ORIGINAL ARTICLE

Comparative analysis of Anterior Cervical Discectomy Fusion versus Lateral Mass Screw for Subaxial Cervical Traumatic Facet dislocation

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Abstract

Aim: The aim of this study is to evaluate and compare the clinical and radiological outcomes of anterior cervical discectomy and fusion (ACDF) versus lateral mass screws (LMS) in the treatment of subaxial cervical facet dislocation.

Material and Methods: A retrospective analysis was conducted on 118 patients with subaxial cervical facet dislocations, divided into two groups: 56 patients treated with lateral mass screws and 62 patients treated with anterior cervical discectomy and fusion. Pre-operative and post-operative neurological statuses were assessed using the ASIA score, and functional outcomes were measured using the Neck Disability Index (NDI). Bony union rates and complications were also evaluated.

Results: In the lateral mass screws group, 50% of patients were in Grade E pre-operatively, and 45.45% maintained Grade E post-operatively. The mean NDI was 21±19.44. In the anterior cervical discectomy and fusion group, 43.5% were in Grade A pre-operatively, with significant improvements post-operatively, as all patients in Grades C and D improved to Grade E. The mean NDI was 14.5±11.9, indicating lower disability. The anterior cervical discectomy and fusion group achieved an 85.4% bony union rate, with dysphagia as the most common complication. Previous literature corroborates these findings, showing significant improvements in neurological function and NDI scores for both methods.

Conclusion: Both anterior cervical discectomy and fusion and LMS are effective in treating subaxial cervical facet dislocation, with anterior cervical discectomy and fusion showing superior functional outcomes and higher bony union rates. LMS provides reliable stabilization and significant functional improvements. Future prospective studies with larger sample sizes and longer follow-up periods are essential to validate these findings further and optimize treatment strategies for cervical spine injuries.

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Introduction:

In the past 20 years, there has been a notable rise in the frequency of high-energy trauma resulting in severe lower cervical fractures and dislocations, especially in vehicle accidents and falls. This has resulted in a high mortality and disability rate.[1,2] Most of the anterior, middle, and posterior cervical spine structures are destroyed in severe lower cervical fractures and dislocations. Additionally, there is a loss of normal spinal sequence, a complete or partial rupture of the injured segment ligaments, and a loss of intervertebral stability. These findings are frequently accompanied by varying degrees of cervical medullary injury.[2,3] The rehabilitation of cervical medulla function should be supported by clinically correcting the spinal deformity as soon as possible, restoring the spinal sequence, relieving the spinal cord compression, and preventing or minimizing further spinal cord injury.[4,5]

In terms of anatomy, the cervical spine can be divided into two areas: the subaxial cervical spine, which includes lesions from C3 to C76, and the craniovertebral junction, which extends from the occiput joint to the axis. The most afflicted section of the cervical spine is between C5 and C7, where around 50% of all injuries occur.[7]

Surgical procedures like Anterior Cervical Discectomy Fusion (ACDF) and Lateral Mass Screw (LMS) are frequently explored for restoring cervical alignment and stability in situations of cervical trauma leading to facet dislocation. When treating facet dislocation in cervical trauma, two surgical techniques are used: Anterior Cervical Discectomy Fusion (ACDF) and Lateral Mass Screw (LMS). By removing the injured disc and fusing the adjacent vertebrae, ACDF surgery decompresses the cervical spine's spinal cord and nerve roots. In contrast, LMS is a fixation method that stabilizes the cervical spine.[8,9]

The safety and effectiveness of cervical pedicle screw fixation and Anterior Cervical Discectomy Fusion in combination with LMS have been compared in a number of studies. According to these studies, facet dislocation can be effectively treated with either approach; however, the choice of fixation technique will vary depending on a number of criteria, such as the extent of the damage and the general health of the patient.[10,11]

Anterior Cervical Discectomy Fusion (ACDF) is a surgical procedure commonly used to treat cervical spine conditions such as facet dislocation. The approach involves accessing the cervical spine from the front of the neck, removing the affected disc or bone spurs, and fusing the adjacent vertebrae with a bone graft. Indications for Anterior Cervical Discectomy Fusion include cervical radiculopathy, myelopathy, and instability due to facet dislocation. Contraindications may include severe osteoporosis, active infection, or significant instability beyond the affected levels. While Anterior Cervical Discectomy Fusion is generally effective in relieving symptoms and restoring stability, complications such as adjacent segment degeneration, dysphagia, and pseudoarthrosis can occur postoperatively.[10] While Lateral Mass Screw (LMS) fixation is another surgical option for addressing facet dislocation in the cervical spine. This procedure involves the placement of screws into the lateral masses of the cervical vertebrae, providing stability and alignment. LMS is indicated for cases of traumatic facet dislocation with significant instability or deformity. Contraindications may include inadequate bone quality or abnormal anatomy that precludes safe screw placement. LMS is known for its ability to restore cervical alignment and stability effectively. However, complications such as screw malposition, hardware failure, and nerve injury are risks associated with this procedure.[13]

