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CLINICAL OUTCOMES OF LATERAL MASS FIXATION FOLLOWING DECOMPRESSIVE LAMINECTOMY IN CERVICAL SPONDYLOTIC MYELOPATHY

Neurosurgery

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ABSTRACT

Lateral mass cervical fixation is the preferred approach for posterior cervical stabilization of the lower cervical spine in cervical spondylotic myelopathy. It is prescribed for individuals who have undergone severe, multiple-level laminectomies with reversed cervical lordosis. **Objective:** The purpose of this study was to examine the results of decompressive laminectomy for cervical spondylotic myelopathy with and without lateral mass fixation. **Patients And Methods:** The study included 25 patients who underwent cervical decompressive laminectomy with lateral mass fixation using polyaxial screws and rods at various levels of the subaxial cervical spine, referred to as group I, and 25 patients who underwent cervical decompressive laminectomy without lateral mass fixation, known as group II. **Results:** Group I had 15 males (60%) and 10 females (40%), with ages ranging from 35 to 62 years. Group II included 16 men (64%) and 9 females (36%), with ages ranging from 42 to 67 years and a mean of 53 ± 7.23. In group I, the average surgical duration was 111 ± 13.16 minutes, hospital stay was 4 ± 1.66 days, and blood loss was 482 ± 192.04 mL. In group II, the average surgical duration was 74 ± 23.38 minutes, hospital stay was 3 ± 1.37 days, and blood loss was 221 ± 114.25 mL. There was a clinically significant difference between neck discomfort and brachialgia. In group I, neck pain reduced by 70% and brachialgia by 85%, However, in group II, neck pain improved by 48% and brachialgia by 64%. Myelopathy and sphincteric disturbance exhibited clinical improvement, although there was no clinically significant difference between the two groups. **Conclusions:** Lateral mass fixation of the cervical spine following cervical laminectomy is a safe and reliable procedure with few complications. It also relieves neck discomfort and brachialgia.

KEYWORDS

INTRODUCTION

Lateral mass cervical fixation is the primary posterior cervical stabilization technique for treating lower cervical spine instability after severe multiple-level cervical laminectomies with reversed lordosis.2,14 It is safe and reliable, but it is difficult to use in patients with abnormal cervical architecture because the insertion of lateral mass screws may cause injury to the spinal nerves or vertebral arteries.2,22 In 1964, Roy-Camille was the first to insert screws into the lateral mass of the cervical spine in France, followed by Louis and Magerl in Switzerland.15,17 There are numerous ways for posterior cervical fixation, including posterior wire, three Halifax clamps, one posterior plate and screws, and finally fixation using polyaxial screws and rods.23 Wiring is rarely used since it only works if the lamina and spinous process of the posterior section of the subaxial spine are intact, and it cannot be used when laminectomies are required for decompression or exposure of target lesions.3,12 The main disadvantage of wire is that it has lower attachment strength when compared to other stiff devices.3 Halifax clamps may have greater fastening strength than wire, but they are still not optimal.1 Lateral mass screws with plate fixation need precise contour customization for each patient, making them extremely challenging to apply in practice.9 The use of polyaxial screws in combination with rod systems for lateral mass fixation has recently grown in popularity because it can avoid the aforementioned problems.16-19

PATIENTS AND METHODS

The study was conducted in two groups. Group I consisted of 25 patients who underwent cervical decompressive laminectomy with lateral mass fixation using the modified Magerl technique at levels ranging from C3 to C7 based on the patient's needs, while group II consisted of 25 patients who underwent cervical decompressive laminectomy without lateral mass fixation. All patients had surgery at the UPUMS Saifai's Neurosurgery Department, and they were randomly allocated to groups I and II, with the two groups nearly comparable in terms of clinical presentation, cord signal, and number of levels damaged. All patients gave informed consent prior to the investigation. Patients were monitored for at least six months.

