

Result of Minimal Invasive Lumbar Discectomy with Arthroscopic-Tubular Retractor System (Chiang Rai System)

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Abstract Nowadays, the minimal invasive spinal surgery technique was recognized from many centers for treated herniated nucleus pulposus (HNP) as it was not inferior to the standard technique and provided more benefit in less soft tissue injury, blood loss and shorter hospitalization. We had evaluated the outcome of local design Arthroscopic-tubular retractor system: Chiang Rai system. A retrospective study was performed at Chiang rai Prachanukroh Hospital in patients with herniated nucleus pulposus (HNP) during May 2016 to February 2019. All patients were operated for 1 level lumbar microdiscectomy with arthroscopic-tubular retractor system: Chiang Rai system by one surgeon. Numeric pain rating scale of back and leg pain, complications, length of stay, Oswestry low back disability index (ODI), and patient's satisfaction using modified Macnab criteria were collected at the date of admission, 1st month, 6th month, 12th month and 24th month follow-ups. Thirty patients (16 males and 14 females) were included in the study. The average operating time was 134.5 minutes. Average blood loss was about 75.7 milliliters. Length of hospital stay was about 2.4 days. The mean NRS score of back pain/leg pain was improved from 6.7 to 1.5 and 8.4 to 0.9 respectively; and the mean ODI changed from 49.9 to 22.7 at 1stmonth, and gradually decrease along follow up study. Based on modified Macnab criteria, 86.6% patients had excellent to good results. Our designed "arthroscopic-tubular retractor system: Chiang Rai system" had quite satisfied results. Limitation of this study was small sample size, thus results of the use of this instrument would be collected continuously for more evaluation.

Keywords: herniated nucleus pulposus (HNP); micro endoscopic discectomy; minimal invasive spine surgery

INTRODUCTION

Herniated nucleus pulposus (HNP) is a common cause of low back pain. In Thailand, the standard operation for HNP is conventional open technique. However, this technique needs larger surgical wound, more paraspinal muscle dissection, leading to more scar at epidural space,⁽¹⁻³⁾ and possibility of post-operative instability. Therefore, minimally invasive spinal surgery techniques were developed, resulting in less injury to epidural tissue, less scar formation, less post-operative instability, less time for hospitalization and rehabilitation. With such techniques, the patients could early return to normal life and work.⁽⁴⁻⁶⁾ One of the minimal invasive spinal surgery technique is endoscopic posterior discectomy with fixed tubular retractor popularly called micro endoscopic discectomy system, introduced by Perez-Cruet MJ, et al.^(7,) and Foley KT and Smith MM.⁽⁸⁾ However instrumentation of these techniques is not compatible with 30° arthroscope that common used in arthroscopy of knee or shoulder joint and conventional microdiscectomy instruments.

The aim of this study was to evaluate results of minimal invasive discectomy performed by Arthroscopic-tubular retractor system: Chiang Rai system

by assessing the surgical outcomes, complications, and patient satisfaction, as well as the advantages, disadvantages of the technique.

