Degenerative lumbar spinal stenosis case series

2023

Twenty-eight patients presenting with degenerative spine disease including concomitant lumbar central spinal canal stenosis and/or lumbar lateral recess stenosis were treated with stand-alone minimally invasive percutaneous pedicle screw fixation. Radiographic measurements were made on axial and sagittal magnetic resonance (MR) images, performed before surgery and after a mean follow-up period of 25.2 months. Measurements included spinal canal and foraminal areas, and anteroposterior canal diameter.

Percutaneous screw fixation was performed in 35 spinal levels. Measurements on the follow-up MR images showed statistically significant increase in the cross-sectional area of the spinal canal and the neural foramen, from a mean of 88.22 and 61.05 mm2 preoperatively to 141.52 and 92.18 mm2 at final follow-up, respectively. The sagittal central canal diameter increased from a mean of 4.9 to 9.1 mm at final follow-up. Visual analog scale (VAS) pain score and Oswestry Disability Index (ODI) both improved significantly after surgery (p < 0.0001).

Stand-alone percutaneous pedicle screw fixation is a safe and effective technique for indirect decompression of the spinal canal and neural foramina in lumbar degenerative diseases. This minimally invasive technique may provide the necessary decompression in cases of common degenerative lumbar disorders with ligamentous stenosis ¹.

The clinical data of 60 patients with single-segment degenerative lumbar spinal stenosis who underwent surgical treatment from January 2018 to October 2019 was retrospectively analyzed. The patients were divided into OLIF groups and TLIF group according to different surgical methods. The 30 patients in the OLIF group were treated with OLIF plus posterior intermuscular screw rod internal fixation. There were 13 males and 17 females, aged from 52 to 74 years old with an average of (62.6 ± 8.3) years old. And 30 patients in the TLIF group were treated with TLIF via the left approach. There were 14 males and 16 females, aged from 50 to 81 years old with an average of (61.7 ± 10.4) years old. General data including operative time, intraoperative blood loss, postoperative drainage volume, and complications were recorded for both groups. Radiologic data including disc height (DH), the left psoas major muscle, multifidus muscle, longissimus muscle area, T2-weighted image hyperintensity changes and interbody fusion or nonfusion were observed. Laboratory parameters including creatine kinase (CK) values on postoperative 1st and 5th days were analyzed. Visual analogue scale(VAS) and Oswestry disability index(ODI) were used to assess clinical efficacy.

There was no significant difference in the operative time between two groups(P>0.05). The OLIF group had significantly less intraoperative blood loss and postoperative drainage volume compared to the TLIF group(P<0.01). The OLIF group also had DH better recovery compared to the TLIF group (P<0.05). There were no significant differences in left psoas major muscle area and the hyperintensity degree before and after the operation in the OLIF group (P>0.05). Postoperativly, the area of the left multifidus muscle and longissimus muscle, as well as the mean of the left multifidus muscle and longissimus muscle, were lower than those in the TLIF group (P<0.05). On the 1st

day and the 5th day after operation, CK level in the OLIF group was lower than that in the TLIF group(P<0.05). On the 3rd day after operation, the VAS of low back pain and leg pain in the OLIF group were lower than those in the TLIF group (P<0.05). There were no significant differences in the ODI of postoperative 12 months, low back and leg pain VAS at 3, 6, 12 months between the two groups(P>0.05). In the OLIF group, 1 case of left lower extremity skin temperature increased after the operation, and the sympathetic chain was considered to be injured during the operation, and 2 cases of left thigh anterior numbness occurred, which was considered to be related to psoas major muscle stretch, resulting in a complication rate of 10% (3/30). In the TLIF group, one patient had limited ankle dorsiflexion, which was related to nerve root traction, two patients had cerebrospinal fluid leakage, and the dural sac was torn during the operation, and one patient had incision fat liquefaction, which was related to paraspinal muscle dissection injury, resulting in a complication rate of 13% (4/30). All patients achieved interbody fusion without cage collapse during the 6- month follow-up.

Both OLIF and TLIF are effective in the treatment of single-segment degenerative lumbar spinal stenosis. However, OLIF surgery has obviously advantages, including less intraoperative blood loss, less postoperative pain, and good recovery of intervertebral space height. From the changes in laboratory indexes of CK and the comparison of the left psoas major muscle, multifidus muscle, longissimus muscle area, and high signal intensity of T2 image on imaging, it can be seen that the degree of muscle damage and interference of OLIF surgery is lower than that of TLIF².

