ORIGINAL ARTICLE

Comparison of Laminoplasty with Laminectomy and fusion in the management of Multilevel Cervical Spondylotic Myelopathy

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ABSTRACT

Aim: To compare the functional outcome (improvement in pain and gait) and complication rates in the patients who underwent laminoplasty or laminectomy plus fusion for multilevel cervical spondylotic myelopathy in our hospital. Secondily, the study will also provide comparative analysis of pre-operative statistics including age, gender, and duration and severity of myelopathic symptoms in the studied population

Methods: The patients who underwent laminoplasty and laminectomy plus fusion for multilevel cervical spondylotic myelopathy at the Department of Neurosurgery, DHQ Teaching hospital, Gujranwala from June 2015 to May 2019 were retrospectively analysed. Information collected included patient's age, gender, duration of symptoms, severity of myelopathy (Nurick grade), operation time, blood lost during surgery, hospital stay duration, objective improvement in patient function/Nurick grade, subjective improvement in pain and gait, and post-operative complications. Statistical analysis was done using SPSS version 25.

Results: Out of 48 patients, 28(58.3%) underwent laminectomy with fusion while 20(32.7%) underwent laminoplasty. Both cohorts had similar preoperative data including age (p=0.884), gender (p=0.635) duration of symptoms (p=0.918), and Nurick grade (p=0.827). In comparison to laminectomy with fusion group, the patients who underwent laminoplasty had significantly lesser operation time (1.65±0.54 hours vs 2.64±0.54 hours, p<0.01), lesser blood loss (198.00±82.44 ml vs 352.68±118.09ml hours, p<0.01),

Conclusion: Laminoplasty had lesser operation time, blood loss, and hospital stay time than laminectomy with fusion among patients with multilevel cervical spondylotic myelopathy, however subjective and objective outcomes and complication rates were nearly similar with both procedures, suggesting non-superiority of one over other. Prospective trials with large sample size are required to find whether one procedure is truly superior

Keywords: Cervical spondylotic myelopathy, Laminectomy with fusion, Laminoplasty, SPSS

INTRODUCTION

Cervical spondylotic myelopathy is common in elderly people world-wide[1]. It affects upto 5% of people of age more than 40 years[2]. It often involves multiple vertebral levels and results progressive neurologic deterioration[3]. Now a days, laminectomy with posterior fusion[4] and laminoplasty[5] are two surgical modalities utilized for the management of multilevel cervical spondylotic myelopathy. Addition of posterior spinal fusion to laminectomy is essential to escape the patients from the risk of postlaminectomy kyphosis[6]. Both current modalities are not without morbidites. Laminectomy with fusion is associated with increased risk of adjacent segment degeneration. Laminoplasty evolved in Japan in 1970[7]. It results less alteratuion in spine natural biomechanics, however it is associated with mechanical neck pain. It is also absolutely contraindicated in kyphotic cervical alignment[8]. Our both surgical modalities are associated with some risks and benefits, non is gold standard. Internationally, several studies and meta-analyses are available favouring benefits of both laminectomy plus fusion and laminoplasty in patients with multilevel cervical spondylotic myelopathy, however superiority of one surgical modality over the other is a subject of contraversy in the avaiable literature[9-11]. Secondly, these majority literature findings were from Western population, local studies about comparison of laminectomy and fusion with laminoplasty are scarce. Therefore, the objective of this study was to compare the functional outcome (improvement in pain and gait) and complication rates in the patients who underwent laminoplasty and laminectomy plus fusion for multilevel cervical spondylotic myelopathy in our hospital. Secondily, the study will also provide comparative analysis of pre-operative statistics including age, gender, and duration and severity of myelopathic symptoms in the studied population.

