



Full-endoscopic spine surgery for radiculopathy after osteoporotic vertebral compression fractures: a case report

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Abstract: Full-endoscopic spine surgery (FESS) is a suitable treatment for lumbar disc herniation (LDH) and foraminal stenosis. Here, we describe the usefulness of FESS for treating radiculopathy after osteoporotic vertebral compression fractures (OVCFs). Between October 2018 and April 2019, three female patients (mean age, 81.7 years) with radiculopathy after OVCFs underwent FESS. Decompression of the corresponding nerve root was achieved using several FESS techniques, including foraminoplasty, discectomy, and removal of osteophyte or cement leakage. The mean operative time was 60.7 min. Preoperative and postoperative statuses were evaluated using numerical rating scale (NRS) scores. The mean pre- and postoperative NRS scores were 9 and 2.3, respectively. We observed no postoperative complications. Our results demonstrate that FESS is a safe and effective minimally invasive treatment for radiculopathy after OVCFs, with the potential to be an alternative to vertebroplasty, balloon kyphoplasty (BKP), or lumbar interbody fusion.

Keywords: Full-endoscopic spine surgery (FESS); radiculopathy; osteoporotic vertebral compression fractures (OVCFs); foraminoplasty; minimally invasive

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Introduction

Percutaneous vertebroplasty (PVP) and balloon kyphoplasty (BKP) are minimally invasive operative procedures for the treatment of osteoporotic vertebral compression fractures (OVCFs). As the population in Japan is aging rapidly, BKP has become one of the most popular and widely used operative procedures. BKP is effective for back and radicular pain (1). Polymethylmethacrylate (PMMA) leakage, the most frequent complication, can occur into paravertebral soft tissue, veins, the intervertebral disc space, or the spinal canal (epidural space or vertebral foramen) (2,3). Subsequently, leakage to the vertebral foramen can cause newly developing radiculopathy (4). Even after conservative therapy for OVCFs (bed rest at the acute

phase, medication, and external fixation by a corset), delayed onset of radiculopathy is observed in some cases due to advanced vertebral collapse. Interbody fusion surgery is a reasonable treatment for vertebral fracture, but such surgery is invasive for elderly patients and the complications are not rare. As OVCFs occur based on osteoporosis, subsequent adjacent vertebral fractures frequently occur even at screwed vertebrae.

In contrast, the recently developed full-endoscopic spine surgery (FESS) is one of the most sophisticated operative procedures for the treatment of lumbar disc herniation (LDH). FESS can be used to treat LDH (5,6) as well as foraminal stenosis using a high-speed drill (7). We have used FESS to treat radiculopathy after OVCFs. In this case report, we summarize our experience and demonstrate

Table 1 Summary of the detailed features of the three cases of radiculopathy after OVCFs

Case	Age (years)	Sex	OVCFs location	Radiculopathy	Onset	Treatment*	FESS** (months)	Foraminoplasty	Discectomy	Operation time (min)	Postoperative hospital stay	NRS	
												Preop	Postop
1	80	F	L3	Left L3	Acute	Conservative	8	+	+	57	1	9	4
2	82	F	L3	Left L3	Chronic	Conservative	9	+	+	53	1	10	2
3	83	F	L3	Right L3	Chronic	BKP	7	+	+	72	1	8	1

* , initial treatment against OVCFs that was performed in a previous hospital; **, duration between onset of OVCFs and FESS. OVCFs, osteoporotic vertebral compression fractures; FESS, full-endoscopic spine surgery; NRS, numerical rating scale; Preop, pre-operation; Postop, post-operation; BKP, balloon kyphoplasty.

the technical FESS-related tips for the treatment of radiculopathy after OVCFs.

Case presentation

Between October 2018 and April 2019, three consecutive patients with radiculopathy after OVCFs underwent FESS with a 7-mm diameter spinal full-endoscopic system (Richard Wolf GmbH, Knittlingen, Germany). All patients had severe unilateral radiculopathy that was resistant to medical treatment, epidural steroid injection, and/or nerve block. To focus on foraminal stenosis after OVCFs, we excluded a patient who received FESS for lateral recesses stenosis after OVCFs.

For all patients, FESS was conducted at only one vertebral level by a single surgeon (Hisashi Koga). Neurological examination, electrophysiological examination, and preoperative magnetic resonance imaging (MRI) and computed tomography (CT) were used to diagnose foraminal stenosis after OVCFs. Each patient's leg pain was evaluated using the numerical rating scale (NRS) score.