Thus, when comparing Anterior Cervical Discectomy Fusion and LMS in patients with facet dislocation in cervical trauma, there are several concerns worthy of consideration. Regarding effectiveness, both procedures are used to treat cervical deformity and instability. Although no significant difference between the two can be identified in terms of efficacy, LMS may provide better control in the case of multiplanar deformity. The recovery period and possible needs for postoperative care are mostly similar for Anterior Cervical Discectomy Fusion and LMS, independent of which level of the spine is operated on since both surgeries involve immobilization and physical therapy. Potential benefits, recurrence rate, long-term results, and patient satisfaction are, however, still debatable, as some studies pointed out that LMS results in better fusion rates and decreased adjacent segment degeneration as compared to Anterior Cervical Discectomy Fusion. Other factors that should determine the kind of surgery to be used between Anterior Cervical Discectomy Fusion and LMS include the patient's desire, the surgeon's skill, and the unique cervical spine facet dislocation.

This study aims to compare the two surgical approaches, examining their procedures, indications, outcomes, and complications. Understanding the nuances of Anterior Cervical Discectomy Fusion and LMS can provide valuable

Table:

NDI Score	Disability
0 - 4	No disability
5 - 14	Mild disability
15 - 24	Moderate disability
25 - 34	Severe disability
35 - 50	Complete disability

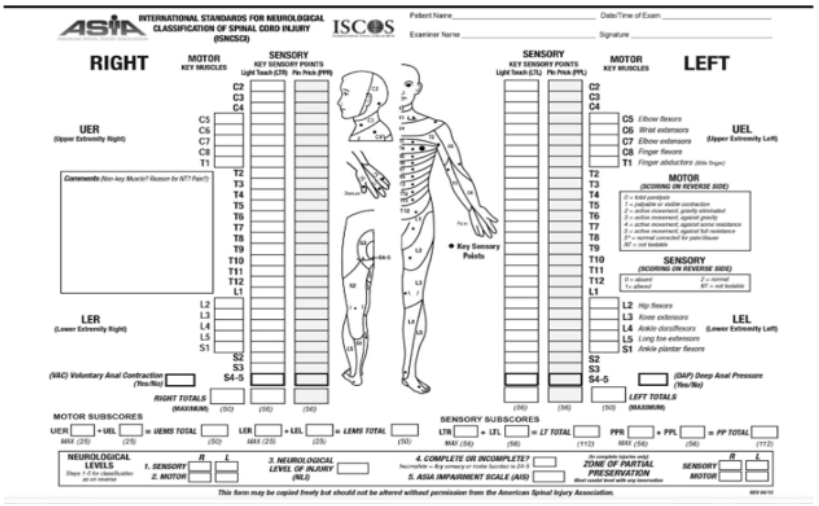

Figure 1:ASIA Score

insights for clinicians in choosing the most appropriate treatment for patients with cervical facet dislocation.

Material and Methods:

This retrospective study compares two surgical methods for treating sub-axial cervical facet dislocation: Anterior Cervical Discectomy Fusion (ACDF) and Lateral Mass Screw (LMS) fixation. We evaluated 118 patients who presented at the Orthopaedics and Spine Centre, Ghurki Trust Teaching Hospital, Lahore, between March 2015 and October 2022. The patients were divided into two groups: those who underwent LMS fixation (56 patients) and those who underwent ACDF (63 patients).

Patients included in the LMS group had sub-axial cervical spine bilateral facet dislocation managed by a standard posterior midline approach and LMS fixation using the Margerl technique. Their ages ranged from 13 to 70 years.

Patients included in the Anterior Cervical Discectomy Fusion group had sub-axial cervical spine facet dislocation managed by Anterior Cervical Discectomy Fusion with tricortical iliac crest autograft and Casper plate within 24 hours of presentation. Inclusion criteria were post-traumatic sub-axial cervical spine facet dislocation managed within 24 hours and availability for follow-up. Inclusion criteria were bilateral facet dislocation with intact facets,post-traumatic sub-axial cervical spine facet dislocation patients managed within 24 hours and fit for surgery with no prolapsed anterior disc. Exclusion criteria included fractures of cervical facets, previous neck surgery, infection, tumors, or those not fit for surgery.

