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ORIGINAL ARTICLE

Comparing the Efficacy of Non-Instrumented Versus Instrumented Fusion in Anterior Cervical Discectomy

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ABSTRACT

Objective: to compare the efficacy of management plans for anterior cervical decompression with non-instrumental and instrumental fusion procedures for reducing pain, improving recovery, and assessing complications in cervical degenerative diseases.

Methodology: Study was randomized controlled trial registered under Iranian Registry of Clinical Trials **[81024]** conducted at the Department of Neurosurgery, Gambat Institute of Medical Sciences, Gambat, Pakistan from June 2022 to May 2023. The trial enrolled patients diagnosed with degenerative cervical disease. Pre-operative assessments included VAS scores. Post-surgery, VAS scores were monitored at 3 months, with 50% reduction in pain score (VAS) was labeled as effective pain relief. Post operative hematoma formation, hospital stay were also monitored.

Results: The recovery was excellent in 15 (65.2%) patients of ACD whereas the recovery was excellent in 13 (44.8%) patients of ACDF Group. (p=0.327). The mean preoperative VAS score at 3 months of ACD and ACDF groups was 8.65±0.88 and 8.34±0.67, respectively. (p=0.160). The mean length of hospital stays of ACD and ACDF groups was 6.91±1.68 days and 7.24±1.53 days, respectively. (p=0.464).

Conclusion: Both procedures, with and without fusion, demonstrate good to excellent outcomes in functional recovery and relief in pain. They are comparable in terms of hospital stay length and postoperative complications.

Keywords: Anterior cervical discectomy, instrumented fusion, non-instrumented, Recovery, Pain

INTRODUCTION

Cervical disc herniation also known as cervical spondylosis or degenerative disc disease, commonly cause disability and pain among elderly and middle-aged individuals[1]. Typically, patients present with symptoms such as neck pain, shoulder pain, or arm pain, alongside signs of myelopathy[2]. These signs include weakness in the hands or arms, gait disturbances, muscle atrophy within the affected areas, and sensory disturbances following dermatomic patterns[3]. Surgical intervention becomes necessary when conservative treatment fails to adequately manage pain or when the degenerative condition begins to impair the patient's functional abilities, especially in settings like tertiary care hospitals in developing countries such as Pakistan, where the antero-cervical approach is relatively new[4,5].

Over the past few years, many surgical modalities using different instruments and implants are in practice for decompression of anterior of cervical spine, to attain successful treatment for osteophyte formation, disc herniation and different long and short-term outcomes[6,7].

In surgical procedures when anterior cervical segment assessed the primary aim is to remove the causative problem by decompression method[8]. Among surgical modalities Cloward technique and Smith Robinson techniques most commonly employed[9]. Various advancements have also been made, fusion instrumentation surgical method yielding many long and short term outcomes[10]. Through these approaches patient's recovery time, surgical precision, and spinal stability can be improved after docmpression of cervical spine[11].

As very few studies were conducted in our region on this topic this study designed to assess role of instrumented and non instrumented decompression of cervical spine disorders and to compare these modalities in terms of pain relief and recovery time with little more complication rate.

METHODOLOGY

Place and Duration: The study, conducted at the Department of Neurosurgery, conducted at the Department of Neurosurgery, Gambat Institute of Medical Sciences, Gambat, Pakistan from June 2022 to May 2023.

Trial Registration: Study was randomized controlled trial registered under Iranian Registry of Clinical Trials **[81024].**

Inclusion and Exclusion Criteria: Patients of degenerative cervical disease were enrolled and detailed clinical examination and complete history of any previous medical illness and surgical interventions was obtained. Patients with failed conservative management plan, developed neurological deficits were included and patients with history of any cardiac disease, cervical radiculopathy from below 12 weeks, two level disease, neurological deficit of advance stage, diabetic patients with neuropathy, and unfit for general anesthesia were excluded.

Ethical Consideration and Consent: Study received approval from the Institutional Ethical Review Board prior to commencement and obtaining consent from participating patients.

Data Collection: Pre-operative VAS score was assessed and after that VAS score at 3 months follow up was recorded. Effective pain relief was labeled when 50% of pain was relieved. Surgical technique was decided by senior surgeon after detailed examination and radiological investigations by evaluating severity of disease. Patients with single level disc prolapsed and moderate spondylosis were planned for discesctomy and severe spondylosis was treated with discectomy and fusion corpectomy.

