Cross-Sectional Study

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Results of laminoplasty versus laminectomy and posterior fusion for multilevel cervical spondylotic myelopathy

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Background: The authors compared the clinical, MR, and clinical outcomes for patients with multilevel cervical spondylotic myelopathy (MCSM) who underwent laminoplasty (LP) versus laminectomy with fusion (LPSF).

Materials and methods: The authors evaluated 65 patients with MCSM (2019–2021) with 31 undergoing LP versus 34 having LPSF. Variables studied included JOA scores, T2W MR hyperintense cord signals, preoperative lordosis, number of stenotic levels, and neurological outcomes.

Results: Both groups showed similar preoperative JOA scores, number of stenotic levels, T2-weighted MR hyperintense cord signals, and nearly identifcal 12-month postoperative outcomes (good for 83.9 in the LP group vs. 85.3% in the LPSF group). Differences included: higher preoperative visual analog scale in the LPSF versus LP group, plus the LPSF patients significantly less preoperative cervical lordosis versus LP patients.

Conclusion: LP and LPSF used to treat MCSM resulted in similar clinical improvement and 1-year postoperative outcomes. However, our recommendation would be for patients with neck pain, instability, and/or cervical kyphosis to undergo LPSF.

Keywords: cervical laminectomy, cervical laminoplasty, cervical spinal stenosis, multilevel cervical spondylotic myelopathy, posterior spinal fusion

Introduction

The two common posterior approaches to treat multilevel cervical spondylotic myelopathy (MCSM) include laminoplasty (LP) versus laminectomy with posterior spinal fusion (LPSF). Nevertheless, it remains unclear as to which procedure provides the best outcomes[1,2]. Here, we compared the JOA scores, incidence of T2 W MR hyperintense cord signals, preoperative lordosis, number of stenotic levels, and neurological outcomes for 31 patients undergoing LP versus 34 having LPSF.

HIGHLIGHTS

- Laminoplasty (LP) and laminectomy with posterior spinal fusion (LPSF) are two common posterior approaches to treat multilevel cervical spondylotic myelopathy (MCSM).
- Until now, it remains unclear as to which procedure provides the best outcomes. Here, we compared the results of LP versus laminectomy/posterior fusion for MCSM.
- Our research has shown that, LP and LPSF used to treat MCSM resulted in similar clinical improvement and 1-year postoperative outcomes. However, our recommendation would be for patients with neck pain, instability and/or cervical kyphosis to undergo LPSF.

Materials and methods

There were 65 patients with MCSM undergoing LP (31 patients) or LPSF (34 patients) from 2019 to 2021. The group I 31 patients underwent LP utilizing Hirabayashi's open-door technique (Fig. 1C). The group II 34 patients underwent LPSF including laminectomy supplemented with C2–C7 pedicle screws, C3–C6 Margel lateral mass screws, and C2–C7 rod fixation (Fig. 2B)[2]. This study has been reported in line with the strengthening the reporting of cohort, cross-sectional, and case–control studies in surgery (STROCSS) criteria[3].

