

Full Endoscopic Lumbar Discectomy via Interlaminar Approach: 2-Year Results in Ramathibodi Hospital

Sorayouth Chumnavej MD*, Withawin Kesornsak MD*,
Prasert Sarnvivad MD*, Verapan Kuansongthum MD*

* Division of Neurosurgery, Surgery Department, Faculty of Medicine, Ramathibodi Hospital,
Mahidol University, Bangkok, Thailand

Objective: To present the surgical outcome of the full-endoscopic lumbar discectomy via interlaminar approach.

Material and Method: Analysis of the prospectively collected data. The indication for full endoscopic discectomy is the same as for microscopic discectomy. Sixty consecutive patients with lumbar disc herniation were included. Full-endoscopic discectomy via interlaminar approach were done in all cases. The Visual analog scale (VAS), Thai version of modified Oswestry Disability Index (ODI), Macnab score, neurological symptoms, and complications were collected and followed for two years.

Results: Mean follow-up period was 26 months. Excellent outcomes as defined by Macnab criteria were found in fifty-five of sixty patients (91.6%). The authors found two cases of recurrent disc herniation, which were re-operated by the same method and the symptoms were completely resolved later in the follow up period. There were two cases of persistent radicular pain after the operation, which were completely resolved after selective epidural nerve root injection. There was no serious neurological deficit, dura tear, or cauda equina syndrome in the present study series.

Conclusion: Full-endoscopic lumbar discectomy is a safe and effective procedure for lumbar disc herniation. Patients can expect less postoperative pain, early recovery, and a short period of work absence. However, the learning curve is steep. Proper surgical training and careful patient selection in the early cases are the keys to success.

Keywords: Minimally invasive spine surgery, Lumbar discectomy, Full-endoscopic discectomy, Interlaminar decompression, Visual analog scale (VAS), Thai version of modified Oswestry disability index (ODI)

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Currently, minimally invasive spine surgeries become globally approval particularly in Thailand. Several patients with herniated lumbar disc are candidates for this minimally invasive surgery. Its advantages over the microscopic lumbar discectomy are less tissue traumatization and less operative time⁽¹⁾. Concerning the minimally invasive lumbar discectomy, it had been reported since 1970s⁽²⁻⁷⁾.

After the advent of full-endoscope uniportal procedures by Ruetten, there are two approaches to access the lumbar canal including interlaminar approach (IL) and transforaminal approach (TF)⁽¹⁾. The herniated lumbar disc could be removed and spinal canal decompression could be achieved using this uniportal endoscope. Lumbar discectomy through

interlaminar and transforaminal access was resulted in special advantages and limitations. Transforaminal approach could access to the spinal canal without damage to any spinal structures. However, in limited areas like transforaminal approach, this could result in difficult scope handling and sometimes incapable to reach the migrated free fragment beyond the disc level. Ruetten et al proposed the interlaminar approach, which is possible to dispose of herniated disc not anticipate achieving by the transforaminal approach⁽¹⁾. Another advantage is the endoscopic anatomy from interlaminar approach provides a more familiar route to a spine surgeon more than from transforaminal view. The authors have been using this full endoscopic lumbar discectomy in Ramathibodi Hospital since 2008. The authors' preliminary report of the early outcome revealed the full endoscopic uniportal lumbar discectomy is an effective procedure for herniated lumbar disc⁽⁸⁾. In the present study, the authors would like to share their two years experience, outcomes, and techniques particularly the interlaminar approach.

Correspondence to:

Sarnvivad P, Division of Neurosurgery, Department of Surgery,
Ramathibodi Hospital, Mahidol University, Bangkok 10400,
Thailand.

