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Laminoplasty versus Laminectomy for Multilevel Cervical Spondylotic Myelopathy - A Prospective Study in a Tertiary Level Hospital

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Abstract

Background: Laminoplasty (LP) and Laminectomy (LT) are the two conventional approaches for posterior surgical decompression of Multilevel Cervical Spondylotic Myelopathy (MCSM), but the superiority in between the two remains controversial.
Aim: This study was conducted to compare the clinical outcomes between laminoplasty and laminectomy without fusion for MCSM.
Methods: We prospectively studied a total of 40 cases of MCSM. The patients were included after careful history taking, physical examination and appropriate investigations; and those who fulfilled inclusion and exclusion criteria. Multiple variables were studied, including; demographic data, clinical variables, surgical variables, and functional outcomes. Comprehensive outcome was assessed by Modified Odom's criteria.
Results: The postoperative Visual Analog Scale (VAS), Nurick grading and Modified Japanese Orthopaedic Association (mJOA) score were significantly improved at 12 months in both groups. Though not significant, the laminoplasty group had relatively better improvement in all of the outcome measurement scale compared to the laminectomy group. Overall, the satisfaction rate was 90% and 80% in the laminoplasty and laminectomy groups, respectively ($p > 0.05$) at the end of 12 month follow-up.
Conclusions: Although insignificant, laminoplasty provided better results; in regards to functional outcomes and post-operative complications than laminectomy without fusion for the management of MCSM.

Keywords: Cervical spondylotic myelopathy; Laminectomy; Laminoplasty; Multilevel

Introduction

Cervical Spondylotic Myelopathy (CSM) is the most common cause of atraumatic spastic quadriparesis in the elderly population, generally progresses in slow, stepwise fashion [1]. It affects upto 5% of people of age more than 40 years [2]. The most common causes of this condition are multisegmented cervical spondylosis (MSCS), Ossification of Posterior Longitudinal Ligament (OPLL) and developmental spinal canal stenosis [3]. There are numerous surgical modalities to the address MCSM depending on the pattern and the levels of involvement, however dominance of one surgical modality over the other is a matter of debate [4,5]. Cervical LP and LT are the two most commonly used procedures for addressing multilevel CSM, as both can halt myelopathic progression and improve patients' symptoms [6-8].

However, each are linked with specific morbidity and debate exists as to which surgical intervention should be the standard of care in patients with multilevel CSM and to maintained cervical lordosis. To the authors' knowledge, few retrospective cohort studies that compare the laminoplasty against laminectomy without fusion for multilevel CSM are available, but there are no accounts of prospective randomized control trials. The purpose of this study was to evaluate the clinical outcomes of LP and LT without fusion, for patients with MCSM, and also compare the operative time, blood loss, surgical complications in between these two procedures, so as to aid surgeons to match these two options.

Methods

With approval from the Institutional Review Board (Ref. no. 8173), we prospectively studied post-operative outcomes for 40 patients with MCSM, who underwent decompressive laminoplasty or laminectomy in the Department of Orthopaedic Surgery, BSMMU, Dhaka, from January 2018 to January 2021. The patients were diagnosed by clinically and radiological investigations. After taking informed written consent, detailed history and physical examination; plain radiographs and MRI/ CT scan of cervical spine were done. Plain radiographs included anterior-posterior & lateral, and flexion/ extension views; to determine the general alignment of cervical spine along with segmental instability. MRI/CT scans documented cord compression, identify signal changes within the spinal cord and assess the neural foramen or the presence of OPLL. Degenerative changes were noted in plain X-ray of cervical spine in all cases (Figure 1a,b, Figure 2a,b). MR imaging showed MSCS in 40 cases and cord signal changes were found in 3 cases in T2 weighted images and in one case cord signal change was found in both T1 and T2 weighted images (Figure 1c & 2c). All other necessary investigations for surgery and to exclude differential diagnosis for cervical myelopathy were performed before operation. Patients were allocated into two groups by purposive randomized sampling methods, after they met the inclusion criteria. Those with an odd serial number were classified as a laminoplasty group (n=20), whereas patients with even numbers were classified as a laminectomy (without fusion) group (n=20). The inclusion criteria for this study were (1) patients with multilevel cervical spondylotic myelopathy; (2) failed conservative treatment, (3) 3 or more than 3 level involvements, (4) age more than 45 years and (5) positive MRI findings. Excluded were: (1) cervical spine injury like fracture or dislocation, (2) peripheral neuropathy, (3) infections or tumours (4) kyphotic deformity or instability. Records of 12 men and 8 women aged 47 to 65 (mean,55.4 ± 5.56) years who underwent LP at C3-5 level (n=10), C4-6 (n=8) and C3-6 (n=2), and; 14 men and 6 women aged 48 to 64 (mean, 55.7 ± 5.06) years who underwent LT without fusion at C3-5 level (n=12), C4-6 (n=6) and C3-6 (n=2) were reviewed. Demographics, clinical variables and surgical data including number of levels of surgery, length of surgery, Estimated Blood Loss (EBL), length of hospitalization (Table 1), and complications were collected; and assessment before and after treatment were done by using VAS, Nurick grading and mJOA score. Comprehensive outcome of each patent was done by using Odom's criteria. Patients were followed up at 1, 3, 6, 12 months consequently and yearly thereafter. The quantitative data were analyzed statistically using the SPSS (Statistical Package for the Social Sciences), version 25, Armonk, NY, IBM Corp. Mann-Whitney U Test, Friedman test and chi-square test were performed as applicable. The results were expressed as percentage and mean ± SD and $p < 0.05$ was considered as the level of significance.