A retrospective single-center study enrolled 1233 patients with lumbar spinal stenosis who underwent spinal decompression and fusion surgery between 2014 and 2018. The number and causes of readmission were evaluated.

There were 164 readmissions. Revision surgery at the same level was performed in 63 patients (38.4%), at the higher level - 72 (43.9%), at the lower level - in 29 (17.7%) patients. The most common indication for readmission was spondyloarthrosis with facet joint syndrome (94 (57.3%) patients). The second common complication was pseudoarthrosis (26 (15.9%) patients). These ones comprised 2.1% of all patients with lumbar spine stenosis.

The most common indication for readmission was adjacent segment degeneration. The most severe complications requiring complex and even multiple stage revision surgery were pseudoarthrosis and postoperative spondylodiscitis. Causes of readmission are significantly changing at different periods after surgery ³⁾

2021

152 patients of lumbar spinal stenosis treated with percutaneous pedicle screw placement were enrolled in a study. facet joint violation (FJV) was evaluated on 3-dimensional lumbar CT reconstruction. Three types of grading systems were used to evaluate FJV: Babu's system (grading by the severity of violation), Shah's system (grading by side of violation), and modified Park's system (grading by different components to cause violation). The violation rate and observer consistency of the 3 grading systems were analyzed. Clinical outcomes were evaluated by visual analog score (VAS), Oswestry disability index (ODI) score.

Kappa coefficients of interobserver consistency on Babu, Shah, and Park grading systems were

0.726,0.849,0.692, respectively. The violation rate of Babu, Shah, and Park grading systems were comparable, which were 34.54%, 32.57%, 33.55%, respectively. In all 3 grading systems, the postoperative VAS low-back pain and ODI scores in non-FJV groups were lower than those in FJV groups (P < .05), and there were no significant differences between 2 groups in VAS leg pain(P > .05).

Babu, Shah and modified Park grading system are reliable grading systems, and it reported comparable violation rate. The self-reported clinical outcomes of patients with FJV were worse at 2-year follow-up. For clinical application, it is recommended to use 2 or even 3 different grading systems together to evaluate the FJV⁴⁾

2020

Kim et al. conducted a retrospective study of 60 patients who underwent bilateral decompression for lumbar central canal stenosis. The patients were divided into 2 groups according to the surgical method (endoscopic ULBD vs. microscopic ULBD). We compared the outcomes between the 2 groups in terms of postoperative segmental spinal instability, dura expansion, operation time, estimated blood loss, serum creatine kinase (CK), serum C-reactive protein (CRP), visual analog scale (VAS) score, Oswestry Disability Index (ODI), modified MacNab score, and the incidence of complications.

The mean VAS, ODI, and modified MacNab score improved significantly from the preoperative period to the last follow-up in both groups and were better in the endoscopic ULBD group until the first day after treatment. The degree of horizontal displacement was lower in the endoscopic ULBD group than in the microscopic ULBD group at postoperative 12 months. Dura expansion, operation time, and estimated blood loss did not differ significantly between the 2 groups. Serum CK and CRP on the first day after treatment were lower in the endoscopic ULBD group than in the microscopic ULBD group.

This study showed that both endoscopic ULBD and microscopic ULBD can provide favorable outcomes for lumbar central canal stenosis. However, compared to microscopic ULBD, endoscopic ULBD has advantages in terms of postoperative segmental spinal instability, pain control, and serum CK and CRP ⁵.

Kim et al. performed a retrospective analysis of radiologic efficacy and patient satisfaction in a series of surgical patients treated at our institution. We classified patients into two groups based on the primary pathology (i.e., central or lateral recess stenosis). Medical records were analyzed retrospectively for radiologic outcomes and clinical parameters including pain and changes in quality of life. Data related to outcomes were collected at 2 weeks, 3 months, and 12 months after surgery in the outpatient clinic.

Among the 122 patients enrolled in this study, 51 had central spinal stenosis; 71 had lateral recess stenosis. Radiologically, we observed significant improvements in the anteroposterior diameter and cross-sectional area of the dural sac (central stenosis) and the lateral width of the central canal and depth of the lateral recess (lateral recess stenosis). Two weeks and 12 months after the surgical procedure, we observed significant improvements in the extent of symptoms, patient satisfaction, and quality of life (including physical function).

