ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 05 | May - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPAIRING CLINICAL AND RADIOLOGICAL OUTCOME OF LAMINECTOMY VS LAMINOPLASTY FOR CERVICAL SPONDYLOTIC MYELOPATHY: AN INSTITUTIONAL STUDY.

Neurosurgery

Dr R. K. Barooah Associate professor Department of Neurosurgery, GMCH Guwahati.
Dr. Debdatta Saha Consultant neurosurgeon, AGMC and GBP Hospitals , Tripura.
Dr Ankur Anand* Senior Resident, Department of Neurosurgery, GMCH Guwahati. *Corresponding Author

ABSTRACT

Introduction & Background: Laminectomy has been a traditional approach in the operative management of patients suffering from cervical spondylotic myelopathy. Laminoplasty is an attractive alternative of laminectomy.
Objective: Majority of the previous comparative studies between laminoplasty and laminectomy done in a patient suffering from cervical spondylotic myelopathy did not show any significant difference in neurological outcome. Purpose of this study is to compare the clinical outcome and radiological results following the operation in a similar group of patient at a 12 months of follow-up.
Study Design: Single centered prospective randomized blind control trial.
Materials & Methods: A consecutive series of twenty six patients who underwent laminoplasty for cervical spondylotic myelopathy has been compared with a similar group of twenty five matched patients who underwent laminectomy. They were similar in age, gender and ethnicity.
Results: Modified Nurick scale improved from pre-operative average of 2.51 to 1.44 in the laminoplasty group and from pre-operative average of 2.67 to 2.11 in the laminectomy group. Pain improved in 39% and 8% in laminoplasty and laminectomy group respectively. There was some loss of range of movement in laminoplasty group, although the radiological effectiveness of decompression was greater in laminoplasty group.
Conclusion: Although both laminoplasty and laminectomy are effective at improving the clinical disease severity and quality of life, radiological results are more favourable in laminoplasty group. We therefore conclude that laminoplasty is an effective alternative to laminectomy in patients with cervical spondylotic myelopathy or radiculopathy.

KEYWORDS

Laminoplasty, Laminectomy, Cervical spondylotic myelopathy, Modified Nurick scale

INTRODUCTION AND BACKGROUND

Cervical spondylotic myopathy (CSM) is a progressive disease that often requires surgical intervention.[1] CSM is the leading cause of spinal cord dysfunction.[2] Cervical spondylotic myelopathy often involves multiple vertebral levels, and evidence regarding the natural history of CSM suggests that 20%–60% of patients will deteriorate neurologically.[3] Degenerative cervical spondylosis can result in spinal cord compression and injury, which can lead to myelopathy.[4] The spinal cord in CSM is compressed because of the degeneration of intervertebral discs and the secondary degeneration of stable structures, such as the uncovertebral joint, facet joint, posterior longitudinal ligament, and ligamentum flavum.[5] CSM can be treated through an anterior and/or posterior approach to the spine, and both approaches have been proven to be effective for multilevel disease.[6] Because compressive lesions leading to cervical myelopathy usually arise anteriorly, proponents of anterior surgery cite as advantages the ability to directly remove the majority of compressive lesions in the cervical spine, a muscle-sparing dissection, which results in minimal postoperative pain, and the ability to correct and decompress the cord over kyphotic lesions.[7] The two posterior approaches traditionally used are laminoplasty, and laminectomy with posterior spinal fusion (LPSF). Laminectomy alone is generally avoided given the significant risk for delayed postlaminectomy kyphosis.[8] In CSM Patients with more than 3 affected spinal cord segments, the posterior approach looks attractive given the accelerated complication rates associated with anterior surgery and especially fusion-related problems with long strut grafts to reconstruct multilevel corpectomies.[7]

OBJECTIVE

Majority of the previous comparative studies between laminoplasty and laminectomy done in a patient suffering from CSM did not show any significant difference in neurological outcome. A randomized controlled trial study is therefore necessary to determine the best currently available treatment for multi-level CSM. Purpose of this study is to compare the clinical outcome and radiological results following the operation in a similar group of patient at a 12 months of follow-up.

