Clinical Outcomes of Microscopic Lumbar Discectomy with Tubular Retractor

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Background: *The conception of microscopic lumbar discectomy with tubular retractor (MDT) was first introduced in 1997. In Thailand this procedure and its clinical outcomes have not been described.*
Objective: *To describe the MDT technique for treatment of lumbar disc herniation and to report clinical outcomes.*
Material and Method: *A prospective study involving 20 consecutive cases with lumbar disc herniation treated by MDT was conducted. The SF-36 was used to quantify the clinical results. The degree of pain was also measured by visual analog scale (VAS). The outcomes were measured pre-operatively, and then 1 month and 1 year after the surgery.*
Results: *There was dramatic improvement of mean SF-36 and VAS at 1 month and 1 year postoperatively, as compared to pre-operative status. The average length of hospital stay was 4 days. The time to return to work or normal activity was 37.5 days. The average operative blood loss was 50 ml and the intravenous narcotic use was 9/20 (45%).*
Conclusion: *MDT is effective with fine long-term outcomes in treating lumbar disc herniation when compared with standard open microdiscectomy. It allows smaller incisions and less tissue trauma. Strict adherence to pre-operative patient-selection criteria should ensure optimal postoperative outcomes.*

Keywords: *Microscopic lumbar discectomy, Tubular retractor, Lumbar disc herniation, Outcome*

J Med Assoc Thai 2017; 100 (Suppl. 3): S73-S78
Full text. e-Journal: *http://www.jmatonline.com*

Lumbar disc herniation is a degenerative disease of the lumbar spine. This condition is one of the most common causes of "sciatica" pain[1,2]. Some of disc materials displace from the disc space, and compress spinal nerve roots, causing back pain that radiates down to the leg. If the nerve compression is more severe, it can produce motor and sensory deficits in lower extremity; as well as bowel and bladder dysfunction. Generally, it affects people in their fourth to fifth decade of life[3]. However, only 4 to 6% of lumbar disc herniation become symptomatic, with men being up to three times more likely than women[4]. The most common level is L4 to L5 disc[5]. Management of lumbar disc herniation is medical and surgical, with initial treatment is generally non-surgical. Medical treatment typically consists of rest, steroidal & non-steroidal anti-inflammatory drugs, epidural steroid, and physical therapy. Most patients improve within a few weeks to months. Surgical treatment is recommended for those who fail to recover. With development of new surgical tools and techniques, minimally invasive spine procedures have emerged as an alternative to conventional open surgery. The minimally invasive discectomy is a relatively new technique. With the aid of microscopic or endoscopic and special-designed equipment, the wound size and tissue trauma are minimized. This may lead to shorter hospital stay and recovery period. However, its effectiveness compared with the conventional open discectomy has not yet been determined[6,7].

Open discectomy is a standard treatment for lumbar disc herniation. However, it may cause marked postoperative pain due to extensive paraspinal muscle dissection. With use of operative microscope by Caspar[8] in 1977 and Williams[9] in 1978, and newly-designed tubular retractor system by, Foley and Smith[10] in 1997, the tissue trauma and wound size are diminished. This may result in less postoperative pain and narcotics use, reduced hospital stay, and shorter recuperation. However, in Thailand, this procedure is new. Its efficacy, safety, as well as recurrence rate need to be studied carefully before being accepted as

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an alternative surgical procedure to standard open discectomy.

Material and Method

Patients and clinical evaluation

Patients with lumbar radiculopathy caused by lumbar disc herniation were enrolled in the study from August 2007 to January 2011. They were assigned to have surgical treatment by microsurgical discectomy with tubular retractor (MDT). Inclusion criteria were the presence of a posterolateral disc herniation on magnetic resonance imaging (MRI) (Fig. 1) and persistent radiating pain, and/or numbness/weakness in the lower limb after 12 weeks of conservative treatment. Patients were excluded if they had either one of the followings: 1) spondylolithesis as evidence on lateral lumbar flexion-extension x-ray view, 2) lumbar stenosis, and 3) lumbar kyphoscoliosis. After the inclusion criteria were met and informed consent was obtained, operations were performed by a spine neurosurgeon.

The pre-operative and postoperative evaluation consisted of, a neurological examination, a scoring for leg pain using visual analogue scale (VAS), and quality of life outcome using SF-36 questionnaires (Thai version). Postoperative evaluations were done on months 1, 12 after the operation. All patients underwent a pre-operative MRI.

Surgical technique

Microscopic lumbar discectomy, using the tubular retractor system, consists of a guidewire, series of sequential dilators, and tubular retractors.