After induction under general anesthesia, supine positionewas made with slightly extended head and supported shoulders. Prior to neck incision, an autologous bicortical bone graft was harvested from the iliac crest under aseptic conditions. The surgical approach involved layer-by-layer blunt dissection and meticulous hemostasis during a transverse neck incision. Intraoperative C-arm fluoroscopy was utilized to confirm the correct vertebrae level and after that longus coli muscles were dissected and separated from vertebral bodies. Discectomy was performed with loupe magnification to achieve precise surgical intervention.

During surgery in cases of hypertrophy and OPLL posterior longitudinal ligament and dura matter were severed, foramina patency was assessed and stenosis was relieved with foraminotomy. Bone graft was placed with graft cage and anterior interlocking was done at specific positions. Plate positioning and sagittal alignment were confirmed intraoperatively using

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fluoroscopy. The wound was closed in layers after thorough irrigation and achieving hemostasis.

Data Analysis: SPSS version 27 was used for analysis of data set, with a significance level set at $P \leq 0.05$. Categorical variables were analyzed using the chi-square test, while the t-test for independent samples was used for continuous variables.

RESULTS

Demographics and Baseline Study Variables: Overall, 52 patients were included in our study. In this study, ACD procedure was performed to 23 (44.2%) patients and ACDF was performed to 29 (55.8%) patients. The mean age of ACD and ACDF patients was 55.26±7.81 years and 58.65±5.74 years, respectively. (p=0.077). There were 14 (60.9%) males and 9 (39.1%) females in ACD Group, whereas there were 18 (62.1%) males and 11 (37.9%) females in ACDF Group. (p=0.930). Sensory deficits was noted in 13 (56.5%) and 10 (34.5%) patients of ACD and ACDF Groups, respectively. (p=0.112). Reduction of ROM was observed in 7 (30.4%) and 12 (41.4%) of ACD and ACDF Group, respectively. (p=0.416). Muscle atrophy was found in 15 (65.2%) and 16 (55.2%) of ACD and ACDF Group, respectively. (p=0.463). (Table. I).

Comorbidities: According to comorbidities, there were 5 (21.7%) and 11 (379%) patients in ACD and ACDF, respectively, had hypertension. (p=0.209). There were 9 (39.1%) and 10 (34.5%) patients diabetic in ACD and ACDF, respectively. (p=0.730). Osteoarthritis was found in 6 (26.1%) and 9 (31.0%) patients of ACD and ACDF, respectively. (p=0.696). (Figure. I).

Outcomes: There was only 1 (4.3%) patient of ACD had hematoma formation whereas 6 (20.7%) patients of ACDF had hematoma formation. (p=0.086). The recovery was excellent in 15 (65.2%) patients of ACD whereas the recovery was excellent in 13 (44.8%) patients of ACDF Group. (p=0.327). The mean preoperative VAS score at 3 months of ACD and ACDF groups was 8.65±0.88 and 8.34±0.67, respectively. (p=0.160). The mean length of hospital stays of ACD and ACDF groups was 6.91±1.68 days and 7.24±1.53 days, respectively. (p=0.464). (Table. II).

Table 1: Demographic and baseline profile

Variable	Group		p-value
	ACD 23 (44.2%)	ACDF 29 (55.8%)	
Age (years)	55.26±7.81	58.65±5.74	0.077
Gender			
Male	14 (60.9)	18 (62.1)	0.930
Female	9 (39.1)	11 (37.9)	
Sensory deficits	13 (56.5)	10 (34.5)	0.112
Reduction of ROM	7 (30.4)	12 (41.4)	0.416
Muscle atrophy	15 (65.2)	16 (55.2)	0.463
Mean±S.D, N (%)			

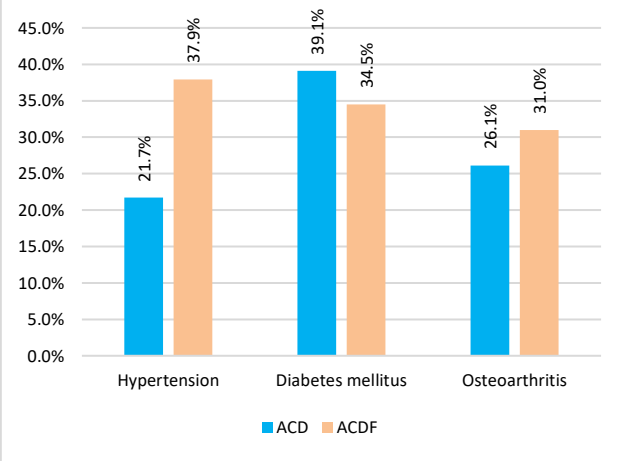

Figure 1: Comorbidties among the groups

Table 2: Postoperative complication, and outcomes

Variable	Group		p-value
	ACD 23 (44.2%)	ACDF 29 (55.8%)	
Hematoma formation	1 (4.3)	6 (20.7)	0.086
Recovery			
Excellent	15 (65.2)	13 (44.8)	0.327
Good	6 (26.1)	11 (37.9)	
Poor	2 (8.7)	5 (17.2)	
VAS score pr-eop at 3 months	8.65±0.88	8.34±0.67	0.160
Hospital stays (days)	6.91±1.68	7.24±1.53	0.464
Mean±S.D, N (%)			