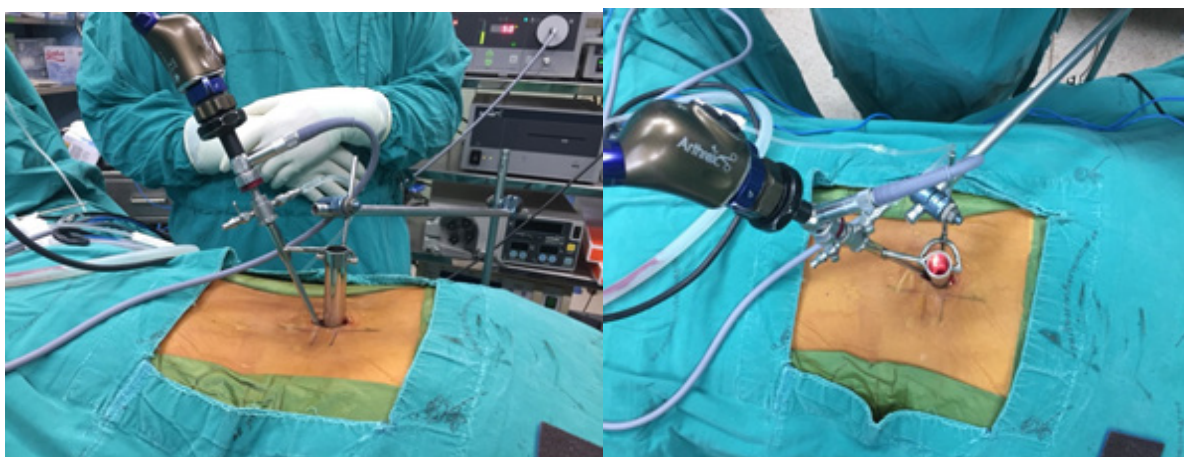
MATERIAL AND METHODS

Patients in this study were those who did not respond to conservative treatment indicating the need for lumbar discectomy. It was conducted in Chiang Rai Hospital during May 2016 to February 2019. All patients were operated for 1 level lumbar microdiscectomy with of arthroscopic-tubular retractor system: Chiang Rai system (Figure 1) by one surgeon.

Demographic data were collected at the date of admission. Data on complications were collected after surgery. Numeric pain rating scale of back and leg, Oswestry Low Back Disability Index (ODI)⁽⁹⁾ were collected on the date of admission, 1 month, 6 month, 12 month and 24 month follow-ups. Treatment outcomes were assessed using modified Macnab criteria⁽¹⁰⁾ as follow:

- Excellent: no pain, no restriction of mobility, Return to normal work and level of activity
- Good: occasional non radicular pain, relief of presenting symptoms, be able to return to

Figure 1 Arthroscopic-tubular retractor system: Chiang Rai system



modified work.

- Fair: some improved functional capacity, still handicapped and/or unemployed.
- Poor: no improvement or insufficient improvement to enable increase in activities; further operative intervention required.

Operative procedure

The patient was positioned on a radiolucent table in prone position with bolsters below the chest and the iliac crest keeping the abdomen free. The surgeon stood on the side of the herniation. In lateral fluoroscopy imaging, a K-wire was inserted at the level

of the involved disc space. In AP fluoroscopy imaging, the K-wire was inserted lateral to the midline point to lateral border of body, pointed to the inferior lamina of the superior vertebrae that was the junction of lamina and medial facet. A 20 mm paramedian incision was then made centered over the K-wire and deepened till the fascia. Sequential dilators were then inserted while confirming the target site under fluoroscopy. The final tubular retractor was then locked with the external fixator and docked with operating table (Figure 2). A set of 30° arthroscope and video camera was connected with system by side connector

Figure 2 A 20 mm paramedian incision. Sequential dilators were then inserted while confirming the target site under fluoroscopy The final tubular retractor was then locked with the external fixator and docked with operating table

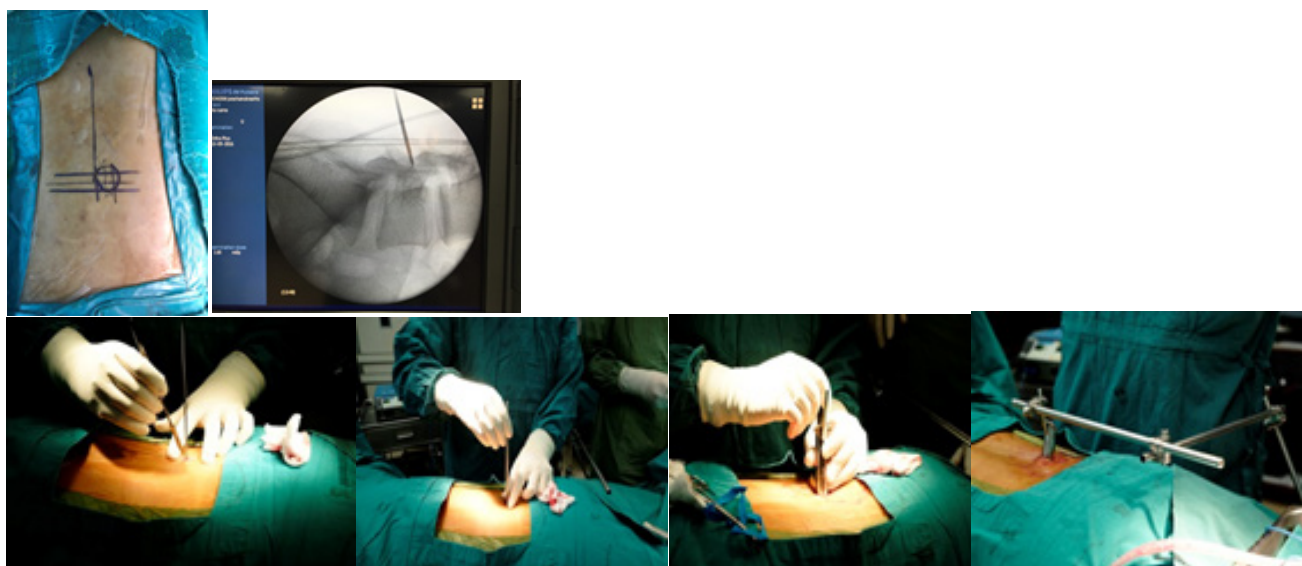


Figure 3 30° arthroscope and video camera was connected with system by side connector

