Lumbar unilateral laminotomy

see also Lumbar undercutting laminectomy.

One risk of established decompression techniques for lumbar spinal stenosis is the resection of lumbar facet joints, especially if they are steeply configured, promoting destabilization.

Minimally invasive bilateral crossover decompression aims to preserve the facet joints and thus the stability of the spine.

For Minimally invasive lumbar spinal canal stenosis treatment, the microsurgical unilateral lumbar laminotomy (MUL) technique for bilateral decompression of lumbar spinal stenosis (LSS) is a less destabilizing alternative to lumbar laminectomy and leads to good short-term outcomes. However, little is known about the long-term results including predictive factors.

The navigated minimally invasive posterior decompression consisted of a unilateral laminotomy with crossover. The patient is placed in a prone position with flexion of the thigh and legs ¹⁾.

The skin incision is performed over the spinous processes of the interested level. Unilateral incision of the muscular fascia and subperiosteal dissection of paravertebral muscles are performed up to visualize the spinous processes of the two interested vertebrae, the corresponding laminae, and the interlaminar space. The side of the access is defined according to clinical signs/symptoms and/or neuroradiological findings. A Williams retractor is positioned, and a small contralateral incision of the muscular fascia is performed just to visualize the contralateral surface of the spinous process of the upper vertebra. The navigation optical reference is clamped over the spinous process of the upper vertebra and positioned with an inclination toward the head of the patients to avoid interference with the microscopic view and surgical instruments. A baseline intraoperative low-dose 3D fluoroscopy is performed to acquire imaging for neuronavigation (O-arm Surgical Imaging, Medtronic Navigation, USA). At this point, the microsurgical technique is employed, and neuronavigation is ready to be used (Spine software, StealthStation S7, Medtronic Navigation, USA).

The purpose of a study by Klingler et al. was to demonstrate the feasibility and early results of this technique.

This retrospective case series includes 10 consecutive patients with lumbar spinal stenosis and steepangle (<35 degrees) facet joints who were treated with minimally invasive bilateral crossover decompression. Eleven segments were decompressed, most commonly L3/L4 (63.6%), followed by L1/L2 and L2/L3 (18.2% each). The effectiveness of surgical decompression was assessed by selfreporting questionnaires.

After a follow-up of 10.5 months, the Symptom Severity Scale and Physical Function Scale of the Swiss Spinal Stenosis Questionnaire improved by 0.9 (p < 0.05) and 0.7 points, respectively. The mean Oswestry Disability Index improved from 53.9 to 34.6 (p < 0.05). Local and radiating pain under strain showed statistically significant improvement on the Visual Analog Scale (8.9 vs. 5.0 and 8.4 vs. 4.6, respectively). Maximum walking distance increased from 190 to 1,029 m. Apart from one patient requiring surgical decompression of an adjacent segment, there were no reoperations, neurological

deteriorations, or other complications.

The results of this study indicate that minimally invasive bilateral crossover decompression is a promising technique for the treatment of spinal canal stenosis. With its design to spare facet joints, it can potentially reduce the risk of spinal instability, especially in patients with steep facet joint²⁾

Systematic reviews

2015

The evidence provided by a systematic review for the effects of unilateral laminotomy for bilateral decompression, bilateral laminotomy and split-spinous process laminotomy compared with conventional laminectomy on functional disability, perceived recovery and leg pain is of low or very low quality. Therefore, further research is necessary to establish whether these techniques provide a safe and effective alternative for conventional laminectomy. Proposed advantages of these techniques regarding the incidence of iatrogenic instability and postoperative back pain are plausible, but definitive conclusions are limited by poor methodology and poor reporting of outcome measures among included studies. Future research is necessary to establish the incidence of iatrogenic instability using standardised definitions of radiological and clinical instability at comparable follow-up intervals. Long-term results with these techniques are currently lacking ^{3) 4)}.

Case series

Patients who underwent unilateral laminotomy for bilateral decompression for lumbar canal stenosis were prospectively enrolled in a study of Chang from the Department of Neurosurgery, Tokai University, Kanagawa, Japan. Before surgery and six months after surgery, the following sagittal alignment parameters were measured: lumbar lordosis (LL), pelvic tilt (PT), pelvic incidence minus lumbar lordosis (PI-LL), and sagittal vertical axis (SVA). At the same time, Short Form 36 and visual analog scale (VAS) were estimated. The patients were divided into poor postoperative physical score group (P_poor) and good postoperative physical score group (P_good) as well as into poor postoperative VAS group (V_poor) and good postoperative VAS group (V_good). The postoperative spinopelvic parameters were compared between these two groups, respectively. Finally, Chang examined the correlation between the spinopelvic parameters and the outcome scores using scatter plots and linear regression analysis.