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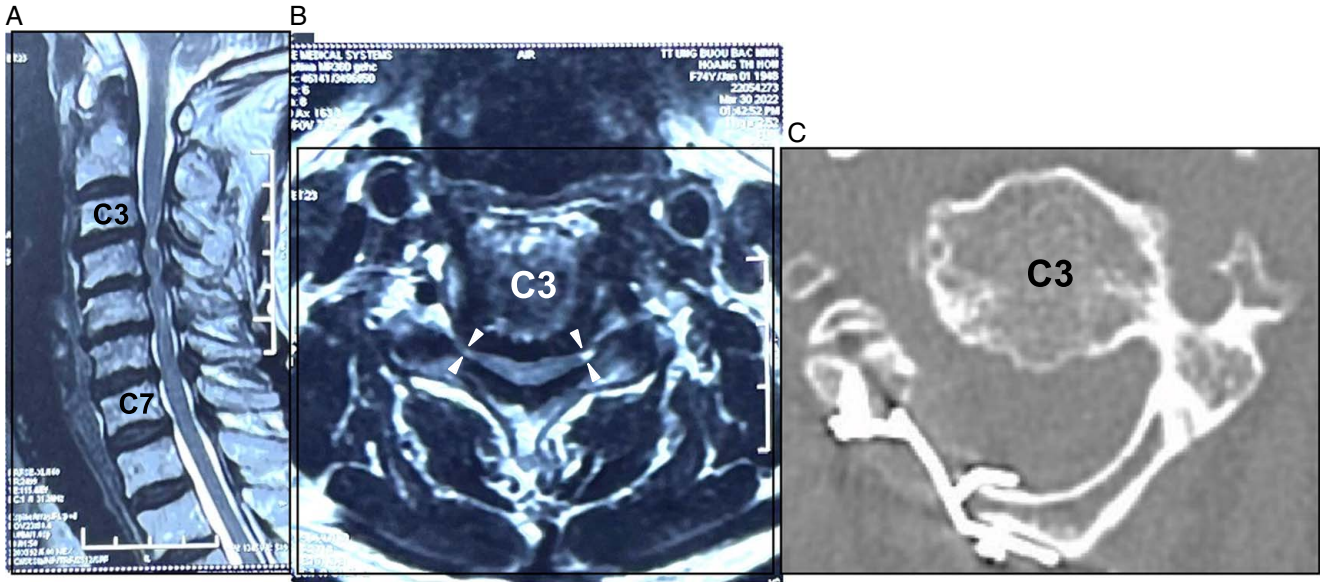

Figure 1. (A): The preoperative sagittal MRI of a 52-year-old showed four-level cervical spondylotic myelopathy (C3–C7) with T2W intrinsic cord edema at C3–C4. (B): The preoperative axial MRI at C3–C4 showed spinal cord compression anteriorly, and foraminal stenosis. (C): The postoperative axial CT showed the laminoplasty defect.

Data collected

The data collected included clinical, imaging studies, and surgical results. Clinical data utilized the Japanese Orthopedic Association (JOA) scale and visual analog scale (VAS) scores preoperatively, at discharge, and 1-year later. Imaging studies included X-rays (i.e. C2–C7 Cobb angles, range of motion (ROM) and flexion/extension studies), and MR scans (i.e. number of stenotic levels, presence of a high T2W cord signal) (Fig. 3) Surgical outcomes were assessed using JOA and VAS scores. Other variables studied included: surgical time, complications, and recovery rate (RR).