Phone: 0-2201-1315, Fax: 0-2201-1316

E-mail: rapsb@mahidol.ac.th

Material and Method

After the IRB approval, consecutive patients were recruited. Inclusion criteria were all the patients who received full endoscopic discectomy during July 2008 and January 2010 in the Neurosurgery Division, Surgery Department, Ramathibodi Hospital, Faculty of Medicine, Mahidol University, Bangkok, Thailand. The indications for interlaminar approach lumbar discectomy judged by patient clinical conditions especially the neurological deficit, lumbosacral MRI showing nerve root compression from a herniated disc. Patients with spinal instability, spinal canal stenosis, and previous open spinal surgery were excluded. Patients will be asked to fill in the ODI questionnaire (Thai version)⁽⁹⁾ and Visual analog score (VAS) before meeting the surgeon. Other parameters including general patient profile, neurological symptoms, and complications were recorded preoperatively, immediate postoperative period and 1, 3, 6, 12, and 24 months postoperatively at follow-up. Patients who missed the follow-up will be contacted by phone. Patients were followed at least 1 year after surgery to demonstrate the long-term outcome. The operation was performed by the authors' team using Vertebris Lumbar[®] (Richard Wolf GmbH) instruments in all cases. Vertebris Lumbar[®] system comprised of 4.1 mm working channel, 7.9 mm outer sheath diameter and 25 degree angled scope with continuous water irrigation system.

Sixty consecutive patients met the criteria including 27 male and 33 female patients. The level of herniation was 33 cases of L4-5, 26 cases of L5-S1 and 1 case of L3-4. There was no patient with Cauda equina syndrome in the present study group as a contraindication for full endoscopic discectomy.

Operative techniques for interlaminar approach

The authors prefer general anesthesia to give the patient most comfort during prone position. It is very important that the patient should be positioned to allow the lumbar spine to be flexed as much as possible to widen the interlaminar space. Pressure points during prone position should be considered and carefully supported with a soft cushion. Position of the pillar of the operating table, height of the operating table and the position of the fluoroscope should be checked to suit the most comfort and convenience for the surgical team. Proper level of the incision is verified under fluoroscopic guidance. A small skin incision was made just enough to pass through an 8-mm working channel. A dilator and a working sheath were inserted subsequently according to aim for disc space with

fluoroscopic guidance (Fig. 1). The optimal position of the working channel is on the lateral edge of the interlaminar window and near the facet joint. This optimal finding had eased to decompress nerve root. A little bone shaving might be needed, depending on the position of the migrated disc. Ligamentum flavum is cut until the intraspinal canal is reached. In thecal sac, together with the shoulder of the traversing nerve root are retracted medially. The bevel of the working channel needed to be rotated at the same time to prevent the retracted nerve root coming in and obstruct the surgical field. This step is difficult so proper training with cadavers will shorten the learning curve. Sometimes decompression through the nerve root axilla might be needed before it was retracted. The

