

Figure 1. Before treatment of Case 1.

In the sagittal section of the T1 weighted MRI, the left L3 nerve root was poorly visualized in the left L3/4 foramen due to a herniation (A, arrowhead). A horizontal section of T2 weighted MRI showed lateral disc herniation from inside to outside the left foramen at L3/4 (B, arrowhead). In the mid-sagittal section of a T2 weighted MRI, the degree of affected-disc degeneration was Grade IV, according to Pfirrmann classification⁸⁾ (C, arrowhead). Standing radiography revealed that the L3/4 disc height was maintained (D, arrowhead). A CT after myelodiscography showed inflow of contrast media into a left extraforaminal herniation at L3/4, but no intraforaminal or extraforaminal bony stenosis (E, arrowhead).

men due to a herniation (Fig. 3A). In the horizontal section of the T2 weighted MRI showed right extraforaminal disc herniation with high signal intensity at L3/4 (Fig. 3B). The degree of affected-disc degeneration was Grade III, according to Pfirrmann classification⁸⁾ (Fig. 3C). Standing radiography showed that the L3/4 disc height was maintained (Fig. 3D). A plain CT did not show osteophytes (Fig. 3E).

Due to the poor analgesic effect of oral drugs and selective nerve root blocks, the patient was unable to proceed with rehabilitation. Similar to case 1, 1.25 U condoliase was injected (Fig. 4A).

The pain had gradually decreased and had almost disappeared after 10 days. An MRI performed four months after treatment showed that the herniation had slightly decreased

in size, and the right L3 nerve root could be visualized (Fig. 4B, C). On standing radiography, the L3/4 disc height was slightly diminished (Fig. 4D). The JOA score had improved to 21/29 points.

Condoliase injected into an intervertebral disc specifically dissolves glycosaminoglycans, which constitute proteoglycans, the main component of the nucleus pulposus⁶⁾. This restricts the proteoglycans' water-holding capacity, reducing pressure inside the intervertebral disc, lowering the pressure on the nerve root from the hernia, and improving lower extremity and low back pain⁶⁾. A previous study observed significant analgesic effects, improved lumbar function, and improved quality of life compared to a placebo in cases of protrusion-type or subligamentous-type lumbar disc hernia-

