**Originl Article**

J. of Advanced Spine Surgery
Volume 6, Number 2, pp 57~60

JASS

# An Augmentation Technique for the Treatment of Osteoporotic Vertebral Compression Fracture

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Percutaneous vertebroplasty and balloon kyphoplasty are both safe and effective procedures in case of patients with osteoporotic vertebral compression fractures. The authors have already reported a new technique called lordoplasty using polymethylmethacrylate to manage vertebral osteoporotic compression fractures. The purpose and indication of lordoplasty do not differ from that of percutaneous vertebroplasty or balloon kyphoplasty. However, there are advantages of lordoplasty in terms of restoration of the wedge and kyphotic angle and cost-effectiveness compared with the other procedures mentioned above. For the advantages of lordoplasty, authors thereby introduce the detailed procedure of lordoplasty.

**Keywords:** Compression fracture, Osteoporosis, Vertebroplasty, Lordoplasty

The use of percutaneous vertebroplasty (PVP) is increasing as a treatment for painful vertebral compression fracture. When performed by experienced practitioners for carefully selected patients, PVP has been found to be a safe, inexpensive and highly effective procedure. Despite the high success of PVP, the procedure does not address the associated spinal malalignment because of kyphotic deformity. This kyphotic deformity leads to the relapse of pain, cosmetic problems and consequently pulmonary and gastrointestinal problems.[1] There is also an increased risk of further osteoporotic fractures of the adjacent vertebrae.[2] It is well known that a loss of lordosis encourages further vertebral compression fractures due to overloading the anterior column of the spine and that the height of the vertebral body and the segmental lordotic curve cannot be sufficiently restored using PVP. One way to restore the height and lordosis is performing kyphoplasty (KP). However, the restoration of the kyphotic angle is limited up to 6 to 9 degrees due to collapse of height after deflating bone temps.[3] A more effective method has already been introduced by Orler et al.[4] and it is known as lordoplasty (LP). We present here the detailed procedures and technical cautions of this novel technique.

## Surgical Technique

Under the spinal anesthesia, the patient should be placed in hyperextended position in order to achieve and support the restoration of kyphotic angle. Consultation to the anesthetist must be underwent in case of requring high-level anesthesia. The abdomen of the patient should be allowed to hang freely with a pad supporting the pelvis and sternum. A stab incision is made on the pedicle level of the skin. The correct incision site is identified with the anteroposterior (AP) view of the image intensifier. A guide wire is placed through the incision, and the position of the tip of wire should be cranial and lateral of the pedicle projection. The wire can be led by long forceps to keep the operator's hand away from the X-ray projection. The guide wire is then penetrated further with hammer blows until the tip of

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guide wire reaches the medial wall of the pedicle. This step can be repeated on another pedicle of the fractured vertebra and adjacent upper and lower vertebrae. Kirschner wires can be used to perform LP of one fractured vertebra. The depth of the tip of the wire is verified on the lateral view of the image intensifier. It is important that the wire tip be at least over the posterior cortex of the vertebral body. The filling cannulas are inserted over the wire with gentle rotating movements. The tip of the cannula must also be placed over the ventral half of the vertebral body. Then the guide wires are removed and the bony remnants in the cannula can be cleared with a blunt trochar. A blunt trochar should be inserted into the anterior border of the vertebral body to ensure a pathway for the cement. The cement is then mixed and placed into a 20 ml syringe, and the cement is transferred to 3 ml and 1 ml syringes. The cement should be highly viscous before injection and not be dropped from the syringe. After all cannulas are placed, as described above, both the distal and proximal vertebral bodies are augmented first. The cannula should be filled carefully with cement in a 1.5 ml syringe. As soon as the cement is beaded at the tip of cannula, the next cannula is filled with the same procedure (Fig. 1A). The filling should be carried out separately to control the cannulas. The filling is always carried out under lateral control with an image intensifier. After filling the cannulas, the cement is injected into the vertebral body through a 1 ml syringe. The spread of the cement is monitored by lateral control with an image intensifier (Fig. 1B). One to two mL of cement is sufficient for each cannula. After the cement became hardened, a lordosing force is ap-

