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Bi-portal Arthroscopic Spinal Surgery (BASS) with 30° arthroscopy for far lateral approach of L5-S1 – Technical note

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ABSTRACT

Background context: Lumbar foraminal stenosis or extraforaminal stenosis is a common cause of spinal cord radiculopathy. Recently, several authors have introduced an endoscopy-based spinal surgery technique.
Purpose: The study aimed to introduce far lateral approach of biportal arthroscopic technique using 30° arthroscopy for foraminal decompression of L5-S1.
Study design: Technical note.
Patient sample: 12 consecutive patients.
Outcome measures: The leg VAS with modified Macnab criteria was measured.
Result: The leg VAS improved from VAS 7.5 to 1.8.
Conclusion: Far lateral approach of BASS with 30° arthroscopy is an alternative method that can decompress foraminal stenosis minimally invasively.

1. Introduction

Degenerative lumbar spinal stenosis is one of the most common diseases of the spine. Lumbar foraminal stenosis, or extraforaminal stenosis, is a common cause of spinal cord radiculopathy with a frequency of about 8–11%. It is caused by ligamentous and osseous structure hypertrophy, therefore, causing the canal space of the exiting nerve root to become narrower.[1–4] In addition, a decrease in intervertebral disc height also causes a decrease in the dimension of the canal space. Several techniques including partial pediculectomy, fusion, foraminotomy, and facetectomy have been introduced to solve this problem. There are currently two major surgical treatment options for this disease: one is decompression with fusion and the other is simple decompression.[5–7] The micro decompression technique to protect facet joints without fusion was first introduced by Wiltse and Spencer, several authors have modified it, and has since been modified by several authors. This operation improved the conditions of about 80% of patients and is considered to be a good surgical treatment for lumbar foraminal stenosis or far lateral stenosis. Alternatively, interbody fusion surgery can definitively expand the intervertebral space to resolve foraminal stenosis without foraminotomy.[7] However, fusion surgery may cause complications such as adjacent segment disease and pseudoarthrosis.[8–10] Thus, several authors introduced the decompression of foraminal stenosis using uniportal endoscopy of the docking type,[2,3] At the L5-S1 level, the disadvantage is that proper decompression is not possible due to the difficulty of access created by the prominence of iliac crest. Recently, biportal arthroscopic spinal surgery has been reported by several authors,[11–13] and has started to get spotlighted. The literature on the far lateral approach of biportal endoscopy is still lacking. In this report, we would like to introduce far lateral approach of biportal arthroscopic spinal surgery using 30° arthroscopy as an alternative to open surgery for L5-S1 foraminal stenosis without instability and central stenosis.

2. Material and methods

12 consecutive patients were involved in this study. Preoperative lumbar plain x-ray including flexion extension view, CT, and MRI were checked in all patients. These patients were diagnosed with foraminal stenosis at L5-S1. Patients who did not respond to conservative treatment including medication and physiotherapy despite 6 weeks of conservative treatment were involved. The clinical outcomes including Modified Macnab criteria, VAS, operation time, and complication rate were analyzed from patients who were treated by biportal arthroscopic spinal surgery using 30° arthroscopy.

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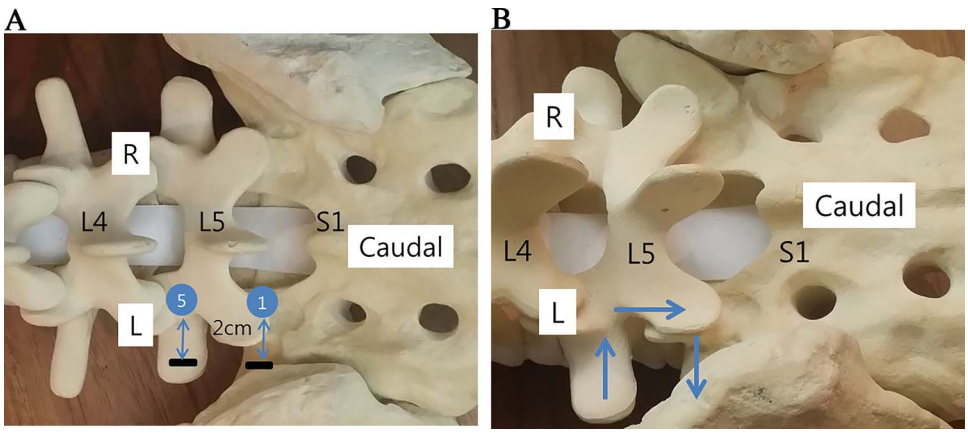

Fig. 1. A. Preoperative magnetic resonance imaging demonstrated the foraminal stenosis of left L5-S1 was caused by the presence of an asymmetrical left posterolateral disc extrusion. B. Postoperative magnetic resonance imaging revealed that left L5-S1 foraminal stenosis due to posterolateral disc extrusion was well decompressed, the superior articular process of S1 was partially removed and the enlargement of the L5-S1 foramen was confirmed by computerized tomography after surgery.

