



Original Article

Surgical Outcome of Anterior Cervical Decompression and Fusion in Patients with Cervical Spondylotic Myelopathy and Radiculopathy in Terms of Improvement of Pain

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ABSTRACT

Objective: Cervical spondylosis is a common degenerative condition leading to compression of nerve roots or spinal cord, causing radiculopathy or myelopathy. Anterior cervical decompression and fusion (ACDF) techniques are commonly recognized procedures in treating axial cervical spine pain and upper extremity radicular discomfort. The study analyzed the surgical outcome of anterior cervical decompression and fusion (ACDF) in cervical spondylotic myelopathy (CSM) and radiculopathy patients in terms of pain improvement.

Material and Methods: This descriptive case series analysis was performed at the Neuro Surgery department, Lady Reading Hospital Peshawar. A total of 146 patients between age 18 – 65 years meeting the inclusion criteria underwent anterior decompression & post-procedure improvement in pain of neck and arm/shoulder was determined using patient reported outcome (PRO) measure, namely visual analog scale (VAS) of 0-10 and a final outcome that is an improvement of pain, i.e., Mild to no pain (VAS score ≤ 3) was considered after 12 months.

Results: The mean age was 52 years \pm 8.273. As regards gender distribution, 78% of patients were male, while 22% were female. The mean baseline VAS score was 6.5 \pm 2.37, mean postoperative VAS score was 3.5 \pm 1.161 with a mean point improvement in pain of 3.0 points (p -value < 0.05). 80% of patients had shown improvement in reducing pain, while 20% did not have shown any improvement.

Conclusion: This study revealed that independent of symptoms duration and presentation, patients reported dramatic improvements in neck and arm pain after ACDF.

Keywords: Surgical Outcome, Anterior Cervical Decompression and Fusion (ACDF), Cervical Spondylotic Myelopathy (CSM), Radiculopathy.

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INTRODUCTION

Cervical spondylotic myelopathy (CSM) is a common debilitating cervical spine cord disorder-induced via narrowing of the cervical spinal canal due to age-induced degenerative changes and genetic modifications leading to substantial neurological impairment.¹ It is commonly seen in patients above the age of 50 years.² Three clinical syndromes can be broadly defined as complications caused by cervical spondylosis: axial neckline pain, cervical radiculopathy, cervical myelopathy, and some patients, usually experiencing a mixture of these syndromes.³ Patients typically have neck pain symptoms that radiate to the upper limb, particularly the arms, headache, and myelopathic weakness. In more extreme cases, depending on the cord level involved, fine motor coordination may be lost and even contribute to full upper and lower limb paralysis.⁴

When myelopathy occurs, surgical procedures are the recommended treatment. Conservative approaches that might include analgesia, cervical traction, immobilization, skull traction, anti-inflammatory drugs, physical therapy, and epidural analgesia are used in patients who are moderately impaired by Cervical spondylotic myelopathy (CSM).^{4,5} Surgical care is intended for those patients who have progressive neurological problems or intractable pain. Nerve impingement due to cervical spondylosis can be addressed with

either a posterior or anterior route. Similarly, it is possible to decompress the spinal cord through any route.⁵ The two primary decompression modalities in which an anterior approach is followed are anterior cervical corpectomy and fusion (ACCF) and anterior cervical discectomy and fusion (ACDF). High clinical effectiveness and increasing fusion rates had been reported after anterior discectomy and fusion, and both approaches have proved to be secure and effective.^{2,6}

The literature review doesn't show explicitly that one approach is scientifically superior to another but evaluates a variety of surgical techniques that exist, including both posterior or anterior approach either with or without fusion. Decision making thus focuses on patient variables and concomitant complications correlated to the strategy. The aims of surgical treatment should be decompression of the spinal cord or nerve roots, preventing deformity by preserving or supplementing the cervical spinal column's essential integrity, and alleviating neck and arms pain.^{5,7} Despite other parameters, it is important to consider reducing axial neck pain and arm pain.

Because further research on pain improvement after anterior cervical decompression and fusion appears to be required, studies that focus on surgical results of such procedures would be useful. This study's aim is in line with the same intent, which evaluates pain improvement after employing anterior cervical decompression ± fusion in patients having cervical spondylotic myelopathy and radiculopathy in our local population. One of the critical reasons for this study is that only one such analysis by Arif et al. has been identified so far in our region.⁴ This study's results would be projected on different health care institutions to improve treatment measures, and these findings can deliver neurosurgeons of knowledge about the probability and gradation which their patients

would encounter symptom changes following an ACDF.

