

Central Spinal Canal Decompression for Lumbar Spondylosis with Uniportal Full-Endoscopic Interlaminar Approach: Technical Note and Preliminary Results in Thailand

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Objective: To describe surgical techniques for central spinal canal decompression with uniportal full-endoscopic interlaminar approach and report preliminary results of the first three cases.

Material and Method: Surgical technique for uniportal full-endoscopic interlaminar approach for central spinal canal decompression was described step by step. Three consecutive cases that were operated by this new technique were illustrated by retrospective chart review.

Results: All three illustrative cases achieved excellent clinical outcomes in terms of leg pain and claudication without postoperative complications. A follow-up period was two to eight months. Intra-operative blood loss varied from 20 to 50 milliliter. All cases were discharged from the hospital within two days after surgery.

Conclusion: Uniportal full-endoscopic interlaminar approach is a viable alternative procedure for central spinal canal decompression with the advantages of smaller skin incision and less tissue trauma. However, studies with larger number of cases and longer follow-up periods are needed in order to make a clear conclusion of the superiority of this new technique comparing to conventional microsurgical laminectomy.

Keywords: Spinal stenosis, Central canal stenosis, Spinal decompression, Endoscopic spinal decompression, Minimally invasive spinal surgery

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Lumbar spondylosis is a common problem for the elderly⁽¹⁾. Symptoms vary from low back pain, radicular pain, leg numbness, leg weakness to neurogenic claudication. Less severe cases can be treated conservatively by activity modification, medication and physical therapy⁽¹⁾. However, those who are suffering from progressive neurological deficit, severe limitations of daily activities by pain and failure of conservative treatment should be considered for surgical treatment.

The current standard procedure for lumbar spondylosis is neural decompression with or without spinal fusion⁽²⁾. Central spinal canal and bilateral lateral recess decompression and medial facetectomy can be

achieved by this procedure either under naked eyes, loupe magnification or microscopic view.

Endoscopic assisted spinal surgery is one of the procedures with minimally invasive spinal operative techniques with growing popularity. The illumination, magnification and very tiny skin incision are the benefits of this procedure, especially full-endoscopic spinal surgery. Significant advantages in terms of back pain, rehabilitation, complications and traumatization have been reported in the literature for full endoscopic discectomy and lateral recess decompression⁽³⁻⁹⁾. However, there are very few studies regarding full-endoscopic central spinal canal decompression. This study describes surgical technique and reports three consecutive cases that were operated by this technique.

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Material and Method

Patient's charts of three consecutive cases that were operated by full-endoscopic central spinal canal decompression at Ramathibodi Hospital were

reviewed retrospectively.

Operative technique

Patient positioning

The patients were positioned in prone with two rolls supporting under upper anterior chest wall and iliac crest. Care was taken to avoid pressure point injury, especially at eyeballs, ulnar nerves and peroneal nerves. Lumbar spines were placed in neutral position on operating table. Intravenous prophylactic antibiotics covering gram positive bacteria were administered. Skin was prepared and draped. Endoscope, endoscopic station, instruments for endoscopic surgery, high-speed drill and fluoroscope were brought into surgical field.

Incision

Left or right sided approach was determined by the side with more symptoms. Interlaminar window of interest was marked under fluoroscopic guidance in standard antero-posterior view (Fig. 1). One centimeter long skin incision was made in-line with lower part of lamina of upper vertebra just above interlaminar window in supero-inferior dimension and a few millimeters lateral to midline in medio-lateral dimension. Incision at fascial sheath was created in-line with skin incision. Dilator and outer sheath of endoscope were inserted through skin, subcutaneous tissue, fascial sheath and paravertebral muscles down to ipsilateral facet joint. Depth of dilator and outer sheath was determined by tactile sensation of bony facet and by lateral fluoroscopic view (Fig. 2).

Removal of medial part of facet joint

Special designed endoscope for central spinal canal decompression was inserted through the outer sheath. Remaining muscles and soft tissue covering medial part of facet joint were removed with radiofrequency coagulator and pituitary rongeur. Ligamentum flavum attaching to medial border of facet joint and medial part of facet capsule were partially cut with punch rongeur. The medial part of facet joint was removed with high-speed drill starting from descending facet down to dorsal part of ascending facet. The remaining ventral part of ascending facet was removed with Kerrison's rongeur.