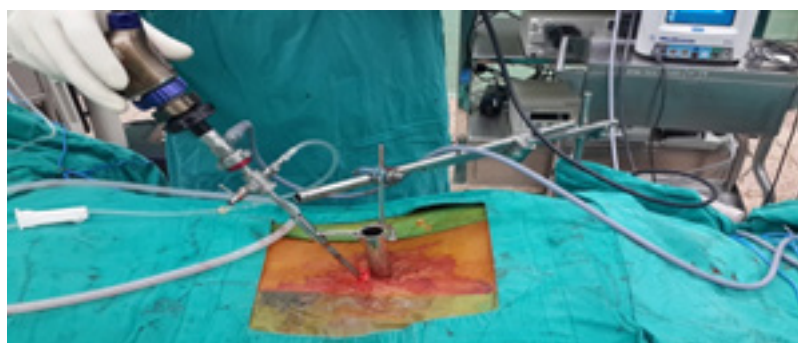
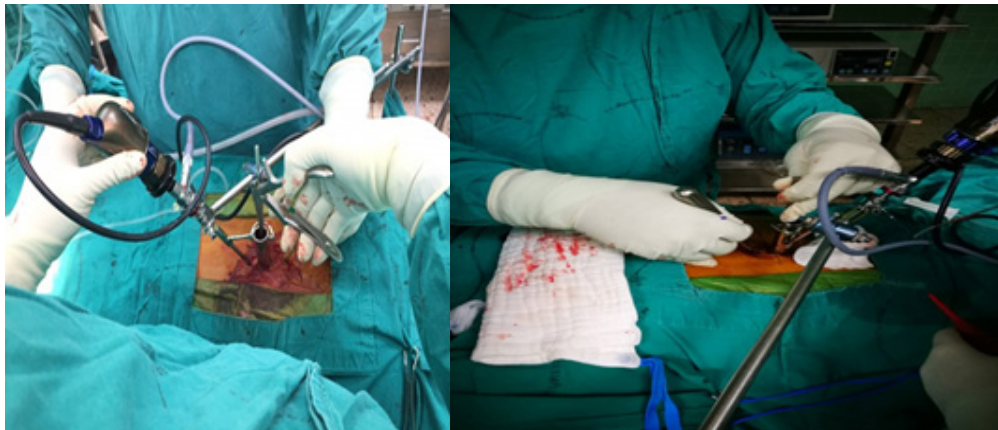


Figure 4 Microdiscectomy was performed with standard spinal instrument



(Figure 3). Microdiscectomy was performed with standard spinal instrument (Figure 4). Check and stop bleeding. Closed wound without radivac drain. Routine postoperative care was begun immediately after surgery. When patient was able to walk and pain score under 3/10, the patients allowed to discharge.

RESULTS

Thirty patients (16 males and 14 females) were included in the present study. The average BMI was 23.1 Kg/M2 (± 3.6).

All these patients were operated by single surgeon by arthroscopic-tubular retractor system. The levels operated included L3-L4 (n = 1), L4-L5 (n = 22),

and L5-S1 (n = 7). There were 12 right side radiculopathy patients and 18 on left side. The average size of surgical wound was about 2 cm. (Figure 5). The average operating time with Chiang Rai system was 134.5 ± 43.5 minutes. Average blood loss was about 75.7 ± 88.4 milliliters. Length of hospital stay in the present study was about 2.4 ± 1.0 days. The average follow-up time of all cases was 19 ± 16.4 months. The NRS score of back pain was improved at 1st month post-operation (Figure 6). The NRS score of leg pain was improved at 1st month post-operation (Figure 7). Mean ODI changed from 49.9 to 22.7 at 1st month and gradually declined (Figure 8).