Before the operation, the affected level was marked by al lateral C-arm fluoroscopy. An approximately 1.5 to 2 cm paramedian incision; 1.5 cm from the midline was made and carried down to the lumbar fascia. A fascial stab incision was made. Then a guide wire was inserted and directed toward inferior aspect of superior lamina and facet junction, under fluoroscopic guidance. After the set of serial dilators were inserted to the incision, a 16 mm diameter tubular retractor was typically used in almost all cases. The operative microscopy was brought in. Partial removal of inferior lamina with/without medial facetectomy was done by a high speed drill. Ligamentum flavum was removed; the nerve root and thecal sac identified. Then discectomy and nerve root decompression was done using varying sizes and shapes of Kerrison Rongeur, curettes, and pituitary rougeurs. The wound was closed in layers with subcuticular stitches for skin closure.

Postoperative care

Patients were given only oral analgesic drugs; acetaminophen and NSAID. Intravenous narcotic medication was used only for severe breakthrough pain. All were discharged home after they were comfortable, ambulatory and had intact bladder function.

Results

Data were collected completely in all of 20 patients. There were equal numbers of male and female patients, whose mean age was 43.5 years. One patient suffered significant co-morbid medical conditions. Disc sizes ranged from 5 to 25 mm (Fig. 2). The most common location of herniation was at the level of the intervertebral disc space L4 to 5 (43.5%). The mean operative time was 144 minutes, and mean blood loss was 50 ml (Table 1).

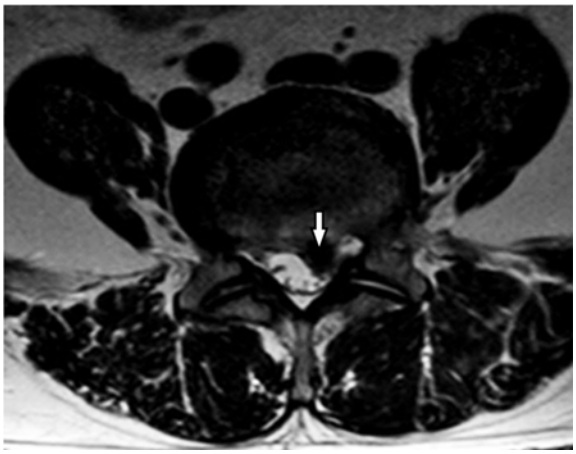

Fig. 1 MRI of the lumbar spine showing posterolateral disc herniation (arrow).

Fig. 2 Intervertebral discs removed by microscopic lumbar discectomy.

Intra-operative complications included one dural defect that could not be primarily repaired but covered with gelfoam. The patient was kept bed rest for 48 hours after the surgery. No delayed cerebrospinal fluid leaks or pseudomenigocele developed. Excessive bleeding, arbitrarily defined as greater than 100 ml, occurred in one patient. This may be due to the underlying co-morbidity (autoimmune nephropathy and obesity). Postoperative complications included one case of posterior interosseous neuropathy due to compression from C-arm fluoroscope, which resolved spontaneously about 3 months later.

Table 1. Clinical characteristics of the patients

No. of cases	20
Sex (male/female)	10/10
Mean age (years)	43.5
Disc level	
L3 to L4	3
L4 to L5	10
L5 to S1	9
Mean follow-up (months)	28
Mean hospital stay (day)	4
Mean blood loss (ml)	50
Mean operative time (minutes)	144
Return to work (days)	37.5
Complication (cases)	2

The average length of hospital stay is 4 days. The mean time to return to work or normal activity was 37.5 days. No patients required intra-operative or postoperative blood transfusion. Nine patients (45%) used intravenous narcotic medications, mainly because of incision pain during the first one or two postoperative day. Evaluation by the VAS, the leg pain relief during the follow-up was dramatic. The mean value of the pre-operative VAS compared with at 1 year after surgery for all 20 patients was 7.5 and 0.75, respectively. There was dramatic improvement in SF-36 score between pre-operative, postoperative 1 month and 12 months in all modalities (Fig. 3). No patient had recurrent lumbar disc herniation during follow-up. The first patient with longest duration of follow-up lasted 53 months. The mean follow-up was 28 months. Two patients had 2-level discectomy. Two patients in this study aged more than 60 years at the time of surgery.

