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## Percutaneous endoscopic stenosis surgery under local anaesthesia

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### Abstract

A retrospective study including 50 cases of lumbar canal stenosis patients who underwent percutaneous endoscopic stenosis decompression surgery through unilateral/bilateral transforaminal approach under local anaesthesia. Clinical outcomes such as back and leg VAS, the Macnab criteria were evaluated. Surgical results including operative time, postoperative hospital stay, recurrence, and surgical complications were also studied.

**Results:** All 50 patients were followed up. The average operation time was 73 +/- 22.8min. The mean VAS of leg and back pain improved from 7.06 +/-1 to 2.2 +/-1. According to the Macnab criteria, 97.7% of patients achieved excellent and good results. There was 1 case of dural tear and 3 cases of transient postoperative dysthesia.

**Conclusions:** Except for the main pathogenic factors on the dorsal side of the dural sac namely bony canal stenosis, percutaneous endoscopic decompression through a unilateral/bilateral transforaminal approach is sufficient for Lumbar canal stenosis and affords better foraminal decompression than an open approach. It is a feasible, safe, and clinically effective minimally invasive procedure.

**Keywords:** Percutaneous Endoscopic stenosis surgery (PESS), Lumbar canal stenosis (LCS), visual analogue scale (VAS), minimally invasive surgery (MIS), Transforaminal endoscopy

### Introduction

Lumbar canal stenosis (LCS) is a progressive degenerative disease, most commonly seen in elderly patients. LCS is usually caused by arthritis of the facet joint, ligament hypertrophy and calcification, and disc herniation, which can significantly affect patients' quality of life and daily activities and lead to progressive disability. Neurogenic claudication is the main symptom, which can be exacerbated by standing walking and relieved by lying flat. Patients may also have tingling, numbness and weakness in the lower extremities.

Conservative management is the preferred treatment for most LCS patients, including physical therapy, exercise therapy, analgesics, and epidural block. If conservative treatment fails, decompressive surgery should be considered. Surgical treatment of degenerative LCS usually involves decompression nerve structure with or without fusion. Conventional laminectomy provides adequate decompression by removing posterior structures including lamina, spinous processes, interspinous ligaments, ligamentum flavum and part of the facet joints. However, this method has the disadvantages as it fails to decompress the foramen and exiting nerve root unless total facetectomy and stabilisation is done, chronic low back pain and iatrogenic instability and sometimes a need for second operation are the other complications. In recent years, minimally invasive surgery (MIS) represented by micro- endoscopic decompression (MED) has achieved good clinical results in the treatment of LCS, and some studies have revealed that these MIS techniques have obvious advantages over traditional laminectomy.

With the rapid development of MIS, percutaneous endoscopic techniques have achieved satisfactory clinical results in disc herniation of cervical and lumbar spine. Moreover, recent studies have shown percutaneous endoscopic decompression techniques yielded optimal results and favourable long-term outcomes in patients who had various types of stenosis. Percutaneous endoscopic stenosis surgery (PESS) is one of the most popular minimally invasive spine surgeries. It has been widely used for treating lumbar degenerative diseases.

The endoscopic approach is considered as a safe and effective minimally invasive surgery. It is associated with better outcomes, small incisions, less damage to human tissues, lower complication rate, and shorter hospitalisation times. Lumbar inter-body fusion surgery has the advantages of a high fusion rate and an obvious decompression effect, but it causes great damage to the paravertebral muscles and facet joints. It has been reported that adjacent segment disc degeneration may occur due to increased mechanical stress on discs adjacent to the fusion. Besides, elderly patients with severe osteoporosis were prone to internal fixation failure after pedicle screw fixation. One advantage of the endoscopic approach is the preservation of spine stability and the adjacent anatomy, and there is a decrease in adjacent segment disc degeneration. It has been argued whether decompression alone or decompression with concomitant fusion yields better results when treating LCS, and only a few studies investigated the curative effect of PESS for the treatment of LCS.

In this study, 50 cases of LCS were collected and analysed. Unilateral/Bilateral lumbar spinal decompression was performed through a percutaneous endoscopic transforaminal approach under local anaesthesia. Our goal was to evaluate the outcome and efficacy of PESS for the treatment of LCS.

## Methods

### Patients

A retrospective review was performed from September 2018 to July 2021, 50 patients of LCS underwent PESS through unilateral/ bilateral transforaminal approach in our hospital, Aster-MIMS, Kotakkal.