Based on modified Macnab criteria to assess

Figure 5. Surgical wound



Figure 6 Numeric rating scale of back pain

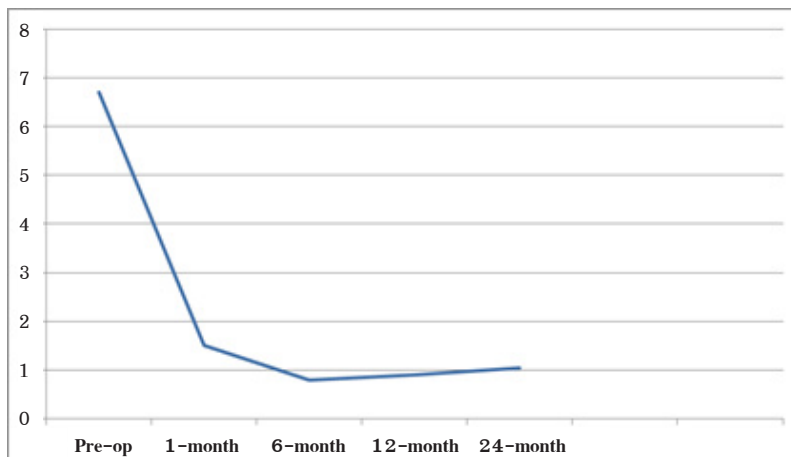


Figure 7. Numeric rating scale of leg pain

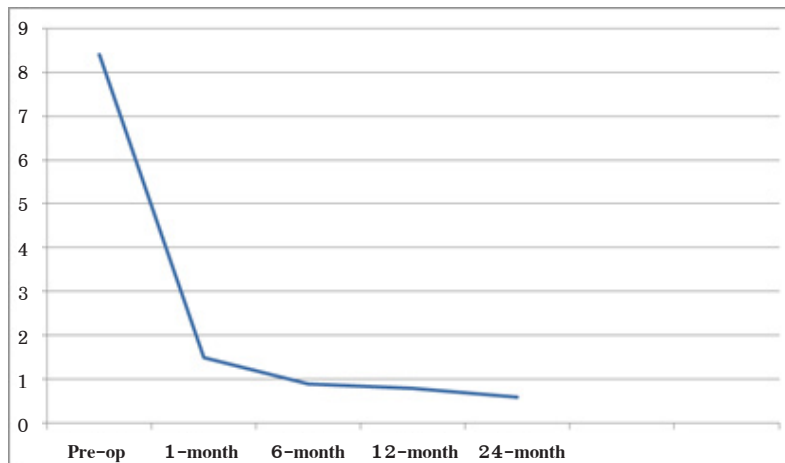
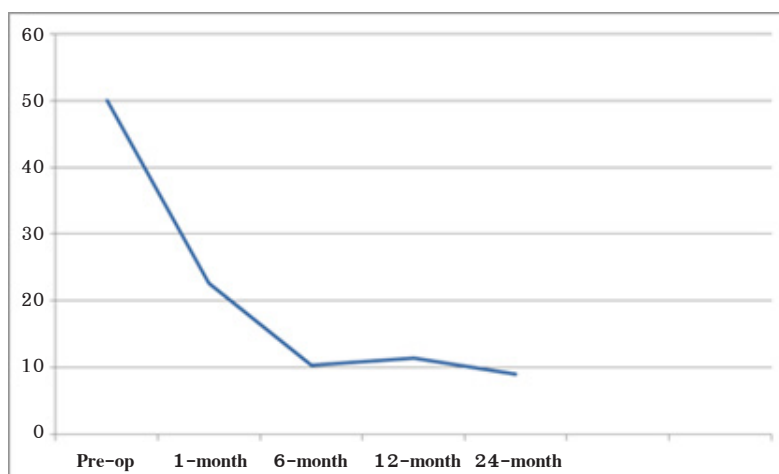


Figure 8. Mean Oswestry Low Back Disability Index (ODI)



patients' satisfaction, 50% exhibited excellent outcome, 36.6% good, 10% fair and 3.4% were with poor results. Complications were found in 3 cases. One case had L5 nerve root neurapraxia, which return to motor grade V at 3-month post-operation. One case had significant blood loss (500 ml.) from radicular arteries injury. One case had recurrent disc herniation, that need surgical treatment. The re-operation was performed by discectomy, posterior lateral fusion; and instrumentation of L4/L5 was performed at 12 months after first operation.

