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A new endoscopic technique to decompress lumbar nerve roots affected by spondylolysis

Technical note

KOICHI SAIRYO, M.D., PH.D., SHINSUKE KATOH, M.D., PH.D., TADANORI SAKAMAKI, M.D., SHINJI KOMATSUBARA, M.D., AND NATSUO YASUI, M.D., PH.D.

Department of Orthopedics, The University of Tokushima, Tokushima, Japan

✓ The authors describe a new endoscopic technique to decompress lumbar nerve roots affected by spondylolysis. Short-term clinical outcome was evaluated. Surgery-related indications were: 1) radiculopathy without low-back pain; 2) no spinal instability demonstrated on dynamic radiographs; and 3) age older than 40 years. Seven patients, four men and three women, fulfilled these criteria and underwent endoscopic decompressive surgery. Their mean age was 60.9 years (range 42–70 years). No subluxation was present in four patients, whereas Meyerding Grade I slippage was demonstrated in three. For endoscopic decompression, a skin incision of 16 to 18 mm in length was made, and fenestration was performed to identify the affected nerve root. The proximal stump of the ragged edge of the spondylotic lesion, and the fibrocartilaginous mass compressing the nerve root were removed. The follow-up period ranged from 6 to 22 months (mean 11.7 months). Clinical outcome was evaluated using Gill criteria; in three patients the outcome was excellent, and in four it was good. This new endoscopic technique was useful in the decompression of nerve roots affected by spondylolysis, the technique was minimally invasive, and the clinical results were acceptable.

KEY WORDS • spondylolysis • endoscope • decompression • lumbar spine

GILL, et al.,[5] were the first to describe nonfusion decompressive surgery in patients with lumbar spondylolysis. Subsequently, some authors reported that the operation reported by Gill, et al., would result in further vertebral slippage postoperatively; therefore, some surgeons recommended decompression with spinal fusion.[7,9,14] It was, however, also reported that long-term excellent or good results were observed in some patients after the Gill operation.[1,2,8,10] They concluded that the Gill operation was of most benefit to the adult patient with symptomatic spondylolisthesis in whom a preoperative pain pattern indicated radiculopathy, whereas it was contraindicated in young patients.

The pathogenesis of radiculopathy in patients with lumbar spondylolysis has been clarified by various authors.[1–3,5,6,8,13] The most frequent contributing factor has been cited as impingement by the proximal stump of the ragged edge of the spondylotic lesion. Thus, the most important part of the Gill operation was the excision of the ragged edge, not removal of the loose lamina. In this technical note, we describe a new minimally invasive endoscopic technique by which to remove the ragged edge as well as the fibrocartilaginous mass to decompress the nerve roots.

Clinical Materal and Methods

Patient Population

Surgery-related indications of this procedure included the following: 1) radiculopathy without low-back pain; 2) the absence of spinal instability on dynamic radiograms; and 3) age older than 40 years. Seven patients who fulfilled these criteria underwent endoscopic decompressive surgery between January 2001 and July 2002. Their mean age was 60.9 (range 42–70 years). There were four men and three women. Six patients harbored bilateral pars defects at L-5. No subluxation was present in three patients, whereas Meyerding Grade I slippage was demonstrated in three. In the remaining patient we observed a two-level bilateral pars defects at L-4 and L-5 but no subluxation. No patient suffered low-back pain, but leg pain was present. Clinical data are summarized in Table 1.

In all patients a radiculogram of the affected nerve root was obtained before surgery to confirm the impingement of the nerve root by the osseous ragged edge. The proximal stump of the osseous ragged edge of the spondylotic lesion, which compressed the nerve root, was evaluated by CT scanning before surgery. Postoperatively, the lam-

Abbreviations used in this paper: CT = computerized tomography; MED = microendoscopic discectomy.

