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Original Article

Outcome of Management of Multilevel Cervical Disc by Anterior Discectomy and Cage versus Posterior Decompression and Lateral Mass Fixation

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ABSTRACT

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Background: Radiculopathies and cervical myelopathy are well-known complications of multilevel cervical disc degeneration. Multilevel cervical disc herniation remains a challenging condition to manage, with debate regarding the optimal surgical approach.

Aim of the work: This study aims to compare outcomes of anterior cervical discectomy and fusion [ACDF] using cage versus posterior cervical foraminotomy/laminoplasty with lateral mass fixation for multilevel cervical disc herniation.

Patients and Methods: The current Prospective comparative study was conducted on 30 cases with multilevel cervical disc at Al-Azhar university hospitals. Twenty patients [66.7%] were subjected to anterior cervical discectomy with fusion [ACDF] [Group 1], while the remaining 10 patients [33.3%] were subjected to posterior cervical discectomy with fixation [Group 2]. Clinical outcomes were assessed post-surgery. Radiographic fusion/union was also evaluated.

Results: As regards the post-operative neck pain, it was present in 40% of the patients who underwent ACDF versus 30% of the patients who underwent Posterior cervical discectomy with fixation [P = 0.5]. However, the radiculopathy was significantly higher in group 2 [50%] than group 1 [10%] postoperatively [P = 0.01]. The cord manifestations were reported only in one case in group 2.

Conclusion: Both anterior and posterior approaches are effective in management of multilevel cervical disc in radiculopathy and myelopathy with higher incidence of persistent radiculopathy in posterior approach and with higher incidence of complication like transient dysphagia, hoarseness of voice and weakness in anterior approach.

Keywords: Intervertebral; Disc Displacement; Radiculopathy; Discectomy.



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INTRODUCTION

Multilevel cervical disc disease is a prevalent condition within cervical spine disorders, typically associated with radicular syndromes or cervical myelopathy. While single or double-level cervical herniated discs are frequent among adults, elderly individuals commonly experience multilevel cervical degenerative disc herniation in conjunction with spinal stenosis. The underlying cause for both scenarios remains consistent: the progressive degeneration of the intervertebral discs^[1].

Surgical approaches for multilevel cervical disc can be categorized into anterior, posterior, or a combination of both approaches. Anterior methods typically consist of anterior cervical discectomy with fusion [ACDF] or anterior cervical corpectomy with fusion [ACCF]. On the other hand, the posterior approach includes procedures such as laminectomy with or without instrumentation and laminoplasty. It's worth noting that performing a laminectomy without fusion may lead to post laminectomy kyphosis^[2,3].

In certain cases, there is a requirement for combined anterior/posterior procedures despite the technical challenges, higher blood loss, and extended surgical durations involved^[4].

Selecting the appropriate procedure is not solely determined by the surgeon's expertise and patient preferences, but also takes into account factors such as the number of affected levels, the site of spinal cord compression, the presence of instability affecting sagittal alignment, concurrent axial neck discomfort and neurological condition, as well as any accompanying patient comorbidities^[5].

The aim of this study is to compare the outcome of management of multilevel cervical disc by anterior discectomy and cage versus posterior decompression and lateral mass fixation.

PATIENTS AND METHODS

This prospective study included 30 cases with multilevel cervical disc attending at Al-Azhar university hospitals. Our study adhered to the principals of Al-Azhar Medical research Ethical Committee, and according to the declaration of Helsinki. Patients gave their written agreement to the use of their information in the study and the research. All patients signed the informed consent to publish their information and images in an online open-access publication. Patient were randomized into two groups, Group 1; included 20 patients who underwent anterior discectomy and cage, and Group 2 included 10 patients who underwent posterior decompression and lateral mass fixation. We recruited the patients according to the following criteria:

The inclusion criteria were age more than 25 years, and the patient had three or more cervical disc levels with or without cervical myelopathy

The exclusion criteria were patients who were bed ridden, had heart failure or unfit for surgery, those with cervical trauma associated with fractures, patients with cervical tumors or cervical kyphosis or patients with ossification posterior longitudinal ligament.