The inclusion criteria were: 1) Imaging examinations showed LCS, and the dural sac area (DSA) on the cross-sectional image of magnetic resonance imaging (MRI) was less than 100 mm<sup>2</sup>; 2) Neurogenic intermittent claudication and bilateral lower extremity radiculopathy (buttock and lower extremity pain); 3) Back pain on the visual analogue scale (VAS) was less than 3; 4) Conservative treatment failed for at least 3 months. Exclusion criteria were: 1) Lumbar segmental instability, and degenerative spondylolisthesis exceeded than

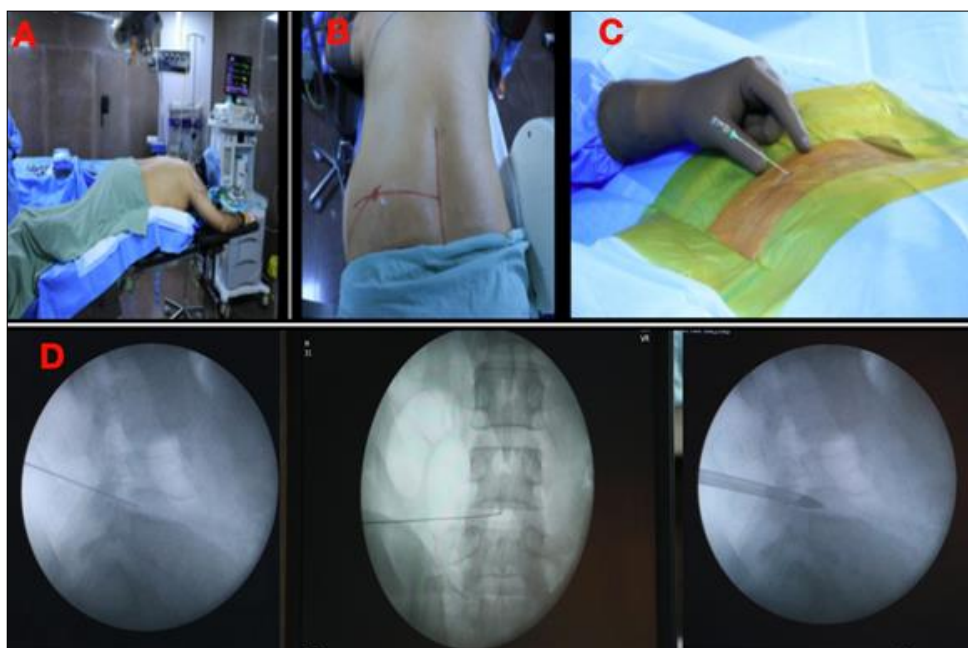
Meyerding I; 2) Pathological conditions (infection/tumors/fractures); 3) Incomplete information or lost to the follow-up during follow-up period.

### Imaging

All patients were evaluated before the operation via X-ray and magnetic resonance imaging (MRI). The severity of LCS was graded based on the observed morphology of the dural sac on image findings according to the method by Schizas. We defined grade A as mild stenosis, B as moderate stenosis, C as severe stenosis. The locations of stenosis were classified as central canal, lateral recess, and foraminal narrowing of the spine. Dynamic X-ray images were used to examine spinal instability or backward slippage of the vertebral body.

### Surgical method

Patients were placed in the prone position with the lumbar spine in mild flexion on a radiolucent table, and a C-arm fluoroscopy machine was used. The entry point of the needle was selected at a distance of 8–12 cm from the midline and was situated just above the facet joint on the lateral view. After injecting local anesthesia (2%), a puncture needle (18 gauge) is inserted and position is confirmed by AP and lateral views under C-ARM. After infiltrating 1–2 mL of 1% lidocaine in the intervertebral foramen, the stylet in the needle was replaced by a 1-mm-diameter guidewire and is seen entering inside the disc. A blunt tapered cannulated Dilator was passed over the guide wire under fluoroscopic guidance. A cannula was introduced over the dilator and was placed in the proper position. The endoscope was introduced through the cannula. The hypertrophied ligamentum flavum, facet joints, and herniated disc were resected to achieve a 360 degree decompression. Epidural bleeding was controlled with a radiofrequency probe under saline irrigation. Lastly, the working cannula and the endoscope were removed and taping of the skin was done. The patient was mobilised within 2 hours after surgery, passed urine by self ambulation, oral intake given within 2 hours and discharge within 24 hours after surgery.