Surgical technique

The patients were carefully log-rolled into a prone position. The surgery was performed under general anesthesia and simultaneous motor-evoked potential monitoring. During the operation, a fluoroscope was placed across the center of the operating table to ensure appropriate positioning. Eight-millimeter ipsilateral skin and fascial incisions were made on the corresponding vertebral level 6–7 cm lateral from midline. The basic operative procedures for LDH [full-endoscopic discectomy (FED)-transforaminal approach (TFA)] (8) and for foraminoplasty [(FED)-posterolateral approach (PLA)] (5) were performed as described previously.

Three female patients were registered in this study. The mean patient age was 81.7 years (range, 80–83 years), significantly higher than that of our previous case series of FESS (5–8). BKP was previously performed on one patient in another hospital. The average period between onset of OVCFs and FESS was 8 months (range, 7–9 months) (Table 1).

The detailed disease states are described in Table 1; the operative findings revealed that all patients had foraminal stenosis and LDH. The presence of extraforaminal stenosis was also suspected by impingement of osteophytes on the nerve root; thus, removal of the osteophytes along a

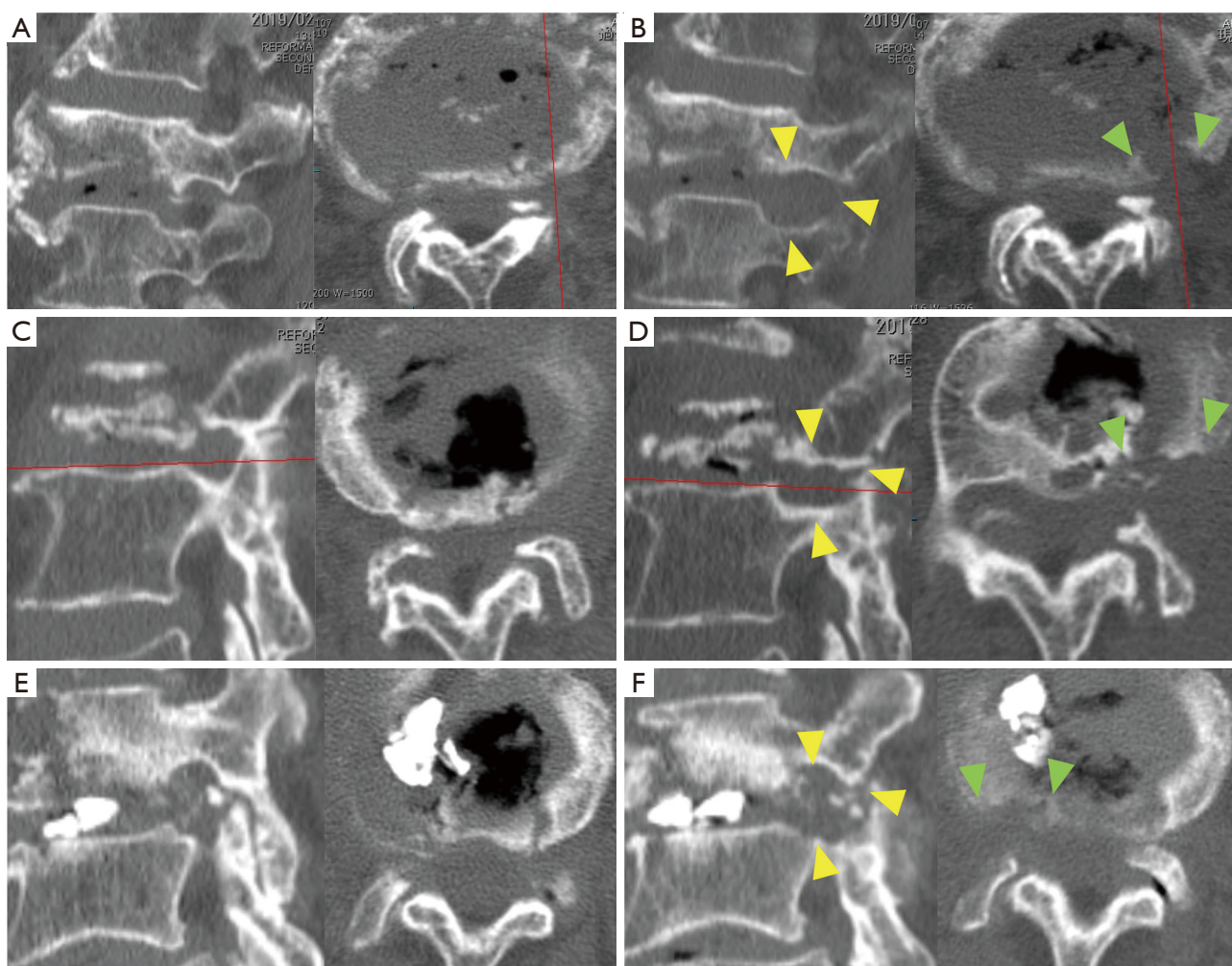


Figure 1 Computed tomography findings of case 1 (A,B), case 2 (C,D), case 3 (E,F). Preoperative (A,C,E) and postoperative (B,D,F) sagittal (left) and axial (right) CT images are shown. The yellow arrows indicate the areas of foraminoplasty, while the green arrows indicate the areas of osteophyte removal located along a vertebral endplate. CT, computed tomography.

vertebral endplate was also performed in all cases (*Figure 1*). The mean operative time was 60.7 min (range, 53–72 min); the mean blood loss was negligible in all patients. We observed no operative complications, and all patients were discharged from the hospital the day after the FESS. Immediately after the FESS, leg pain stemming from radiculopathy after OVCFs improved in all cases. The NRS scores improved in all cases from a mean of 9 to a mean of 2.3 (*Table 1*).

The MRI and intraoperative endoscopy findings of a representative case (No. 3) are shown in *Figure 2*. This 83-year-old woman presented with lower back pain and right leg pain (L3 dermatomes) that started 7 months after L3 OVCF. Despite undergoing BKP in another hospital,

her pain did not improve. She visited our outpatient clinic in a wheelchair. A neurological examination revealed a positive straight leg raise on the right side (40+/80) and moderate muscle weakness (iliopsoas muscle: 3/5; quadriceps muscle: 4/5). Lumbar MRI revealed L3 OVCF and foraminal stenosis of the right L3 nerve root (*Figure 2A*). In addition to decreasing foraminal length and width due to OVCF (*Figure 1E*), CT demonstrated PMMA leakage into the intervertebral disc space (*Figure 2D*, left, blue arrowhead). During the operation, the superior articular process was removed first, followed by the osteophyte and extruded disc material (*Figure 2C*). Immediately postoperative, the patient's leg pain improved and the leaked PMMA disappeared (*Figure 2D*, right). At 2 months postoperative,