TABLE 1

*Clinical data obtained in patients who underwent endoscopic decompression**

Case No.	Age (yrs), Sex	Op Level (side)	Spondylo-listhesis (grade)	Op Time (hrs)	
				Overall	Per Level
1	59, M	L-5 (lt)	NA	3.0	3.0
2	60, F	L-5 (rt)	I	3.0	3.0
3	64, F	L-5 (bilat)	I	4.0	2.0
4	63, F	L-5 (bilat)	NA	3.0	1.5
5	70, M	L-4 (rt), L-5 (rt)	NA	4.0	2.0
6	68, M	L-5 (lt)	I	3.0	3.0
7	42, M	L-5 (lt)	NA	1.5	1.5

* NA = not applicable.

inotomy area was assessed using plain anteroposterior radiography, and resection was confirmed using CT scanning. At the final follow-up examination, criteria established originally by Gill were used to evaluate clinical outcome.[2,5]

Surgical Technique

Figure 1 provides a detailed schema of this procedure. A longitudinal skin incision of 16 to 18 mm in length was made 1 cm lateral to the affected side from the midline. According to the method of endoscopic discectomy described by Forley and Smith,[4] a guide pin was placed onto the caudal edge of the cranial adjacent lamina of the spondylotic level, and the intramuscular fiber space was enlarged using dilators. A tubular retractor or a 10-ml syringe was placed to ensure preservation of the surgical space (Fig. 1, *black circle* in Step I). In this procedure, detachment of paravertebral muscle from the laminae is not required to access the interlaminal space. Endoscopically, laminotomy and removal of the ligamentum flavum were conducted (Step II, Fig. 1). The affected nerve root was identified after fenestration, and the proximal stump of the ragged edge of the spondylotic lesion, and the fibrocartilaginous mass compressing the nerve root were removed (Step III, Fig. 1). In most cases, the osseous ragged edge was seen to compress tightly the nerve root. First, the osseous edge was thinned using a high-speed drill or a specially made chisel so that the edge could be safely removed endoscopically. The osseous mass was then safely and completely removed using a Kerrison rongeur or a curved curette.

The endoscopic system used in this study was METRx MED system (Medtronic Sofamor Danek, Memphis, TN) and the ESD System (Surgical Dynamics Co., Ltd., Tokyo, Japan). The MED system is a spinal endoscope system introduced by Foley and Smith,[4] and the ESD system is similar. In the ESD system, a 10-ml syringe is applied and in the MED system a tubular retractor is used to ensure preservation of the surgical space.

Results

Endoscopic decompressive surgery was successfully used to treat 10 vertebral levels in seven patients. We were never required to convert the endoscopic procedure to a

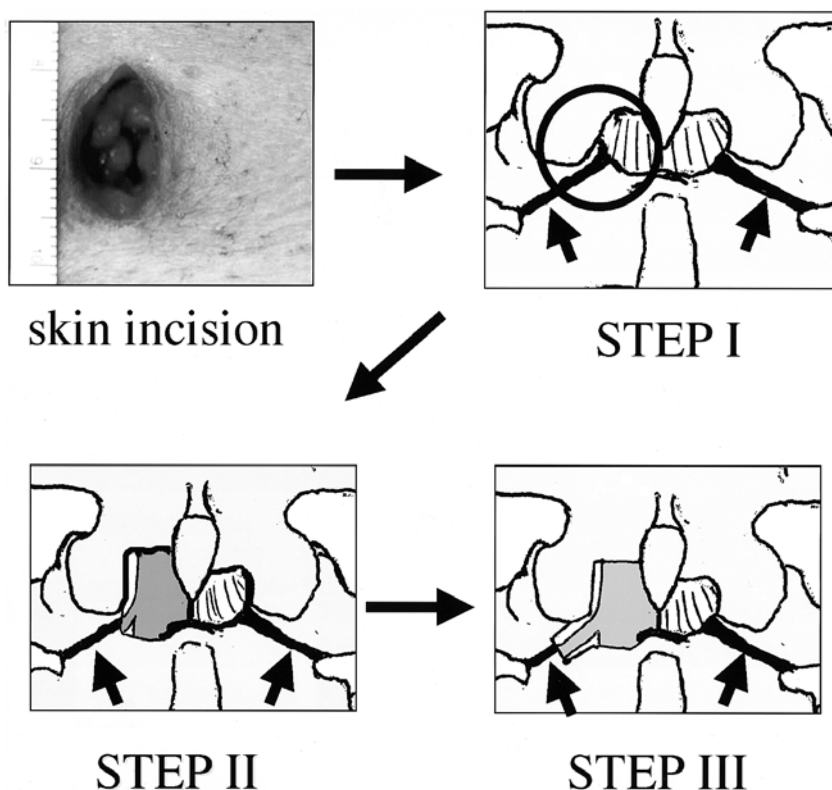

FIG. 1. Schematic representation of surgical procedure. *Arrows* in Steps I, II and III indicate the site of pars defects.