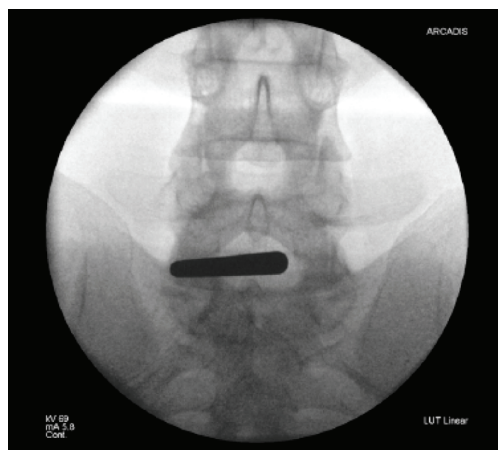


Fig. 1 Working channel pointed to lateral laminar window

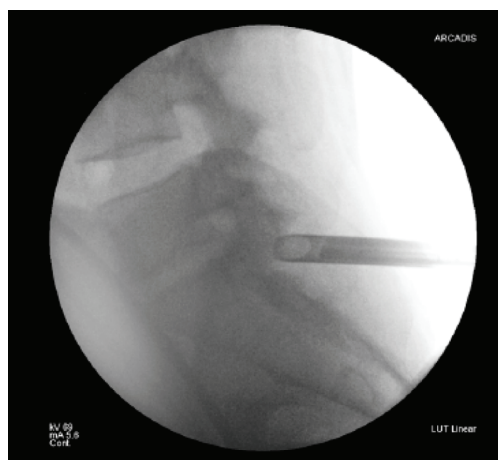


Fig. 2 Working channel pointed toward disc space in lateral film

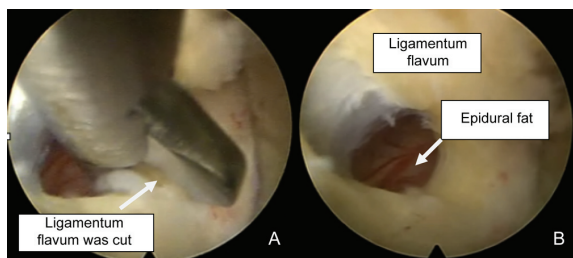


Fig. 3 A) Endoscopic view showing ligamentum flavum cutting before entering the spinal canal. Too much scope angle may lead to contralateral side. If there is some muscle coming the view, it can be coagulated. B) Epidural fat can be seen through the defect. Ligamentum flavum should be cut to allow the instrument to pass in

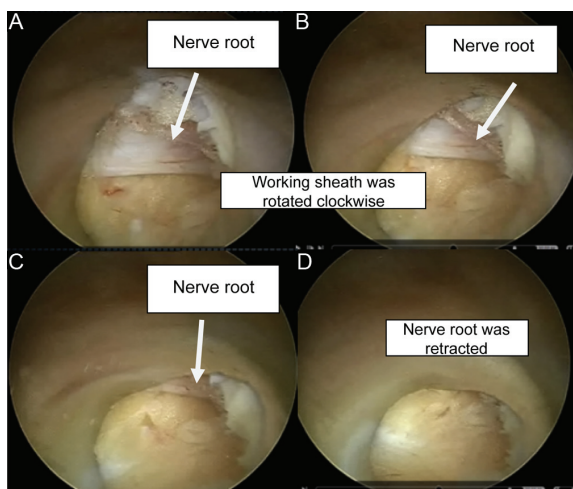


Fig. 4 (A-D) showed using the working sheath as a nerve hook while the bevel was being rotated and retracted away from the working area. This is the critical period which may injure the traversing root. If the laminar window is too narrow, remove additional bone to prevent excessive nerve root retraction

Table 1. Modified Macnab criteria

Excellent	Free of pain, no restriction of mobility, able to return to normal work
Good	Occasional nonradicular pain, relief of presenting symptoms, able to return to modified work
Fair	Some improved functional capacity, still handicapped and/or unemployed
Poor	Continued objective symptoms of root involvement, additional operative intervention needed at the index level irrespective of repeat or length of post operative follow-up

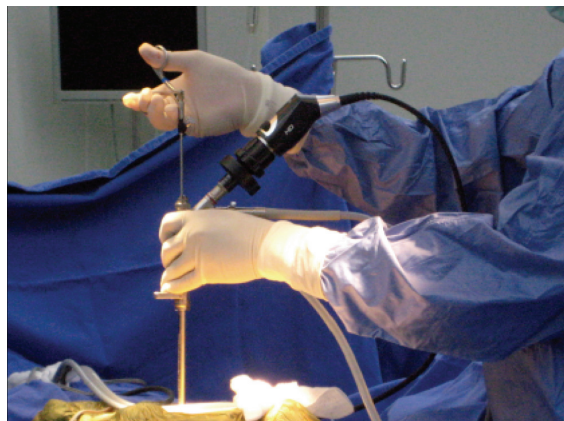


Fig. 5 The endoscope mostly controlled by left hand. Its movement is like joystick. Notice that the surgeon's left little finger is pressing on the sheath all the time to prevent malposition of the sheath

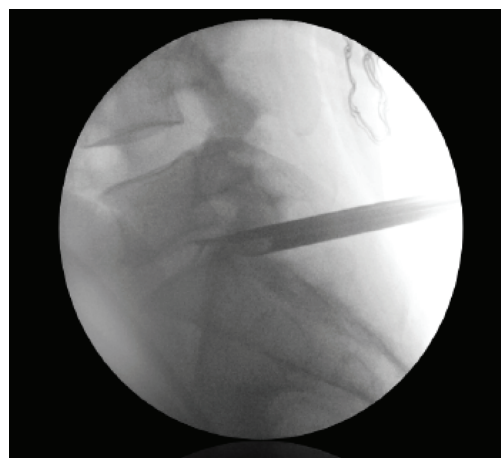


Fig. 6 Depth of instrument can be checked with lateral film

controversial question is how much nerve root decompression is enough. Commonly, the authors remove the entire free fragment and performing intradiscal decompression until the nerve root is pulsating freely. There was minimal blood loss and drainage was not necessary. The patients are usually admitted one night after operation and allowed to ambulate independently with lumbar support.

