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Clinical Efficacy of OLIF in the Treatment of Lumbar Spinal Stenosis

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Abstract: The safety and efficacy of oblique lateral interbody fusion (OLIF) for lumbar spinal stenosis (DLCS) were analysed. clinical and imaging data of 63 patients who underwent OLIF for DLCS at our hospital from October 2020 to June 2022, of whom 24 were male and 39 were female; 55 patients had simple spinal stenosis and 8 patients had combined lumbar spondylolisthesis; 63 The age distribution of the patients was over 60 years, with a mean of (66.4±6.0) years. Patients' preoperative and postoperative pain visual analogue scale (VAS) scores, Oswestry dysfunction index (ODI), Japanese Orthopaedic Association treatment assessment (JOA) scores at 3, 6 and 12 months and surgical complications were statistically analysed. All 63 patients over 60 years of age with degenerative DLCS underwent successful surgery, with an operative time of 48.5 ± 15.48 minutes (40-70 minutes) and intraoperative bleeding of 39.37 ± 29.78 ml (20-75 ml). All 63 patients were followed up for approximately 12 months and leg VAS scores improved from 8. 32±2.7 (preoperatively) to 1.2±0.4 ($p < 0.001$) at 12 months postoperatively. The low back VAS score improved from 6.53±1.9 preoperatively to 1.5±0.7 at 12 months postoperatively ($P < 0.05$). the JOA score improved from 13.3±7.8 preoperatively to 25.7±5.2 at 12 months postoperatively ($P < 0.05$). the ODI score improved from 56.6±16.9 preoperatively to 15.6±12.6 at 12 months postoperatively ($P < 0.05$). Complications at 12 months postoperatively included two dural tears and one inadequate decompression. The OLIF technique provides safe and effective decompression of the DLCS and also has many advantages, such as less trauma, less bleeding, shorter operative time and hospital stay, and fewer postoperative complications, making it the clinical choice.

Keywords: Lumbar Spinal Stenosis, Elder, Lumbar Decompression, OLIF Technology

1. Introduction

With the accelerating ageing of our population, the number of elderly patients with lumbar spinal stenosis is increasing year by year, and the number of elderly patients is often combined with a variety of medical conditions and a reduced ability to regulate all body functions [1-2]. The OLIF technique is effective for unilateral decompression of the lamina. In this study, we retrospectively counted the surgical outcomes and related complications of patients with lumbar spinal stenosis who underwent posterior lumbar OLIF technique in our hospital from October 2020 to June 2022, and evaluated the safety, effectiveness, advantages and disadvantages of OLIF technique in treating patients with lumbar spinal stenosis.

2. Information and Methods

General information: Clinical and imaging data of 63 patients who underwent the OLIF technique for DLCS at our hospital between October 2020 and June 2022 were included, including 24 males and 39 females; 55 patients had simple spinal stenosis and 8 patients had concomitant lumbar spondylolisthesis; the age distribution of the 63 patients was over 60 years, with a mean of (66.4±6.0) years. The patients' preoperative and postoperative visual analogue scale scores (VAS) for pain, Oswestry dysfunction index (ODI), Japanese Orthopaedic Association Assessment of Treatment (JOA) scores, surgical complications and patient satisfaction were statistically analysed at 3, 6 and 12 months.

Inclusion criteria: (1) age ≥ 60 years; (2) clinical signs of

neurogenic intermittent claudication with or without radiculopathy and imaging of lumbar spinal stenosis; (3) unsatisfactory clinical relief after conservative treatment for ≥ 3 months; (4) all patients voluntarily underwent surgical treatment and regular postoperative review. Exclusion criteria: Lateral radiographs of lumbar hyperextension and hyperflexion showing lumbar instability, Cobb angle difference >15° in hyperextension and hyperflexion or displacement of more than 3 mm, requiring fusion surgery; clear-cut cases of intermittent vascular claudication, obvious lumbar disc herniation, vertebral slippage II° or more, lumbar infection or stenosis combined with malignancy.

Surgical programme: The surgical approach is the posterior lumbar OLIF technique. According to the preoperative plan, the patient is positioned prone on the spinal table, the corresponding segment is positioned, and after routine decontamination of the sheet, a kerfing needle guide is inserted at an oblique medial tilt of approximately 20-30° on the more symptomatic side of the corresponding interspace to the surface of the vertebral plate of the corresponding segment. The endoscope is then inserted through the working channel. The lamina, hyperplastic synovial joint and ligamentum flavum are removed using a grinding drill and lamina bite forceps, and haemostasis is achieved using the plasma tip. Depending on the condition, in cases with bilateral lower limb symptoms and severe imaging of spinal stenosis combined with bilateral lateral saphenous fossa stenosis, the ligamentum flavum can be removed and decompressed via the laminar junction, the base of the spinous process and into the contralateral spinal canal. After decompression during the procedure, the nerve root pull is seen to be around 1-2 mm, and decompression is stopped when the nerve probe hook is probed up and down the nerve root canal and the nerve root is seen to be relaxed and the dural sac pulsation is more significantly restored.

Post-operative management: A drainage tube was routinely placed in the incision. In four patients with intraoperative cerebrospinal fluid leakage, a drainage tube was placed intraoperatively and connected to a drainage bag, and the drainage tube was removed 24 hours after surgery as appropriate. Post-operative antibiotics were routinely administered to prevent infection. Patients were instructed to move their lower limbs as soon as possible to prevent deep vein thrombosis in the lower limbs and to reduce bed-ridden complications. Monitor the patient's inflammatory and biochemical indexes postoperatively. Actively control blood pressure, blood glucose and other coexisting conditions.