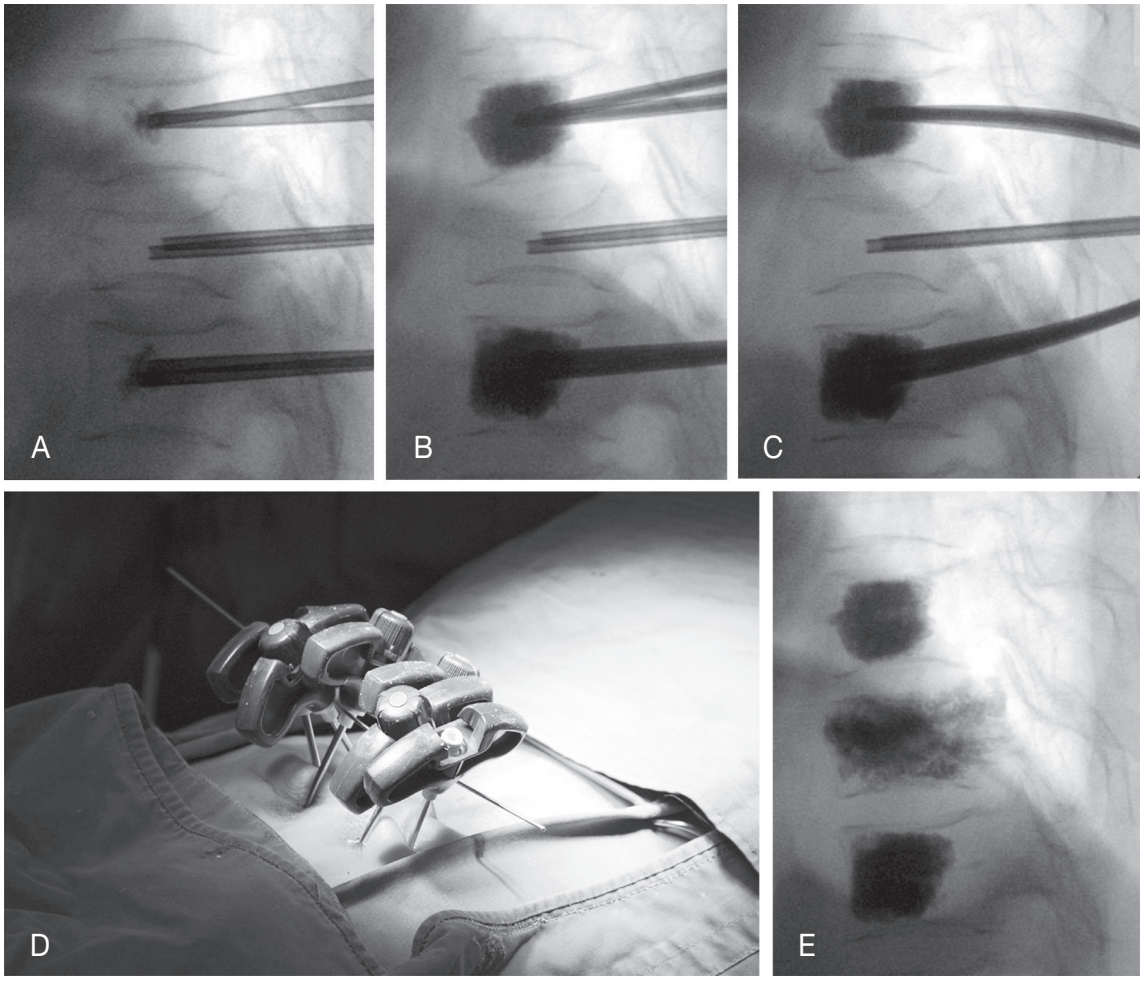


**Fig. 1.** The procedures of loroplasty. **(A)** The cement was injected under control with an image intensifier. The condition of the cement at the tip of the cannula must be observed. **(B)** The cement spread like a growing cloud and should be injected gradually. **(C, D)** Relevant reduction of the vertebral body was achieved with using lordotic force. **(E)** Lordoplasty was completed.