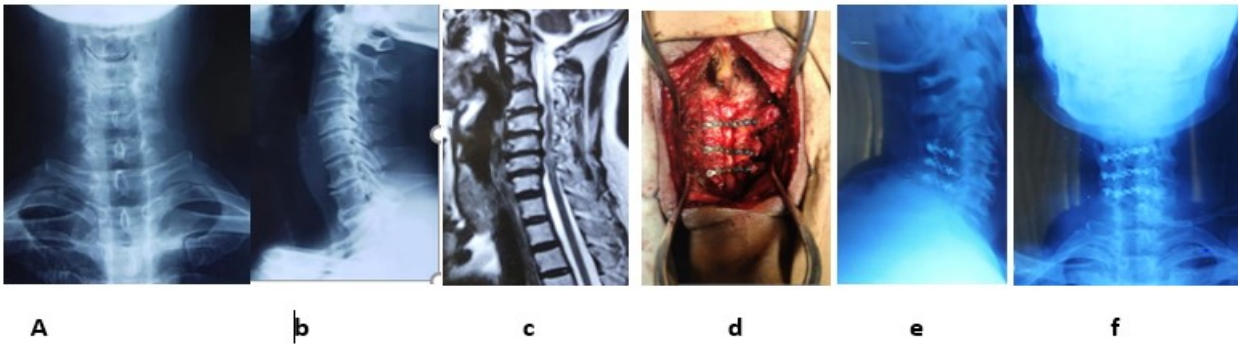

Figure 1: 49-year-old male, diagnosed spastic quadriparesis **(a, b)** plain X-ray cervical spine A-P and lateral view shows multilevel cervical spondylosis **(c)** sagittal section T2 weighted MRI shows MCSM compressing the cord at C3/4 to C5/6 **(d)** per operative picture **(e,f)** x-ray lateral and A-P view at 12 months after laminoplasty.

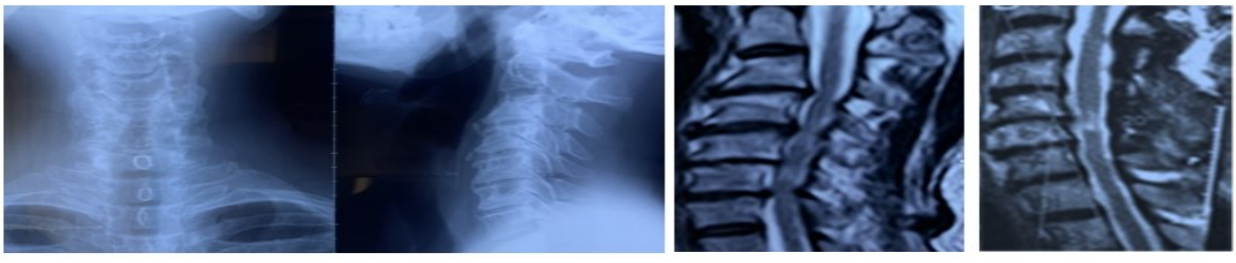

Figure 2: 55 year old man, diagnosed quadriparesis due to MCSM involving at C3/4 to C6/7; **(a,b)** plain X-ray cervical spine A-P and lateral view shows multilevel cervical spondylosis, **(c)** sagittal section T2 weighted MRI shows MCSM compressing the cord **(d)** MRI at 12 months after laminectomy.