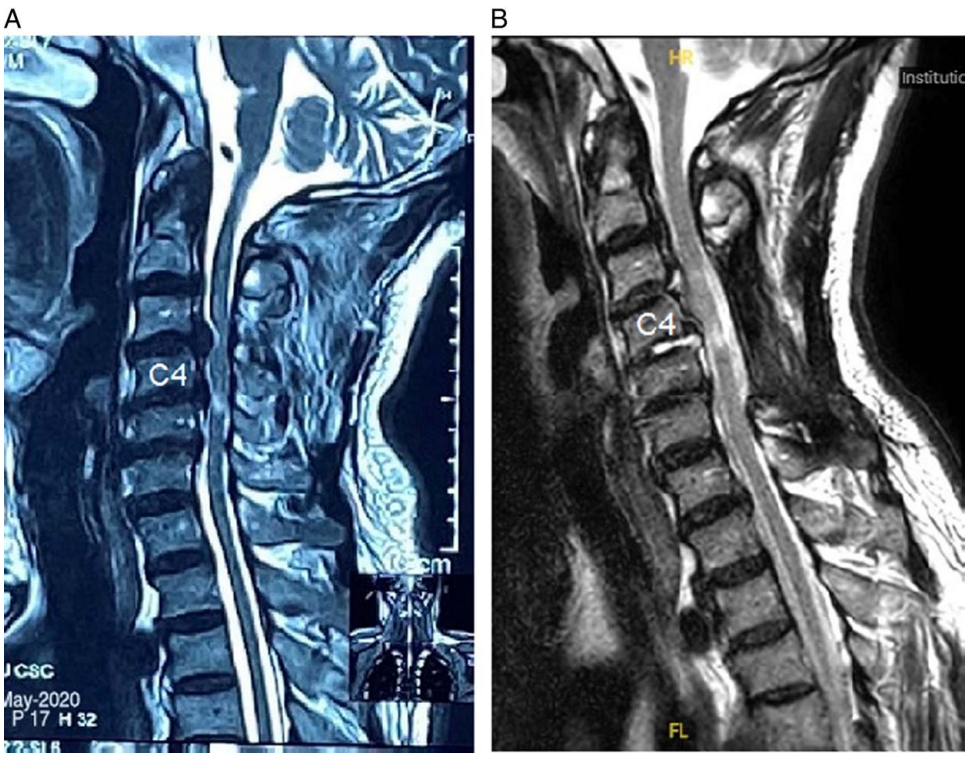

Figure 2. (A): The preoperative saggital MRI in a 65-year-old showed C3–C6 spinal stenosis with intrinsic T2W MR C45cord edema. (B): The postoperative saggital MRI showed the spinal cord completely decompressed following a laminectomy/fusion.

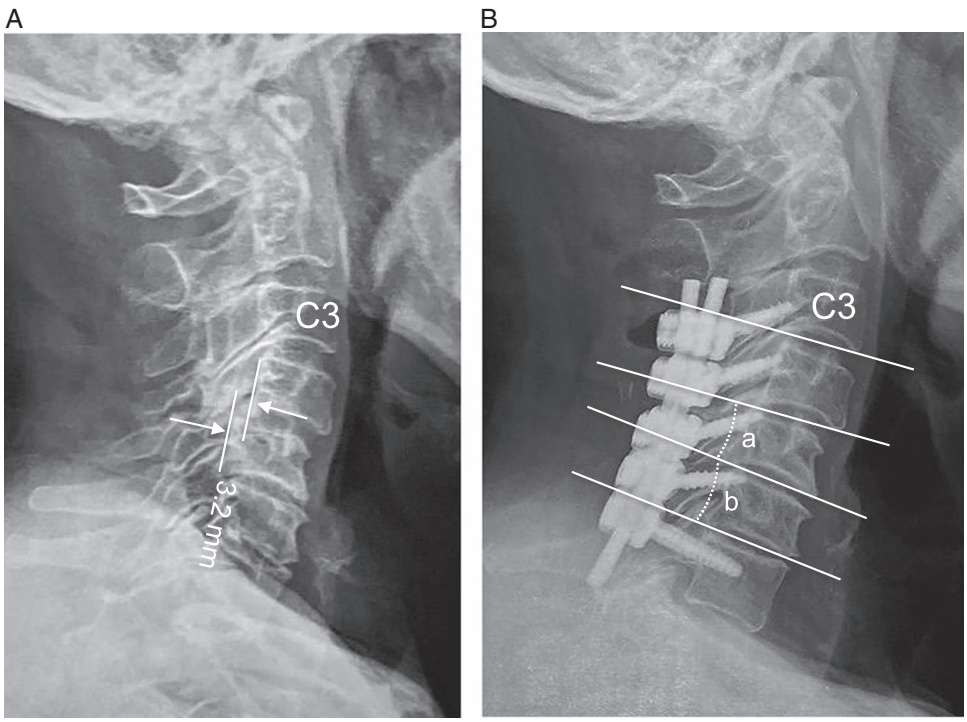

Figure 3. A 57-year-old with MCSM underwent a laminectomy/PF. (A): The preoperative lateral radiographs showed obvious cervical instability at C4–C5 level in this 57-year-old male with MCSM (arrows). (B): The postoperative lateral radiographs documented the laminectomy defect C3–C7 with C7 pedicle and C3–C6 lateral mass screw/rod fixation.