Over the past 5–10 years, there has been a greater understanding of the relation of regional and global spinal alignment with functional and pain outcomes. In particular, cervical alignment has been suggested as an important factor associated with neck pain. This study compared perioperative and follow up outcomes of patients who underwent either laminoplasty or LPSF.

STUDY DESIGN

Single centered prospective randomized blind control trial, in a tertiary care hospital.

SAMPLING

Simple random sampling.

MATERIALS AND METHODS

Study Cohort: A consecutive cohort of patients diagnosed with multilevel CSM based on physical examination and radiographic imaging was identified from the time period June, 2018 to May, 2019. All laminoplasties were performed with the Hirabayashi technique (single-hinge door) with plating (fig1) and LPSF was performed with screw-rod fixation. In general, the decision to pursue either LPSF or laminoplasty was case based and patient wishes were taken into account if they fit indications for both procedures.

Research Questions

Question 1: Laminectomy or laminoplasty- which treatment would be optimal with regard to the complications?
Question 2: which treatment is good in radiographic outcome?
Question 3: Which one is superior to the other in clinical outcome?
Question 4: Is there any specific complication associated with?

INCLUSION CRITERIA-

1. Informed written consent.
2. Aged 18 to 65 years
3. Patient diagnosed to have spondylotic cervical myelopathy (clinically and radiologically).
4. Patients scheduled to undergo either cervical laminoplasty or laminectomy.

EXCLUSION CRITERIA-

1. Age less than 18 years or more than 65 years.
2. Patients who underwent cervical spine surgery previously.
3. Patients with known coagulopathy.
4. Patients with severe systemic disorder (respiratory, cardiovascular, hepatic, renal, neurological).
5. Pregnant and lactating patients.
6. Morbidly obese.

Data collection

Parameter of Outcome were pain, quality of life and neurological outcome. Neurological outcome was evaluated based upon the Nurick

myelopathy grading. Parameter of quality of life was karnofsky performance score. The radiographic outcomes of interest were cervical lordosis, cervical sagittal vertical axis (SVA), and T-1 slope. All of these clinical and radiographic parameters were measured preoperatively and at the most recent follow-up at 3 months following the operation. Perioperative outcomes were complications, hospital length of stay (LOS) and readmissions (within 28 days of index surgical hospitalization).

STATISTICALANALYSIS

The cohort was stratified into two groups: patients who underwent laminoplasty and patients who underwent LPSF. Demographic profiles, baseline clinical variables, and outcome measures were compared between the two groups. Chi-square test for categorical outcomes and 2-tailed Student t-test for continuous outcomes, has been used. A p value < 0.05 considered as the threshold for statistical significance. All statistical analyses were performed using the SPSS 21.0 J for windows.

RESULTS

In our study, we included a total of 51 patients. There were 26 laminoplasty patients and 25 patients who underwent LPSF. Postoperative cervical sagittal Cobb's angles ranged from -7° (kyphosis) to 40° (lordosis) for laminoplasty patients and -5° (kyphosis) to 35° (lordosis) for LPSF patients. The mean age of all patients was 58.9 years.

List of Tables:

Table 1: Comparison Of Demographic Profiles And Preoperative Clinical Variables In Patients Who Underwent Laminoplasty Versus Lpsf.

Variable	Total	Laminoplasty	LPSF	p-value
No. of patient	51	26	25	-
Age (years)	58.92 ± 10.23	58.47 ± 9.87	59.38± 11.26	0.761
Males (%)	37 (72.54)	21 (56.75)	16 (43.24)	0.418
Preop neck pain	35 (68.63)	23 (80.77)	12 (48.00)	0.050
Preop VAS score	6.01± 2.27	6.17 ± 1.95	5.59 ± 2.44	0.326
Preop cobb angle(°)	9.16 ±10.87	7.58 ± 11.10	10.37 ± 9.87	0.345
Preop SVA (mm)	27.96 ± 12.39	24.55 ± 11.52	29.03 ± 13.37	0.211
Preop T1-slope (°)	25.88 ± 5.22	23.63 ± 4.61	26.10 ± 5.44	0.809
Preop Nurick score	2.58± 1.64	2.51 ± 1.72	2.67 ± 1.63	0.734
Karnofsky score	74.16 ± 15.87	71.80 ± 14.71	75.52 ± 17.94	0.422

*Data given as mean ± SD unless otherwise indicated.