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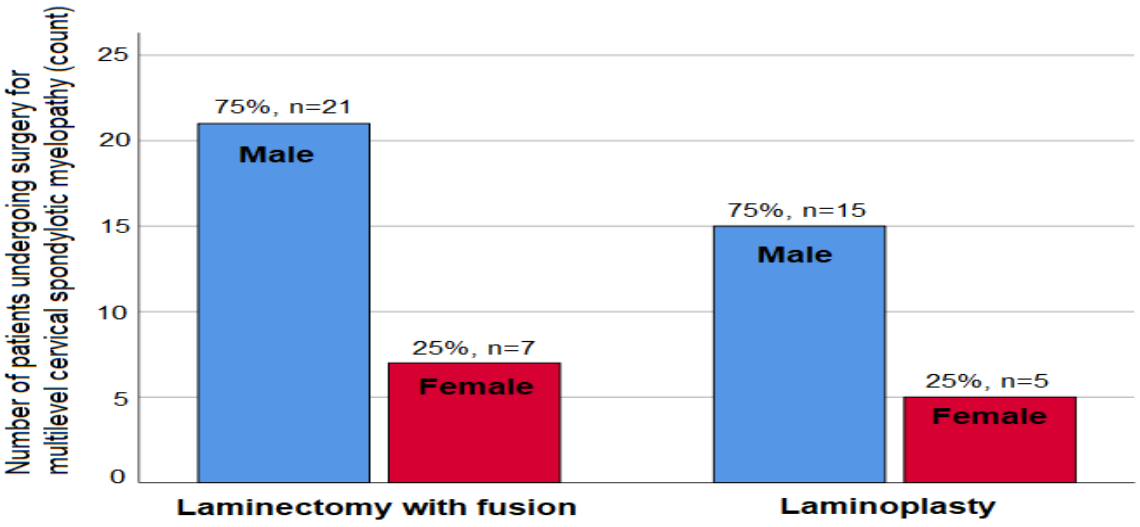
MATERIAL AND METHODS

The patients who underwent laminoplasty or laminectomy plus fusion for multilevel cervical spondylotic myelopathy at the Department of Neurosurgery, DHQ Teaching hospital, Gujranwala from June 2015 to May 2019 were retrospectively analysed. Inclusion criteria were (1) patients with progressive myelopathy or myeloradiculopathy symptoms and signs who failed nonsurgical therapies, (2) multilevel disease with cord compression at ≥3 levels on imaging; and (3) lordotic sagittal alignment with absent large anteriorly located osteophyte. The patients with metabolic disorders, cervical fractures, tumor, instability of cervical segment, history of cervical spine operation, or those with combined laminectomy and laminoplasty were

excluded. Information collected included patient's age, gender, duration and severity of myelopathic feature (Nurick grade), operation time, blood lost during surgery, hospital stay duration, objective improvement in patient function/Nurick grade, subjective improvement in pain and gait, and post-operative complications. According to Nurick clinical grading of myelopathy,[12] root disease without spinal cord involvment was grade zero, while cord disease without walking difficulty was grade 1. Patients with slight walking difficulty which does not restrict full-time employment were in grade 2, while patients with extreme walking difficulty which restrict full-time employment were in grade 3. The walking difficulty which requires assistance of someone, or walker is grade 4, while bed-ridden or chair bound patient is in grade 5. Each procedure was personalized to the patient's discrete pathology. At least 6 months after surgery, gait and pain improvement was assessed on a on a 5-point scale, where very good, good, fair, poor, or very poor was noted on a descending scale from 1 to 5. A response in area of very good (1) or good (2) for each gait and pain was considered a positive response to surgery. In addition to this subjective measurement, we also noted objective improvement in patient function by measuring improvement in the Nurick grade at 6 months after surgery. Postoperative imagings obtained at 1- and 6-months' follow-up were analyzed for problems with hardware (loose or broken screws), cervical lordosis, and lucent portion around the work area. In addition to that other postoperative complications were also noted. All findings were recorded in a structured performa. Statistical Package for Social Science (SPSS), version 25 was used. Means with standard deviations were computed of quantitative variables, and frequencies-percentages for qualitative variables. Chi-square test for independence and Independent sample T test were used for qualitative and quantitative variables respectively to determine their significant association with type of surgery. The p values were taken statistically significant if < 0.05.