DISCUSSION

Nowadays, open discectomy and microdiscectomy remain the current standard of surgical treatment in lumbar disc herniated nucleus pulposus.⁽¹¹⁻¹⁵⁾ Many studies proposed that outcomes of microendoscopic discectomy did not inferiorly compare with open discectomy and had better result in less soft tissue damage, decrease blood loss and length of hospital stay and pain medication requirements.^(6,11-12)

So we created "arthroscopic-tubular retractor Chiang Rai system" as an attempt to allow standard microsurgical discectomy and decompression to be performed using 30° arthroscope used in knee and shoulder arthroscopy with standard discectomy instruments.

These techniques had surgical advantages such as better illumination, better magnification and better visualization through the rotation of the 30° lens, and less soft tissue damage with minimal bone resection.

About results of our study, we compared numeric pain rating scale of back pain/leg pain and mean ODI before and after surgery. The results of our study showed that back pain/leg pain and mean ODI

significant decreased since in the 1st month after surgery and continue to decline gradually.

Patient's satisfaction in our study showed 50% excellent, 36.6% good, 10% fair and 3.4% poor results according to the modified Macnab criteria.

Compare with conventional open discectomy in Chiang Rai hospital in 2016-2017, 89 HNP patients had blood loss about 390 ml. (with post-operative drain), and the length of hospital stay was 3.5 days. This study show better results in decrease blood loss and shorter hospitalization.

The mean blood loss in Wu X, et al.⁽¹⁷⁾ series was 44 ml, in Zhao LJ, et al.⁽¹⁸⁾ was 45 ml., in Nakagawa Y, et al.⁽¹⁹⁾ was 67.5 ml.; and in Zhang C, et al. series⁽²⁰⁾ was 47.5±11.6 ml. In our series the mean blood loss was 75.7 ±88.4 ml. We have more blood loss compare with other studies because of an artery injury in one case with the estimated blood loss of 500 ml.

The mean hospital stay in Wu X, et al. series⁽¹⁷⁾ was 4.8 days and in Kodeeswaran M, et al. study⁽²¹⁾ was 2.8 days. In our series the mean hospital stay was 2.4 days.

The mean operative duration in Wu X, et al. series⁽¹⁷⁾ was 75±26 minutes in their initial 220 patients. The duration was about 60 minutes in 20 senile patients in Zhao LJ et al. study.⁽¹⁸⁾ In Nakagawa Y, et al. series⁽¹⁹⁾ the mean duration for microsurgical discectomy was 95.3 minutes; and in Zhang C, et al.'s⁽²⁰⁾ the reported mean duration was 64.8±17.8 minutes.

In our study, the mean duration was 134.5 ±43.5 minutes. Due to our initial learning curve, we had longer operative time. The Nakagawa Y, et al. study required 30 cases for them to complete the learning

curve.⁽¹⁹⁾ The Kodeeswaran M, et al. study required more than 20 cases for improving microsurgical discectomy technique.⁽²¹⁾

Lastly, in the outcome assessment, the rates of any complication of microendoscopic discectomy from systematic review and meta-analysis in Shriver MF, et al. study⁽²²⁾ were 13.3%. With post-operative complications in our study, there were 3 from 30 patients (10.0%). One patient was L5 neuropraxia that no direct nerve injury and return to motor grade V at 3 months post-operation. The Shriver MF, et al. study⁽²²⁾ showed 3.0% of new or worsening neurological deficit, while direct nerve root injury occurred at the rate of 0.9%. Other complication in our study was recurrent disc herniation in one patient (3.3%) and reoperation at 1 year after the 1st surgery, the rate of recurrent disc complications was 3.1%, while reoperation was indicated in 3.7% in Shriver MF, et al. study⁽²²⁾. The last complication was blood loss from artery injury, we analyzed this complication, that was from steep learning curve of microendoscopic discectomy to control bleeding. As reported in Nakagawa Y, et al. study⁽¹⁹⁾ and Kodeeswaran M, et al. with more than 30 and 20 patients respectively, the operative time and blood loss were decreased due to surgical skills.⁽²¹⁾

Conclusion

Our designed “arthroscopic-tubular retractor system: Chiang Rai system” is used with 30° arthroscope and conventional discectomy instruments. Results of microendoscopic discectomy with this instruments have been quite satisfactory. And because of our local instrument design, it is much economical as compared to other posterior arthroscopic/endo-

scopic discectomy spine systems.

