Clinical Effectiveness and Safety of Microdecompression in Thai Lumbar Spinal Stenosis Patients

Ekkapoj Korwutthikulrangsri MD*, Areesak Chotivichit MD*,
Panya Luksanapruksa MD*, Kamolchanok Siribunchachai BSc*

** Department of Orthopedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

Background: *Microdecompression (MD) is a minimally invasive spine surgery for lumbar spinal stenosis (LSS). However, there was no long-term outcome study of this procedure in Thailand.*

Objective: *The aim of this study was to evaluate the safety, complications, and surgical outcomes in Thai patients who underwent MD for LSS.*

Material and Method: *A single-institution database was reviewed for Thai patients with LSS who underwent MD during the 2005 to 2014 study period. We analyzed demographic data and clinical data, intraoperative and postoperative data, and immediate complications. Oswestry Low Back Disability Index (ODI) and EQ-5D-5L were used to measure outcomes.*

Results: *Seventy patients were enrolled (43 female and 27 male), with an average age of 64.1±10.6 years. Mean operative time was 99.5±31.6 minutes per level. Average length of stay was 5.2±2.8 days. Estimated blood loss was 90.5±65.6 ml. The most common level was L4-5. The average follow-up was 47.5±33.8 months. All postoperative patient-reported outcome measures were statistically significantly improved compared to preoperative measures ($p<0.05$). Average preoperative and postoperative ODI score was 60.8±20.6 and 15.9±15.7, respectively. Average pre-operative and postoperative EQ-5D-5L scores were 35.2±23.4 and 92.2±10, respectively. Immediate complications were found in 7 patients, including 5 incidental dural tear, 1 epidural hematoma, and 1 superficial wound infection. Late complications were found in 5 patients, including 1 cerebrospinal fluid leakage and 4 additional fusion surgeries. Of note, 14 patients had grade I degenerative spondylolisthesis (DS) before surgery although none of these patients complained of significant back pain. However, 3 of 4 cases that underwent additional fusion had pre-operative DS.*

Conclusion: *Microdecompression surgery was found to be effective for treating patients with degenerative spinal stenosis. This procedure should be cautiously used in patients with spondylolisthesis, even in the absence of significant back pain.*

Keywords: *Spinal stenosis, Microdecompression, Surgical outcome, Complications, Decompression*

J Med Assoc Thai 2016; 99 (10): 1080-5
Full text. e-Journal: *http://www.jmatonline,com*

Lumbar spinal stenosis (LSS) is one of the most common spine problems, especially among the elderly. Prevalence of lumbar spinal stenosis was reported to be 5.7-9.3%[1,2]. This condition is caused by a degenerative process that involves the intervertebral discs and facet joints of the spine. As a result of this process, the intervertebral disc space becomes narrow causing buckling of the ligamentum flavum and narrowing of the intervertebral foramen. An osteophyte is then formed around the endplate of the vertebra and facet joints. If the rate of wear and tear exceeds the rate of healing, a subluxation of the spine can occur. This condition is referred to as spondylolisthesis. All of the aforementioned pathology cause compression of neural elements in the spine, which can be subdivided into central, lateral recess, and foramina stenosis. A typical symptom in these patients is neurogenic claudication, which can be described as leg pain that radiates from the buttocks down to the leg below the knee when walking a certain distance. This distance will gradually decrease as the condition worsens. Numbness and weakness of the leg are common patient complaints, but physical examination usually yields no clinical finding. Diagnosis of this condition is normally made from clinical presentation and image study, which includes plain film x-ray in upright position, flexion/extension films and MRI. Treatment for this condition includes medication, physical therapy, spinal nerve block, and then surgical decompression when the other modalities fail to improve symptoms.