Data collection

Every case was subject to complete medical history taking, clinical examination, and routine preoperative laboratory investigations. Neurological Examination was done with special attention to motor power, sensory examination, deep tendons reflexes and pathological reflexes. Radiological investigations were done for every patient at the time of recruitment including MRI, X-RAY and CT in special cases. The primary outcomes of this study were to assess the patient's clinical improvement in relation to preoperative assessment regarding neck pain, brachialgia, motor and sphincteric affection.

Surgical technique

Anterior approach [multiple ACDF]

Patients were placed under general anesthesia in a supine position for the procedure. The anterior cervical discectomy and fusion [ACDF] were performed using the Smith-Robinson approach. Following confirmation through radiographic imaging and exposure of the affected vertebral levels, a discectomy was carried out along with the removal of anterior and posterior bony spurs and the cervical posterior longitudinal ligament [PLL]. The PLL was eliminated by grinding and thinning it down with a drill, then extracting it using a hook from the dura. To ensure proper decompression of the dura and neural structures, the PLL was dissected, and any additional compressive materials like posterior osteophytes were removed. The size of the Polyetheretherketone [PEEK] cage was determined using trial spacers, and the cage was inserted into the central portion of the disc space with the help of an impactor.

Posterior approach [posterior laminectomy]

Performed with the patient lying face down in a suitable position, a central incision was made on the back. The paraspinal muscles were dissected from the lamina, and the side of the lamina to be opened was determined based on the side of the main symptoms and findings from the preoperative imaging scan. In the process of performing laminectomy, a high-speed electric drill was used to create a groove and eliminate the supraspinous, interspinous, and yellow ligaments.

Postoperative Follow up

All patients were followed up early postoperative for neck pain, brachialgia, blood loss, CSF leakage, motor power. Post-operative infection and neck rigidity, motor power, pathological reflexes, sphincters control, cervical spine stability and range of

movement. Radiological follow up after 1 month by X-ray then after 2, 4 and 6 months was done by Plain X ray or CT cervical spine.

Statistical analysis

Statistical Package for the Social Sciences [SPSS] version 24 was used to analyze the data. Summaries of quantitative information were provided as means \pm SD. Numbers and percentages were used to illustrate patterns in the qualitative data. Independent t test was used to compare the quantitative data. The Chi-square test was developed to compare the qualitative data. P-value < 0.05 indicated statistical significance.

RESULTS

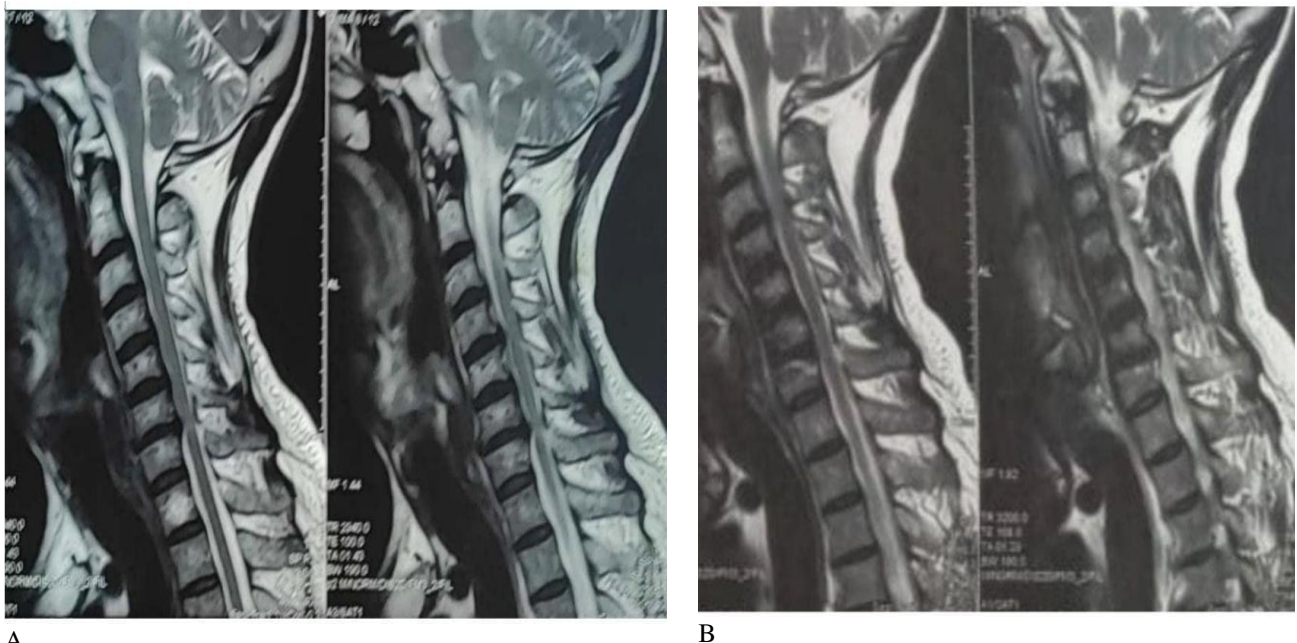
A total number of 30 cases were included in this study. The mean age of the studied patients was 50.2 ± 8.4 years with a range of 38 – 67 years old. According to their gender distribution, 20 patients [66.7%] were male, and 10 patients