MATERIAL AND METHODS

Study Design and Setting

A descriptive case series analysis was performed at the Neuro Surgery department, Lady Reading Hospital Peshawar, from January 2019 to January 2020. A total of 146 patients, through non-probability consecutive sampling, taking 75.3% proportion of improvement in pain of neck and arm,⁶ 7% margin of error and 95% confidence level under WHO formula for sample size, meeting inclusion criterion were enrolled in the study.

Inclusion Criteria

Patients of either gender with age between 18 – 65 years, diagnosed as per operational definition having unbearable pain (VAS – visual analog score four and above). Patients with one-level disease, i.e., either at C3 – C4 through C7 – T1, including one or a mixture of signs and symptoms such as arm or shoulder pain, motor weakness, altered sensations, and abnormal reflexes, and myelopathic symptoms. Patients not responding to conservative measures for more than 6 weeks.

Exclusion Criteria

Patients with prior failed cervical fusion, prior cervical trauma causing substantial bony or discoligamentous injuries to cervical spine & radiographically confirmed facet joint pathology. Patients with comorbidities such as severe diabetes mellitus and obesity, autoimmune disorders such as rheumatoid arthritis, malignancy of and/or metastatic to the cervical spine, osteoporosis, local or systemic infections, and allergic to implant materials were excluded from the study.

Data Collection

The analysis was carried out after the hospital's ethical & research committee's appraisal (Institutional board review PGMI Lady Reading Hospital Peshawar (Ref no: 1070Dy/reg/PGMI). Patients were informed of the research and treatment's intent and advantage, and written informed consent was received. All patients have been exposed to a detailed history of the duration of symptoms and Neurological examination. The cervical spondylotic myelopathy diagnosis was based on the operational definition.

A single neuro spine surgeon performed the anterior decompression at a single academic institution through a team of neuro spine surgeons with extensive experience of more than one year in their specialties. Post-procedure patients were followed regularly as per departmental protocol (2-weeks, 1-month, 3-months, 6-months, and one year). All the information, including name, age, gender, address, baseline VAS, and post-op VAS, was recorded in a proforma before and after the procedure and during follow-up uptill one year and an outcome that is an improvement of pain (VAS score three or less) was considered after 12 months. To restrict confounders and bias in study outcomes, strict exclusion criteria were followed.

Data Analysis

Using SPSS Version 20, the collected data was analyzed. Mean & Standard deviation was calculated for continuous variables such as age, duration of symptoms, height, weight, BMI, baseline VAS, post-op VAS. Categorical variables such as gender, obesity & pain improvement were stated as Percentages and frequencies. Effect modifiers such as gender, age, duration of symptoms, and obesity (BMI > 27.5) were dealt with through stratification to see these effects on the outcome. Post-stratification, the chi square

test was applied, holding a p-value of ≤ 0.05 as significant & results were expressed as tables.

RESULTS

Gender Distribution

In our study, 114 (78%) patients were male, while 32 (22%) were female.

Age Range

The age-wise distribution of 146 patients was observed, as 20 (14%) patients were within 31 and 40 years, 51 (35%) patients were in between 41 and 50 years, 75 (51%) patients were in 51 and 65 years of age. The mean age was 52 ± 8.273 years.

Clinical Presentation

The duration of symptoms was evaluated as 61 (42%) patients had a 1 – 3 months course, while 85 (58%) patients had 4 – 6 months with a mean duration of 3 months ± 2.149 . The status of obesity was evaluated as 92 (63%) patients were non-obese (BMI < 27.5) and 54 (37%) were obese (BMI > 27.5) with a mean BMI of 26 ± 3.451 . Mean, and the standard deviation was evaluated for numerical variables as mean height was 5.5 feet ± 1.76 , mean weight was 77 Kgs ± 9.23 .

Outcome Analysis

The mean baseline VAS score was 6.5 ± 2.37 , mean postoperative VAS score was 3.5 ± 1.161 with a mean point improvement in pain of 3.0 points (p-value 0.001, which is less than 0.05). The status of improvement in pain among 146 patients was evaluated as 117 (80%) patients showed improvement in reducing pain, while 29 (20%) patients did not improve.

Stratification of improvement in pain for, gender, age, duration of symptoms, and obesity is given in Tables 1-3.

Table 1: Stratification of Improvement in Pain with respect to Gender Distribution (n = 146).

Variable	Male	Female	Total
Improvement in pain:			
Improved	91	26	117
Not improved	23	6	29
Total	114	32	146

Table 2: Stratification of Improvement in Pain with respect to Age Distribution (n = 146).