Statistical evaluation

The Statistical Package for the Social Sciences (SPSS) 22.0 (IBM) was used for statistical processing, along with an independent *t*-test, a paired sample *t*-test for two and χ^2 analysis.

Results

Similar versus different for both groups

There was no difference in the preopereative JOA score between the two groups, the mean number of stenotic levels, and frequency of preoperative hyperintense intramedullary MR T2 cord signals. The only difference noted prior to surgery were that the LP group were younger and has less severe cervical pain. Postoperatively, there were statistically significant differences in; spine pain, JOA scores, RRs, or mean Cobb angles, between the two groups at ($P > 0.05$).

Cobb angles and ROM

Cobb angles and the average cervical ROM for the LP group were statistically higher than for the LPSF group. For the LPSF group,

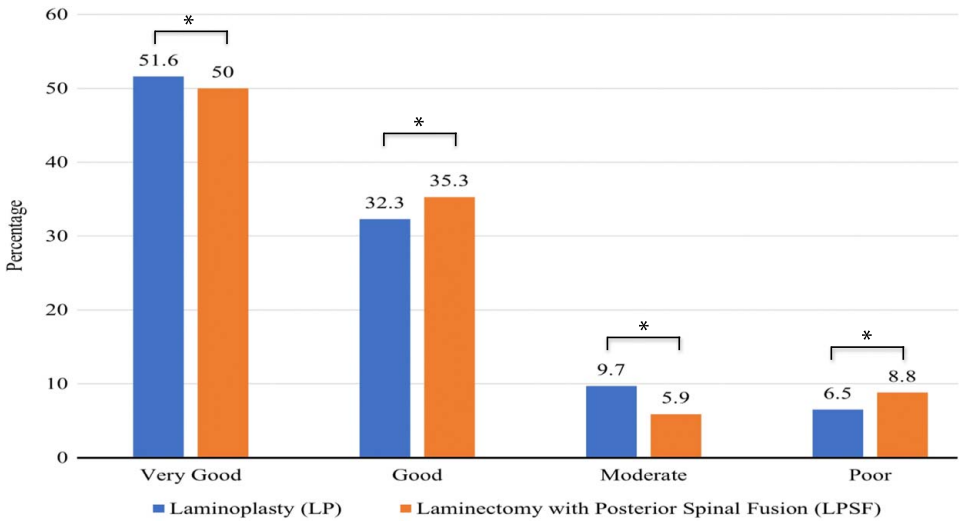

Figure 4. Both LP and LPSF groups had similar postoperative neurological recovery outcomes.

Table 1

Comparision of some preoperative clinical and imaging characteristics between two patient groups.

Parameters	Group 1 (LP)	Group 2 (LPSF)	P
Patient number	31	34	—
Sex (% of male)	67.7%	82%	—
Age	56.84 ± 8.23	65.56 ± 9.68	< **0.001**
Preoperative neck VAS score	1.57 ± 0.67	3.53 ± 1.69	< **0.001**
Preoperative JOA score	9.03 ± 1.68	9.65 ± 1.86	0.061
Preoperative cervical Cobb angle (°)	22.35 ± 9.03	11.95 ± 12.30	< **0.001**
Kyphosis	0	11/34 (32.4%)	—
Cervical instability*	0	19/34 (55.9%)	—
ROM (°)	45.26 ± 10.25	37.31 ± 13.74	**0.002**
Number of levels	4.29 ± 0.68	4.35 ± 0.54	0.742
Signal change of spinal cord on T2W	96.8%	91.2%	0.058
Surgical time (min)	123.55 ± 33.84	112.79 ± 20.27	**0.004**

Bold value statistical significance $p < 0.05$.

*Cervical instability was determined when X-ray examination of the cervical spine in flexion and extension showed horizontal displacement of two adjacent vertebrae > 3mm and/or an angle difference > 11° between two adjacent vertebral spaces (Figure 3).

32.4% of patients had kyphosis, 55.9% had spinal instability, lower mean Cobb angles (not clinically significant), shorter surgical times, but higher complication rates versus the LP group (8.6 vs. 3.2%, $P < 0.05$).