Table 1 shows there was no statistically significant difference in age (p=0.761) and no gender bias (P=0.418) between the two study group. The overall incidence of preoperative neck pain was 80.4% and the mean VAS neck pain score was 6.0. Patients who underwent laminoplasty had a higher incidence of pain (laminoplasty 80.77% vs LPSF 48.00%, p=0.050) and mean VAS neck pain score (6.10 vs 5.50, p=0.326). The study groups were homogenous in terms of mean preoperative cervical sagittal Cobb angle, cervical SVA and T-1 slope value (p-values respectively 0.345, 0.211 and 0.809). Nurick scale score in the laminoplasty group had slightly lower value (2.51 vs 2.67), but the difference is not statistically significant (P=0.734). Mean karnofsky performance score was not statistically significant different in between the two study groups (p= 0.422).

Table 2: Comparison Of Perioperative Outcomes In Patients Who Underwent Laminoplasty Versus Lpsf

Periop Outcome	Total	Laminoplasty	LPSF	p-value
Mean no. of levels operated	3.91 ± 1.13	3.35 ± 0.87	4.48 ± 1.31	0.0007
Periop complications (%)	4 (7.84)	2 (7.69)	2 (8.00)	0.968
Mean LOS	3.75 ± 2.06	3.48 ± 2.12	4.59 ± 2.03	0.062
No. of 4-weeks readmissions (%)	3 (5.88)	1(3.85)	2 (7.69)	0.559

Table 2 compares perioperative outcomes between patients who underwent laminoplasty and those who underwent LPSF. There was a statistically significant difference in the number of levels operated between the two groups (p < 0.0007). The overall perioperative surgical complication rate was 7.84%, and the mean hospital LOS was 3.75 days, however there was no statistically significant difference in these two parameters (respective p-values are 0.968 and 0.062). The overall 28-day readmission rate was 5.88%, and it is not statistically significantly different between the two groups (p=0.559).

Table 3: Comparison Of Follow-up Outcomes Between Patients Who Underwent Laminoplasty Versus Lpsf.

Variable	Total	Laminoplasty	LPSF	p-value
No. of patients	51	26	25	-
Long term complications (%)	3 (5.88)	1 (3.85)	2 (8.00)	0.533
Neck pain (%)	25 (71.43)	14 (60.87)	11 (91.67)	0.011
VAS score	3.22 ± 3.75	2.79 ± 3.55	3.99 ± 3.86	0.253
Loss of range of neck flexion (%)	24.56 ± 11.22	32.81 ± 13.39	25.34± 10.98	0.034
Loss of range of neck extension (%)	33.46 ± 12.99	46.93± 12.78	35.87± 13.44	0.004
Loss of range of neck lateral flexion (%)	9.98 ± 11.42	12.45 ± 10.65	8.89 ± 11.87	0.265
Loss of range of neck rotation (%)	15.56 ± 8.54	17.35 ± 8.90	13.97 ± 7.98	0.160
Cervical cobb angle (°)	7.80 ± 10.42	5.70 ± 10.82	9.50 ± 10.13	0.202
cervical SVA (mm)	30.09 ± 13.45	28.72 ± 13.69	32.11 ± 13.34	0.375
T-1 slope (°)	27.55 ± 6.32	25.87 ± 6.66	28.13 ± 5.95	0.208
Dorsal cord shift	3.79± 4.31	4.57 ± 3.88	2.45 ± 4.56	0.080
Nurick scale score	1.87 ± 2.50	1.44 ± 2.32	2.11 ± 2.75	0.351
Karnofsky score	84.58 ± 15.63	85.05 ± 14.89	83.78 ± 16.74	0.776
Length of follow-up (mos)	7.10 ± 1.37	6.82 ± 1.21	7.15 ± 1`.53	0.396