	Laminoplasty (%)	Laminectomy (%)	P value
Age(years)			
<50	4 (20)	2 (10)	0.815*
50-59	12 (60)	14 (70)	
>60	4 (20)	4 (20)	
Mean	55.4 ± 5.56	55.7 ± 5.06	1.00**
Sex			
Male	12 (60)	14 (70)	1.00*
Female	8 (40)	6 (30)	
Residence			
Rural	8 (40)	14 (70)	0.370*
Urban	12 (60)	6 (30)	
Occupation			
Service holder	4 (20)	2 (10)	
Day laborer	4 (20)	4 (20)	0.90*
Business	2 (10)	4 (20)	
Farmer	6 (30)	4 (20)	
House wife	4 (20)	6 (30)	
Disc space invol. (No. of lamina)			
C3/4, C4/5, C5/6 (3)	10 (50)	12 (60)	
C4/5, C5/6, C6/7 (3)	8 (40)	6 (30)	0.890*
C3/4, C4/5, C5/6, C6/7 (4)	2 (10)	2 (10)	
Duration of disease (Months)			
<6	4 (20)	4 (20)	
6-12	10 (50)	12 (60)	0.865*
>12	6 (30)	4 (20)	
*Pearson chi-squired Test(x^2) **Mann-Whitney U test			

Table1: Demographic characteristic of patients with Laminoplasty and Laminectomy (n=20).

Surgical Techniques

Open-Door Laminoplasty and Laminectomy

After obtaining informed written consent, the patient is prepared for operation. The patient is anesthetized under general anesthesia after intravenous and arterial access is obtained. The patient is catheterized and then placed in prone position on to the longitudinal bolsters with the abdomen free thus minimizing venous pressure. All bony prominences are padded and the cervical spine is immobilized with Gardner Wells tong traction with 12-15 lbs. weight, and the neck is positioned into a neutral to slightly flexed configuration. The venous pressure is also diminished at the surgical site by keeping the bed in reverse trendelenburg position. The knees are bent with the legs appropriately padded in order to prevent the patient from sliding caudally. For optimal exposure and localization by lateral x-ray of cervical spine, the shoulders are then fastened longitudinally in order to allow them to be pulled caudally. All operative procedures were performed under the care of the same surgeon.

A midline longitudinal incision is made at the desired level. To reduce muscle damage and bleeding, it is strictly mandate to stay in the midline raphe and subperiosteal. Without disrupting the facet joint capsule, the exposure is carried out laterally to just beyond the lateral mass-laminar junction. The C2 and C7 spinous process muscular attachments are left intact as far as possible to minimize post operative axial neck pain and unfavorable radiologic changes. After adequate exposure and the correct level are verified, the upper and lower construct of interspinous ligaments is excised. Then the opening and hinge troughs are created (Figure 3(a-d)). The open trough is created first; we usually perform an opening trough on the side that has greater compression or symptoms along with foraminotomies if there is concomitant root compression.

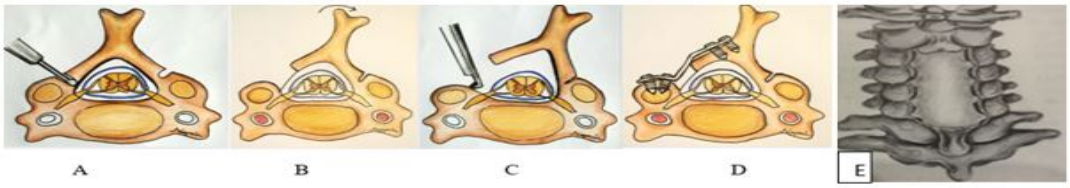

Figure 3: Schematic picture demonstrated the laminoplasty and laminectomy technique. **(a)** The opening is created at the lateral mass-laminar junction by angling the burr perpendicular to the lamina and the opposite side creating a hinge leaving the ventral cortex intact; **(b)** green-stick fractures are created by placing dorso-lateral tension on the spinous process or cut edge of lamina; **(c)** the ligamentum flavum is put under tension and cut with a Kerrison rongeur. **(d)** Fixation is applied. **(e)** complete laminectomy done.