Microdecompression is a minimally invasive

Correspondence to:
Chotivichit A, Department of Orthopedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, 2 Wang Lang Road, Bangkok Noi, Bangkok 10700, Thailand.
Phone: +66-2-4197969, Fax: +66-2-4197961
E-mail: Areesak.cho@mahidol.ac.th

spine surgery that has become well-accepted because it minimizes surgical injury to normal structures, especially the paravertebral muscles and interspinous ligament, both of which play an important role in spinal stability[3]. However, the initial positive results that have been reported by several studies[4-6] may not be sustainabledue to the ongoing degenerative process within the patient's spine. As a result, some surgeons prefer decompression with instrumented fusion. However, a large proportion of LSS patients are elderly with many other medical conditions that render them unsuitable for major surgical procedures. Accordingly, a long-term outcome study is needed to justify the long-term benefit of this Microdecompression procedure. The aim of this study was to evaluate the safety, complications, and surgical outcomes in Thai patients who underwent microdecompression (MD) for lumbar spinal stenosis (LSS).

Material and Method

This study was a retrospective review of medical records of patients who underwent microdecompression surgery of the spine by the senior author (AC) during the March 2005 to May 2014 study period. The protocol for this study was approved by the Siriraj Institutional Review Board (SIRB), Faculty of Medicine Siriraj Hospital, Mahidol University. Patients meeting the following 4 inclusion criteria were enrolled: 1) diagnosis of spinal stenosis with significant leg symptoms at the thoracolumbar level; 2) no significant back pain at rest or during normal activities; 3) no gross instability by clinical and radiographic appearance; and 4) failure to improve with conventional conservative treatment, such as medication and/or physical therapy.

The microdecompression technique is briefly described, as follows: 1) identification of level by intra-operative C-arm radiograph; 2) posterior midline skin incision of 3 centimeters per level; 3) uni/bilateral approach; 4) microscopically visualized surgical field; and 5) bayonet-shaped instruments.

All medical records and radiographs were stored in electronic form and were retrieved directly from our center'spatient database. Demographic and clinical data, intra-operative and postoperative data and immediate complications were collected, analyzed and reported. Oswestry Low Back Disability Index (ODI) and EQ-5D-5L were used to measure outcomes. Patients were asked to answer the questionnaires at the clinic or by telephone. Outcomes were determined by comparison between pre-operative and postoperative measurement scores using paired t-test. Data were analyzed using SPSS Statistics version 18 (SPSS, Inc., Chicago, IL, USA). A *p*-value <0.05 was regarded as being statistically significant.

Results

Seventy surgically-treated lumbar spinal stenosis patients were included. Average age of patients was 64.1 years (range: 39-89, SD: 10.6), with a gender proportion of 43 males and 27 females. Average BMI was 25.6 (range: 16.4-38.4, SD: 4.3). Mean operative time was 99.5 minutes per level (range: 30-215, SD: 31.6) and average length of stay was 5.2 days (range: 2-12, SD: 2.8). Mean estimated blood loss was 90.5 ml (range: 20-300, SD: 65.6). The most common level was L4-5 (Fig. 1). Average follow-up was 47.5 months (range: 0-123, SD: 33.8). Eighty-five percent of patients were followed-up for at least 1 year, 80% were followed-up for at least 18 months and 43% were followed-up for at least 4 years. Fourteen patients had grade I degenerative spondylolisthesis (DS) before surgery although none of those complained of significant back pain. One patient died from another condition.

Thirty-nine patients (55.7%) completed the postoperative outcome questionnaires. Outcomes, as defined by the difference between pre-operative and postoperative survey scores, were statistically significant for both measures. Mean Oswestry Low Back Disability Score was 60.8 (range: 0-92.5, SD: 20.6) pre-operatively and 15.9 (range: 0-51.1, SD: 15.7) postoperatively (p<0.001). Mean EQ-5D-5L was 35.2 (range: -5.6-83.3, SD: 23.4) pre-operatively and 92.2 (range: 59.4-100, SD: 10) (Fig. 2). Postoperative scores