Spinal canal decompression

Ligamentum flavum on ipsilateral side was cut with punch rongeur and Kerrison's rongeur (Fig. 3 and 4). Ipsilateral traversing nerve root (Fig. 5) was identified from emerging point from thecal sac down to medial

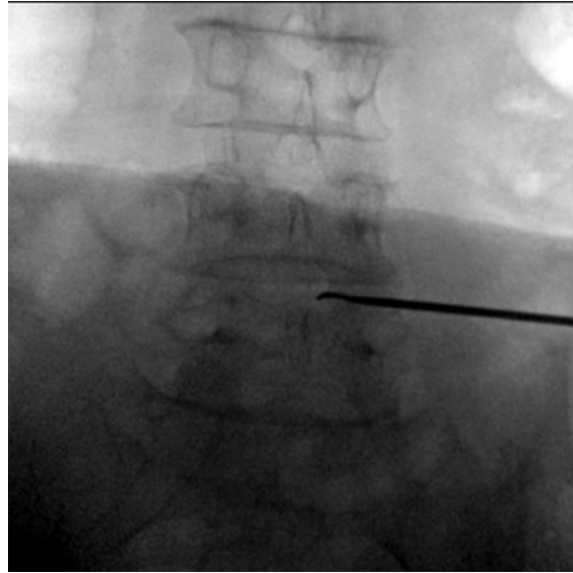


Fig. 1 Antero-posterior view x-ray shows marking of L4-5 interlaminar window.

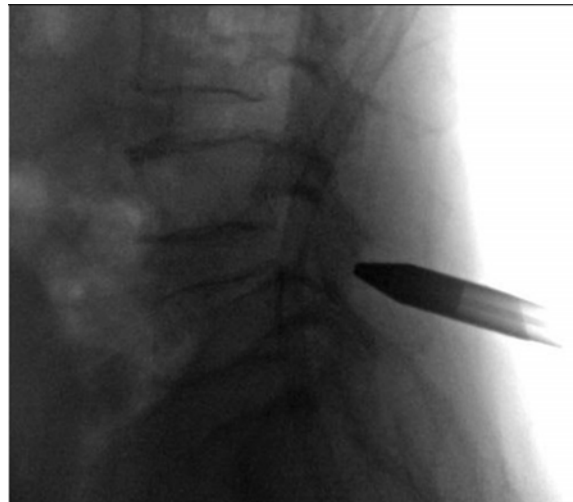


Fig. 2 Lateral view x-ray shows depth of dilator at the level of facet joint.

part of lower pedicle before entering neural foramen. If there is any disk herniation, it could be removed at this stage by pituitary rongeur. The tip of endoscope was then moved to contralateral side. Ventral part of interspinous ligament and lamina along with ligamentum flavum on contralateral side and medial part of contralateral facet joint were cut with Kerrison's rongeur until contralateral traversing root (Fig. 6) was identified. Hemostasis was achieved with radiofrequency coagulator. Endoscope and outer



Fig. 3 Bone cutting by Kerrison's ronguer.



Fig. 5 Ipsilateral traversing nerve root.



Fig. 4 Ligamentum flavum cutting by Kerrison's ronguer.



Fig. 6 Contralateral traversing nerve root.

sheath were removed. Skin incision was approximated either by simple suture or suturing in subcuticular fashion.

Illustrative cases

Case 1

A 63-year-old Thai female presented with back pain radiating to both legs for ten months. The symptoms were aggravated by prolonged standing for ten minutes and 500 meters walking. MRI of lumbar

spine (Fig. 7) showed L4-5 central canal stenosis. After failure of conservative management, she was scheduled for full-endoscopic central spinal canal decompression of L4-5. Estimated intra-operative blood loss was 20 milliliters. She was discharged from hospital two days after operation without any complication. She had no claudication at the last follow-up of eight months after operation.

Case 2

A 67-year-old Thai male presented with radiating right more than left leg pain for two months. He had a history of abdominal aortic aneurysm status post endovascular aneurysm repair (EVAR) 1 year ago. Physical examination showed weakness of muscle power of right extensor hallucis longus to grade 3. MRI of lumbar spine (Fig. 8) showed L4-5 central canal stenosis. After failure of conservative treatment, he underwent full-endoscopic central spinal canal decompression of L4-5. Estimated intra-operative blood loss was 50 milliliters. He was discharged from hospital next day after operation without any complication. At the last follow-up of 6 months after operation, there was no radiating leg pain.