A 3 mm burr is used to make an opening at the lateral mass-laminar junction. The dorsal and ventral cortices are drilled down upto thin shell of ventral bone that is only left. The remaining flake of the anterior cortex is removed by a curette or 1mm/2mm kerrison rongeur. The hinge side trough is then created at the opposite lateral mass -laminar junction. Here only the dorsal cortex and some cancellous bones are removed. The hinge is thinned gradually so that the lamina does not recoil and slam into the dural sac during testing of the hinge. Then segmental greenstick fractures are created by placing dorso-lateral tension on the spinous process or cut edge of lamina. During this maneuver, the ligamentum flavum will come under tension and needs to be released with kerrison rongeur. Once all lamina on the open side is elevated, fixation is applied in the form of titanium miniplates (double-bended 10 or 12mm plate) and screws (7 or 8mm in length, 1.8 or 2mm diameter) (Figure 1(d-f)). This is classic Hirabayashi open-door laminoplasty [9] which is performed in 20 patients. Alternatively, 20 patients underwent laminectomies at multilevel without fusion [Figure 2c,2d, Figure 3e]. Hemostasis is ensured with bipolar diathermy and thrombin-soaked gelatin sponge and the wound is closed in layers with suction drain. A soft collar is employed, postoperatively for comfort and is worn for 4 weeks. Neck mobilization exercises were allowed as pain improved.

Results

The patients were followed an average of 14.6 (range, 12 -24) and 13.5 (range 12 -24) months in LP and LT, respectively. Mean duration of symptoms prior to admission was 11.35 months (range, 4-24 months). All patients had mild (n = 35) to moderate neck pain (n = 5), gate difficulty (n=40), sensory changes in upper and lower limbs (n=34), motor weakness in upper and lower limbs (n=36), myelopathic sign (n=40), radiculopathy (n=8) and bladder and bowel involvement (n=4). Mean EBL was 169.60 ± 3.20mL and 131.70 ± 2.50 mL (p <0.001), mean operative time was 145 minutes (range: 95-195) and 125 minutes (range: 75-170) and mean length of hospital stay post-operatively was 5 days (range, 4-8 day) and 4.5 days (range, 3-7 day) in LP and LT group respectively. Patients undergoing laminoplasty had significantly higher blood loss and higher operation time than the laminectomy group.

The postoperative VAS, mJOA score and Nurick grading were significantly improved at 12 months in both groups (Table 2). Though not significant, the laminoplasty group had relatively better improvement in all of the outcome measurement scale compared to the laminectomy group except per operative blood loss and duration of operative time. All patients with symptoms of <6 months duration, and 14 (63.63%) of the patients with symptoms of 6 to 12 months duration had excellent outcome following surgery, whereas 10 patients with symptoms of >12 months, had a good to poor outcomes according to Modified Odom's criteria (Table 3). Overall, an excellent outcome was seen more in the laminoplasty group than the laminectomy group (60 vs 50% respectively) whereas a good and fair outcome was equal in both groups. Poor outcome was only found in the laminectomy group (10%) (Table 4). However, there was no significant difference, in regards to the final outcome after 12 months of follow up (p >0.05) (Table 4). All patients (n=6) in Nurick's Grade III and 2 patients of Nurick's Grade IV improved to Nurick's Grade I (n=8). Other 8 patients of Nurick's grade IV improved to Nurick's Grade II (n=8). All patients (n=4, 100%) who were in Grade V (Chair-bound or bedridden) improved to Nurick's Grade III (ambulatory without support) postoperatively following laminoplasty at 12 months follow-up (Table 4). In laminectomy without fusion group, all patients of Nurick's Grade III (n=6) and IV (n=6) improved to Nurick's Grade I and II respectively and 6 out of 8 patients in grade V improved to Nurick's grade III and 2 patients improved to grade IV postoperatively (Table 2).