Fifty-two patients were enrolled into the study. Although the spinopelvic parameters (LL, PT, PI-LL) significantly improved after surgery, the absolute values of improvement were relatively small. The postoperative spinopelvic parameters were significantly worse in the P_poor and the V_poor group compared to the P_good and the V_good group, respectively. The correlation analyses also showed that worse postoperative spinopelvic parameters correlated to worse outcome in SF-36 and VAS.

Sagittal spinal balance significantly affected the outcome of patients undergoing decompression surgery for lumbar canal stenosis, the knowledge of which may serve better patient management ⁵.

2016

Medical records of patients who underwent MUL for LSS decompression between 2005 and 2010 were reviewed, and a questionnaire was distributed to complement the long-term outcome data. The study population consisted of 176 patients including 17 patients with stable grade I spondylolisthesis. Complications and reoperations were meticulously analyzed. Clinical outcome was measured using a modified Prolo scale and was further dichotomized in good vs. poor outcome. Predictive factors were obtained from uni- and multivariate analyses.

The median age of the cohort was 70.0 years and the follow-up 71.7 months. Complications occurred in 5.1 % of the patients. The overall reoperation rate was 17.0 %, including surgery, which was exclusively performed at other levels in 4.0 %. The reoperation rate for fusion was 4.5 %. Good neurogenic claudication outcome faded from 98.3 % at hospital discharge to 47.2 % at 6 years. Multivariate analysis identified previous lumbar operation as a potential independent predictor of a reoperation; potential independent predictors of poor long-term claudication outcome were older age, female gender, higher body mass index (BMI) and tobacco smoking.

In our experience, the long-term reoperation rate after MUL for LSS is not negligible and higher in previously operated patients. It seems like the good initial clinical results after MUL may fade over time, and several patient-related predictive factors including potentially modifiable obesity and tobacco smoking seem to play an important role ⁶.

2009

A total of 165 consecutive patients underwent decompression for lumbar spinal stenosis. They were divided into 3 age groups: A (<65 years), B (65-75 years), and C (>75 years). Further classification was performed according to body mass index (BMI): BMI 1 (<26), BMI 2 (26-30), and BMI 3 (>30), anesthesiological risk factors (American Society of Anesthesiologists), and the number of levels decompressed. The outcome was monitored by an independent observer at 1 week, 3 months, and 1 year after surgery. The following parameters were evaluated: pain (visual analog scale and analgesic consumption), functional improvement (Neurogenic Claudication Outcome Score), and walking performance, defined as walking distance x speed (treadmill).

One week after surgery, pain decreased in 85.9% of patients, and a comparison of the pre- and postoperative use of analgesics showed that 38% of nonopioid use and 74% of opioid use were discontinued, whereas nonsteroidal anti-inflammatory drug consumption increased 13%. One year after surgery, pain remained decreased in 83.9% of patients, Neurogenic Claudication Outcome Score increased in 90.3% of patients, and walking performance improved in 92.2% of patients. BMI greater than 30 was the only negative prognostic factor for pain reduction (P = 0.012) and Neurogenic Claudication Outcome Score improvement (P = 0.019). Surprisingly, patients who underwent multilevel decompression benefitted more from surgery than those who underwent single-level decompression.

Microsurgical bilateral decompression using unilateral laminotomy is an effective surgical option for lumbar spinal stenosis, even in high-risk patients with multilevel stenosis⁷⁾.

2006

One hundred thirty-three consecutive patients (73 men and 60 women; mean age, 63 yr) meeting clinical and radiographic criteria for LSS who underwent first-time ULBD between 1994 and 1999 entered the study. The study parameters were set to ensure a follow-up period of at least 4 years. All

patients were available for short-term follow-up re-evaluation within 3 months, and 102 (77%) of the 133 patients were available for long-term examination after a mean duration of 5.6 years. The scale of Finneson and Cooper was used for evaluation of the clinical results.

One hundred thirty patients (97.7%) improved immediately after surgery. Ninety-four (92.2%) of the 102 patients available for long-term follow-up examination remained improved, and 85.3% had an excellent-to-fair operative result. The incidence of complications was 9.8%. Resurgery for complication was necessary in three patients, for restenosis in seven patients, and for spinal instability in two patients, accounting for a reoperation rate of 11.8%.

ULBD allows achievement of good and long-lasting operative results in patients with LSS. Postoperative deterioration, recurrences, and spinal instability are infrequent. For the authors, ULBD is the preferred technique to treat symptomatic LSS ⁸⁾.

Lumbar Endoscopic Unilateral Laminotomy

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