These findings suggest that bilateral decompression via a unilateral approach shows improved radiologic outcomes, varying based on the type of stenosis. Furthermore, patient satisfaction significantly improved regardless of the type of disease ⁶⁾.

2019

Whether Lumbar Decompression Surgery for Spinal Canal Stenosis alone or decompression with dynamic stabilization offers better surgical outcomes remains unclear. Tosic et al. compared the clinical and radiologic results of patients with single-level lumbar spinal stenosis and grade 1 spondylolisthesis undergoing microsurgical decompression alone or decompression with transpedicular dorsal dynamic stabilization.

They retrospectively analyzed 20 patients undergoing microsurgical decompression and dorsal dynamic transpedicular stabilization using polyetheretherketone rods in one center from 2011 to 2017. Twenty patients with the same diagnosis undergoing microsurgical decompression alone were used as controls. Reoperation of the index and neighboring segments, back/leg pain, neurologic deficits, and the use of pain medication was assessed. For stabilization patients, radiographic progression of degeneration in the neighboring segments, spondylolisthesisdegree in the index segment, and implant failure were assessed.

All patients had good clinical outcomes at 3 and 12 months postoperatively. In stabilization patients, the visual analog scale (VAS) score for leg pain decreased from 5 points (median) to 1.6 at 3 months and 0.6 at 1 year postoperatively. In controls, the VAS score improved from 4.8 points to 1.1 at 3 months and 0.3 at 1 year postoperatively. The VAS score for back pain in stabilization patients decreased from 7.6 points (median) to 1.7 at 3 months and 0.1 at 1 year postoperatively. In controls, it decreased from 7.7 points to 1.1 at 3 months and 0.2 at 1 year postoperatively. In controls, it decreased from 7.7 points to 1.1 at 3 months and 0.2 at 1 year postoperatively. In patients with additional dynamic stabilization, a longer hospital stay (stabilization group: 8.7 ± 4.1 ; control: 6.2 ± 1.6 days), longer operative time (stabilization group: 132.7 ± 41.3 ; control: 83.2 ± 31.7 minutes), and higher complication rates (revision surgery performed in two stabilization patients) were found.

No indications in this study showed that additional dynamic stabilization with PEEK rods offers any advantage over decompression alone $^{7)}$.

Kitab et al., performed a re-analysis of data from their previously reported prospective MRI-based study, stratifying data from the 709 cases into 3 age categories of equal size (instead of the original < 60 vs \geq 60 years). Relative lumbar spinal canal dimensions, as well as radiological degenerative variables from L1 to S1, were analyzed across age groups in a multivariate mode. The total degenerative scale score (TDSS) for each lumbar segment from L1 to S1 was calculated for each patient. The relationships between age and qualitative stenosis grades, TDSS, disc degeneration, and facet degeneration were analyzed using Pearson's product-moment correlation and multiple regression.

Multivariate analysis of TDSS and spinal canal dimensions revealed highly significant differences across the 3 age groups at L2-3 and L3-4 and a weaker, but still significant, association with changes at L5-S1. Age helped to explain only 9.6% and 12.2% of the variance in TDSS at L1-2 and L2-3, respectively, with a moderate positive correlation, and 7.8%, 1.2%, and 1.9% of the variance in TDSS at L3-4, L4-5, and L5-S1, respectively, with weak positive correlation. Age explained 24%, 26%, and 18.4% of the variance in lumbar intervertebral disc (LID) degeneration at L1-2, L2-3, and L3-4, respectively, while it explained only 6.2% and 7.2% of the variance of LID degeneration at L4-5 and L5-S1, respectively. Age explained only 2.5%, 4.0%, 1.2%, 0.8%, and 0.8% of the variance in facet degeneration at L1-2, L2-3, L3-4, L4-5, and L5-S1, respectively.

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Age at presentation correlated weakly with degeneration variables and spinal canal morphometries in LSS segments. Age correlated with upper lumbar segment (L1-4) degeneration more than with lower segment (L4-S1) degeneration. The actual chronological age of the patients did not significantly correlate with the extent of degenerative pathology of the lumbar spinal stenosis segments. These study results lend support for a developmental contribution to LSS⁸⁾.