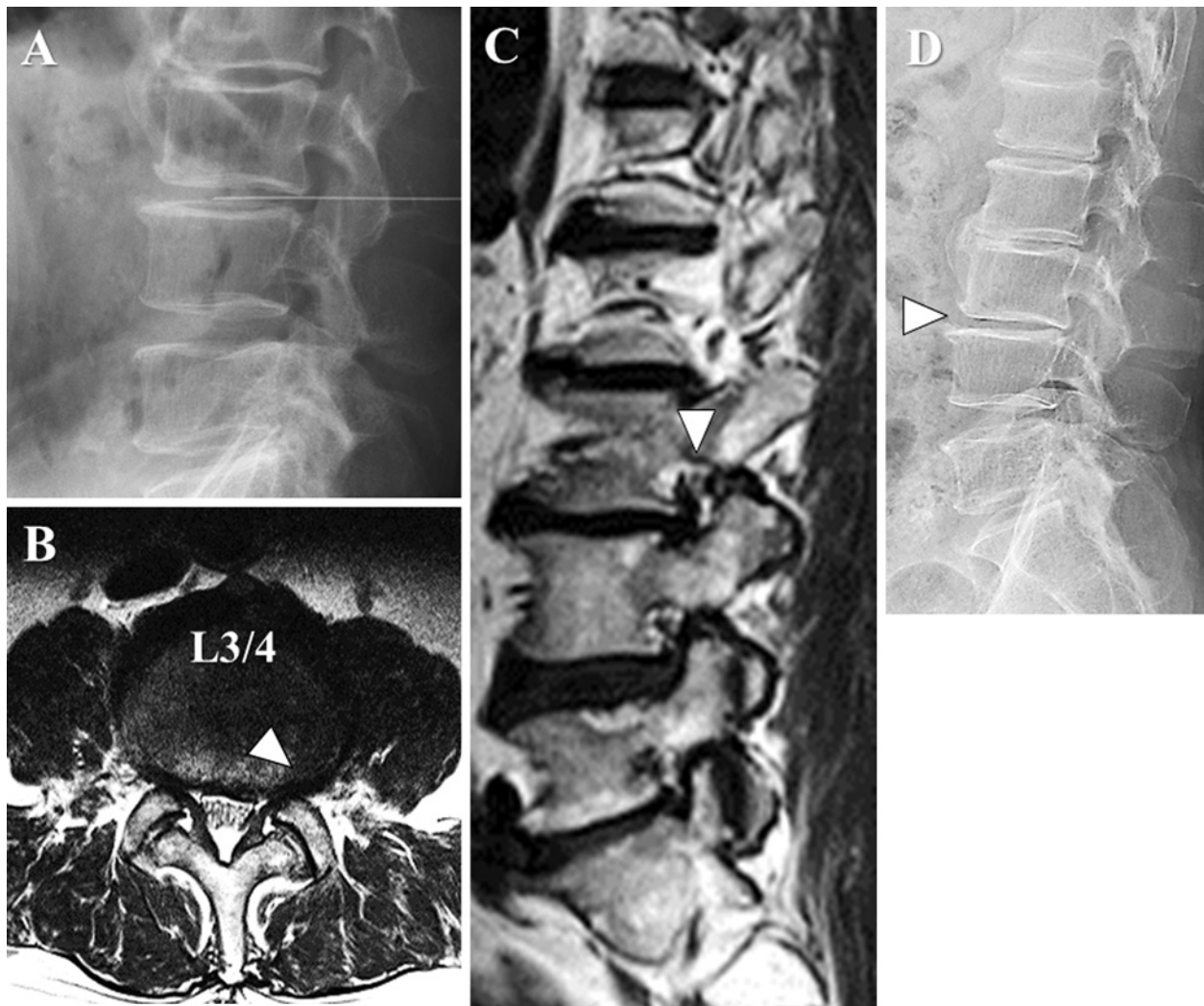


Figure 2. During and after treatment of Case 1.

In the prone position, a 12 cm spinal needle was inserted from the right-lateral side under fluoroscopy and advanced to the center of the L3/4 disc, where 1.25 U condoliase dissolved in 1.2 mL of physiological saline was injected (A). A lumbar MRI three months after treatment showed that the left extraforaminal herniation at L3/4 had slightly decreased in size in the horizontal section of a T2 weighted image (B, arrowhead) and the left L3 nerve root in the L3/4 foramen was visualized in sagittal section of T1 weighted image (C, arrowhead). On standing radiography, the L3/4 disc height was slightly diminished (D, arrowhead).

tion inside the spinal canal⁹). Another study concluded that condoliase injections seem to be most effective for transligamentous type and herniation with high signal change on the T2 weighted image⁹. They also indicated that there was no significant difference in affected-disc degeneration between efficacious and inefficacious group⁹.

This study is the first report on condoliase injections for LLDH. In both cases, conservative therapy with oral medications and selective nerve root block were not successful. However, intradiscal condoliase injections were effective, achieving an analgesic effect soon after treatment and allowing elderly patients to avoid surgery. In case 1, although the affected-disc degeneration had progressed, the disc height was maintained. Therefore, there seemed to be contained nucleus pulposus component in the herniated disc. In case 2, the disc herniation showed high signal change on the T2 weighted image, which is the better condition for condoliase

injection therapy⁹.

Although more findings from large case series or comparative studies are needed, this report suggests that intradiscal condoliase injection could be a useful, novel conservative treatment option for LLDH.

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Ethical Approval: Unnecessary for Clinical Correspon-