Results

There were 60 patients, 27 male and 33 female. Mean age was 46.3 ± 11.3 years old (ranged from 18 to 70 years old). Mean follow-up period was 23 months. Mean VAS decreased significantly from 7 to 1.5 in the

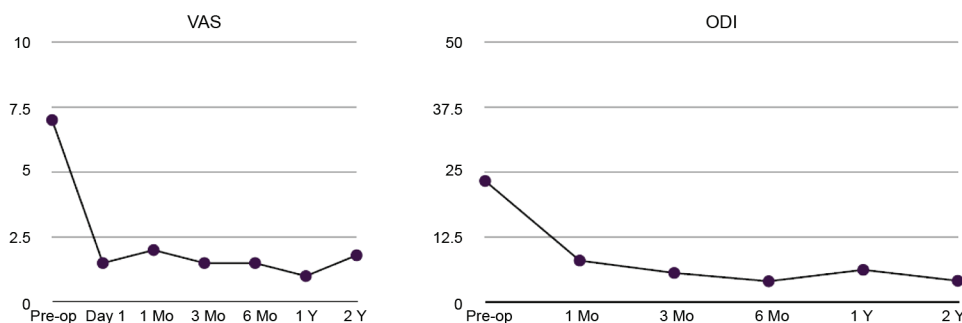


Fig. 7 Showed decreased VAS and ODI score over time. Note that they decreased most during early post-operative period

immediate postoperative period ($p < 0.05$) while there was not much difference of the VAS in follow-up period ($p > 0.05$). The same pattern was also seen in ODI which decreased significantly ($p < 0.05$) at the early follow-up period but did not change much during later follow-up (Mean ODI decreased from 24.5 to 6.5 in the first month. Mean ODI at 2-year was 5 ($p > 0.05$)). Macnab score, which focused on subjective symptoms and the patients' ability to get back to their work, showed 91.6% excellent result (fifty-five from sixty patients). Eight of all patients were unable to contact. However, all of them met criteria of having follow-up at least one year. There were two cases of recurrent symptoms after a few months of operation. Both of them showed complete resolution following the first operation and were able to perform their work normally before the symptoms came back again. MRI showed recurrent lumbar disc herniation at the same level and they were re-operated with the same technique. Finally, they responded well with the treatment and there was no recurrent symptom afterward. Moreover, there were two patients with persisting lumbar radicular pain even although there was no nerve root compression from the MRI scan. All of them responded well with lumbar selective nerve root block. According to this, the authors' provisional diagnosis was some degree of nerve root irritation during the operation caused lumbar root inflammation. There was no serious neurological symptom such as motor weakness, cauda equina syndrome, or dural tear periprocedurally and at follow-up. Surgical wound pain was minimal and well controlled with an oral analgesia medication.

Discussion

Results from the present study revealed interlaminar approach of full endoscopic lumbar discectomy is safe and effective method for herniated

lumbar disc treatment. Significant lumbar radicular pain reduction can be expected in the immediate postoperative period. With ODI score, the authors had followed up for 1 month after operation to let them get back to their normal life before making an assessment again at the clinic. Most of the patients could get back to work normally (91.6% as defined by Macnab criteria). There were two cases of recurrent lumbar disc herniation after a period of symptoms free. Both of them were re-operated successfully with the same technique. Persisting radicular pain was found in two cases without demonstrable nerve root compression in the MRI scan. The authors' hypothesis was there were some nerve root irritations from retraction while the intradiscal fragment was being removed. Interlaminar approach was developed to overcome lumbar disc herniation located mainly in spinal canal or migrated beyond level of the disc space, which was considered difficult, or sometimes incapable to remove from the transforaminal approach⁽¹⁾. As the authors' result demonstrated, this technique is feasible and repeatable as Ruetten proposed. Limitation of this technique is foraminal or extraforaminal lumbar disc herniation, which is more appropriate for decompression via transforaminal approach. High learning curve in full endoscopic procedures is also steep. Some studies claimed 30 cases are needed before the learning curve is passed for full endoscopic procedures^(10,11). Training in an experienced spine center and attending the cadaveric workshops could shorten the learning curve. In the authors' opinion, starting with classic cases such as big laminar window, not too large a disc and no migration is a good selected case before overcoming this approach. Nevertheless, the advent of full endoscopic procedures is not an alternate for existing microscopic technique. Experience in open

spinal surgery would help surgeons to understand and correct the complications of full endoscopic procedures.