[33.3%] were females. As regards the patients' comorbidities 11 patients [36.7%] were diabetic and 11 patients [36.7%] were hypertensive. According to the patients' clinical presentations, all patients were presented by neck pain and radiculopathy, however only 10 patients [33.3%] presented by cord manifestations. In terms of the type of surgical procedure, 20 patients [66.7%] underwent ACDF, while 10 patients [33.3%] underwent Posterior cervical discectomy with fixation.

As regards the post-operative neck pain, it was present in 40% of the patients who underwent ACDF versus 30% of the patients who underwent Posterior cervical discectomy with fixation [P = 0.5]. However, the radiculopathy was significantly higher in group 2 [50%] than group 1 [10%] postoperatively [P = 0.01]. The cord manifestations were reported only in one case in group 2. According to the post-operative complications, no complications were reported in group 2 patients, however 15 patients [75%] developed dysphagia [P = 0.001], two patients [10%] developed hoarseness of voice [P = 0.3], and two patients [10%] developed weakness [P = 0.3] [Table 1].

Table [1]: Postoperative outcomes of the studied patients

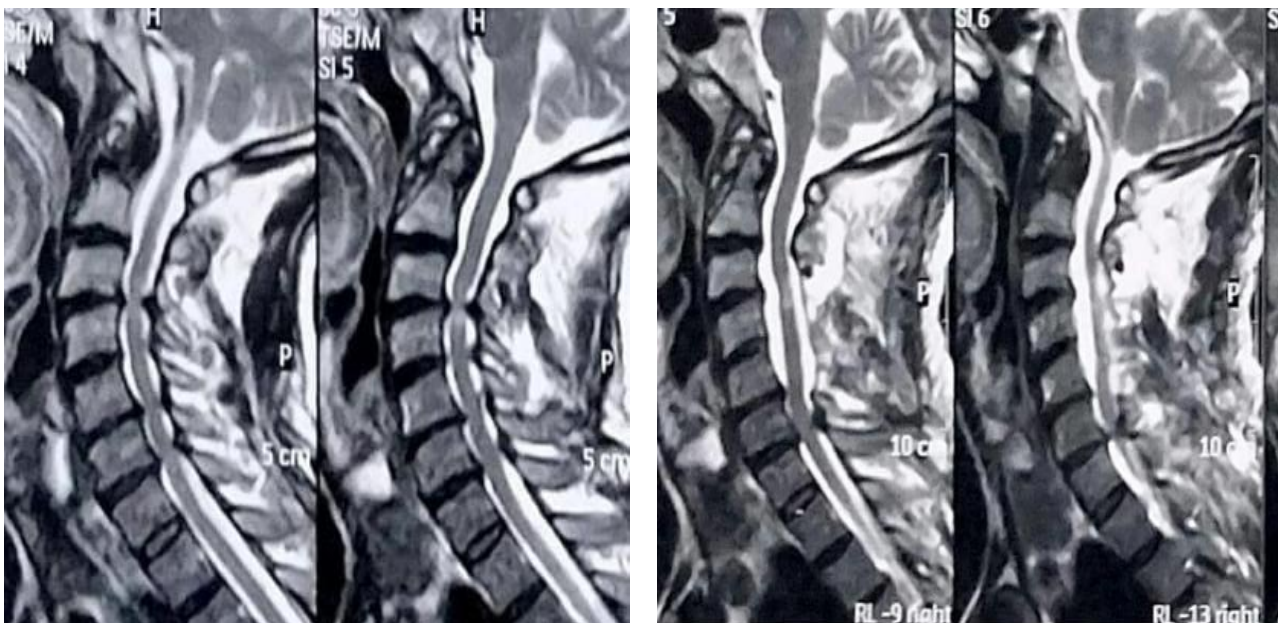
Variables	[Group 1 [N=20	[Group 2 [N=10	P value
Neck pain			
Yes	8 [40%]	3 [30%]	0.56
No	12 [60%]	7 [70%]	
Radiculopathy			
Excellent	6 [%]	3 [30%]	0.014*
Good	8 [%]	3 [30%]	
Fair	4 [%]	2 [20%]	
Poor	2 [%]	2 [20%]	
Cord manifestations			
Excellent	0 [0%]	4 [40%]	0.43
Good	1 [5%]	2 [20%]	
Fair	1 [5%]	1 [10%]	
Poor	0 [0%]	1 [10%]	
Complications			
Dysphagia	15 [75%]	0 [0%]	0.01*
Hoarseness of voice	2 [10%]	0 [0%]	0.3
Weakness	2 [10%]	0 [0%]	0.3