Plain X-ray cervical spine was performed in AP and lateral studies prior to discharge from the hospital and at 2-month intervals thereafter. Patients were advised to wear a stiff cervical collar for at least 6 weeks after surgery, and bone fusion was observed throughout this time.

RESULTS

The 2 groups were operated, group I comprised 25 patients (100%) operated with decompressive laminectomy with lateral mass fixation. It comprised 15 males (60%) and 10 females (40%), the age ranged from 35 to 62 years with a mean of 49.0 ± 9.68. Group II comprised 25 patients (100%) operated upon by decompressive laminectomy only without fixation, it comprised 16 males (64%) and 9 females (36%), the age ranged from 42 to 67 years with a mean of 53 ± 7.23 (Table 1).

Table 1 Age And Gender Of The Patients

	Group I (n = 25)	Group II n-=25	Test of sig.
Sex			
Males	15	16	P = 0.573
Females	10	9	
Age (years)			
Range	35-62	42-67	P^1 = 0.129
Mean ± SD	49.0 ± 9.68	53 ± 7.23	

: p-value for Chi-Square **test.**

P^1 value for Student t-test

In group I, neck pain was the most commonly present in all the 25 patients (100%) followed by brachialgia in 15 patients (60%). Myelopathy was present in 20 patients (80%) according to the JOA-score, grade 1 myelopathy in 13 patients (52%), grade 2 myelopathy in 5 patients (20%) and only 2 patients (8%) with grade 3 myelopathy. Sphincteric disturbance was present in 7 patients (28%). In group II, neck pain was present in 25 patients (100%) followed by brachialgia in 14 patients (56%). Myelopathy was present in 21 patients (84%), grade 1 myelopathy in 13 patients (52%), grade 2 myelopathy in 6 patients (24%) and 2 patients (8%) with grade 3 myelopathy. Sphincteric disturbance was present in 8 patients (32%) (Table 2).

Table 2 The Clinical Presentation Of The Patients.

	Group I (n = 25)	Group II n-=25	Test of sig.
Neck pain	25(100%)	25(100%)	
Brachialgia	15(60%).	14(56%)	FEp=0.123
Myelopathy	20(80%)	21(84%)	MCp=0.155
Grade 1	13(52%)	13(52%)	
Grade 2	5(20%)	6(24%)	
Grade 3	2(8%)	2(8%)	
Sphincteric disturbance	7(28%)	8(32%)	P=0.889

FEp: p value for Fisher Exact test; MCp: p value for Monte Carlo test; p: p value for Chi Square test. * Statistically significant at p < 0.05.

In group I, the operative time ranged from 90 to 150 min with a mean of 111 ± 13.16 min, the hospital stay ranged from 3 to 7 days with a mean of 4 ± 1.66 days and the blood loss ranged from 240 to 810 ml with a mean of 482 ± 192.04 mL . In group II, the operative time ranged from

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50 to 110 min with a mean of 74 ± 23.38 minutes , the hospital stay ranged from 1 to 5 days with a mean of 3 ± 1.37 days and the blood loss ranged from 110 to 440 ml with a mean of 221 ± 114.25 mL. (Table 3).

Table 3 Operative Data Of The Two Groups

	Group I (n = 25)	Group II n-=25	Test of sig.
Surgical time			
Range	90 to 150 min	50 to 110 min	
Mean± SD	111 ± 13.16 min	74 ± 23.38 minutes	p value < 0.001
Hospital stay			
Range	3 to 7 days	1 to 5 days	
Mean± SD	4 ± 1.66 days	3 ± 1.37 days	p value < 0.036
Blood loss			
Range	240 to 810 ml	110 to 440 ml	
Mean± SD	482 ± 192.04 mL	221 ± 114.25 mL.	p value < 0.001

P value for Student t-test. * Statistically significant at p< 0.05

In group I, 15 patients (60%) were operated from C3 to C6 levels followed by C3–7 in 6 patients (24%), 2 patients (8%) from C4 to C7 and lastly 2 patients (8 %) from C4 to C6 (Table 4).

