after percutaneous vertebroplasty. *Acta Radiol* 2004;45:440-5. (PMID:15323398).
10. Jensen ME, Dion JE. Percutaneous vertebroplasty in the treatment of osteoporotic compression fractures. *Neuroimaging Clin N Am* 2000;10:547-68. (PMID:11083018).
11. Kim HW, Song JW, Kwon A, Kim IH. Extreme multi-level percutaneous vertebroplasty for newly developed multiple adjacent compression fractures. *J Korean Neurosurg Soc* 2009;45:378-80. (PMID:19609423).