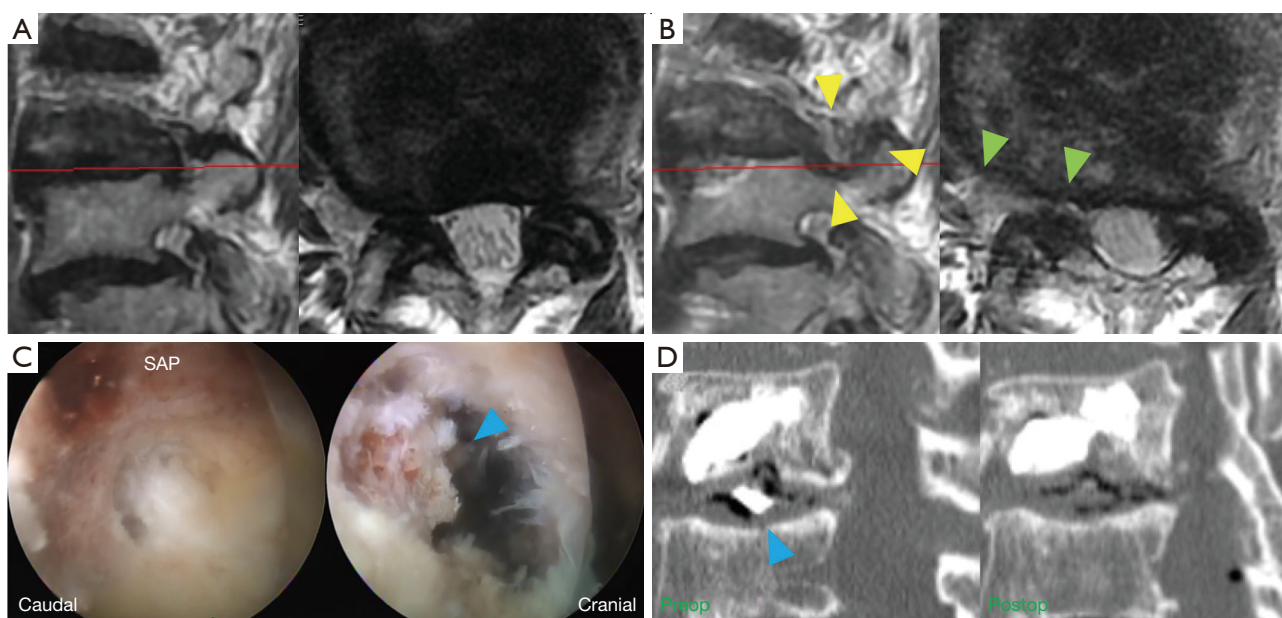


Figure 2 MRI, intraoperative endoscopy, and CT findings of case 3. Preoperative (A) and postoperative (B) sagittal (left) and axial (right) T2-weighted MRI showing the enlarged foramen (yellow arrows) and the area after removing vertebral osteophytes (green arrows) (B); (C) after removal of the SAP, a protruded white disc material appeared at the center of the endoscopic view (left). Subsequent removal of the disc material created a large cavity at the intervertebral disc space that leaked PMMA (blue arrow) at the bottom of the cavity; (D) preoperative (left) and postoperative (right) sagittal CT showing leaked PMMA at the intervertebral disc space (blue arrow). Note that the leaked PMMA disappeared after the full-endoscopic spine surgery. SAP, superior articular process; Preop, pre-operation; Postop, post-operation; MRI, magnetic resonance imaging; CT, computed tomography; PMMA, polymethylmethacrylate.

the patient's muscle weakness had also improved, allowing her to walk with a cane. Postoperative MRI (Figure 2B) and CT (Figure 1F) images revealed enlargement of the intervertebral foramen.

Discussion

The frequency of OVCFs is increasing as the elderly population grows. Although the major symptom of OVCFs is back pain, neurological symptoms such as myelopathy, cauda equina syndrome, and radiculopathy also occur. The incidence of radiculopathy with severe pain is not rare. Sasaki *et al.* observed severe pain in 10 of 66 OVCF patients (15.2%), while Kim *et al.* reported a 25% (15/59) rate (1,9). It was also reported that OVCFs at the lower lumbar spine occasionally induce radiculopathy (10).

Myelopathy and cauda equina syndrome combined with bladder and rectal disturbances require rapid surgical treatment, whereas radiculopathy after OVCFs without severe motor dysfunction is frequently treated conservatively. Prolonged radiculopathy must be treated

surgically; however, posterior decompression may be insufficient and additional intervertebral fusion is frequently required. Interbody fusion surgery is effective for radiculopathy after OVCFs but is invasive and high-risk for elderly patients with osteoporosis. The advent of a less invasive surgical treatment would allow surgical intervention at the early stage of radiculopathy. PVP and BKP have the potential to be such treatments, but they may also cause radiculopathy via PMMA leakage (4).