Both groups underwent similar preoperative evaluations, including a detailed history, physical examination with a complete neurological assessment using the ASIA score, and radiological assessments with plain anteroposterior and lateral views of the cervical spine, thin-slice helical CT scans, and MRI for soft tissue integrity.

For the LMS group, patients were positioned prone under general anesthesia. A posterior midline approach was used, and LMS fixation was performed using the Margerl technique. The cervical facets were intact, and the dislocation was managed through this posterior approach.

For the Anterior Cervical Discectomy Fusion group, patients were positioned supine on a radiolucent table under general anesthesia. The Robinson and Southwick approach with a transverse skin incision was used. The disc material was removed, endplates were prepared with a high-speed bur, and facet dislocation was reduced by gentle traction. A tricortical iliac crest graft was placed in the disc space, and a Casper plate was applied and secured with unicortical screws. Post-operatively, a Philadelphia collar was applied for 6 weeks.

Post-operative Evaluation and Follow-Up: Functional outcomes were measured by the Neck Disability Index (NDI)13 at the last follow-up for both groups. The Neck Disability In-

Table 1: Demographic and clinical characteristics of patients

Parameters	LMS Group	ACDF Group	p-value
Total Patients	56	62	
Gender (Male/Female)	42/14	49/13	
Mean Age (years)	39 ± 17.02 (13-70)	34.8 ± 11.5 (15-64)	.0603
Follow-up Time (months)	N/A	18.6 ± 5 (3-9)	
Type of Facet Dislocation	N/A	30 unilateral, 32 bilateral	
Preoperative Neurology (ASIA)			
Grade E	50%	19.40%	
Grade D	30%	37.10%	
Grade C	10%	-	<.05
Grade B	5%	-	
Grade A	5%	43.50%	
Postoperative Neurology (ASIA)			
Intact (Grade E)	45.45%	83.90%	
Partial Loss (Grade C)	31.82%	16.10%	<.05
Complete Loss	22.73%	0%	
Neck Disability Index (NDI)	21 ± 19.44	14.5 ± 11.9	.029
No Disability	22.73%	-	
Mild Disability	50.00%	-	
Moderate Disability	18.18%	-	
Severe Disability	4.55%	-	
Complete Disability	4.55%	-	
Bony Union	N/A	85.40%	
Complications	N/A	Dysphagia (most common)	

dex is a ten-item questionnaire that measures a patient's disability due to neck pain, with scores indicating varying degrees of disability. Pre- and postoperative neurological status was evaluated using the ASIA score.[14] Follow-up assessments were conducted at 3 and 9 months to assess clinical and radiologic results. Data were recorded and analyzed using SPSS version 27, with significant findings reported at a p-value of 0.05.

Results:

The study included a total of 118 patients, with 56 in the LMS group and 62 in the ACDF group. The mean Age of patients in the LMS group was 39±17.02 years, while the mean Age in the ACDF group was 34.8±11.5 years. The majority of patients were male in both groups, with 75% in the LMS group and 79.0% in the ACDF group.

Pre-operative neurological status was assessed using the ASIA score. In the LMS group, 50% of patients were in Grade E, 30% in Grade D, 10% in Grade C, 5% in Grade B, and 5% in Grade A. Post-operatively, 45.45% of patients maintained intact neurological function, while 22.73% experienced complete loss, and 31.82% had partial loss. In the ACDF group, pre-operative neurology was Grade E in 19.4% of patients, Grade D in 37.1%, and Grade A in 43.5%. Post-operatively, all patients in Grades C and D improved to E, and 10 patients with Grade A changed to C, with no neurological deterioration reported.

The mean NDI in the LMS group was 21±19.44. In terms of disability levels, 22.73% had no disability, 50% had mild disability, 18.18% had moderate disability, 4.55% had severe disability, and 4.55% had complete disability. In the ACDF group, the mean NDI was 14.5±11.9, indicating a lower level of disability compared to the LMS group.

Bony union was achieved in 85.4% of patients in the ACDF group, while the most common complication was dysphagia. Data on bony union and specific complications were not reported for the LMS group.