Statistical indicators: Patients were counted for gender, age, duration of surgery, intraoperative bleeding, visual analoge score (VAS) score for pain, Oswestry Dysfunction Index (ODI), Japanese Orthopaedic Association Assessment of Treatment (JOA) score, and surgical complications.

Statistical methods: SPSS 26.0 software was used for statistical analysis. Paired t-tests were used to compare patients' pre- and post-operative VAS scores, ODI index, and JOA scores, and differences were considered statistically significant at $P < 0.05$.

3. Results

All 63 patients over 60 years of age with degenerative DLCS were successfully operated on, with an operative time of 48.5±15.48 minutes (40-70 minutes) and intraoperative bleeding of 39.37±29.78ml (20-75ml). There were three cases of cerebrospinal fluid leakage and zero cases of poor incision healing after surgery, with no other serious complications. 63 Patients were all followed up for approximately 12 months, and the leg VAS score improved from 8.32±2.7 preoperatively to 1.2±0.4 12 months after surgery (P<0.001); the lumbar VAS score improved from 6.53±1.9 preoperatively to 1.5±0.7 12 months after surgery (P <0.05); JOA score improved from 13.3±7.8 preoperatively to 25.7±5.2 12 months postoperatively (P<0.05); ODI improved from 56.6±16.9 preoperatively to 15.6±12.6 12 months postoperatively (P<0.05), see Table 1.

Table 1. *Patients' preoperative pre-discharge and final follow-up VAS scores and ODI scores (X±S).*

	Pre-operative	3 months postoperative	6 months postoperative	12 months postoperative	P
Leg VSA score	8.32±2.7	6.63±1.93*	4.53±1.4*	1.2±0.4*	0.008
Waist VSA score	6.53±1.9	5.32±1.53*	2.88±1.15*	1.5±0.7*	0.013
JOA score	13.3±7.8	15.5±6.4*	19.5±7.3*	25.7±5.2*	0.033
ODI score	56.6±16.9	46.4±15.7*	42.1±14.4*	15.6±11.6*	0.022

Note: *$P < 0.01$ vs. preoperative.

4. Discussion

Lumbar spinal stenosis is one of the common degenerative diseases of the lumbar spine in elderly patients [3]. With physiological degeneration, the loss of water in the nucleus pulposus of the intervertebral disc in elderly patients is accompanied by partial tearing of the annulus fibrosus, herniated or bulging discs leading to narrowing of the intervertebral space and relaxation of the intervertebral ligaments, resulting in increased movement of the lumbar motor unit and hyperplasia and coalescence of the corresponding segmental synapses, leading to spinal stenosis [4]. Currently, both conservative and surgical treatments are used in clinical practice. Conservative treatment is easily tolerated by elderly patients, and although it is effective, it often does not achieve satisfactory results, especially for patients with more serious conditions [5]. Surgery, on the other hand, is less tolerable in older patients, but it can achieve results that conservative treatment cannot [6]. Therefore, surgical decompression of the spinal canal is now one of the treatment options. There are many surgical treatment options

regarding lumbar spinal stenosis in elderly patients. Minimally invasive microscopic or endoscopic decompression surgery can adequately enlarge the spinal canal and can avoid the disadvantages of major surgery [6-7].

It is necessary to choose the appropriate surgical option according to the patient's condition. Adequate decompression, interbody fusion and internal fixation with a nail rod system is one of the effective methods of treating lumbar spinal stenosis, which can better maintain the stability of the spinal segments [8]. The posterior lumbar OLIF technique has the advantages of shorter operative time, less intraoperative bleeding and less postoperative slipped degeneration of the lumbar spine than open decompression surgery [9]. Posterior lumbar Delta endoscopic opening decompression is based on preoperative imaging to precisely decompress and preserve as much of the soft tissue and bony structures of the spine as possible, reducing the impact on spinal stability. In our study, we found that in elderly patients with lumbar spinal stenosis with stable lumbar spine treated with minimally invasive access decompression, the postoperative complications were one case of cerebrospinal fluid leak and one case of pulmonary infection, both of which were 4.5%, and they all improved and recovered after appropriate prolonged bed rest, anti-infection and medication changes. Age does not necessarily lead to a higher rate of perioperative complications in patients over 70 years of age [10-14].

Our analysis suggests that there is a learning curve for the posterior lumbar OLIF technique and that the initial implementation of this technique may result in damage to vital tissues such as the dural sac due to unskilled manipulation under the access or inability to clear the local anatomy. There is a link between the occurrence of cerebrospinal fluid leaks and adhesions between the dura and the ligamentum flavum. When separating the dural sac in a patient with severe spinal stenosis, the gap between the ligamentum flavum and the dural sac should be carefully searched for and a slow stentorian separation along the gap should be found to reduce the occurrence of cerebrospinal fluid leaks. The occurrence of pulmonary infection was related to the patient's preoperative status. The patient had preoperative pulmonary pathology and was susceptible to postoperative pulmonary infection, which improved after anti-infective symptomatic treatment.

Pre-operative communication with the patient and his family is required. In elderly patients with other degenerative conditions of the lumbar spine, this surgery addresses the patient's symptoms due to lumbar spinal stenosis but does not relieve the patient's symptoms due to other lumbar degenerations, which may lead to lower satisfaction if the patient's expectations are too high. Also incomplete knowledge of the extent and degree of decompression at the beginning of the procedure may affect patient satisfaction.

The lumbar posterior OLIF technique for lumbar spinal stenosis is clinically feasible and safe, and has the advantages of less muscle trauma, less postoperative back pain and faster patient recovery compared with traditional open microscopic techniques. There are still certain shortcomings in the present study. The number of cases observed in the study is small, the clinical observation time is short, and there may be some bias in the reporting of treatment effects, pending further supplementary studies at a later stage.

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