2.1. Case

An 80-year-old woman visited our outpatient clinic complaining of leg pain that began 2 months prior to her visit. In a neurologic examination, there were no motor weaknesses, patient appealed paresthesia with radiating pain in left side lower extremity. A plain x-ray showed degenerative spondylosis but no scoliosis or prominent instability. Magnetic resonance imaging showed no stenosis of the central canal, but the foraminal stenosis of left L5-S1 was observed due to the presence of an asymmetrical left posterolateral disc protrusion (Fig. 1.A). The patient was treated with conservative therapy including selective root block and medication. In spite of conservative therapy, symptoms were not controlled within 6 weeks. She was scheduled to undergo surgery to decompress L5-S1 left foramen and relieve neurologic symptoms. At the time of surgery, the patient underwent biportal endoscopic spinal surgery using the far lateral approach in a prone position under general anesthesia. The patient had improved symptoms prior to surgery. Magnetic resonance imaging and computerized tomography of the patient revealed that the foraminal stenosis was decompressed (Fig. 1.B.).

2.2. Operation technique

2.2.1. Basic setup

Instruments including basic spine instruments, 30° 4 mm arthroscopy which were commonly used in joint arthroscopy, radioflequency catheter, 4.2 mm arthroscopic burr, and a shaver were used in operation. The procedures were operated under general anesthesia. The patients were positioned prone along with the abdomen free. Level confirmation was conducted under intraoperative fluoroscopy.

2.2.2. Landing of extra foramen

In order to perform this operation, we need to basically create two portals. Additionally we can make a portal for water outflow. The proximal portal should be made 2 cm away from the L5 pedicle, and the distal portal was made on the sacral ala (Fig. 2.A). The two portals were 0.5 cm in diameter, enough to insert instruments and endoscope. Two portals are made with a diameter of about 0.5 cm and should have a diameter sufficient to insert instruments and endoscope. The proximal portal was used as the viewing portal and the distal portal was used as the working portal. After inserting a scope into the viewing portal and inserting a muscle detacher into the working portal, the muscle separation was started from the L5 transverse process using the triangulation technique, and the muscle was detached in the order of L5 pedicle, L5 S1 facet joint, and ala to create a primary space (Fig. 2.B). When approaching the transverse process, it is helpful to orient the 30° arthroscopic arrow to 6 o'clock. Tarsus muscles and tissues blurring the field of vision were removed using radioflequency catheter or shaver, and a radioflequency catheter was used to ensure a clear field of view when there was active bleeding (Fig. 3.A). If the water flow is congested, the visual acuity deteriorates rapidly, so a 5.0 mm plastic cannula can be used or an additional portal can be made (Fig. 3.B).

2.2.3. Decompression of foramen

After a sufficient working space was created, the half of the superior articular process in the thickened facet joint was removed using an arthroscopic burr and osteotome, and the remaining part of the inside was removed using kerrison punch and pituitary punch (Fig. 3.C). At the unroofing of the foramen, a 30° arthroscopy was rotated at 12 o'clock to gain more visibility. When 0° arthroscopy and 30° arthroscopy were compared at the same position, at 0° it was not visible due to the facet joint, but at 30° we could see more inside the foramen. The ligamentum flavum was removed from the distal portion of the L5 transverse process using curret and kerrison punch in the proximal to distal direction (Fig. 3.D). After completion of the flavectomy, the root and epidural fat were identified, and the outer layer of the annulus was identified just distal to the root, followed by annulotomy using a radioflequency catheter. At the time of discectomy, the 30° arthroscopy was rotated to 6 o'clock and the field of view was secured so that the floor could be seen. More curret and pituitary were used to remove disc fragments that were ruptured under the root (Fig. 3.E). After confirming that the space of the same size as the root dimension was secured, the operation was completed after inserting the drain tube (Fig. 3.F).

3. Result

The mean operation time was 55 min (range: 45–70). There were no infections, dura tears, or neurologic complications. Of the 12 cases, 8 cases were on the left side and 4 were on the right side. The mean leg VAS of patients improved from 7.5 to 1.8 after surgery. At the final follow-up, all twelve cases were recorded with excellent on the Modified Macnab criteria.

4. Discussion

Open decompression surgery using the Wilte approach is a conventional treatment for extraforaminal or foraminal stenosis.[14] Open microforamotomy reports a success rate of 58%–80% and is reported to have poor outcomes compared to other spinal surgeries.[15] However, excessive dissection of the paraspinal muscle may cause back pain or muscle atrophy. Minimal invasive technique using endoscopy has been attempted by several authors in extraforaminal or foraminal decompression. Recent advances in optics and endoscopy devices have allowed better vision and more precise operation, and good results of decompression surgery in foramen or extraforaminal stenosis using endoscopy have been reported.[2,3,16] The primary advantage of endoscopy-based spinal surgery in minimally complicated and minimally invasive tissues has been reported in several papers.[3,16] The recently