Table 4 Laminectomy Levels And Fixation In Group I.

Levels of laminectomy and fixation	Group I (n = 25)
C3–6	15(60%)
C3–7	6(24%)
C4–7	2(8%)
C4–6	2(8%)

A total of 208 screws were used most of them (188 screws)(90.4%) were 3.5 mm in thickness and 20 screws (9.6%) were 4 mm as revision screws. 6 screws were used in 2 patients (8%), 8 screws were used in 17 patients (68%), and 10 screws were used in 6 patients (24%). The length of screws varied from patient to patient and according to the level of fixation we found that 10 screws (4.6%) were 12 mm in length, 50 screws (25.03%) 14 mm, 130 screws (62.5%) 16 mm and finally 18 screws (8.6%) 18 mm (Table 5).

Table 5 Instrument Profile.

No. of screws per patient	No. of patients %
6 screws	2 (8%)
8 screws	17(68%)
10 screws	6(24%)
Total no of screws	208
Thickness of the screws used	No. of screws
3.5 mm	188(90.38%)
4 mm	20(9.6%)
Average length of screws used	No. of screws %
12 mm	10(4.6%)
14 mm	50(25.03%)
16 mm	130(62.5%)
18 mm	18 (8.6%)

As regards the complications, we found no recorded cases of spinal cord injury or spinal nerve root injury in both groups. In group I screw pullout occurred in 3 screws of 208 screws used in 3 different patients(12%) that were managed conservatively as there was no complaint from them Dural tear was present in 2 patients (8%) in group I and 1 patient (4%) in group II. Postoperative neurological deficit occurred in 1 patients in group I (4%) and 2 patients (8%) in group II in comparison with the preoperative condition of the patients. In group I, we found that 3 patients (12%) complained of posterior circulation ischemia as vertigo, dizziness and vomiting mostly due to excessive epidural hemorrhage during dissection and screw insertion. No wrong level was detected in postoperative radiography. In group I, we recorded 4 patients (16%) complained of superficial wound infection that was treated medically in comparison with 3 patients (12%) in group II. No recorded cases of vertebral artery injury were found (Table 6).

Table 6 Complications In The 2 Groups

Complications	Group I (n = 25)	Group II n-=25	Test of sig. FEp
Screw pullout	3(12%).	0	0.128
Intraoperative spinal cord or nerve root injury	0	0	
Dural tear	2(8%)	1(4%)	1.000
Posterior circulation ischemic manifestation as vertigo, dizziness and vomiting	3(12%).	0	0.591
Postoperative new neurological deficit as myelopathy or radiculopathy	1(4%)	2(8%)	0.669
Vertebral artery injury	0	0	
Superficial wound infection	4(16%)	3(12%).	1

FEp: p value for Fisher Exact test.

In group I, plain X-ray was done in A–P and lateral positions for all the patients immediately postoperative and after 2 month interval till bony fusion was detected. Bony fusion was achieved in all the patients after 6 month follow up. Stability of the fixation was confirmed in postoperative X-ray in flexion and extension films in all the patients. As regards the outcome of the patients according to the clinical conditions determined by the visual analog scale VAS we found that in group I, neck pain improved in 19 patients (76%) and 5 patients (20%) remained stationary without improvement and only 1 patients (4%) deteriorated mostly due to wound infection, but in group II we found that neck pain improved in 10 patients (40%) and 8 patients (32%) remained stationary without improvement and 7 patients (28%) deteriorated mostly due to increased kyphosis. This indicates that neck pain improved much better in group I in comparison with group II with positive clinical significance test. As regards brachialgia, determined by the visual analog scale VAS, we found in group I, brachialgia improved in 13 patients (86.6%) and 1 patients (6.6%) remained stationary without improvement and only 1 patient (6.6%) deteriorated mostly due to dural tear intraoperative, but in group II we found that brachialgia improved in 7 patients (50%) and 5 patients (35.7%) remained stationary without improvement and 2 patients (14.2%) deteriorated mostly due to foraminal stenosis. This indicates that brachialgia improved much better in group I in comparison with group II with positive clinical significance test. As regards the myelopathy and sphincteric disturbance, we found that both group I and group II showed improvement of the 3 grades but without any clinically significant difference (Table 7).