No differences in 1-year postoperative outcomes

One year postoperatively, there was no difference in VAS score, JOA score, and RRs between the two groups; both demonstrate comparable 'good' outcomes (Fig. 4).

Discussion

Most studies including our own demonstrated comparable outcomes for LP versus LPSF to treat cervical spondylotic myelopathy. A meta-analysis of 23 studies showed no significant differences in JOA scores, cervical curvature index (CCI), ROM, VAS, cervical lordosis (C2–7), and axial pain between LP (774 patients) and LPSF patients (743 patients)[4]. Xin *et al.*[5] also found no differences in JOA scores, RR, and cervical spine pain between LP and the LPSF patients. Alternatively, in Lau *et al.* (2017) 145 patients (i.e. 101 LP vs. 44 LPSF), those undergoing LPSF showed better neurological outcomes versus LP patients (0.9 vs. 1.4%, $P = 0.014$). Our study showed comparable 'good' outcomes on JOA and VAS scores at 1 postoperative year (Tables 1 and 3).

Table 2

Early clinical and imaging results between two patient groups when hospital discharged

Parameters	Group 1 (LP)	Group 2 (LPSF)	P
Complications	1/31 (3.2%)	3/34 (8.6%)	**0.025**
VAS score	2.72 ± 1.23	2.65 ± 0.69	0.543
JOA score	12.96 ± 1.92	13.24 ± 2.08	0.445
Average recovery rate (%)	44.45 ± 23.15	49.41 ± 20.34	0.165
Cobb angle (°)	11.52 ± 9.19	11.76 ± 1.25	0.850

Bold value statistical significance $p < 0.05$.

Table 3

Clinical and imaging results between two patient groups at the 12 months after the operation.

Parameters	Group 1 (LP)	Group 2 (LPSF)	P
VAS score	2.19 ± 1.28	2.15 ± 1.23	0.84
JOA score	14.42 ± 1.97	14.52 ± 2.07	0.761
Average recovery rate (%)	69.43 ± 26.22	66.49 ± 22.79	0.457
Results (very good, good)	83.9%	85.3%	—
Cobb angle (°)	14.15 ± 9.69	9.35 ± 6.13	**0.011**
Spinal kyphosis	1/31	1/34	—

Bold value statistical significance $p < 0.05$.

Complication rates

The complication rate for LP versus LPSF varied depending in different studies. In Xin's (2020) study, complications rates were comparable for both groups[5]. Lau (2017) demonstrated that the LP group's complication rate was 2.2%, that was significantly lower than that of the LPSF group (11.6%)[6]. Yuan's meta-anylasis (2019) showed the overall complication rate for the LP group was also 3.2%, significantly lower than the 8.8% seen for the LPSF patients[7]. In our study, the complication rate for LPSF was 8.6%, significantly higher than 3.2% for the LP group (Table 2).

Conclusion

The study showed that, LP and LPSF have similar clinical outcomes (i.e. using JOA, VAS scores, and RR). Although, the LPSF group had a shorter surgical times, they also exhibited higher complication rates versus LP patients ($P < 0.05$).

Ethical approval

Ethical approval for this study (No 2368/QĐ-BV) was provided by the Ethical Committee NAC of 108 Military Central Hospital and Military Medical Academy, Hanoi, Vietnam on 12 December 2018.

Consent

Written informed consent was obtained from the patients for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

N.T.Y.: study concept, data collection, data analysis, and writing the paper; T.Q.D.: study concept, data collection, data analysis, and writing the paper; N.K.H.: study concept and writing the paper; P.Q.A.: study concept, data collection, data analysis, and writing the paper; L.V.A.: study concept and writing the paper.

Conflicts of interest disclosure

All authors declare no conflicts of interest.

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Guarantor

Nguyen Trong Yen, PhD, MD, Tran Quang Dung, MD.

Data availability statement

Data are available, available upon reasonable request.

Provenance and peer review

Agree.

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