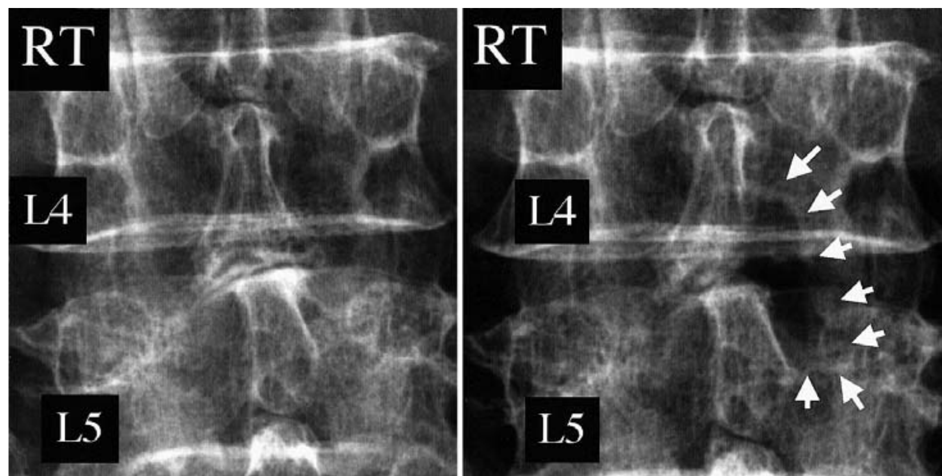

FIG. 2. Case 5. Radiographs obtained before *(left)* and after operation *(right)*. *White arrows* indicate the laminectomy-treated area.

conventional open procedure. No complication, such as dural laceration and postsurgical epidural hematoma, was observed intra- or postoperatively. Operative time ranged from 1.5 and 4 hours, and the mean time per level was 2.3 hours (Table 1).

Leg pain disappeared or decreased in all patients, and they returned to their daily activities within 3 weeks. The follow-up period ranged from 6 to 22 months (mean 11.7 months). Based on Gill criteria, excellent and good clinical outcomes were demonstrated respectively in three and four patients at the final follow-up examination.

Figure 2 shows pre- and postoperative plain radiographs obtained in the patient in Case 6. The laminotomized area is shown. In all cases the proximal stump of the osseous ragged edge of the spondylotic lesion was removed and confirmed on CT scanning (Fig. 3). Lateral flexion-neutral-extension radiographs obtained at the final follow-up examination revealed no further increase in slippage in any patient.

Discussion

We have described a new endoscopic minimally invasive technique by which to treat spondylosis-induced lumbar nerve root compression. Our technique was a modification of the MED technique described by Foley and Smith,[4] who used an endoscope for minimal invasive removal of a herniated lumbar nucleus pulposus. We used the endoscope to remove the osseous ragged edge of the lesion and the fibrocartilaginous mass at the pars defect, which was compressing nerve root, in patients with lumbar spondylolysis.

Lumbar spondylolysis comprises two pathological entities, inducing symptoms such as low-back pain and leg pain: 1) pseudarthrosis of a fractured pars defect produces radiculopathy by compressing the nerve root; and 2) discogenic problems causing instability and low-back pain. The surgical strategy should be tailored to these pathological entities.[2] To treat radiculopathy, decompression is required, whereas spinal fusion is necessary to treat discogenic pain and spinal instability. When both of these entities are simultaneously present, both decompression and fusion are needed. Furthermore, the age of the patient must be considered because subluxation in young patients with spondylolysis is likely to progress.[11,12]

Since Gill, et al.,[5] first described decompressive surgery in 1955, the technique has been widely used. Osterman, et al.,[10] reported long-term follow-up data (mean 12 years) obtained in patients in whom the Gill operation was performed, and concluded that the main indication for this procedure was painful spondylolisthesis with nerve root–related symptoms in patients older than 40 years of age. Furthermore, the authors emphasized that the operation was basically contraindicated in adolescents. Davis and Bailey[2] reviewed data in 39 patients who underwent the Gill operation and found that spinal fusion is needed in pediatric patients to prevent likely vertebral slippage. Based on those clinical results, the surgery-related indications for our technique were: 1) radiculopathy without low-back pain; 2) absence of spinal instability on dynamic radiographs; and 3) age older than 40 years. Although the follow-up period was comparatively short, clinical outcome was acceptable and no further slippage was observed in any of our patients.