Table 3 compares long-term complication rates, neurological status, radiological parameters and the quality of life (QoL) in the study groups. All 51 patients were available during the follow-up. The mean follow-up length was 7.1 months. There was no statistically significant difference in the follow-up durations between the two study groups (p = 0.396). The overall long-term complication rates were 5.88%. Patients who underwent LPSF had significantly higher long-term complication rates than laminoplasty patients, although it was not statistically significant (p= 0.533). There was a statistically significant disappearance of pain during the follow-up in the laminoplasty group, compared to the laminectomy (p=0.11), however VAS score was not statistically significantly different between the two groups (p=0.253). Post operatively, both the group had loss of range of neck movements. However there was statistically significant difference only during flexion and extension movements (p=0.034 and 0.004, respectively), it was not statistically significant different during lateral flexion and rotation movements (p=0.265 and 0.160, respectively) between the two groups. The overall mean cervical Cobb's angle was 9.16° of lordosis in the preoperatively which is 7.8° post operatively. Post operatively the mean cobb's angle is 5.7° and 9.5° in laminoplasty and laminectomy group, respectively (p=0.202). Mean follow-up cervical SVA and T-1 slope were 30.09 mm and 27.55°, respectively. There were no significant differences in cervical SVA (28.72 vs 32.11 mm, p = 0.375) or T-1 slope (25.87° vs 28.13°, p = 0.208) between groups. During the follow-up the dorsal spinal cord shift has been measured which was more in the laminoplasty group (p=0.80). Fig2 showing the MRI image of the spine, 6 months following the laminoplasty and fig3 showing the pre-operative image of the same patient. Nurick scale improved from pre-operative average of 2.51 to 1.44 in the laminoplasty group and from pre-operative average of 2.67 to 2.11 in

the laminectomy group (p = 0.351).During the follow up, both the group had improved karnofsky performance score, however there was no significant differences in karnofsky score (85.05 vs 83.78, p = 0.776) between the groups.

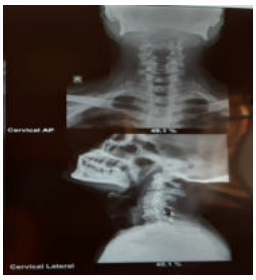

Fig1: Postoperative neutral lateral cervical radiograph showing C4–6 Hirabayashi (single-hinge door) laminoplasty.

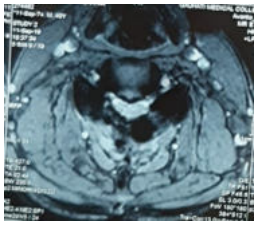

Fig2: Postoperative MRI (spine) image of a patient who underwent laminoplasty 6 months before.

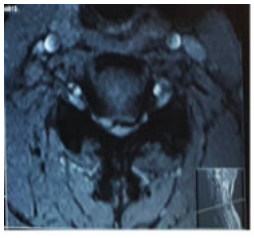

Fig3: Pre-operative MRI (spine) image of the same patient whose post-operative image was shown in fig2.

DISCUSSION

Laminoplasty is primarily used to treat CSM caused by ossification of the PLL.[9] Laminoplasty was first described in 1968 and much of the literature comes from asia.[10,11] Several studies have demonstrated that laminoplasty offers neurological improvement (modified Japanese Orthopaedic Association [JOA], Odom, and Nurick scales) similar to that of LPSF in the treatment of multilevel CSM.[12,13,14] No studies demonstrate that laminoplasty is superior to laminectomy alone, laminectomy with posterior fusion or anterior decompression with fusion for the treatment of CSM.[15,16] The decision as to which surgical procedure to perform is not always transparent and often depends on a multitude of patient- and clinically related factors, such as age, medical morbidity (risk for surgery), neck pain, cervical lordosis, axial movement with neck flexion-extension, and social factors.[17,18] Cervical LPSF is generally accepted as a more invasive surgery with higher morbidity than laminoplasty. This is not surprising as LPSF requires additional muscle exposure (dissection to the lateral masses), spinal fixation, and bone arthrodesis, which can result in greater intraoperative blood loss and postoperative pain.[19,20] Furthermore, pseudarthrosis becomes a concern with LPSF over time, and reported rates are as high as 38%.[14] However, the actual difference in perioperative morbidity and complications between multilevel laminoplasty and LPSF is relatively small and patients tolerate both procedures well. In fact, it has been suggested that when addressing more than 4 levels, postoperative pain following laminoplasty is greater than that in LPSF.[21] Laminectomy and laminoplasty patients demonstrated improvement in gait, strength, pain and improvement in myelopathy.[22]