Variables	Laminoplasty					Laminectomy					P value
VAS											
Preoperative	6.9 ± 0.74					07 ± 0.82					0.796
Postoperative											
1 month	2.8 ± 0.42					03 ± 0.47					0.529
3 months	2.2 ± 1.03					2.5 ± 0.71					0.631
6 months	1.5 ± 0.97					1.7 ± 0.68					0.796
12 months	0.5 ± 0.71					0.7 ± 0.68					0.529
Pre vs postoperative P value	<0.001					<0.001					
mJOA											
Preoperative	9.2 ± 2.15					7.3 ± 3.34					0.218
Postoperative											
1 month	11.7 ± 3.20					8.4 ± 3.50					0.053
3 months	12.2 ± 3.26					9.4 ± 3.51					0.089
6 months	13.2 ± 3.26					10.4 ± 3.78					0.123
12 months	14.5 ± 3.81					11.5 ± 4.25					0.143
Pre vs postoperative P value	<0.001					<0.001					
Nurick grading	**I**	**II**	**III**	**IV**	**V**	**I**	**II**	**III**	**IV**	**V**	
Preoperative	0	0	6	10	4	0	0	6	6	8	0.558
postoperative											
1 month	0	0	14	6	0	0	0	6	10	4	0.129
3 months	0	8	6	6	0	0	4	2	12	2	0.3
6 months	6	6	4	4	0	2	4	6	6	2	0. 627
12 months	8	8	4	0	0	6	6	6	2	0	0.686
MCSM, multilevel cervical spondylotic myelopathy											

Table 2: Outcome variables for MCSM, (n=20) MCSM, multilevel cervical spondylotic myelopathy.

Outcome	Disease duration (months)			P value
	<6 (n=8)	6-12 (n=22)	>12 (n=10)	
Excellent	8 (100%)	14 (63.63%)	0	0.021
Good	0 (0%)	8 (36.36%)	4 (40%)	
Fair	0 (0%)	0 (0%)	4 (40%)	
Poor	0 (0%)	0 (0%)	2 (20%)	

Table 3: Association of disease duration with final outcome according to Modified Odom's criteria (n=40).

Outcome	Laminoplasty n (%)	laminectomy n (%)	P value
Excellent	12 (60%)	10 (50%)	0.779
Good	6 (30%)	6 (30%)	
Fair	2 (10%)	2 (10%)	
Poor	0 (0%)	2 (10%)	

Table 4: Final outcome according to Modified Odom's criteria.

During the perioperative period, two patients developed dural tear in the LT group whereas hinge breakage occurred in two cases from the LP group; and were managed accordingly. Blood loss was significantly lesser in the laminectomy group compared to the laminoplasty group. During follow up at 1 month, 2 (10%) patients developed paresthesia from each group, who recovered within 3 months. Another, two patients developed transient C5 palsy, from each group and recovered within 6 months. Occasional axial neck pain was reported in three patients in the laminoplasty group and 2 patients from the laminectomy group. All of these patients fully recovered after 3 months of physical therapy. Four patients (20%) from the laminectomy group developed kyphosis after 6 months follow-up; two of them developed progressive instability, requiring fusion and stabilization at 12 months of follow-up. Superficial wound infections were observed in two patients, who were managed by regular dressing and antibiotic therapy (Table 5).

Complications	Laminoplasty n (%)	Laminectomy n (%)	P value
Perioperative Complications			
Dural damage	0 (0)	2 (10)	
Hinge breakage	2 (10)	0 (0)	0.368
Per operative blood loss(mL)	169.60 ± 3.20	131.70 ± 2.50	<0.001
Postoperative complications			
Paresthesia	2 (10)	2 (10)	
Root palsy	2 (10)	2 (10)	
Axial neck pain	3 (15)	2 (10)	
Kyphosis	0 (0)	4 (20)	
Subluxation	0 (0)	2 (10)	
Wound infection	0 (0)	2 (10)	

Table 5: Complications.

Discussion

Cervical Spondylotic Myelopathy (CSM) is the consequence of progressive narrowing of the cervical spinal canal and the most common cause of spinal cord dysfunction in adults worldwide that commonly presents with subtle symptoms that are easily missed by clinicians, often leading to a delay in diagnosis and irreversible neurologic damage [10,11]. The pathophysiology of this condition is multifactorial, including the repeated injuries to the spinal cord, which results in direct trauma or ischemia; and are caused by both static and dynamic mechanical factors. CSM is a progressive disorder that causes deterioration of symptoms and gradual limitation in function. It has been reported that declination of Japanese Orthopaedic Association scale by at least 1 point was seen in 20% to 62% of patients with symptomatic myelopathy, if they were not treated surgically [12,13]. It is mention in the literature that most patients in the long run will necessitate surgical intervention as 75% of cases progress in a stepwise manner, whereas 20% deteriorate slowly and 5% have rapid deterioration [14]. Surgical intervention significantly improves the neurological symptoms, functional outcome and quality of life as it halts the progression of the disease and also prevent further neurological exacerbations [15,16].