DISCUSSION

It was suggested by experts neurologists and neuro-surgeons that cervical degenerative disorders like chronic instability, ossification of posterior longitudinal ligament, cervical disc prolapsed, sign and symptoms of restricted movements, pain and weakness must be treated conservatively for at least 6 to 12 weeks[12].

In our study there were more male patients in both groups having mean age 55.26±7.81 years in ACD group and 58.65±5.74 years in ACDF group, most common comorbidities include hypertension, diabetes and osteoarthritis. In a study conducted by Faryal et al.[13], 40 patients were enrolled, consisting of 60% men and 40% women. The patients in this study had a mean age of 56.6 ± 6.7 years. The study identified hypertension in 8 patients, osteoarthritis in 6 patients, and a positive history of diabetes in 4 patients. Additionally, ischemic heart disease was found in 7 of the patients included in the analysis.

The mean preoperative VAS score at 3 months of ACD and ACDF groups was 8.65±0.88 and 8.34±0.67, respectively. McCarthy et al.[14] discovered that ACDF and ACD showed comparable results in functional improvement and pain relief. However, ACDF demonstrated superior outcomes in enhancing neural foraminal height, reducing neck pain, and preserving disc space compared to ACD. Similarly, in their study, Haimoto et al.[15] documented that patient's demonstrated significant improvement in both pain levels and overall disability within the initial three-month follow-up period.

In a prospective non-randomized study led by Hirai et al.[16], examining the effects of various fusion techniques on pain relief, it was concluded that all patients experienced effective pain relief, irrespective of the specific fusion technique employed. In the randomized controlled trial conducted by Ghogawala et al.[17], 51 out of 71 patients received surgical procedures performed by a single surgeon. The study found that, two years post-surgery, decompression alone led to

limited recovery in components of physical quality scoring compared to instrumented fusion.

In this study the mean length of hospital stays of ACD and ACDF groups was 6.91±1.68 days and 7.24±1.53 days, respectively. In their study evaluating the efficacy of anterior cervical discectomy and fusion, Tan et al [18] found that preoperative Visual Analog Scale (VAS) significantly improved postoperatively (VAS: 7.1 ± 1.2 vs. 3.1 ± 1.3; ($P < 0.01$). However, they also reported an incisional hematoma in one patient, occurring on the 6th day after discharge, which was successfully treated with a pressure dressing.

Our study demonstrated significant postoperative improvements in both pain levels and spinal nerve function, which align with or even surpass the positive outcomes observed in previous studies conducted by Qi et al [19] and Zhang et al.[20] showing shorter hospitalization and short recovery time when ACDF performed with instruments.

In this study the recovery was excellent in 15 (65.2%) patients of ACD whereas the recovery was excellent in 13 (44.8%) patients of ACDF Group. (p=0.327). A study conducted by Andrews et al.[21] found that most patients in Ghana undergoing

non-instrumented anterior cervical discectomy and fusion (ACDF) for cervical myelopathy achieve excellent or good clinical outcomes following surgery.

CONCLUSION

Both procedures, with and without fusion, demonstrate good to excellent outcomes in pain relief and functional recovery. They are comparable in terms of hospital stay length and postoperative complications.

REFERENCES

1 Andresen AK, Carreon LY, Overgaard S, Jacobsen MK, Andersen MØ. Safety and reoperation rates in non-instrumented lumbar fusion surgery: secondary report from a randomized controlled trial of ABM/P-15 vs allograft with minimum 5 years follow-up. Global Spine Journal. 2024 Jan;14(1):33-40. doi: 10.1177/21925682221090924.

2 Mella P, Suk KS, Kim HS, Lee HM, Moon SH, Park SJ et al. Acdf with total en bloc resection of uncinate in foraminal stenosis of the cervical spine: Comparison with conventional acdf. Clin Spine Surg. 2021 May 1;34(4):E237-42. doi: 10.1097/BSD.0000000000001117.

3 Nichols N, Chou D, Jamieson A, Tan LA. P13. ACDF fusion rates. The Spine J. 2020 Sep 1;20(9):S153-4. doi: 10.1016/j.jocn.2020.10.024.