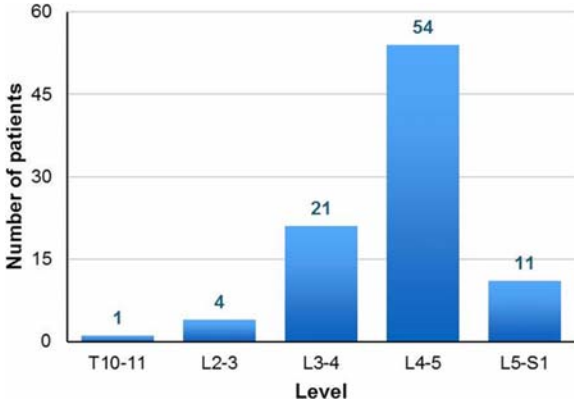

Fig. 1 Distribution of lumbar spinal stenosis level in this study.

were significantly different from pre-operative scores for both measurements (p<0.05) (Table 1).

Complications

Immediate complications

There were 5 dural tears among the operations included in this study. One patient, a 64-year-old man, had received radiation therapy over the surgical field for treatment of lymphoma prior to the operation. The dura was torn while dissecting the nerve root from heavy scar tissue that surrounded it. Another patient, a 74-year-old female, had received epidural steroid injection prior to the operation. The dura appeared very thin and adhered to the ligamentum flavum. There was 1 postoperative hematoma in a 56-year-old female who had undergone microdecompression at level L4-5. She reported increasing pain on postoperative day 3 when starting to ambulate. The pain increased to the point of having rest pain. MRI with gadolinium was performed, which revealed epidural hematoma. That patient underwent reoperation on postoperative day 5.

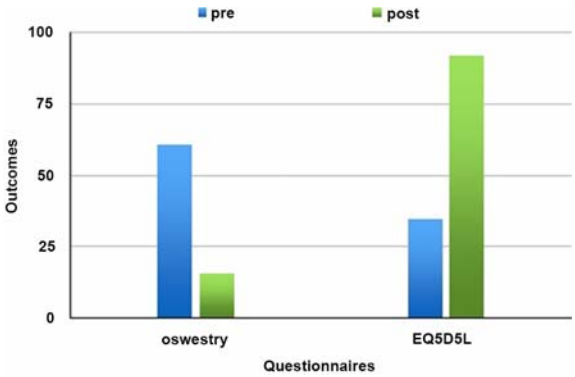

Fig. 2 Patient-reported outcome measurement between preoperative period and postoperative period.

There was 1 superficial wound infection which required prolonged antibiotic therapy and a hospital stay of 12 days. This was a 70-year-old man with underlying hyperuricemia who had undergone 3 levels of microdecompression (L2-5).

Late complications

There was 1 case of cerebrospinal fluid leakage that developed 2 months after the index operation in a 62-year-old man. The patient noticed a bulge at the surgical wound (3 centimeters in diameter). He reported the same back and leg pain that he had experienced before the surgery. MRI with gadolinium was performed, which revealed fluid collection in the epidural space over the surgical site. Surgical exploration was performed, but no dural tear was observed. The patient's condition was resolved following surgery.

There were 4 patients who underwent additional instrumented fusion using pedicle screws, rods, and fixation due to late instability with associated back and leg pain. All of these patients were operated upon within 18 months after microdecompression surgery. Three of four patients who underwent fusion surgery (75%) had preoperative DS.

Discussion

Lumbar spinal stenosis (LSS) is one of the most common spine problems among the elderly. LSS causes pain, disability, depressive symptoms, and adversely affects overall quality of life[7,8]. Decompressive laminectomy (DL), the treatment of choice in LSS after failure of conservative treatment, produced good clinical outcomes[9,10]. DL can be performed by various techniques, including conventional, endoscopic, and microdecompressive

Table 1. Patient-reported outcome measurement between preoperative period and postoperative period