Surgical decompression may be done either by anterior or posterior approaches but there is still uncertainty regarding the preference of these approaches for multi-level compression. Anterior Cervical Discectomy With Fusion (ACDF) or corpectomy with fusion are treatment options for anterior approach whereas the posterior approach includes laminectomy with or without instrumentation, skip laminectomy and laminoplasty. The important factors that determine the surgical approach include the direction of spinal cord compression, the number of levels involved, the sagittal alignment of the spine, the presence or absence of instability and significant axial neck pain; and the approach during any previous cervical spine surgery. The goal of posterior cervical laminectomy and laminoplasty is the relief of compression over the cord, either directly or indirectly. When the causative pathology is located dorsally, such as with congenital stenosis and ligamentum flavum hypertrophy, then cervical laminectomy or laminoplasty directly decompresses the spinal cord.

With ventral pathology, such as degenerative disc disease and OPLL, removal of dorsal elements would indirectly decompress the spinal cord which is successful, if the cord is able to translate dorsally, thus alleviating any impingement presented by ventral pathology. The sagittal alignment of the cervical spine dictates the degree of translation possible after laminectomy or laminoplasty. In cases where there is neutral or lordotic sagittal alignment, dorsal translation of the cord would be expected after decompression [17].

Most of the surgeons prefer posterior decompression than anterior decompression for multilevel disease as because posterior surgery is easier than anterior surgery, as well as avoidance of fusion and its associated complications (nonunion, graft extrusion, implant failure, adjacent segment degeneration, dysphagia, dysphonia and vertebral artery injury). However, the posterior approach presents fewer approach related complications than an anterior approach such as kyphosis, axial neck pain, instability, dural tear and C5 root palsy. Postoperative kyphosis, instability and postlaminectomy membrane formation are main concerns while performing posterior laminectomy without instrumentation or fusion [18,19]. However, literature review states that 6 to 47% of adults and 100% of children's, developed postoperative kyphosis and segmental instability after laminectomy, [20-22] but there is a little reported correlation of postoperative kyphosis to neurological deterioration or poor clinical outcomes [16].

Guigui et al. described 58 patients who underwent multilevel cervical laminectomy and reported that 31% developed post-operative kyphosis, 25% developed instability, with 3% necessitating surgical stabilization [23]. On the other hand, laminoplasty is an effective technique for prompt and safe spinal cord decompression in the properly selected patients with multilevel cervical myelopathy, where the posterior vertebral elements are preserved along with neck motions by avoiding fusion [24].

Hence, the risk of kyphotic deformity following laminoplasty is minimum than compared with the laminectomy. Besides that, laminoplasty preserves normal cervical range of motion in comparison to laminectomy with fusion, so as a result there is decreased incidence of adjacent-level degeneration [25,26] Another cohort, retrospective study of laminoplasty against laminectomy with fusion for the treatment of MCSM; reported that both procedures provided functional improvement without marked difference in complications; but myelopathic progression was consistently prevented only following laminoplasty, and had added patient satisfaction along with noticeably lower rate of complications [7]. The superiority of laminoplasty over laminectomy and fusion haven't been illuminated by other studies [5,6,27,28].

In one previous retrospective comparative study of 45 patients who underwent anterior cervical fusion (n=18), LT (n=12) and LP (n=15) for the treatment of multi-level cervical spondylotic radiculopathy, found successful outcome in 86% and 66% of patients following LP and LT, respectively. A striking difference in complication rates was seen in the anterior procedure (70%) followed by LT (25%) and LP (13%) [29] which were consistent with our study. Lao, et al. systematic review showed that kyphosis occurred in 4.44% and 6.34% patients undergoing LP and LT, respectively [30].