Conclusion

Full endoscopic lumbar discectomy via interlaminar approach is safe and a comparably helpful means for lumbar disc herniation treatment. Patients can expect less post-operative pain, immediate pain relief, and ability to get back to work normally. However, the learning curve is steep, proper training and careful case selection in the early period is the key to success.

Potential conflict of interest

None.

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การศึกษาเทคนิคการผ่าตัดรักษาโรคหมอนรองกระดูกสันหลังระดับเอวกดทับเส้นประสาทโดยการส่องกล้องโดยวิธี *interlaminar approach*: ผลการศึกษาการผ่าตัดจากโรงพยาบาลรามาริบัติในช่วงเวลา 2 ปี

สรยุทธ ชำนาญเวช, วิธวินท์ เกสรศักดิ์, ประเสริฐ ศัลยวิวรรณ, วีระพันธ์ ควรทรงธรรม

วัตถุประสงค์: ในปัจจุบันเทคนิควิธีในการรักษาอาการปวดหลังจากโรคหมอนรองกระดูกสันหลังระดับเอวกดทับเส้นประสาทด้วยการผ่าตัด แบบบาดเจ็บน้อยเป็นที่ยอมรับกว้างขวาง งานวิจัยนี้เป็นการศึกษาแบบย้อนหลังโดยประเมินจากข้อมูลของผู้ป่วย 60 ราย ที่ได้ทำการผ่าตัดด้วยวิธีส่องกล้องโดย *interlaminar approach* ซึ่งเป็นเทคนิคใหม่ในบริเวณกระดูกสันหลังส่วนล่าง เป้าหมายของการศึกษานี้เพื่อแสดงให้เห็นถึงประสิทธิผลการรักษาและประเมินผลของการผ่าตัดด้วยวิธีส่องกล้องโดย *interlaminar approach*

วัสดุและวิธีการ: ศึกษาผู้ป่วย 60 ราย ที่มีอาการหมอนรองกระดูกทับเส้นประสาทซึ่งมารับการรักษาที่โรงพยาบาลรามาริบัติ ในระหว่าง เดือนกรกฎาคม พ.ศ. 2551 ถึงเดือนมกราคม พ.ศ. 2553 ซึ่งได้รับการรักษาด้วยการผ่าตัดวิธีส่องกล้องระบบของ *Vertebris* โดยการผ่าตัดผ่านเข้าทาง *lamina (interlaminar approach)* และประเมินคุณภาพการรักษาติดตามการรักษาผู้ป่วยหลังผ่าตัดทันทีและที่ 1, 3, 6, 12 และ 24 เดือนหลังผ่าตัดโดยใช้ *Visual Analogue Scale (VAS)* แบบสอบถามภาษาไทยฉบับประยุกต์เวอร์ชัน 1.0 จาก *Oswestry disability index (ODI)* และ *modified McNab criteria*

ผลการศึกษา: จากการประเมินโดยใช้ *Modified McNab criteria* พบว่าผลการรักษาในระดับดีมาก 91.6% และพบว่ามีผลแตกต่างอย่างมีนัยสำคัญในการประเมินด้วย *VAS* และ *modified ODI*

สรุป: การผ่าตัดรักษาอาการปวดหลังจากโรคหมอนรองกระดูกสันหลังกดทับเส้นประสาทด้วยวิธีผ่าตัดส่องกล้องโดย *interlaminar approach* มีประสิทธิภาพในเกณฑ์ที่ดีมากและบาดเจ็บน้อย ระยะเวลาในการฝึกฝนทักษะการผ่าตัดเพื่อให้เกิดความชำนาญและการคัดเลือกผู้ป่วยมีความสำคัญอย่างยิ่งต่อผลการผ่าตัดรักษา