Clinical measurement	Mean	SD	95% confidence interval		*p*-value
			Lower	Upper	
ODI					
Preoperative	60.8	20.6	38.5	51.2	<0.001
Postoperative	15.9	15.7			
EQ-5D-5L					
Preoperative	35.2	23.4	-63.8	-50.2	<0.001
Postoperative	92.2	10			

SD = standard deviation; ODI = Oswestry Low Back Disability Index; EQ-5D-5L

methods. Microdecompression method is minimally invasive and is performed using a surgical microscope. Previous publications reported good clinical outcomes after performing this technique in both single level[11,12] and multi-level stenosis cases[13]. Based on our review of the literature, the present study is the first to report the effectiveness of this method in Thai LSS patients.

Several previous studies reported that MD significantly improved pain and disability[4-6,14]. Yang et al reported that 61.9% of patients had excellent to fair outcomes[4] after a minimum of 3 years of follow-up. Costa et al reported that 87.9% of patients experienced clinical benefit (i.e., neurological improvement in VAS and Prolo Scale scores)[5].

The present study showed that MD produced statistically significant postoperative improvement. The perioperative complication rate was 17.14%. There were a wide range of operative times in this study. Almost half (31/70) of patients had an operative time less than 1.5 hours per level. As would be expected, longer operative times were observed in multiple-level casesand in cases requiring dural tear repair and in cases with post-radiation fibrosis around the nerve. Mean estimated blood loss also varied widely for the same reasons. Nearly half (32/70) of patients lost less than 50 ml of blood during surgery. The average follow-up time of patients in this study was almost 4 years, with 42.9% of patients having at least 4 years of follow-up. The dropout rate (less than 1 year) was 21.4%; however, 55.7% of patients completed the postoperative outcome questionnaires. Statistically significant differences were observed between preoperative and postoperative survey scores for all measurement methods. These results indicate the effectiveness of this DL method. In this study, 4 patients underwent additional spinal fusion after the index MD procedure. Three patients in this subsequent spinal fusion group had grade I degenerative spondylolisthesis without significant back pain at the time of microdecompression surgery. The fourth fusion patient had no evidence of spondylolisthesis. This patient was a 62-year-old female who recovered well after microdecompression surgery, but hurt herself by moving heavy furniture during the flood in 2011. As a result, at one year after the index MD operation, she underwent fusion surgery with good outcome. The present study showed good clinical results from this procedure, which is consistent with the results of previous reports.

Notable limitations of this study include its retrospective single-institute design. A multicenter randomized controlled trial is needed to definitively establish the safety and effectiveness of this method among Thai LSS patients.

Conclusion

Microdecompression surgery was found to be effective for treating patients with degenerative spinal stenosis. This procedure should be cautiously used in patients with spondylolisthesis, even in the absence of significant back pain.

What is already known on this topic?

Microdecompression techniques in lumbar spinal stenosis provide good postoperative results, especially in back pain and disability, with few perioperative complications.

What is study adds?

Microdecompression in Thai lumbar spinal stenosis patients yielded significant improvement in disability and quality of life with a low rate of perioperative complications (17.4%).

Acknowledgements

The authors gratefully acknowledge Mrs. Boontira Sumrithluan, RN for assisting data collection.

Potential conflicts of interest

None.

References

1. Yabuki S, Fukumori N, Takegami M, Onishi Y, Otani K, Sekiguchi M, et al. Prevalence of lumbar spinal stenosis, using the diagnostic support tool, and correlated factors in Japan: a population-based study. J Orthop Sci 2013; 18: 893-900.
2. Ishimoto Y, Yoshimura N, Muraki S, Yamada H, Nagata K, Hashizume H, et al. Prevalence of symptomatic lumbar spinal stenosis and its association with physical performance in a population-based cohort in Japan: the Wakayama Spine Study. Osteoarthritis Cartilage 2012; 20: 1103-8.
3. Park HK, Chang JC. Microdecompression in spinal stenosis: a review. J Neurosurg Sci 2014; 58: 57-64.
4. Yang SM, Park HK, Chang JC, Kim RS, Park SQ, Cho SJ. Minimum 3-year outcomes in patients with lumbar spinal stenosis after bilateral microdecompression by unilateral or bilateral laminotomy. J Korean Neurosurg Soc 2013; 54: 194-200.
5. Costa F, Sassi M, Cardia A, Ortolina A, De Santis