RESULTS

Out of 48 patients with multilevel cervical spondylotic myelopathy, 28 patients underwent laminectomy with fusion while 20 underwent laminoplasty. Both cohorts had similar preoperative data. In both procedure groups, there was no statistically significant difference of mean age of the patients (64.21±5.79 years vs 63.95±6.59 years, p=0.884), mean duration of symptoms (14.04±4.43 months vs 13.90±4.54 months, p=0.918), and mean preoperative Nurick grade (3.36± 0.83 vs 3.30±0.92, p=0.827) (Table 1). Similarly, the distribution of gender in both cohorts was similar (p=0.635) (Picture 1&Table 2). In comparison to laminectomy with fusion group, the patients who underwent laminoplasty had significantly lesser operation time (1.65±0.54 hours vs 2.64±0.54 hours, p<0.01), lesser blood loss (198.00±82.44 ml vs 352.68±118.09ml hours, p<0.01), and lesser hospital stay time (3.50±0.83 days vs 4.86±1.27days, p<0.01) (Table 1). There was a similar result of objective improvement in Nurick grade after laminectomy with fusion and laminoplasty (67.9% vs 65%, p=0.539), and subjective improvement in pain (71.4% vs 70%, p=0.582) and gait (60.7% vs 60%, p=0.597). The incidence of post-surgery complications was also similar in both cohorts (10.7% vs 10%, p=0.660) (Table 2). Chronic pain, instrumentation failure, deep infection, and development of kyphotic alignment were the post-operative complications in laminectomy with fusion group, while chronic pain and persistent radiculopathy were seen in laminoplasty group. One patient in each cohort required revision surgery.



Picture 1: Gender wide distribution of patients who underwent Laminectomy-fusion and Laminoplasty (n=48)

Table 1: *Associations of various quantitative variables* with type of procedure (Laminectomy with fusion vs Laminoplasty) performed in patients s*uffering* multilevel cervical spondylotic myelopathy *(n = 48)* [*]

Quantitative variables	**Type of procedure**		**Mean difference**	**p-value**
	Laminectomy fusion (mean + SD)	**Laminoplasty** (mean + SD)		
Age (years)	64.21±5.79	63.95± 6.59	0.26	0.884
Duration of symptoms (months)	14.04± 4.43	13.90±4.54	0.14	0.918
Severity of myelopathy (Nurick grade)	3.36± 0.83	3.30± 0.92	0.06	0.823
Operation time (hours)	2.64± 0.54	1.65± 0.54	0.99	<0.01
Blood loss (ml)	352.68± 118.09	198.00± 82.44	154.168	<0.01
Hospital stay (Days)	4.86± 1.27	3.50± 0.83	1.36	<0.01

[*]Independent sample T-test was used

Table 2: *Associations of various qualitative variables* with type of procedure (Laminectomy with fusion vs Laminoplasty) performed in patients s*uffering* multilevel cervical spondylotic myelopathy *(n = 48)* [*]

Predictors / Factors	**Type of procedure**		**Total**	**p-value**
	Laminectomy fusion	**Laminoplasty**		
Gender:				
Male	21 (75%)	15 (75%)	36 (75%)	0.635
Female	07 (25%)	05 (25%)	12 (25%)	
Objective improvement in patient function (Nurick grade)**:**				
Yes	19 (67.9%)	13 (65%)	32 (66.7%)	0.539
No	09 (32.1%)	07 (35%)	16 (33.3%)	
Subjective improvement in pain:				
Yes	20 (71.4%)	14 (70%)	34 (70.8%)	0.582
No	08 (28.6%)	06 (30%)	14 (29.2%)	
Subjective improvement in gait:				
Yes	17 (60.7%)	12 (60%)	29 (60.4%)	0.597
No	11 (34.3%)	08 (40%)	19 (39.6%)	
Post-operative complications:				
Yes	03 (10.7%)	02 (10%)	05 (10.4%)	0.660
No	25 (89.3%)	18 (90%)	43 (89.6%)	