Limitation of this study was small sample size, thus results of the use of this instrument would be collected continuously for more evaluation.

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บทคัดย่อ: ผลการรักษาหมอนรองกระดูกทับเส้นประสาทด้วยอุปกรณ์ผ่าตัดกระดูกสันหลังแบบแผลเล็กโรงพยาบาล เชียงรายประชานุเคราะห์

เปรมชัย ตีรางกูร พ.บ.*; ต่อพงษ์ บุญมาประเสริฐ พ.บ.**; จิราพร เพิ่มเยาว์ พย.บ.*

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วารสารวิชาการสาธารณสุข 2563;29(4):670-8.

ปัจจุบันการผ่าตัดรักษาภาวะหมอนรองกระดูกทับเส้นประสาทด้วยวิธีผ่าตัดแบบแผลเล็กเป็นที่ยอมรับมากขึ้น มีผลการรักษาไม่แตกต่างจากการผ่าตัดแบบมาตรฐานดั้งเดิมและมีข้อดีในแง่ลดการเสียเลือดจากการผ่าตัด เนื้อเยื่อ บาดเจ็บน้อยลง ลดวันนอนโรงพยาบาล การศึกษานี้มีวัตถุประสงค์เพื่อรายงานผลการรักษาภาวะหมอนรองกระดูก ทับเส้นประสาท ด้วยอุปกรณ์ที่พัฒนาขึ้นเองสำหรับผ่าตัดกระดูกสันหลังแบบแผลเล็กโรงพยาบาลเชียงรายประชานุเคราะห์ (Arthroscopic-tubular retractor system: Chiang Rai system) ศึกษาย้อนหลังในผู้ป่วยโรคหมอนรองกระดูกทับเส้นประสาท อายุ 18 ปีขึ้นไปในโรงพยาบาลเชียงรายประชานุเคราะห์ ระหว่างเดือน พฤษภาคม 2559 – กุมภาพันธ์ 2562 ก่อนผ่าตัดและหลังผ่าตัดเปรียบเทียบคะแนนความเจ็บปวด (numeric pain rating scale) แบบทดสอบ Oswestry disability index (ODI) วัดความรุนแรงและการจำกัดกิจวัตรประจำวันจากอาการปวดหลังร้าวลงขา และความพึงพอใจหลังการรักษา (modified Macnab criteria) เมื่อแรกรับ 1 เดือน 6 เดือน 12 เดือน และ 24 เดือน หลังผ่าตัด ผลการศึกษาพบว่า ผู้ป่วยได้รับการผ่าตัดด้วยอุปกรณ์ชุดนี้จำนวน 30 ราย (เพศชาย 16 ราย เพศหญิง 14 ราย) ใช้เวลาในการผ่าตัดเฉลี่ย 134.5 นาที การสูญเสียเลือดระหว่างผ่าตัดเฉลี่ย 75.7 ml. ระยะเวลาในการนอนโรงพยาบาลเฉลี่ย 2.4 วัน ผลการผ่าตัดผู้ป่วยด้วยอุปกรณ์ผ่าตัดแบบแผลเล็ก พบว่า คะแนนการปวด ทั้งบริเวณหลัง และปวดร้าวลงขา ลดลงตั้งแต่หลังผ่าตัดเดือนแรก (ปวดหลัง 6.7 ลดลงเหลือ 1.5, ปวดร้าวลงขา 8.4 ลดลงเหลือ 0.9) ผู้ป่วยมีความพึงพอใจในการรักษาอยู่ในเกณฑ์ดีเยี่ยมถึงดี ร้อยละ 86.6 อุปกรณ์ผ่าตัดนี้ สามารถนำมาประยุกต์ใช้ในการผ่าตัดได้โดยมีผลการรักษาที่น่าพอใจ อย่างไรก็ตาม การศึกษานี้มีข้อจำกัดใน ประเด็นของจำนวนกลุ่มตัวอย่างที่ทำการศึกษายังมีจำนวนน้อย จึงต้องมีการเก็บรวบรวมข้อมูลผลการรักษาต่อไป เพื่อประเมินและพัฒนาการใช้งานอุปกรณ์ชุดนี้ต่อไป

คำสำคัญ: หมอนรองกระดูกทับเส้นประสาท; อุปกรณ์กล้องผ่าตัดกระดูกสันหลังแบบแผลเล็ก; วิธีการผ่าตัดกระดูก-สันหลังแบบแผลเล็ก