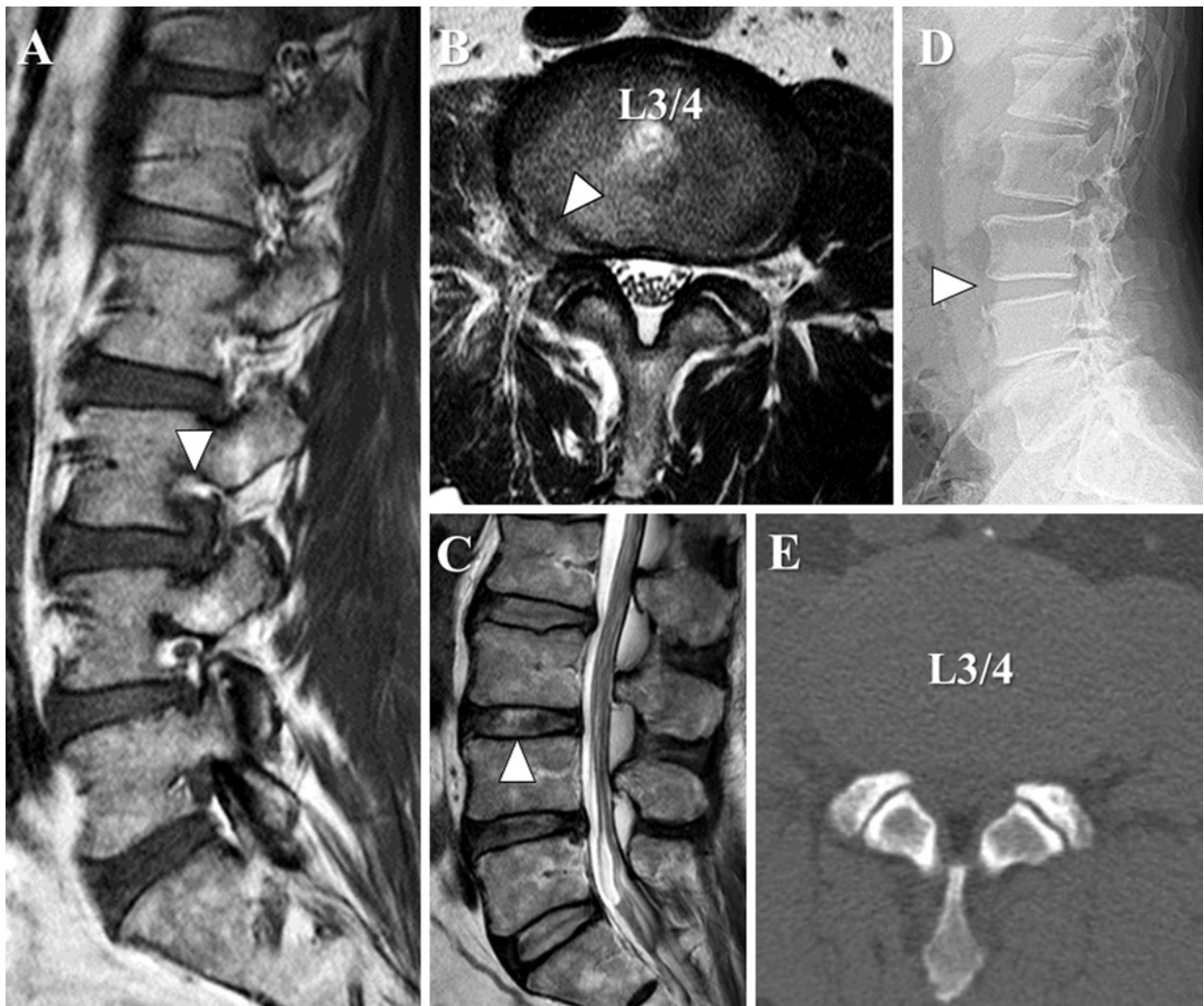


Figure 3. Before treatment of Case 2.

In the sagittal section of a T1 weighted MRI, the right L3 nerve root was poorly visualized in the right L3/4 foramen due to a herniation (A, arrowhead). In the horizontal section of a T2 weighted MRI showed right extraforaminal disc herniation with high signal intensity at L3/4 (B, arrowhead). In the mid-sagittal section of T2 weighted MRI, the degree of affected-disc degeneration was Grade III, according to Pfirrmann classification⁸⁾ (C, arrowhead). Standing radiography showed that the L3/4 disc height was maintained (D, arrowhead). A plain CT did not show osteophytes at L3/4 (E).

dence.

Informed Consent: Informed consent was obtained by the patients in this study.

References

1. Marquard G, Bruder M, Theuss S, et al. Ultra-long-term outcome of surgically treated far-lateral, extraforaminal lumbar disc herniations: a single-center series. *Eur Spine J.* 2012;21(4):660-5.
2. Epstein NE. Foraminal and far lateral lumbar disc herniations: surgical alternatives and outcome measures. *Spinal Cord.* 2002;40(10):491-500.
3. Salame K, Lidar Z. Minimally invasive approach to far lateral lumbar disc herniation: technique and clinical results. *Acta Neurochir.* 2010;152(4):663-8.
4. Lee JH, Lee SH. Clinical and radiological characteristics of lumbar lateral disc herniation in comparison with those of medial disc herniation. *Medicine.* 2016;95(7):e2733.
5. Matsuyama Y, Chiba K. Condoliase for treatment of lumbar disc herniation. *Drugs Today.* 2019;55(1):17-23.
6. Matsuyama Y, Chiba K, Iwata H, et al. A multicenter, randomized, double-blind, dose-finding study of condoliase in patients with lumbar disc herniation. *J Neurosurg Spine.* 2018;28(5):499-511.
7. Chiba K, Matsuyama Y, Seo T, et al. Condoliase for the treatment of lumbar disc herniation: a randomized controlled trial. *Spine.* 2018;43(15):E869-76.
8. Pfirrmann C, Metzdorf A, Zanetti M, et al. Magnetic resonance classification of lumbar intervertebral disc degeneration. *Spine.* 2001;26(17):1873-8.
9. Banno T, Hasegawa T, Yamato Y, et al. Clinical outcome of condoliase injection treatment for lumbar disc herniation: Indications for condoliase therapy. *J Orthop Sci.* 2020.