Case 3

A 68-year-old Thai female presented with three-year progressive bilateral leg pain during walking. She had to stop walking at 300 meters. Physical examination showed slightly weakness of right extensor hallucis longus muscle and decreased sensation of right L5 dermatome. MRI of lumbar spine (Fig. 9) showed L4-5 central canal stenosis. She underwent full-endoscopic central spinal canal decompression

at L4-5 level without complications. Estimated intra-operative blood loss was 20 milliliters. She was discharged from hospital 2 days after the operation. At the last follow-up of two months after surgery, there was no claudication.

Discussion

Degenerative disorders of lumbar spine are normal, age-related phenomena. Most patients respond appropriately with nonsurgical management including restriction of aggravating activities, physical therapy and anti-inflammatory medications⁽¹⁾. Surgical management is reserved for patients who are unresponsive to conservative treatment^(1,2). The standard surgical treatment for lumbar spondylosis is neural decompression such as laminectomy with or without spinal fusion⁽²⁾. This procedure can be achieved with naked eyes, loupe magnification or microscopic view.

Tubular retractor had been used for minimally invasive spinal procedure under microscopic view. Microscope enhances illumination and magnification of surgical field. This leads to a smaller skin incision



Fig. 7 Sagittal MRI of lumbar spine of case 1 shows central spinal canal stenosis at L4-5.



Fig. 8 Sagittal MRI of lumbar spine of case 2 shows central spinal canal stenosis at L4-5.



Fig. 9 Sagittal MRI of lumbar spine of case 3 shows central spinal canal stenosis at L4-5.

and less tissue trauma. Effectiveness of application of tubular retractor for lumbar discectomy⁽¹⁰⁾, bilateral decompression of lumbar spinal stenosis⁽¹¹⁾ and lumbar spondylolisthesis⁽¹²⁾ has been reported. The benefits of this technique include preservation of facet joint and multifidus muscle⁽¹³⁾, less postoperative pain and better clinical outcomes in the acute postoperative period of less than three months⁽¹⁴⁾. However, there are no significant differences in clinical and radiological outcomes in long-term follow-up periods⁽¹⁴⁾.

Microscopic decompression (MED) is a modification of microscopic assisted decompression via tubular retractor. An endoscope is passed through tubular retractor for illumination and magnification instead of microscope. There are several reports of successful treatment of lumbar foraminal stenosis and lumbar spinal canal stenosis by this technique⁽¹⁵⁻¹⁷⁾.

Full-endoscopic surgery of lumbar spine offers less traumatization to patient's tissue. The effectiveness of this 8 mm-diameter uniportal endoscope for lumbar discectomy has been reported^(5,6). Prospective, randomised, controlled study comparing between full-endoscopic and microscopic lumbar discectomy by Ruetten et al⁽⁵⁾ showed the same clinical outcomes in both groups. However, the full-endoscopic techniques brought significant advantages

in terms of back pain, rehabilitation, complications and traumatization.

Full-endoscopic transforaminal approach for foraminal decompression and foraminoplasty has been reported for decade^(3,4,8,9). The rate of good or excellent outcomes after surgery is 72-85%^(3,4,8,9). This technique offers minimal morbidity, rapid rehabilitation and return of patient to preoperative functioning level⁽³⁾. However, clinical failure of this approach has been reported in patient with bony stenosis in the lateral recess and entry zone of the neural foramen⁽⁹⁾.

Ruetten et al⁽⁷⁾ reported outcomes of full-endoscopic interlaminar approach for lumbar lateral recess stenosis comparing to conventional microsurgical technique. The clinical results were comparable in both groups, whereas the rates of complications and revisions were significantly reduced in full-endoscopic group. Full-endoscopic technique also had benefits of less tissue trauma and rapid rehabilitation.

Recently, there were a few reports of full-endoscopic approach for central spinal canal decompression. Soliman⁽¹⁸⁾ introduced two 0.5-cm portals technique named irrigation endoscopic decompressive laminotomy. One portal for the endoscope and the other for instruments. Good or excellent outcomes were achieved in 87% of cases. Complications were limited to six out of 104 cases of dural tear without open conversion. Komp et al⁽¹⁹⁾ reported outcomes of uniportal full-endoscopic interlaminar approach for lumbar degenerative central spinal canal stenosis. The study showed that 72% of the patients no longer had leg pain or the pain was almost completely reduced. The clinical results were comparable to microsurgical laminotomy. The advantages of endoscopic techniques included less complications and revisions, less tissue trauma and rapid rehabilitation.