[*]Chi-square test for independence was used

DISCUSSION

Cervical spondylotic myelopathy mainly affects male in their 7th decade of life.[13] Michael G. Fehlings et al studied multilevel cervical spondylotic myelopathy patients where dominant gender was male (71.2%) in studied population.[14] A study from Egypt also showed that patients suffering from multilevel cervical spondylotic myelopathy who came for surgical decompression belonged to male gender mainly (65.8%).[15] In our study, 75% of the total of cervical spondylotic myelopathy patients were male. Huairong Ding et al[16] studied multilevel cervical spondylotic myelopathy patients who were offered laminoplasty and laminectomy with fusion at Tianjin University hospital, China. Mean age of the patients with multilevel cervical spondylotic myelopathy was 61.9±10.6 years, while gender was dominantly male (76.7%, 89 out of 116). Darryl Lau et al[17] found that in comparison to laminoplasty, laminectomy plus fusion exhibited a higher long-term complication rate (p = 0.036), more perioperative blood loss (p < 0.001), and longer hospital stay (p = 0.054). Mean age of all patients was 63.0 years. Similarly in our study, mean age of the patients was 64.10±6.068 years which suggest that the disease prevalence in 7th decade globally. In our study, both surgical modalites had comparable clinical outcome findings as well as complication rates. Objective improvement in patiens function (a fall in Nurick grade) laminectomy plus fusion and laminoplasty was seen in 67.9% and 65% patients respectively. The association was statistically insignificant (p=0.635). Similarly, subjective improvement in pain occured in 71.4% and 70% patients respectively after two therapeutic surgical modalities. Subjective improvement in gait also occured in 60.7%, and 60% patients respectively. Similarly, Chang-Hyun Lee and colleagues observed a similar loss of lordosis as well as clinical improvement in both groups of multilevel cervical spondylotic myelopathy patients managed with laminoplasty and laminectomy with fusion[18]. In a systematic review of 15 studies,insignificant difference was found in the incidence of surgical and neurological complications in multilevel cervical spondylotic myelopathy patients treated with both laminoplasty and laminectomy with fusion[19]. On the other hand, Chiazor U Onyia & Sajesh K Menon demonstrated that laminoplasty have a better functional outcome compared to laminectomy and fusion.[20] In a meta-analysis of 23 studies about patients treated with laminectomy followed by fusion and laminoplasty, it was concluded that there was no statistically significant difference in JOA scores improvement rate (p=0.27), pain improvement rate (p=0.94), total complications rates (p=0.07), and blood loss (p=0.51).[21] A meta-analysis of 14 studies[22] revealed no significant difference in terms of postoperative neck pain relief (*P*=.64), improvement in Nurick grade (*P*=.16) and reoperation rate (*P*=.21) between two surgical modalities groups. Compared with laminoplasty group, complication rate (*P* < .00001) was higher in the laminectomy-fusion group. In our study, patients undergoing laminoplasty had significantly lesser operation time duration (p<0.01), lesser blood loss (p<0.01), and shorter hospital stay duration (p<0.01) than

patients undergoing laminectomy with fusion. Simialrly, Xiang Lin and his team concluded that laminoplasty had a shorter operation time (P<.05), lesser blood loss (P<.05), and a lower complication rate (P<.05) than laminectomy with fusion.[23] In another study, multilevel cervical spondylotic myelopathy patients treated with both laminoplasty and laminectomy with fusion achieved good but a statistically simiar clinical improvement. However, laminoplasty group showed lower mean operation time (p< 0.001) and mean blood loss (p=0.03) than laminectomy fusion group.[24] Hence, both laminoplasty and laminectomy with fusion have excellent clinical improvement and coparable complications and risk. Mullticenteric studies with larger sample size may nominate single best modalit as the standard of care in patients with multilevel cervical spondylotic myelopathy.

CONCLUSION

Laminoplasty had lesser operation time, blood loss, and hospital stay duration than laminectomy with fusion among patients with multilevel cervical spondylotic myelopathy, however subjective and objective outcomes and complication rates were nearly similar with both procedures, suggesting non-superiority of one over other. Prospective trials with large sample size are required to find whether one procedure is truly superior.

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