Satomi et al. did a study of laminoplasty in 204 patients, with 80 patients with more than 5 years follow-up showed recovery rate of 64%, also superior recovery was seen in patients with age under 60 years and duration of symptoms less than 1 year [31]. Kawaguchi et al. studied 126 laminoplasty patients with 10 years follow-up, found that the JOA recovery rate was 55% and a reduction in range of motion to 25% of preoperative status along with post-operative complications including radiculopathy and kyphosis [32]. Other authors have also established that poor clinical outcome were linked with kyphosis [33,34] and the improved outcomes was related with mean posterior spinal cord shift of >3mm, based on JOA scores [35] Miyazaki and Kirita studied 155 laminectomy patients and found 82% improvement at 1 year follow up, based on JOA scores [36]. However, Kato et al. demonstrated only 33% neurological recovery at 10 years follow-up in patients following laminectomy along with late neurological deterioration in 23% of patients and 47% of patients had progression of a kyphotic deformity [37]. Also development of kyphosis following laminectomy has been reported by several authors [29,38,39]. Kaptain et al reported the incidence of development of kyphosis was doubled if cervical lordosis was straightened in preoperative imaging [39].

Another previous study comparing laminectomy against laminoplasty for cervical myelopathy showed immediate improvement of JOA scores after operation but slight decrease in gains in subsequent follow-up, although no significant difference between the two groups were noted at any period. The decrease in postoperative lordosis in the neutral position was noted and occasionally reversed to a kyphosis in 3 out of 10 (30%) and 5 out of 18 (28%) patients in laminectomy and laminoplasty groups, respectively; which were almost similar to in this study [40].

In this study postoperative VAS scale, for laminoplasty and laminectomy group were significantly improved from 6.9 ± 0.74 to 0.5 ± 0.71 and 07 ± 0.82 to 0.7 ± 0.68 and mJOA score from 9.2 ± 2.15 to 14.5 ± 3.81 and 7.3 ± 3.34 to 11.5 ± 4.25 respectively at 12 months (<0.001). However, laminoplasty group had showed relatively better improvement in pain status and neurological function compared to laminectomy group, though but without significant statistical differences in between groups which were consistent with previous studies [6,22,40].

According to Nurick grading, laminoplasty group showed relatively better improvement in neurological sign and symptoms without any significant difference compared to laminectomy group (p value>0.05) at all of the points which were consistent with previous studies[38-40]. Meta-analysis by Yuan, et al, established no significant difference in Nurick grading between the two groups [41]. Whereas, Lau et al. stated that mean Nurick score was lower in laminectomy than laminoplasty group [42]. Fehlings et al. also found improvement in Nurick grades by 1.57 (95% CI:1.23,1.90) and 1.18 (95%CI:0.92,1.44) in the laminoplasty and laminectomy group, respectively [43].

Overall, the satisfaction rate was 90% and 80% in the laminoplasty and laminectomy group, respectively without significant difference ($p > 0.05$) at the end of 12 month follow-up. These results are corroborated with several former studies [8,22,41,42]. Dobran et al. demonstrated adequate clinical improvement in both techniques, but overall outcome was better in the patients operated by laminoplasty technique [22].

Majority of the patients in our study had suffered disease duration for 6-12 months (55%) with no significant difference between groups ($p > 0.05$). All eight patients with excellent outcome had disease duration <6 months whereas only patients with poor outcome had suffered from MCSM for more than12 months. Besides, there was significant association of disease duration with final outcome ($p<0.05$). Previous study also suggested that the more the duration of disease, the worse the final outcome [8,44,45]. Moreover, patients undergoing laminoplasty had significantly higher blood loss, higher operation time than the laminectomy group because in our study we did laminectomy without fusion. Hence, both laminoplasty and laminectomy without fusion have excellent clinical improvement and comparable complications and risk. However, a relatively better outcome was found in the laminoplasty group, including improvement in neck pain, neurological signs and symptoms, motor and sensory functions of upper and lower extremities.

Conclusions

Although insignificant, laminoplasty provided better results; in regards to functional outcomes and post-operative complications than laminectomy without fusion for the treatment of MCSM.

Disclosure of Contribution of Authors

Corresponding author	: Dr. Md. Kamrul Ahsan
Study concept & design	: Prospective Interventional Study
Acquisition of data	: Records of pretested questionnaire and review of the Documentation and records.
Analysis and interpretation of data	: Mann-Whitney U Test, Friedman test and chi-square test
Statistical analysis	: SPSS version-25, Armonk, NY, IBM Corp, USA
Administrative, technical, or material support	: BSMMU authority and Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU).

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