In our cohort, we did not find any significant difference between the two study groups in regard to the Periop complications, Mean hospital LOS and No. of 4-weeks readmissions rate. However laminoplasty is associated with statistically significant less neck pain. But, the loss of range of neck movement (particularly flexion and extension) is more with laminoplasty. Cervical Cobb's angle, cervical SVA, T-1 slope is only minimally different between the two study group and so the karnofsky performance score. Nurick scale score has been improved more in the laminoplasty group. The radiological decompression is more in the laminoplasty group, as the post-operative dorsal cord shift is more.

LIMITATIONS

As the indications for laminoplasty and LPSF are different and often overlapping with each other, there is an inherent patient selection bias. Furthermore, the timeframe for the follow-up clinical evaluation after surgery was not long enough to comment on some particular issues like long term post-operative complications, delayed neurological sequel or recurrence of the symptoms.

RECOMMENDATIONS

Our study forms a basis for further research work and assessment on a much larger scale to make a precise guideline for the surgical management of this particular patient group.

CONCLUSION

Multilevel laminoplasty and LPSF are both safe and effective procedures associated with low morbidity for the treatment of CSM with immediate stability of the cervical spine. Both these procedures prevents kyphotic deformity and precludes further development of the spondylosis at the fused level. Findings from this study show that although patients who had undergone LPSF had better preservation of the range of neck movements, the control of neck pain and the resolution of myelopathy is better in the laminoplasty group. Radiological parameter of cervical decompression is also better in the laminoplasty. However, there are only minimal difference among other parameters of outcome following operation which are insignificant both clinically and statistically. Based on this analysis, we believe that laminoplasty is an effective alternative to laminectomy in patients with multi-level cervical spondylotic myelopathy or radiculopathy.

ACKNOWLEDGEMENTS

Authors are thankful to all staff of Department of Neurosurgery, Gauhati Medical College and Hospital, Guwahati, Assam, India.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

CONFLICTS OF INTEREST

No conflict of interest associated with this work.