Enlargement of collapsed vertebral foramen (foraminoplasty) is the core principle of FESS treatment. Lumbar disc degeneration is correlated with OVCFs (11), as evidenced by LDH in all cases. FESS seems to be an appropriate strategy in terms of the possibility of discectomy. The participation of osteophytes for radiculopathy after OVCFs was previously reported by Kim *et al.* (1). In this report, radiculopathy was significantly observed in inferior-type fractures, in that the fracture line was located along the caudal endplate of the collapsed vertebral body. The mechanism was as follows: bony fragments (= osteophytes) from the collapsed body invade the foraminal space, directly

compressing the root. Therefore, osteophyte removal seems to also be a reasonable treatment for radiculopathy after OVCFs. The combination of FESS and a high-speed drill could show good performance in such situations.

Few studies have reported the use of the FESS technique for treatment of radiculopathy after OVCFs. Wagner *et al.* reported a case of a 72-year-old woman who presented with L2 radiculopathy after a kyphoplasty procedure. CT imaging showed leakage of the kyphoplasty cement into the vertebral foramen; the TFA was used to remove it and decompress the L2 nerve (12). Şenturk *et al.* reported the case of a 44-year-old woman who presented with L4 radiculopathy after a kyphoplasty procedure and was treated using a translamina approach (13). The advantage of FESS for removing osteophytes has been also reported. Telfeian *et al.* treated a patient with L4 radiculopathy caused by osteophytes at the right L4/5 vertebral foramen using a combination of the TFA and high-speed drill (14). Although we presented only three cases of radiculopathy after OVCFs treated by FESS and could find few studies like ours, the FESS technique is a potential alternative treatment for radiculopathy after OVCFs.

“Take-away” lesson

The preliminary results obtained from only three patients show that FESS is feasible for the treatment of radiculopathy after OVCFs. The combination of foraminoplasty, discectomy, and osteophyte removal is a key in the FESS technique.

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Footnote

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