Discussion

Minimally invasive surgery has been incessantly developed and gaining more popularity. It is based on the concept of minimizing tissue trauma and blood loss, while being as effective as the conventional surgical operation. Thus, postoperative pain and recovery period should be lessened. Open discectomy was once regarded as the “gold standard”

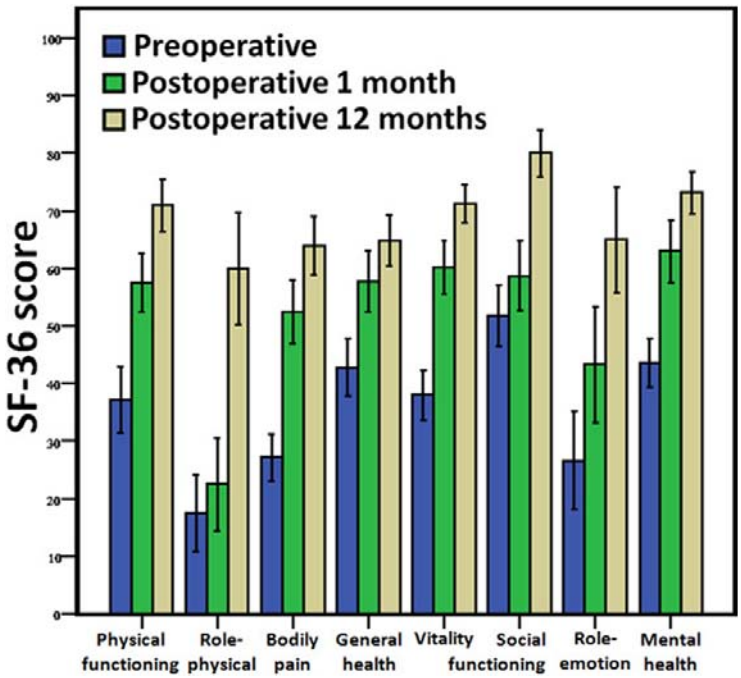

Fig. 3 SF-36 score between before and after the operation.

treatment of lumbar herniation. However, it destroys the rear structure of spine, causing segmental instability and long-term distress. Microdiscectomy with use of tubular retractor produces less tissue trauma than a standard open discectomy. Foley and Smith firstly described the tubular retractor assisted microscopic/endoscopic discectomy for lumbar disc herniation in 1997[10]. They believed that this procedure was a less invasive and more effective technique for treating lumbar disc herniation. Microscopic surgery with use of tubular retractor techniques requires a manual skill that must be working in narrow and deep space. The field of view through the microscope in tubular retractor is more familiar than the endoscopy. The two-dimensional view and hand-eye spatial separation of the endoscopic view can also be extremely disorienting, compared with the microscopic surgery. Accordingly, MDT is a surgical option for surgeons who are used to microscopic surgery, or those who do not have endoscopic instruments, but elect to do minimal invasive spinal surgery. The optimal indication of MDT is single-level radiculopathy secondary to lumbar disc herniation. Consequently, strict adherence to well-defined pre-operative selection criteria is so important that it could ensure optimal postoperative outcomes. As the series progressed, the operative time and bleeding decreased. Other variables that may influence the learning curve were familiarity with instruments as well as type, size and characteristic of disc.

Regarding measurement and comparison of clinical outcomes for lumbar discectomy, the SF-36 questionnaire has been widely used[11,12]. The authors used SF-36 Thai version that is adapted to be appropriate for this country[13,14].

Analysis of the SF-36 quality of life scores also confirmed that patients with lumbar disc herniation had satisfactory outcomes after the operation. The SF-36 scores between pre- and post-operative examination at 1 month and 1 year showed dramatic improvement in all modalities (physicalfunction, role-physical, role-emotional, social function, body pain, mental health, and vitality). The mean value of VAS score for leg pain decreased from 7.5 at pre-operation to 0.75 at one year after the surgery. Our results were comparable with previous reports that used standard microdiscectomy to treat lumbar disc herniation. Williams[9], Finlay et al[15], Ebling et al[16] and Caspar et al[17] reported success rate of 73 to 86%. Palmer[18] who also used tubular retractor for microscopic lumbar discectomy reported his surgical outcomes, using VAS score and SF-36. The results were equivalent to the present article.

In our current series there was no wound infection, no discitis, and 5% of durotomy rate. These rates compared favorably with those reported by Palmer (0.8, 0.80, and 2.33% respectively)[18], Williams (0, 0, and 0%, respectively)[9], Ebling et al (3.3, 0.8, and 3.9%, respectively)[16], Caspar et al (0.7, 0.7, and 6.7%, respectively)[17], and Pappas et al (7.2, 0.5, and 1%, respectively)[19]. Our reoperation rate was 5%. The aforementioned authors reported reoperation rates from 3 to 14%.