Nine hundred and eighteen patients of the Acıbadem Fulya Hospital and Acıbadem Taksim Hospital were treated for single or multilevel lumbar spinal stenosis (LSS) by bilateral decompression via unilateral approach (BDUA) between January 2002 and January 2016. 180 patients of the 918 underwent microdiscectomy with decompression. They were then followed up postoperatively, at 6 and 12 months with radiological investigations, Oswestry Disability Index (ODI) and 36-item short-form health survey (SF-36) tests.

Four hundred and ninety-two patients were females (53,6%), four hundred and twenty six were males (46,4) whose mean age was $63,83\pm10,16$ (range: 43-79 years). Duration of symptoms ranged from 4 to 49 months. Average follow-up time was 98 months (range 25-168 months) and the reoperation rate (RR) was 2,5%. The ODI scores decreased significantly (30.65 ± 7.82 , to 11.32 ± 2.50 at six months and 11.30 ± 2.49 at first year) and the SF-36 parameter scores demonstrated a significant improvement in the early and late follow-up results.

BDUA for LSS allowed a sufficient and safe decompression of the neural structures, resulted in a highly significant reduction of the symptoms and disability, acceptable RR, and improved health-related quality of life ⁹.

A successive series of 102 patients with lumbar spinal stenosis from Aachen (with and without previous lumbar surgery) were treated with decompression alone during a 3-year period. Data on preand postoperative back pain and leg pain (numerical rating scale [NRS] scale) were retrospectively collected from questionnaires with a return rate of 65% (n = 66). The complete cohort as well as patients with first-time surgery and re-decompression were analyzed separately. Patients were dichotomized to short-term follow-up (< 100 weeks) and long-term follow-up (> 100 weeks) postsurgery.

Overall, both back pain (NRS 4.59 postoperative versus 7.89 preoperative; p < 0.0001) and leg pain (NRS 4.09 versus 6.75; p < 0.0001) improved postoperatively. The short-term follow-up subgroup (50%, n = 33) showed a significant reduction in back pain (NRS 4.0 versus 6.88; p < 0.0001) and leg pain (NRS 2.49 versus 6.91: p < 0.0001). Similar results could be observed for the long-term follow-up subgroup (50%, n = 33) with significantly less back pain (NRS 3.94 versus 7.0; p < 0.0001) and leg pain (visual analog scale 3.14 versus 5.39; p < 0.002) postoperatively. Patients with previous decompression surgery benefit significantly regarding back pain (NRS 4.82 versus 7.65; p < 0.0024), especially in the long-term follow-up subgroup (NRS 4.75 versus 7.67; p < 0.0148). There was also a clear trend in favor of leg pain in patients with previous surgery; however, it was not significant.

Decompression of lumbar spinal stenosis without fusion led to a significant and similar reduction of back pain and leg pain in a short-term and a long-term follow-up group. Patients without previous surgery benefited significantly better, whereas patients with previous decompression benefited regarding back pain, especially for long-term follow-up with a clear trend in favor of leg pain ¹⁰.

A total of 25 patients between May 2015 and June 2016 affected by radiologically demonstrated onelevel lumbar spinal stenosis (LSS) with facet joint degeneration and grade I spondylolisthesis were included in this prospective study. All the patients underwent laminectomy, foraminotomy, and onelevel facet fixation (Facet-Link, Inc., Rockaway, New Jersey, United States). Pre- and postoperative clinical (Oswestry Disability Index [ODI], Short Form 36 [SF-36]) and radiologic (radiographs, magnetic resonance imaging, computed tomography) data were collected and analyzed.

Mean follow-up was 12 months. The L4-L5 level was involved in 18 patients (72%) and L5-S1 in 7 patients (28%); the average operative time was 80 minutes (range: 65-148 minutes), and the mean blood loss was 160 mL (range: 90-200 mL). ODI and SF-36 showed a statistically significant (p < 0.05) improvement at last follow-up.

Transfacet fixation is a safe and effective treatment option in patients with single-level LSS, facet joint degeneration, and mild instability ¹¹⁾.