When comparing to studies by Soliman⁽¹⁸⁾ and Komp et al⁽¹⁹⁾, this present study achieved the same good clinical outcomes. All three cases in this report of uniportal full-endoscopic interlaminar approach achieved excellent clinical outcomes in terms of leg pain and claudication after surgery. There were no complications from surgery. Intra-operative blood loss varied from 20 to 50 milliliters. All cases were discharged from the hospital within two days after surgery. These emphasize the effectiveness and benefits of uniportal full-endoscopic interlaminar approach for central spinal canal decompression.

This study described surgical technique and

preliminary results of a novel uniportal full-endoscopic approach for central spinal canal decompression. Limitations of this study are a small number of patients and retrospective design of the study without control group. Further comparative studies with conventional technique and a larger sample size are needed to make a conclusion of the benefits of this novel surgical technique.

Conclusion

Uniportal full-endoscopic interlaminar approach is a viable alternative procedure for central spinal canal decompression with the advantages of smaller skin incision and less tissue trauma. However, studies with a larger number of cases and longer follow-up period are needed in order to make a clear conclusion of the superiority of this new technique comparing to conventional microsurgical laminectomy.

What is already known on this topic?

This topic is very new. There are only few papers in the literature reporting the outcomes of this technique. All the reported papers showed comparable results comparing to microsurgical laminotomy. However, complications and revision rates, tissue trauma and rapid rehabilitation are favorable for this endoscopic technique.

What this study adds?

This study adds the description of clinical outcomes of this novel endoscopic technique. To the best of our knowledge, this is the first study reporting the clinical outcomes of this technique in Asia.

Potential conflicts of interest

None.

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การผ่าตัดรักษาภาวะส่วนกลางของโพรงกระดูกสันหลังส่วนเอวตีบแคบกดเบียดรากประสาทโดยการส่องกล้องเอนโดสโคป: เทคนิคการผ่าตัดและผลการรักษาในประเทศไทย

เกียรติศักดิ์ แซ่เตีย, วีระพันธ์ ควرتงธรรม

จุดประสงค์: เพื่อบรรยายเทคนิคการผ่าตัดรักษาภาวะส่วนกลางของโพรงกระดูกสันหลังส่วนเอวตีบแคบกดเบียดรากประสาท โดยการส่องกล้องเอนโดสโคป และรายงานผลการรักษาในผู้ป่วย 3 รายแรก

วัสดุและวิธีการ: บรรยายเทคนิคการผ่าตัดรักษาภาวะส่วนกลางของโพรงกระดูกสันหลังส่วนเอวตีบแคบกดเบียดรากประสาท โดยการส่องกล้องเอนโดสโคป ที่ละขั้นตอน รายงานผลการรักษาของผู้ป่วย 3 ราย ที่ได้รับการรักษาด้วยเทคนิคดังกล่าว โดยการทบทวนประวัติผู้ป่วยแบบย้อนหลัง

ผลการศึกษา: ผู้ป่วยทั้ง 3 ราย ที่ได้รับการรักษามีผลการรักษาที่ดีในแง่ของอาการปวดร้าวลงขาและอาการปวดขาเวลาเดินโดยไม่มีภาวะแทรกซ้อนจากการผ่าตัด ระยะเวลาติดตามผลการรักษาหลังผ่าตัดอยู่ระหว่าง 2 ถึง 8 เดือน ปริมาตรเลือดที่ออกระหว่างผ่าตัดอยู่ระหว่าง 20 ถึง 50 มิลลิลิตร ผู้ป่วยทุกรายสามารถออกจากโรงพยาบาลได้ภายใน 2 วันหลังการผ่าตัด

สรุป: การผ่าตัดด้วยกล้องเอนโดสโคปเป็นทางเลือกหนึ่งในการผ่าตัดรักษาภาวะส่วนกลางของโพรงกระดูกสันหลังส่วนเอวตีบแคบกดเบียดรากประสาท ข้อดีของการผ่าตัดวิธีนี้คือ แผลผ่าตัดมีขนาดเล็กและมีการบาดเจ็บต่อเนื้อเยื่อน้อย อย่างไรก็ตามการที่จะได้ข้อสรุปที่ชัดเจนว่าการผ่าตัดเทคนิคนี้มีผลที่ดีกว่าการผ่าตัดแบบดั้งเดิมจำเป็นต้องมีจำนวนผู้ป่วยที่มากกว่านี้และระยะเวลาติดตามผลการรักษาที่นานกว่านี้