Table 7 Outcome As Regards The Clinical Presentation Of The Patients.

	Group I (n = 25)	Group II n-=25	Test of sig.
Neck pain	25	25	P=0.041
Improved	19(76%)	10(40%)	
Stationary	5(20%)	8(32%)	
Deteriorated	1(4%)	7(28%)	
Brachialgia	15	14	FEp=0.016
Improved	13(86.6%)	7(50%)	
Stationary	1(6.6%)	5(35.7%)	
Deteriorated	1(6.6%)	2(14.2%)	
Myelopathy	20	21	
Grade 1	13	13	MCp,=0.591
Improved	10(76.9%)	7 (53.8%)	
Stationary	3 (23.1%)	5(38.4%)	
Deteriorated	0	3(23.1%)	
Grade 2	5	6	MCp,=1.000
Improved	3(60%)	3(50%)	
Stationary	1(20%)	1(16.6%)	
Deteriorated	1(20%)	2(33.3%)	
Grade 3	2	2	MCp,=1.000
Improved	2(100%)	1(50%)	
Stationary	0	1(50%)	
Deteriorated	0	0	
Sphincteric disturbance	7	8	MCp,=0.878
Improved	5(71.4%)	3(37.5%)	
Stationary	1(14.2%)	3(37.5%)	
Deteriorated	1(14.2%)	2(25%)	

p, p value for Chi Square test; MCp, p value for Monte Carlo test; FEp, p value for Fisher Exact test. * Statistically significant difference when p < 0.05.

DISCUSSION

Lateral mass cervical fixation is an efficient posterior cervical stabilization technique for treating lower cervical spine instability after severe multiple-level cervical laminectomies with reversed lordosis.2-14 It is safe and effective, although it is difficult to use in people with abnormal cervical architecture. In this study, two groups had surgery. Group I had 25 patients (100%) who underwent decompressive laminectomy with lateral mass fixation. It included 15 men (60%), and 10 women (40%). Group II included 25 patients (100%) who had decompressive laminectomy without fixation; 16 were men (64%), and 9 were women (36%). In both groups, we discovered that males were more influenced than females because they were more exposed to stress, although there were no significant statistical differences between the two groups as regards the sex. This was consistent with previous research by Watter and Levinthal21, who discovered that males were more affected than females (61% males and 39% females) in a comparable study, and Olaorie and Thomas13, who discovered that males are more commonly afflicted than females (65 males to 35 females) in another study. In group I, the age ranged from 36 to 62 years, with a mean of 49.0 ± 9.68. In group II, the mean was 53 ± 7.23. These are mostly because decompressive laminectomy is routinely done in the older age group, and there were no significant statistical differences between the two groups in terms of age.which are matched with numerous studies, such as the Watter and Levinthal21 study, which found that the average age was 46 years. Olaorie and Thomas13 found that the average age was 47 years, whereas Jankowitz8 found that the average age was 50-60 years in a large series. Neck pain was the most common symptom in Group I (100%), followed by brachialgia (60%). Myelopathy was seen in 80% of patients, with 52% having grade 1 myelopathy, 20% having grade 2 myelopathy, and 8% having grade 3 myelopathy. Sphincteric dysfunction was discovered in 28%. Neck discomfort was reported by all patients in group II, with brachialgia accounting for 56%. 84% of patients had myelopathy, with 52% having grade 1 myelopathy, 24% having grade 2 myelopathy, and 8% having grade 3 myelopathy. Sphincteric disturbance was found in 32%.