A

B

Figure [1]: Preoperative imaging [A] and postoperative imaging [B] of a 49-year-old male patient without diabetes mellitus [DM] and hypertension [HTN] who presented with neck pain of gradual onset and progressive course of bilateral brachialgia, predominantly on the right side in C5-6 distribution, persisting for 1 year without responding to conservative treatment. Upon examination, the patient exhibited full power, intact sphincter control, hyperreflexia in both upper limbs, and a positive Hoffman sign. MRI of the cervical spine revealed a multilevel cervical disc bulge. The patient underwent anterior cervical discectomy and fusion [ACDF] of C4-5, C5-6, and C6-7. Postoperatively, there was an immediate improvement in neck pain and brachialgia.



A

B

Figure [2]: Preoperative imaging [A] and postoperative imaging [B] of a 63-year-old male patient without diabetes mellitus [DM] and hypertension [HTN] who presented with heaviness in both upper and lower limbs with a gradual onset and progressive course over a 4-month duration. The patient has a history of neck pain and bilateral brachialgia of C5 and C6 distribution for 2 years and a history of urine precipitancy for 1 year. Upon examination, the patient was found to be spastic quadriparetic, with hyperreflexia throughout the limbs and a positive Hoffman sign. MRI of the cervical spine revealed multilevel cervical disc bulges with cord signal opposite C4. The patient underwent a spinolaminectomy from C3 to C6 and lateral mass fixation from C3 to C6 using 8 screws and 2 rods. Postoperatively, there was an immediate improvement in spasticity, neck pain, and brachialgia, followed by a gradual improvement in weakness during the follow-up period.

DISCUSSION

Reducing the length and size of any incisions made during surgery on elderly individuals who have poor surgical tolerance due to their underlying medical conditions is important. Since ACDF requires a smaller incision, shorter operating time, less blood loss, and no injury to the vital anterior cervical muscle groups, it can result in improved surgical outcomes in this regard. Most of our patients were suffering from symptoms for a time, there was neck pain and radiculopathy in all examined cases [100%] while there was a cord manifestation in 10 cases [33.3%], their symptoms duration was lasting for months, not less than 12 months.

Regarding the duration of symptoms, an Egyptian study mentioned that, on average, people experience symptoms for fourteen months [with a range of twenty-four to sixty months] before receiving a proper diagnosis. Nearly eighty-five percent of patients complained of neck discomfort, seventy-five percent experienced brachialgia, thirty percent complained of heavy legs, and fifteen percent experienced urine incontinence at the time of diagnosis. All of the participants in this analysis had anterior cervical discectomy followed by a four-level fusion using individual PEEK cages. After surgery, patients were evaluated using the Visual Analog Scale [VAS] at several time points. Time showed improvement, with a 24 month after surgery value of 2.15 ± 0.58 [6].