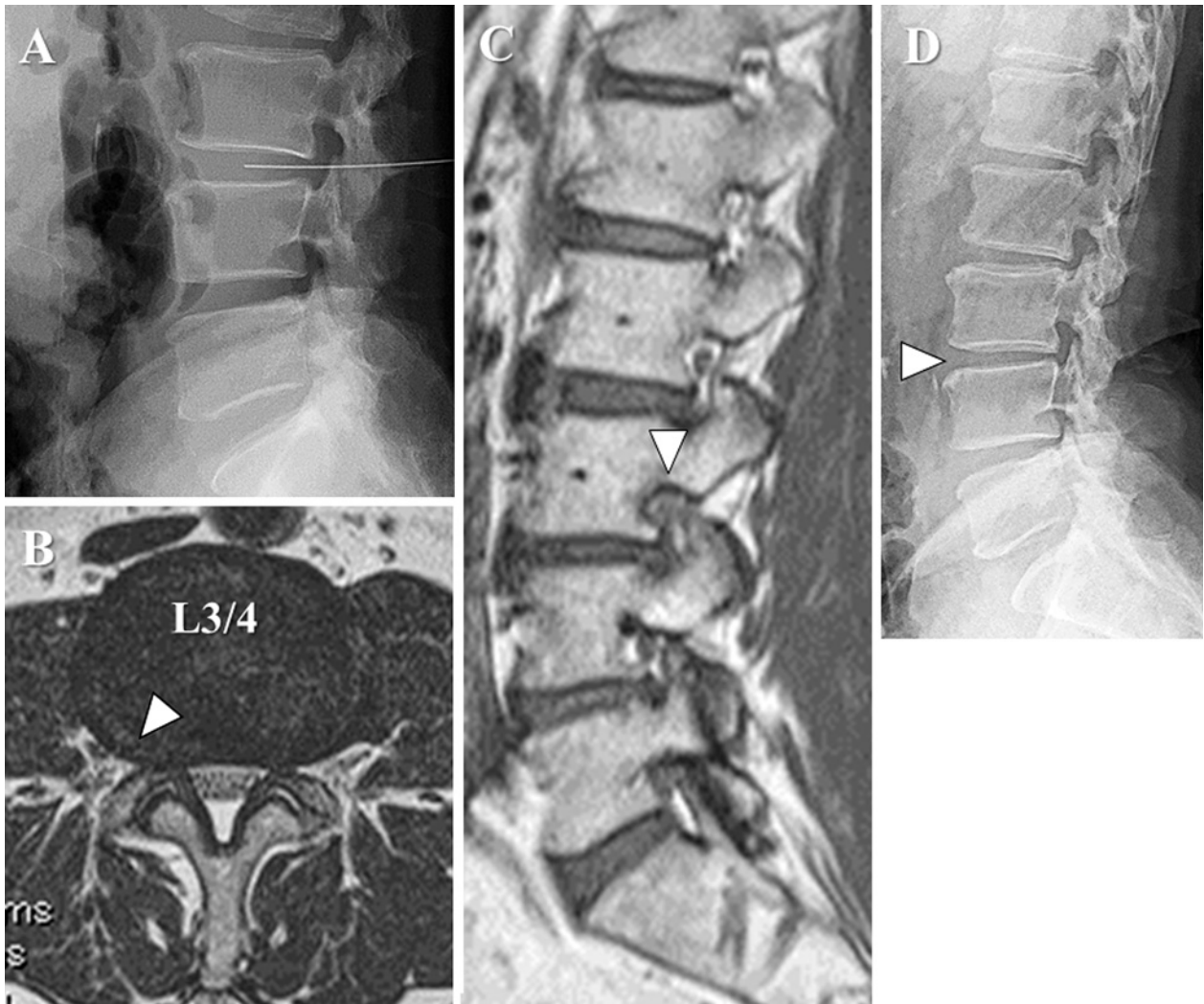


Figure 4. During and after treatment of Case 2.

Similar to case 1, 1.25 U condoliase was injected into the intervertebral disc from the left-lateral side (A). A lumbar MRI performed 4 months after treatment showed that the right extraforaminal herniation at L3/4 had slightly decreased in size in the horizontal section of T2 weighted image (B) and the right L3 nerve root in the L3/4 foramen could be visualized in the sagittal section of T1 weighted image (C, arrowhead). On standing radiography, the L3/4 disc height was slightly diminished (D, arrowhead).

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