Discussion:

The cervical spine typically exhibits anterior, middle, and posterior column injuries, facet joint locking, poor stability, and anterior and posterior cervical medullary compression in cases of severe lower cervical dislocation fractures.[15] In order to fully decompress the spinal canal, restore the cervical spine's natural curvature and intervertebral height, and reconstruct anterior, middle, and posterior cervical spine stability, combined anterior and posterior cervical surgery is necessary for cervical spinal stenosis.[11] The direction of the compression on the spinal cord, the location of the cervical fracture, and the stability of the spine following damage all influence the surgical strategy. We must strictly follow the surgical indications, carefully evaluate the pre-operative imaging data and patient symptoms, pay particular attention to the intervertebral disc injury and the unstable seg-

ments and sites, and perform targeted decompression, repositioning, and fixation in order to minimize surgical trauma and accomplish the surgical goal. This will provide patients with a reliable assurance for both their short- and long-term rehabilitation.

In the present analysis, the Anterior Cervical Discectomy Fusion group had a younger patient population with a mean age of 34.8 ±11.5 years, compared to the Lateral Mass Screw group at 39±17.02 years. This age difference may reflect the surgeons' tendency to offer more complex procedures like Anterior Cervical Discectomy Fusion to younger, healthier patients. The predominance of male patients in both groups is consistent with the epidemiology of cervical spine trauma.[16] Jiang et al. also reported a predominance of male patients in their study on subaxial cervical facet dislocations.[17]

Our study showed a diverse range of preoperative ASIA scores. In the ACDF group, 43.5% of patients were in Grade A, 37.1% in Grade D, and 19.4% in Grade E. In the LMS group, 50% were in Grade E, 30% in Grade D, and 10% in Grade C. This is consistent with Premkumar18, who reported 16 patients in Grade A, 10 in Grade B, and 12 in Grade C.

Post-operatively, in the ACDF group, all patients in Grades C and D improved to Grade E, and 10 patients with Grade A changed to Grade C. In the LMS group, 45.45% of patients maintained Grade E, 31.82% had a partial loss (Grade C), and 22.73% had a complete loss. Jiang et al. (2022)17 found no neurological deterioration post-surgery, with significant improvements in ASIA scores, similar to our ACDF group findings. Kim et al.19 also reported significant post-operative improvements in ASIA scores for patients treated with LMS.

The mean NDI score in the ACDF group was 14.5±11.9, indicating lower disability compared to the LMS group's mean NDI of 21±19.44. Sellin et al.[20] reported a mean postoperative NDI of 5.3 (n=6), indicating mild impairment. Mcafee et al. found significant improvements in NDI scores post-LMS treatment, with a mean preoperative NDI of 56±25 improving to 19±12 post-operatively.[21]

The ACDF group achieved a bony union rate of 85.4%. Brodke et al. reported similar fusion rates in their comparison study of anterior vs. posterior stabilization methods, with no significant differences between the two approaches.[22] Hussein et al. documented successful fusion in all cases with LMS fixation, supporting the reliability of LMS in achieving stable cervical spines.[23]

The most common complication in the ACDF group was dysphagia. Premkumar also reported dysphagia as a frequent postoperative complication.[18] Kim et al.[19] noted no significant complications with LMS, except for two cases where screws were partially pulled out.

Anissipour et al.[24] conducted the study, and the findings revealed that Ten patients (28%) had complete tetraplegia (ASIA A) and 10 patients (28%) had an incomplete spinal cord injury (ASIA B, C, D) on admission. Of the 10 patients with complete tetraplegia, 5(50%) had an improvement in their ASIA score post-operatively. Of the 10 patients with incomplete spinal cord injury, 5(50%) had an improvement in their ASIA score post-operatively underwent ACDF.

Our study's retrospective nature, limited sample size, and single-center focus are acknowledged limitations. In spite of this, our study is the first to look into the radiographic and clinical results of two similar surgeries (ACDF vs. LMS), and preliminary findings are encouraging. To overcome these restrictions and confirm the findings of this investigation, more prospective randomized trials are required.

Conclusion:
ACDF provides better clinical and functional outcomes for patients with sub-axial cervical facet dislocation. While LMS fixation remains a viable option, ACDF's advantages in neurological recovery and lower disability make it a more favorable choice in appropriate cases. Continued research and longer follow-up studies are

necessary to further validate these findings and optimize treatment strategies for cervical spine injuries.

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Role and contribution of authors:
Haseeb Elahi, cdollected the data, references and did the initial writeup.

Farmanul Haq, helped in collecting the data and also helped in introduction writing.

Bilal ud din, helped in collecting the references and also helped in abstract writing.

Faraz Ahmad Khan, helped in collecting the data and also helped in discussion writing.

Latif Khan, critically review the article and made final changes

Muhammad Ismail, collected the references and also helped in material and methods writing.

Abid ullah, collected the data, references and also helped in interpretation of results

Sadaf Saddiq, collected the data, referenes, critically review the article and made useful changes.

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