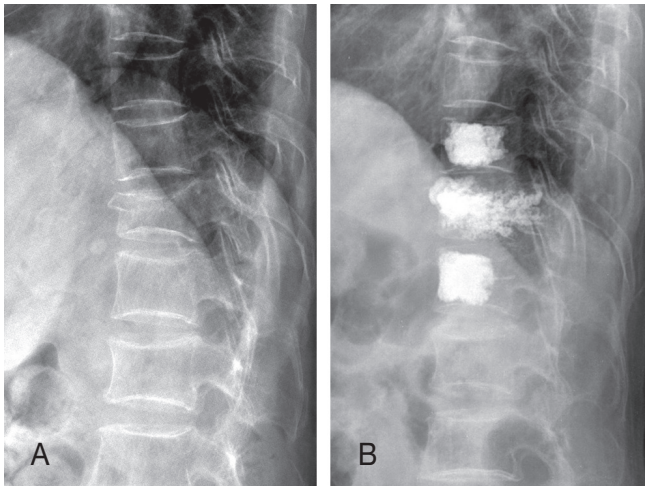


**Fig. 2. (A, B)** A 78-year-old female patient: lordoplasty was performed on a vertebral compression fracture of T11.

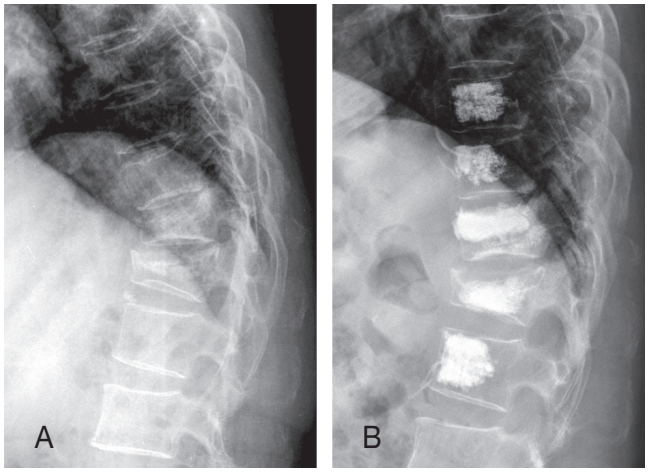


**Fig. 3. (A, B)** A 65-year-old female patient: closed reduction was carried out.

plied to the cannulas of the proximal and distal vertebrae in the place (Fig. 1C). The fracture of vertebral body is then reduced in the sense of ligamentotaxis using adjacent cemented vertebrae as levers. The reduction force of cannulas can be held with a cross bolt. In other words, the anterior height is recovered by cantilever bending. Being kept in a reduced state by a cross bolt, the fractured vertebra body is augmented using another activated cement. The lordosing force should not be loosened until the cement become hardened. After the cement had hardened, the cannulas are removed with a slight turn (Fig. 1D). There are three cases of vertebral compression fractures treated with lordoplasty procedure as follows (Fig. 2-4).