In our study, 30 patients were included, with 20 patients [66.7%] undergoing ACDF while the remaining 10 patients [33.3%] underwent posterior fixation. There was no statistically significant difference [p-value = 0.592] in post-operative neck pain between the two groups of patients who underwent different surgical procedures. However, there was a statistically significant difference [p-value = 0.014] in the elevated percentage of post-operative radiculopathy between patients who underwent posterior fixation [5 patients, 50%] and those who had ACDF [2 patients, 10%].

The median time from onset of symptoms to diagnosis was 24 [range 6-24 months], as reported by *Alaghory et al.* [7]. Myelopathy alone was found in 12 patients, while myelopathy and radiculopathy were reported in 16.

Alaghory et al. [7] accomplished four stages of anterior cervical discectomy and fusion utilizing just peek cages. Clinical and radiological measures [e.g., Japanese Orthopedic Association [JOA] ratings, visual analog scale [VAS]] were included for pre- and post-operative pain evaluation. Both the mean JOA score and the VAS had increased by the third month after surgery.

Schroeder et al. [8] noted improvements in VAS ratings for the neck and arms, as well as reductions in pre- and post-operative VAS values for myelopathy.

In our study, the post-operative weakness which was noticed in 2 patients, was improved within 3:6 months after intensive course of physiotherapy. *Gerszten et al.* [9] discovered that while employing plate fixation devices for three- and four-level ACDF, the overall cohort experienced a decreased risk of dysphagia.

Research by *Bou Monsef et al.* [10] indicated that just one patient [5%] experienced a problem, and that it was a temporary hoarseness of voice that was totally cured by the sixth week after surgery with the use of steroids, speech therapy, and reassurance. We found that steroid treatment for temporary dysphagia was effective in reducing symptoms within 3-7 days.

It was reported by *Alaghory et al.* [7] that hoarseness of voice was a postoperative consequence, but that patients fully recovered within a month. In our research, a course of steroids was able to alleviate hoarseness of voice within two to three months.

Esophageal displacement and soft tissue edema were found in 91% of patients by *Song et al.* [11]. Patients who used the Zero-Profile spacer had a considerably lower risk of developing dysphagia at 1-, 3-, and 6-months post-op, according to a meta-analysis.

The VAS score for axial pain was not substantially distinct among the ACDF and CLF groups in the aforementioned studies. However, we found no substantial distinction [p-value > 0.05] among the post-operative radiculopathy and cord manifestations in any of the cases investigated.

Reducing the size of the surgical site, protecting the cervical hemi acanthus muscle as much as possible, and removing the external fixation as soon as possible are all ways to lessen axial discomfort, as noted by *Xu et al.* [12].

The long-term success rate for ACDF was high, with outcomes similar to those achieved with the combined use of PEEK cages and plates. There was reduced downtime and mortality with standalone cages used in ACDF procedures. Further research on longer follow-up periods is required to fully assess the long-term efficacy of this approach, as the follow-up length in all trials, involving this one, is insufficient.

Anterior and posterior approaches were contrasted in a systematic review by *Liu et al.* [13] for the treatment of multilevel myelopathy, which can be caused by cervical spondylosis and ossification of the posterior longitudinal ligament [OPLL]. They found that the final follow-up JOA score for multilevel CSM cases in the anterior group was substantially greater than the posterior group in the follow-up time ≤ 5 years subgroup, yet had no substantial distinctions in the follow-up time > 5 years subgroup.

According to the meta-analysis conducted by *Zhang et al.* [14] there was no statistically substantial distinction among the preoperative JOA scores of the anterior surgery group and those

of the posterior surgery group, but the after surgery JOA scores of the anterior surgery group were higher than those of the posterior surgery group. These results showed that pre- and post-operative brain function were equal in both groups, but that post-operative improvement was greater in the anterior surgery group .

Conclusion

It has been shown that both the anterior and the posterior techniques are equally successful in management of multilevel cervical disc in radiculopathy and myelopathy with higher incidence of persistent radiculopathy in posterior approach and with higher incidence of complication like transient dysphagia, hoarseness of voice and weakness in anterior approach

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