The two groups saw considerably different levels of alleviation for neck discomfort and brachialgia. We observed that group I saw a 76% reduction in neck pain compared to 40% in group II, as well as an 86.6 percent improvement in brachialgia compared to 50% in group II. The improvement was mostly due to the cervical spine's stability after fixation and widening of the intervertebral foramen to decompress the nerve root in group I. This was consistent with earlier studies, as Epstein and Janin4 reported an 85% improvement after cervical laminectomy with fixation compared to other posterior laminectomy.

This improvement would be far larger if the anterior osteophytes were removed using the posterolateral approach. According to Herkowitz7, the incidence of postoperative kyphosis following cervical laminectomy with partial medial facetectomy was 25% during a two-year follow-up period, resulting in recurrent neck discomfort and brachialgia. Symon and Lavender17 also found a 70% improvement in individuals who had cervical laminectomy without fixing, compared to an 85% improvement with fixation. In terms of myelopathy and sphincteric disturbance, we determined that both groups I and II improved by three grades of myelopathy, however there was no clinically meaningful difference. Grade 1 myelopathy improved by 76.9% in group I compared to 53.8% in group II, grade 2 by 60% in group I and 50% in group II, and grade 3 by 100% in group I vs 50% in group II. Finally, sphincteric disturbance improved in both groups, reaching 71.4% in Group I and 37.5% in Group 2. This was mostly due to the comparable cord decompression, with no clinical difference between the two groups. Kumar et al.11 reported an 80% improvement with a favorable outcome and a 76% improvement in myelopathy score following cervical laminectomy with lateral mass fixation.The two groups differed significantly in terms of operation time, blood loss, and hospital stay. The average operating duration in group I was 111 ± 13.16 minutes, whereas in group II it was 74 ± 23.38 minutes, with a p-value of less than 0.001*. The average hospital stay in group I was 4 ± 1.66 days, while in group II it was 3 ± 1.37 days (p-value < 0.036*). The average blood loss in group I was 482 ± 192.04 mL, while in group II it was 221 ± 114.25 mL, with a p-value of less than 0.001*.Group I had an average hospital stay of 4 ± 1.66 days, while group II had an average of 3 ± 1.37 days (p-value < 0.036). The average blood loss in group I was 482 ± 192.04 mL, while in group II it was 221 ± 114.25 mL, with a p-value of less than 0.001*.Blood loss in group I is more than in group II due to the prolonged operating time and lateral dissection during surgery, which resulted in epidural and paravertebral venous plexus injuries. There was no substantial difference in post-operative sequelae between the two groups; neither group sustained spinal cord, nerve root, or vertebral artery damage.

Dural tears appeared in 8% of Group I and 4% of Group II. A superficial wound infection developed in 16% of group I and 12% of group II. Screw loosening and withdrawal occurred in three of the 208 screws used by three separate patients. Heller et al. 6 and Kast et al. 10 discovered that in a series of patients undergoing decompressive laminectomy with lateral mass fixation, the incidence of nerve root damage was 0.69%, screw loosening was 1.17%, infection was 1.3%, facet breakout was 0.2%, and vertebral artery injury was extremely rare (0%). In a study of patients receiving lateral mass fixation, Graham et al.5 discovered a 6.1% rate of screw malposition and a 1.8% incidence of radiculopathy per screw, with no vertebral artery injury.Traynelis20 observed that decompressive laminectomy with lateral mass fixation results in successful arthrodesis in 98% of patients, with less than 1% experiencing neurovascular injury. After six months of follow-up, all patients had completed bone fusion. Postoperative X-rays in flexion and extension films showed that the fixation was stable in all individuals in the group. I. Swank et al.18 observed that fusion with lateral mass fixing happened 98% of the time.

CONCLUSIONS

Lateral mass fixation of the cervical spine after multilayer cervical laminectomy is both safe and successful. It has developed swiftly, introducing various new fixation mechanisms. It allows for effective decompressions of the cervical canal with little issues while simultaneously restoring cervical lordosis with solid fixation and prevents further kyphosis. It also alleviates neck pain and brachialgia.

Conflict Of Interest. The authors have no conflicts of interest to declare.

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