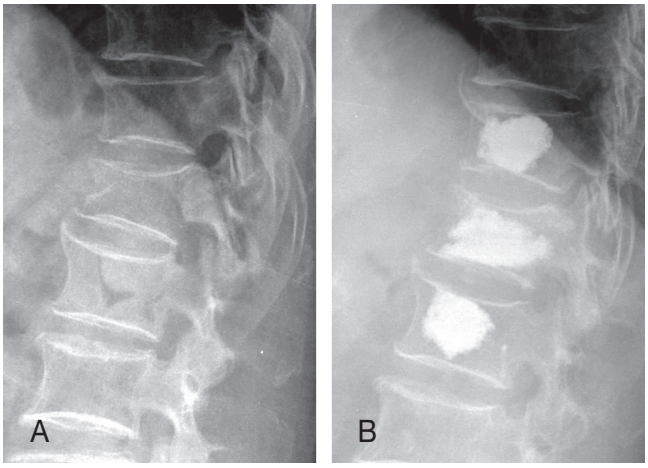


**Fig. 4. (A, B)** A 74-year-old female patient: The kyphotic and wedge angles were recovered.

# Discussion

The objective of treating osteoporotic vertebral compression fracture is relief of pain and the restoration of spinal deformity with minimal invasive therapies such as PVP, KP and LP.[4-6] Kim et al[7] reported an average improvement of the vertebral height of 17.5% and a reduction of 7.0 degrees of the kyphotic angle by performing KP. However, the resulting reduction after cementing was about 25% lower due to the partial collapse after balloon deflation.

LP was first introduced by Orler et al.[4] as an alternative to KP in 2006. They attained a better initial outcome of 15.2 degrees and 10.0 degrees for the vertebral and segmental kyphotic angles, respectively. Jeon et al.[8] also reported successful outcomes of LP, which is as effective as KP. PVP simply introduces cement, and a correction of the vertebral structure is occasionally achieved. Recently Hoppe et al[6] reported that LP showed safe and effective midterm pain alleviation and restoration of kyphotic deformity in osteoporotic compression and insufficiency fractures. Overall, further studies including larger number of patients and a longer follow-up period will be needed to evaluate the clinical efficacy and adverse effects of LP.

# Conclusion

LP is useful procedure in terms of the increased anatomic restoration, increased postoperative maintenance and cost-

effectiveness.

## REFERENCES


1. Schlaich C, Minne HW, Bruckner T, et al. Reduced pulmonary function in patients with spinal osteopo¬rotic fractures. Osteoporos Int. 1998;8(3):261-7.
2. Klotzbuecher CM, Ross PD, Landsman PB, et al. Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis. J Bone Miner Res. 2000;15(4):721-39.
3. Heini PF, Orler R. Kyphoplasty for treatment of osteo porotic vertebral fractures. Eur Spine J. 2004;13(3):184- 92.
4. Orler R, Frauchiger LH, Lange U, et al. Lordoplasty: report on early results with a new technique for the treatment of vertebral compression fractures to restore the lordosis. Eur Spine J. 2006;15(12):1769-75.
5. Benneker LM, Hoppe S. Percutaneous cement augmentation techniques for osteoporotic spinal fractures. Eur J Trauma Emerg Surg. 2013;39:445–53.
6. Hoppe S, Budmiger M, Bissig P, et al. Lordoplasty: midterm outcome of an alternative augmentation technique for vertebral fractures. J Neurosurg Spine. 2016;19:1-6.
7. Kim SB, Jeon TS, Lee WS et al. Comparison of kyphoplasty and lordoplasty in the treatment of osteoporotic vertebral compression fracture. Asian Spine J. 2010;4:102-8.
8. Jeon TS, Kim SB, Park WK. Lordoplasty: an alternative technique for the treatment of osteoporotic compression fracture. Clin Orthop Surg. 2011;3:161-6.


### 전만성형술을 이용한 골다공증성 척추 압박골절의 치료

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경피적 척추성형술과 풍선성형술은 골다공증성 척추 압박골절의 치료에 있어 모두 안전하며 효과적인 치료법이다. 저자들은 이미 골다공증성 압박골절의 치료에 있어 골시멘트를 이용한 전만성형술의 효용성에 대해 보고한 바 있다. 전만성형술의 목적과 치료의 적응증은 경피적 척추성형술이나 풍선성형술과 다를 바 없지만, 쐐기각과 전만각의 복원 및 유지, 경제적 효율성 등에서는 유리한 측면이 있다. 이에 저자들은 전만성형술의 자세한 수술 술기에 대해 소개하고자 한다.

**색인 단어:** 압박골절, 골다공증, 척추성형술, 전만성형술