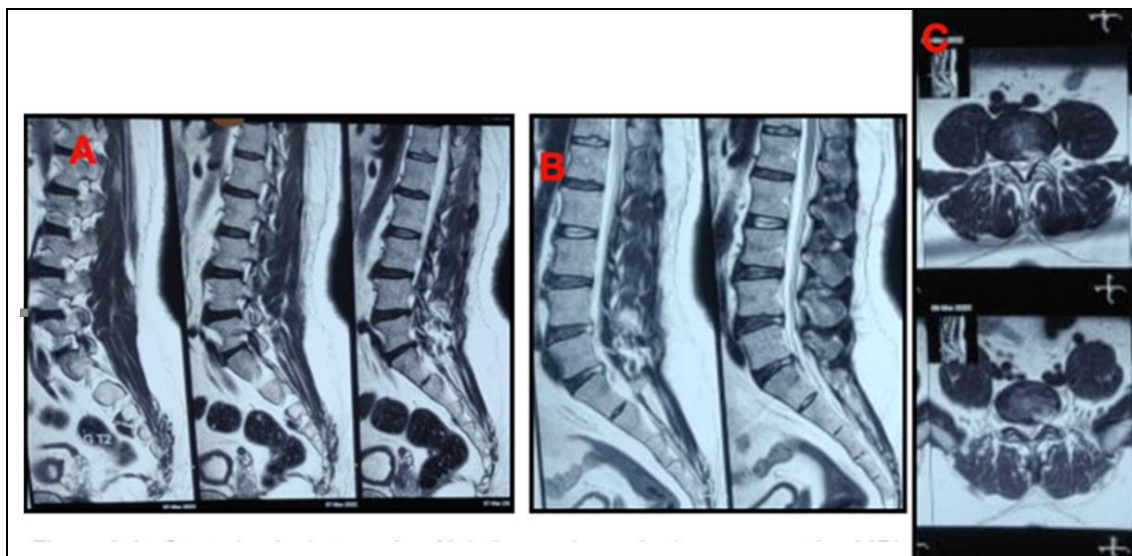
**Fig 1:** A. Patient positioned in prone position, B. Transforaminal site entry-point marked under CARM, C. Needle introduced from entry point, D. AP and Lateral views of Transforaminal entry.

### Assessment of outcome

Clinical outcomes, such as the VAS for leg and back pain, and the Macnab criteria were evaluated. Surgical results, including operative time, postoperative hospital stay, recurrence, and surgical complications were also studied.

Radiologically, lumbar stability was assessed by functional X-rays.

Statistical analysis of the comparison between preoperative and postoperative clinical outcomes was performed using repeated-measures analysis of variance and rank-sum test.



**Fig 2:** A- Central spinal stenosis of L4-5 was shown in the preoperative MRI and disc protrusion at L5-S1 level. B, C- post operative MRI showing adequate decompression in sagittal and axial cuts

### Results

All 50 patients were followed up for 6 to 18 months. Of 50 patients, there were 21 male and 29 female patients. Patients were between 51 and 82 years old, with an average age of  $62.6 \pm 9.5$  years. Their mean symptom duration was 48 weeks (range 16– 148). Thirty-eight patients had co-morbidities such as hypertension (24 cases), coronary heart disease (9 cases), diabetes (12 cases), chronic obstructive pulmonary disease (11 cases), and other medical disorders (8 cases). The affected lumbar segments were 6 in L3/4, 32 in L4/5, and 12 in L5/S1. The VAS score for preoperative back and leg pain improved from  $7.06 \pm 1$  to  $2.2 \pm 1$  at 4 weeks postoperatively, and  $1.94 \pm 1.03$  at last follow-up ( $P < 0.001$  respectively). The mean operative time was  $73 \text{ min} \pm 22.8 \text{ min}$ , and the hospital stay after surgery was 1 or 2 days. 47 patients (97.9%) had good-to-excellent Macnab grade. Three patient developed postoperative dysesthesia and were treated with the anti-neuropathic agent, and symptoms had improved after 1– 2 months. There was 1 case of dural sac tear occurred on the lateral side. Due to severe stenosis, the ligamentum flavum and the dural sac adhered closely. When the hook was used to remove the ligamentum flavum, tears of 1 mm were caused. Dural tears were small crack which needed no special treatment. All patients had no cerebrospinal fluid leakage, hematoma, infection, recurrence, or required for revision surgery during the follow-up.

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