A, Luccarell G, et al. Degenerative lumbar spinal stenosis: analysis of results in a series of 374 patients treated with unilateral laminotomy for bilateral microdecompression. J Neurosurg Spine 2007; 7: 579-86.
6. Weiner BK, Walker M, Brower RS, McCulloch JA. Microdecompression for lumbar spinal canal stenosis. Spine (Phila Pa 1976) 1999; 24: 2268-72.
7. Lin SI, Lin RM, Huang LW. Disability in patients with degenerative lumbar spinal stenosis. Arch Phys Med Rehabil 2006; 87: 1250-6.
8. Sinikallio S, Aalto T, Lehto SM, Airaksinen O, Herno A, Kroger H, et al. Depressive symptoms predict postoperative disability among patients with lumbar spinal stenosis: a two-year prospective study comparing two age groups. Disabil Rehabil 2010; 32: 462-8.
9. Ulrich NH, Kleinstuck F, Woernle CM, Antoniadis A, Winklhofer S, Burgstaller JM, et al. Clinical outcome in lumbar decompression surgery for spinal canal stenosis in the aged population: a prospective Swiss multicenter cohort study. Spine (Phila Pa 1976) 2015; 40: 415-22.
10. Crawford CH 3rd, Glassman SD, Mummaneni PV, Knightly JJ, Asher AL. Back pain improvement after decompression without fusion or stabilization in patients with lumbar spinal stenosis and clinically significant preoperative back pain. J Neurosurg Spine 2016; 25: 596-601.
11. Zhang GL, Ge BF, Gong TJ, Wang YH, Chen KM, Qian J. Micro-decompression procedure for lumbar spinal stenosis. Zhongguo Gu Shang 2009; 22: 751-3.
12. Orpen NM, Corner JA, Shetty RR, Marshall R. Micro-decompression for lumbar spinal stenosis: the early outcome using a modified surgical technique. J Bone Joint Surg Br 2010; 92: 550-4.
13. Zhang GL, Ge BF, Zhao LX, Yang JL, Chen KM, Zhou JH, et al. Micro-decompression procedure for the treatment of lumbar spinal stenosis with multilevel. Zhongguo Gu Shang 2011; 24: 821-3.
14. Jalil Y, Carvalho C, Becker R. Long-term clinical and radiological postoperative outcomes after an interspinous microdecompression of degenerative lumbar spinal stenosis. Spine (Phila Pa 1976) 2014; 39: 368-73.

การศึกษาประสิทธิภาพทางคลินิกและความปลอดภัยของวิธีการผ่าตัดไมโครดีคอมเพรสชั่นในผู้ป่วยโรคโพรงกระดูกสันหลังตีบแคบ

เอกพจน์ ก่อวุฒิกุลรังษี, อารีศักดิ์ โชติวิจิตร, ปัญญา ลักษณะพฤกษา, กมลชนก ศิริบัญชาชัย

ภูมิหลัง: การผ่าตัดไมโครดีคอมเพรสชั่นเป็นการผ่าตัดชนิดลุกล้ำน้อย ซึ่งใช้รักษาโรคโพรงกระดูกสันหลังส่วนเอวตีบแคบ อย่างไรก็ตามพบว่ายังไม่มีการศึกษา ซึ่งรายงานผลทางคลินิกในระยะยาวของการผ่าตัดชนิดนี้ในประเทศไทยมาก่อน

วัตถุประสงค์: เพื่อประเมินความปลอดภัย ภาวะแทรกซ้อน รวมถึงผลการผ่าตัดด้วยวิธีดังกล่าวในผู้ป่วยชาวไทย ซึ่งมีภาวะโพรงกระดูกสันหลังบริเวณเอวตีบแคบ