REFERENCES

1. Sampath P, Bendebba M, Davis JD, Ducker TB: Outcome of patients treated for cervical myelopathy. A prospective, multicenter study with independent clinical review. Spine 2000, 25; 670-76.
2. Woods BI, Hohl J, Lee J, Donaldson W III, Kang J: Laminoplasty versus laminectomy and fusion for multilevel cervical spondylotic myelopathy. Clin Orthop Relat Res 469:688– 695, 2011.
3. Harroud A, Labelle H, Joncas J, Mac-Thiong JM: Global sagittal alignment and health-related quality of life in lumbosacral spondylolisthesis. Eur Spine J 22:849–856, 2013.
4. Matz PG, Anderson PA, Holly LT, Groff MW, Heary RF, Kaiser MG, et al: The natural history of cervical spondylotic myelopathy. J Neurosurg Spine 11:104–111, 2009.
5. Edwards CC II, Riew KD, Anderson PA, Hilibrand AS, Vaccaro AF: Cervical myelopathy. Current diagnostic and treatment strategies. Spine J 3:68–81, 2003.
6. Luo J, Cao K, Huang S, Li L, Yu T, Cao C, et al: Comparison of anterior approach versus posterior approach for the treatment of multilevel cervical spondylotic myelopathy. Eur Spine J 24:1621–1630, 2015.
7. Rhee JM, Basra S: Posterior surgery for cervical myelopathy: laminectomy, laminectomy with fusion, and laminoplasty. Asian Spine J 2:114–126, 2008.
8. Albert TJ, Vacarro A: Postlaminectomy kyphosis. Spine (Phila Pa 1976) 23:2738–2745, 1998.
9. Handa Y, Kubota T, Ishii H, et al. Evaluation of prognostic factors and clinical outcome in elderly patients in whom expansive laminoplasty is performed for cervical myelopathy due to multi segmental spondylotic canal stenosis: a retrospective comparison with younger patients. J Neurosurg (spine 2). 2002; 96:173-179.
10. Masaki Y, Yamazaki M, Okawa A, et al. An analysis of factors causing poor surgical outcome in patients with cervical myopathy due to ossification of the posterior longitudinal ligament: anterior decompression with spinal fusion versus laminoplasty. J Spinal Disord Tech. 2007; 20(1): 7-13.
11. Nagata K, Ohashi T, Abe J, et al. Cervical myelopathy in elderly patients: clinical results and MRI findings before and after decompression surgery. Spinal Cord. 1996; 34: 220-226.
12. Highsmith JM, Dhall SS, Haid RW Jr, Rodts GE Jr, Mummaneni PV: Treatment of cervical stenotic myelopathy: a cost and outcome comparison of laminoplasty versus laminectomy and lateral mass fusion. J Neurosurg Spine 14:619–625, 2011.
13. Woods BI, Hohl J, Lee J, Donaldson W III, Kang J: Laminoplasty versus laminectomy and fusion for multilevel cervical spondylotic myelopathy. Clin Orthop Relat Res 469:688– 695, 2011.
14. Yoon ST, Hashimoto RE, Raich A, Shaffrey CI, Rhee JM, Riew KD: Outcomes after laminoplasty compared with laminectomy and fusion in patients with cervical myelopathy: a systematic review. Spine (Phila Pa 1976) 38 (22 Suppl 1): S183–S194, 2013.
15. Lizuka H, Lizuka Y, Nakagawa Y, et al. Interlaminar bony fusion after cervical laminoplasty: its characteristics and relationship with clinical results. Spine. 2006;

31(6): 644-47.
16. Kawaguchi Y, Kanamuri M, Ishihara H, et al. progression of ossification of the posterior longitudinal ligament following en bloc cervical laminoplasty. J Bone Joint Surg Am. 2001; 83: 1798-1802.
17. Protopsaltis T, Schwab F, Bronsard N, Smith JS, Klineberg E, Mundis G, et al: The T1 pelvic angle, a novel radiographic measure of global sagittal deformity, accounts for both spinal inclination and pelvic tilt and correlates with health-related quality of life. J Bone Joint Surg Am 96:1631–1640, 2014.
18. Schwab F, Patel A, Ungar B, Farcy JP, Lafage V: Adult spinal deformity-postoperative standing imbalance: how much can you tolerate? An overview of key parameters in assessing alignment and planning corrective surgery. Spine (Phila Pa 1976) 35:2224–2231, 2010.
19. Heller JG, Edwards CC II, Murakami H, Rodts GE: Laminoplasty versus laminectomy and fusion for multilevel cervical myelopathy: an independent matched cohort analysis. Spine (Phila Pa 1976) 26:1330–1336, 2001.
20. Varthi AG, Basques BA, Bohl DD, Golinvaux NS, Grauer JN: Perioperative outcomes after cervical laminoplasty versus posterior decompression and fusion: analysis of 779 patients in the ACS-NSQIP database. J Spinal Disord Tech 29:E226–E232, 2016.
21. Nurboja B, Kachramanoglou C, Choi D: Cervical laminectomy vs laminoplasty: is there a difference in outcome and postoperative pain? Neurosurgery 70:965–970, 2012.
22. Kaminsky SB, et al: Operative treatment of cervical spondylotic myelopathy and radiculopathy. A comparison of laminectomy and laminoplasty at 5 year average follow-up. Lowa Ortho J 23(3); 34: 2004.