2017

A retrospective matched-pair cohort study included a total of 144 patients who underwent surgery for bisegmental spinal stenosis at the levels L3-4 and L4-5 between 2008 and 2012. There were 72 matching pairs that corresponded in sex, year of birth, and width of the stenosed segments. The patients' impairments were reported before, immediately after, and 6 and 12 months after surgery using the Oswestry Disability Questionnaire (ODQ-D) and the EuroQol-5D (EQ-5D). The data were evaluated statistically. Results The comparison of both surgical procedures regarding walking ability (walking a distance with and without a walking aid) revealed a significant difference. Patients who underwent hemilaminectomy had better postoperative results. The individual criteria of the ODQ-D and EQ-5D revealed no significant differences between 2-level fenestration and hemilaminectomy; however, there is always significant postoperative improvement in comparison with preoperative status. Age, sex, body mass index, comorbidities, smoking, and alcohol consumption had no influence on the surgical results. The reoperation rate was between 13% and 15% for both surgical techniques, not being significantly different. Conclusion Fenestration and hemilaminectomy are equivalent therapies for bisegmental lumbar spinal canal stenosis. Regarding walking, the study revealed better results for hemilaminectomy than for fenestration in this cohort of patients. Pain intensity, personal care, lifting and carrying of objects, sitting, social life, and travel all improved significantly postoperatively as compared with preoperatively. In both groups, health status as the decisive predictor improved considerably after surgery. We could show that both surgical methods result in significant postoperative improvement of all the individual criteria of the ODQ-D and the EQ-5D¹².

2016

726 patients with lumbar stenosis (without spondylolisthesis or scoliosis) and a baseline back pain score \geq 5 of 10 who underwent surgical decompression only. No patient was reported to have significant spondylolisthesis, scoliosis, or sagittal malalignment. Standard demographic and surgical variables were collected, as well as patient outcomes including back and leg pain scores, Oswestry Disability Index (ODI), and EuroQoL 5D (EQ-5D) at baseline and 3 and 12 months postoperatively. RESULTS The mean age of the cohort was 65.6 years, and 407 (56%) patients were male. The mean body mass index was 30.2 kg/m2, and 40% of patients had 2-level decompression, 29% had 3-level decompression, 24% had 1-level decompression, and 6% had 4-level decompression. The mean estimated blood loss was 130 ml. The mean operative time was 100.85 minutes. The vast majority of discharges (88%) were routine home discharges. At 3 and 12 months postoperatively, there were significant improvements from baseline for back pain (7.62 to 3.19 to 3.66), leg pain (7.23 to 2.85 to 3.07), EQ-5D (0.55 to 0.76 to 0.75), and ODI (49.11 to 27.20 to 26.38). CONCLUSIONS Through the 1st postoperative year, patients with lumbar stenosis-without spondylolisthesis, scoliosis, or sagittal malalignment-and clinically significant back pain improved after decompression-only surgery ¹³.

2015

88 patients with LSS (47 men and 41 women) who ranged in age from 39 to 86 years (mean age 68.7 years). All patients had undergone microendoscopic laminotomy at Osaka City University Graduate School of Medicine from May 2008 through October 2012. The minimum duration of clinical and radiological follow-up was 6 months. All patients were evaluated by Japanese Orthopaedic Association (JOA) and visual analog scale (VAS) scores for low back pain, leg pain, and leg numbness before and after surgery.

The distance between the C7 plumb line and the posterior corner of the sacrum (sagittal vertical axis [SVA]) was measured on lateral standing radiographs of the entire spine obtained before surgery.

Radiological factors and clinical outcomes were compared between patients with a preoperative SVA \geq 50 mm (forward-bending trunk [F] group) and patients with a preoperative SVA < 50 mm (control [C] group).

A total of 35 patients were allocated to the F group (19 male and 16 female) and 53 to the C group (28 male and 25 female).

The mean SVA was 81.0 mm for patients in the F group and 22.0 mm for those in the C group. At final follow-up evaluation, no significant differences between the groups were found for the JOA score improvement ratio (73.3% vs 77.1%) or the VAS score for leg numbness (23.6 vs 24.0 mm); the VAS score for low-back pain was significantly higher for those in the F group (21.1 mm) than for those in the C group (11.0 mm); and the VAS score for leg pain tended to be higher for those in the F group (18.9 \pm 29.1 mm) than for those in the C group (9.4 \pm 16.0 mm).

Preoperative alignment of the spine in the sagittal plane did not affect JOA scores after microendoscopic laminotomy in patients with LSS. However, low-back pain was worse for patients with preoperative anterior translation of the C-7 plumb line than for those without ¹⁴.

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