Regarding the mean time to return to work or normal activity, ours was 37.5 days. Palmer reported a mean return-to-work time of 32 days[16], and Caspar et al reported a mean return-to-work time of 18.6 weeks[18]. Therefore, our result was similar to those of previous studies.

Conclusion

This is a study that specifically examines the clinical outcomes following lumbar discectomy and attempted to use a validated questionnaire (SF-36) and VAS to correlate postoperative outcomes. Our study suggests that overall results are comparable with standard open discectomy, in terms of success rate, complication, reoperation rate, and return-to-work time. Microscopic lumbar discectomy is safe, effective and a viable surgical option for treatment of lumber disc herniation.

What is already known from this topic?

MDT is a good alternative to open discectomy in the surgical management of lumbar disc herniation with radiculopathy pain. This procedure renders high success rate and low complication.

What this study adds?

MDT obviously relieves painful radiculopathy caused by lumbar disc herniation. Our results were comparable to those of prior studies.

Potential conflicts of interest

None.

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ผลการรักษาทางคลินิกของการผ่าตัดหมอนรองกระดูกสันหลังระดับเอวโดยใช้กล้องจุลศัลยกรรมและอุปกรณ์ถ่างที่มีลักษณะเป็นท่อขยายตามลำดับ

อัคคพงษ์ นิติสิงห์, ธนภณ งามมณี, บรรพต สิทธินามสุวรรณ, หลักชัย พลวิจิตร

ภูมิหลัง: หลักการของการผ่าตัดหมอนรองกระดูกสันหลังระดับเอวโดยใช้กล้องจุลศัลยกรรมและอุปกรณ์ถ่างที่มีลักษณะเป็นท่อขยายตามลำดับ (tubular retractor) ถูกนำมาใช้ครั้งแรกในปี พ.ศ. 2540 สำหรับในประเทศไทยยังไม่มีการรายงานผลการรักษาโดยการผ่าตัดวิธีนี้

วัสดุและวิธีการ: การศึกษานี้เป็นการศึกษาโดยการเก็บข้อมูลไปข้างหน้าในผู้ป่วย 20 รายที่เป็นโรคหมอนรองกระดูกสันหลังระดับเอวกดทับเส้นประสาท ซึ่งได้รับการผ่าตัดหมอนรองกระดูกสันหลังระดับเอวโดยใช้กล้องจุลศัลยกรรมและอุปกรณ์ถ่างที่มีลักษณะเป็นท่อขยายตามลำดับ การประเมินทางคลินิกใช้แบบประเมิน SF-36 สำหรับระดับความปวดประเมินโดยใช้ visual analog scale เปรียบเทียบผลการรักษาระหว่างก่อนผ่าตัด และหลังผ่าตัดที่เวลา 1 เดือนและ 1 ปี

ผลการศึกษา: มีการดีขึ้นอย่างมากของคะแนนเฉลี่ย SF-36 และ visual analog scale ที่เวลา 1 เดือน และ 1 ปี หลังผ่าตัดเมื่อเปรียบเทียบกับก่อนผ่าตัด ระยะเวลาอยู่โรงพยาบาลเฉลี่ยเท่ากับ 4 วัน ระยะเวลาเฉลี่ยที่กลับไปทำงานได้หรือกลับไปมีกิจวัตรได้ปกติเท่ากับ 37.5 วัน ปริมาณเลือดที่เสียระหว่างผ่าตัดเฉลี่ยเท่ากับ 50 มิลลิลิตร และมีการใช้ยาแก้ปวดชนิดฉีดหลังผ่าตัดในผู้ป่วย 9 จาก 20 รายหรือคิดเป็นร้อยละ 45

สรุป: การผ่าตัดหมอนรองกระดูกสันหลังระดับเอวโดยใช้กล้องจุลศัลยกรรมและอุปกรณ์ถ่างที่มีลักษณะเป็นท่อขยายตามลำดับมีประสิทธิภาพดีในการรักษาหมอนรองกระดูกสันหลังระดับเอวกดทับเส้นประสาท ช่วยให้แผลผ่าตัดมีขนาดเล็กและเกิดการบาดเจ็บกับเนื้อเยื่อน้อยเมื่อเปรียบเทียบกับการผ่าตัดหมอนรองกระดูกสันหลังระดับเอวโดยวิธีมาตรฐาน การใช้เกณฑ์การเลือกผู้ป่วยที่เหมาะสมสำหรับการผ่าตัดวิธีนี้ทำให้ได้ผลการรักษาเป็นที่น่าพอใจ