วัสดุและวิธีการ: ทำการค้นฐานข้อมูลในสถาบันเดียวเพื่อหาผู้ป่วยโรคโพรงกระดูกสันหลังส่วนเอวตีบแคบที่ได้รับการผ่าตัดด้วยวิธีไมโครดีคอมเพรสชั่นระหว่างปี พ.ศ. 2548-2557 ผู้นิพนธ์วิเคราะห์ข้อมูลส่วนตัว ข้อมูลระหว่างและหลังการผ่าตัดรวมถึงภาวะแทรกซ้อนที่เกิดขึ้น ผลลัพธ์ทางคลินิกใช้แบบประเมิน ODI และแบบประเมินคุณภาพชีวิตชนิด EQ-5D-5L

ผลการศึกษา: มีผู้ป่วยเข้าเกณฑ์จำนวน 70 คน (ชาย 27 คนและหญิง 43 คน) อายุเฉลี่ย 64.1±10.6 ปี ตำแหน่งที่พบได้บ่อยที่สุด คือกระดูกสันหลังส่วนเอวปล้องที่ 4 และ 5 ระยะเวลาผ่าตัดเฉลี่ย 99.5±31.6 นาที พักในโรงพยาบาลเฉลี่ย 5.2±2.8 วัน เสียเลือดโดยประมาณจากการผ่าตัด 90.5±65.6 ลูกบาศก์เซนติเมตรช่วงเวลาติดตามการรักษาเฉลี่ยอยู่ที่ 47.5±33.8 เดือน เมื่อเปรียบเทียบผลการรักษาก่อนและหลังผ่าตัดพบว่า ผู้ป่วยมีผลลัพธ์ดีขึ้นอย่างมีนัยสำคัญทางสถิติ ค่าคะแนน ODI ก่อนและหลังผ่าตัดคือ 60.8±20.6 และ 15.9±15.7 ตามลำดับ ค่าคะแนนแบบประเมินคุณภาพชีวิตชนิด EQ-5D-5L ก่อนและหลังผ่าตัดได้แก่ 35.2±23.4 และ 92.2±10 ภาวะแทรกซ้อนที่เกิดขึ้นทันทีพบในผู้ป่วยจำนวน 7 คน ได้แก่ ถุงหุ้มดูราฉีกขาด 5 คน มีก้อนเลือดเหนือถุงหุ้มดูรา และแผลอักเสบติดเชื้อในชั้นตื้น 1 คน ภาวะแทรกซ้อนที่เกิดภายหลังพบในผู้ป่วย 5 คน ได้แก่ มีน้ำหล่อเลี้ยงไขสันหลังรั่ว 1 คน และผู้ป่วยต้องผ่าตัดเพิ่มเติมอีก 4 คน พบว่าผู้ป่วยจำนวน 14 คนมีภาวะกระดูกสันหลังเคลื่อนจากความเสื่อมระดับ 1 และไม่มีผู้ป่วยมีอาการปวดหลังอย่างมีนัยสำคัญ แต่อย่างไรก็ตามพบว่าผู้ป่วย 3 ใน 4 คน ที่ได้รับการผ่าตัดเพิ่มเติมมีภาวะกระดูกสันหลังเคลื่อนจากความเสื่อมก่อนการผ่าตัด

สรุป: การผ่าตัดด้วยวิธีไมโครดีคอมเพรสชั่นในผู้ป่วยโพรงกระดูกสันหลังส่วนเอวตีบแคบมีประสิทธิภาพที่ดี แต่อย่างไรก็ตามการผ่าตัดชนิดนี้ควรระวังในผู้ป่วยที่มีกระดูกสันหลังเคลื่อนแม้ว่าจะไม่มีอาการปวดหลังอย่างมีนัยสำคัญก็ตาม