Variable	31 – 40 Years Age	41 – 50 Years Age	51 – 65 Years Age	Total
Improvement in pain:				
Improved	16	41	60	117
Not improved	4	10	15	29
Total	20	51	75	146

The chi square test was applied, where p-value was 0.8582 for gender-wise & 0.9984 for age-wise distribution.

Table 3: Stratification of Improvement in Pain with respect to Duration of Symptoms & Obesity (n = 146).

Variable	1 – 3 Months	4 – 6 Months	Total
Improvement in pain:			
Improved	49	68	117
Not improved	12	17	29
Total	61	85	146
Variable	Non-Obese	Obese	Total
Improvement in pain:			
improved	74	43	117
Not improved	18	11	29
Total	92	54	146

The chi square test was applied, where p-value was 0.9609.

DISCUSSION

Cervical spondylosis is a degenerative condition leading to compression of nerve roots and spinal cord, causing radiculopathy or myelopathy.⁶

Anterior cervical decompression and fusion (ACDF) techniques are commonly recognized procedures in treating axial cervical spine pain and upper extremity radicular discomfort.^{8,9} Previous literature testified success rates of up to 94% and about 96% of patients suggesting that they remained pleased with the treatment or very satisfied with it.⁹⁻¹² Previous findings have shown that postoperative improvements in axial neckline pain and radicular arm pain could be of utmost significance in patients' satisfaction.⁹ The patient-reported outcome scales (PRO), as the visual analogue scale for pain, are frequently used to determine treatment outcomes after spinal surgery concerning treatment response and functional impairment.¹³ Prior literature analyzed surgical features and PROs (VAS) after anterior cervical surgery.^{9,13,14} Limited trials, however, have measured and stratified the gradation of improvement in pain (neck and arms discomfort) that somehow patients may experience after an ACDF after the first postoperative year.

Our study results revealed that most patients (n = 117) could expect improvement in their axial neck pain and arm pain afterwards, the first postoperative year following anterior cervical decompression ± fusion. VAS arm & neck pain improved from preoperative baseline in 80 percent of patients. Comparison of means between two independent variables, i.e. Mean baseline VAS & Mean postoperative VAS, showed a statistically significant difference between two groups with a p-value of 0.001 which is less than 0.05 and a mean point improvement in pain of 3.0 points. Improvements in arm pain are expected to occur following discectomy and intervertebral disc space height restoration leading to decompression of impinged nerve roots, while neck pain seems likely to improve because of bone fusion of the involved segment.

The current findings further indicate that patients with pain as the primary symptom undergo the most significant improvement (3.0 Points decline) in their respective condition

irrespective of age, gender, obesity, duration of symptoms (p-value > 0.05). It is expected to occur because a higher pain score as a primary symptom has a tremendous recovery prospect. In another study performed by Phillips FM et al,⁶ similar findings were reported wherein mean VAS pain values improved substantially over preoperative levels overall postoperative periods, with 75.3% of patients who underwent anterior cervical discectomy ± fusion had testified a clinically significant reduction in axial neck pain and worst arms discomfort.⁶

Zigler et al.¹⁵ reported that most of the improvements in patient complaints measured by the visual analogue scale were found in the first six weeks after surgery; however, the authors have not stated the degree of improvement in the assessed patient-reported outcome measure.¹⁵ Carreon et al.¹⁶ observed a 2.4 points (33.3%) decline in axial neck pain and a 2.2 points (35.5%) decrease for arm pain. Still, despite the vast pool of patients, the researchers had not provided the number of disease levels or that their research's fusion methods were through an anterior or posterior approach, limiting applicability to anterior cervical fusions only¹⁶.

Our work wasn't without restrictions. Firstly, all operations were carried out by a neurosurgeon at one tertiary care institute. This could restrict the generalization of the findings to the whole population undertaking anterior cervical decompression ± fusion. Secondly, there was a limited overall number of patients included within our study, so strictly speaking, this analysis could be under powered &, therefore, may provide a restricted valuation of the amount of progress encountered by ACDF patients.

CONCLUSION

The findings of our research indicate that patients can observe noteworthy improvements in their neck and arm pain, independent of their age, gender, and obesity & duration of symptoms

after an ACDF and could expect a 3.0 mean point reduction (80% improvement) over the first postoperative year.

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Additional Information

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Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Hamayun	Study design and methodology, manuscript writing and correspondence.
2.	Afzal Raza	Paper writing, referencing, and data calculations.
3.	Mumtaz Ali	Data collection and calculations.
4.	Naseer Hassan	Analysis of data and interpretation of results etc.
5.	Mohammad Ayaz	Literature review and manuscript writing.
6.	Hina Arooj	Analysis of data and quality insurer.
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