As proposed in a previous report, the osseous edge of the lesion, which has been described as a hooklike projection of the proximal lamina,[3] is the most significant contributing factor in the impingement of nerve root in patients with spondylolysis.[2,3,6,13] Considerable attention had been dedicated to this pathological process, and Johnson and Power[6] have proposed a method by which the affected nerve root is decompressed using a conventional open technique, without removal of the loose lamina, in patients with spondylolysis. The advantage of this procedure is the preservation of posterior elements, including the lamina, as well as inter- and supraspinous ligaments; thus, instability is unlikely to occur as it would after the Gill operation. Johnson and Power reported a good postoperative clinical outcome in their patients. Shiraishi and Crock[13] also undertook decompressive surgery without removal of the loose lamina, reporting good clinical results in 12 of 13 patients. Our new endoscopic technique is also useful in removing the osseous ragged edge and fibrocartilaginous mass compressing the nerve roots,

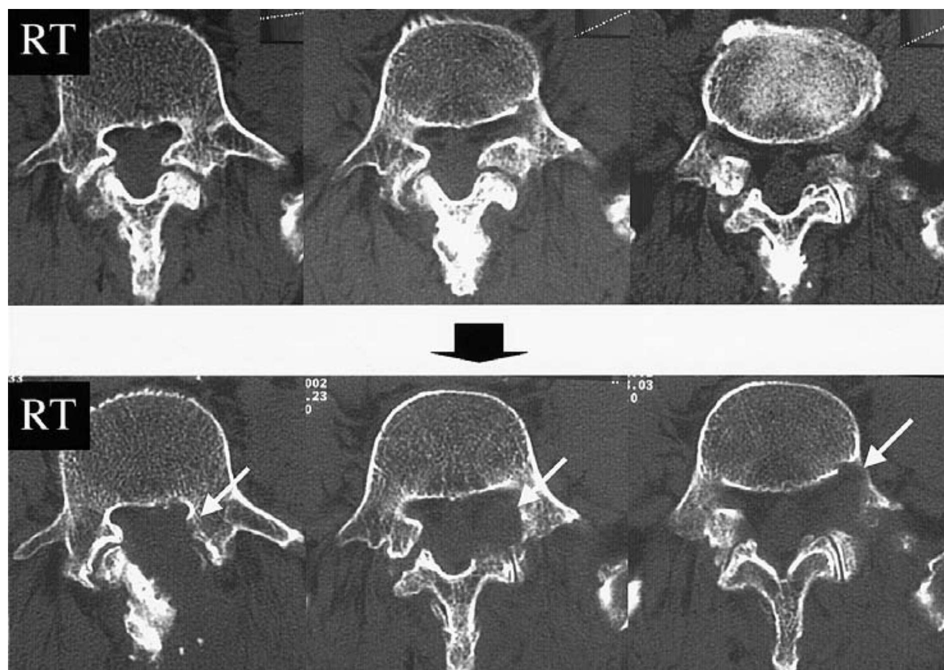

FIG. 3. Case 5. Axial CT scans obtained before *(upper)* and after operation *(lower)*. *White arrows (lower)* indicate the site to be decompressed.

thereby decompressing the affected nerve root. Compared with conventional open surgery, endoscopic decompressive surgery is considered to be less invasive because skin incision is as small as 16 to 18 mm in length, and it is not necessary to detach the paravertebral muscle from the laminae to ensure an appropriate surgical field.

Conclusions

A new endoscopic technique to decompress lumbar nerve roots affected by spondylolysis was described. This technique is minimally invasive and associated with excellent and good clinical outcome in a mean follow-up period of 11.7 months.

Disclaimer

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Address reprint requests to: Shinsuke Katoh, M.D., Department of Orthopedics, School of Medicine, The University of Tokushima, 3-18-15, Kuramoto, Tokushima 770-8503 Japan. email: skatoh@clin.med.tokushima-u.ac.jp.