4 Barrios-Anderson A, Adetokunbo'Toki'Oyelese MD. Navigation in Non-Instrumented Spine Surgery. Robotic and Navigated Spine Surg: Surgical Techniques and Advancements. 2022 Jun 3:89. DOI:10.1016/B978-0-323-71160-9.00007-1

5 Ando K, Machino M, Ito S, Segi N, Tomita H, Koshimizu H et al. Surgical outcomes in instrumented surgery for dumbbell type spinal cord tumor-the comparison with non-instrumented surgery for spinal cord tumor. J Orthop Sci. 2023 Nov 1;28(6):1234-9. doi: 10.1016/j.jos.2022.10.026.

6 Farag AA, Mahmoud B, Hammad W, Khoudir MA, Sukkar FA. Spinal Instrumentation in Spondylodiscitis: An Experience from Saudi Arabia. J Spine Res Surg. 2020;2(4):115-29.https://www.fortunejournals.com/articles/spinal-instrumentation-in-spondylodiscitis-an-experience-from-saudi-arabia.html

7 Karikari IO, Jain D, Owens TR, Gottfried O, Hodges TR, Nimjee SM et al. Impact of subsidence on clinical outcomes and radiographic fusion rates in anterior cervical discectomy and fusion: a systematic review. J Spinal Disord Tech. 2014 Feb;27(1):1-10. doi: 10.1097/BSD.0b013e31825bd26d.

8 Lamas V, Charles YP, Tuzin N, Steib JP. Comparison of degenerative lumbar scoliosis correction and risk for mechanical failure using posterior 2-rod instrumentation versus 4-rod instrumentation and interbody fusion. European Spine Journal. 2021 Jul;30:1965-77. doi: 10.1007/s00586-021-06870-9.

9 Koch KM, Nencka AS, Klein A, Wang M, Kurpad S, Vedantam A et al. Diffusion-weighted MRI of the spinal cord in cervical spondylotic myelopathy after instrumented fusion. Frontiers in Neurology. 2023 May 19;14:1172833. doi: 10.3389/fneur.2023.1172833.

10 Jiang L, Liu L, Dong L, Xu Z, Zhang X, Qian L. Comparison of instrumented and stand-alone lateral lumbar interbody fusion for lumbar degenerative disease: a systematic review and meta-analysis. BMC Musculoskeletal Disorders. 2024 Feb 3;25(1):108. doi: 10.1186/s12891-024-07214-6

11 Saqib M, Khan MA, Khan MI, Ullah S, Khan MM. Clinical Features and Short-Term Outcome Analysis of Anterior Cervical Discectomy; Effect of Instrumented Vs Non-Instrumented Fusion. Journal of Pakistan Orthopaedic Association. 2016 Jan 1;28(1):6-11. http://www.jpoa.org.pk/index.php/upload/article/view/86

12 Newcomb AG, Hostetler T, Lehrman J, Pereira BD, Wangsawatwong P, Turner JD, Kelly B. P12. Lumbosacral residual rod strains in long PSR constructs often exceed in vitro rod bending strains. The Spine Journal. 2020 Sep 1;20(9):S153. https://doi.org/10.1016/j.spinee.2020.05.410

13 Faryal MA, Afnan WA, Sajid Khan ZA. Short-Term Outcomes and Clinical Features Analysis of Anterior Cervical Discectomy; Effect of Non-Instrumented Vs. Instrumented Fusion. Pak J Med Health Sci. 2022 Jun 25;16(04):1139. DOI: https://doi.org/10.53350/pjmhs221641139

14 McCarthy MH, Lafage R, Smith JS, Bess S, Protopsaltis TS, Ames CP et al. P11. How much lumbar lordosis does a patient need to reach their age-adjusted alignment target? A formulated approach predicting successful surgical outcomes. The Spine J. 2020 Sep 1;20(9):S152-3. doi: 10.1177/21925682221092003.

15 Haimoto S, Schär RT, Nishimura Y, Hara M, Wakabayashi T, Ginsberg HJ. Reduction in surgical site infection with suprafascial intrawound application of vancomycin powder in instrumented posterior spinal fusion: a retrospective case-control study. J Neurosug: Spine. 2018 Aug 1;29(2):193-8. DOI: 10.3171/2017.12.SPINE17997

16 Hirai T, Yoshii T, Sakai K, Inose H, Yamada T, Kato T et al. Long-term results of a prospective study of anterior decompression with fusion and posterior decompression with laminoplasty for treatment of cervical spondylotic myelopathy. J Orthop Sci. 2018 Jan 1;23(1):32-8. DOI: 10.1016/j.jos.2017.07.012

17 Ghogawala Z, Dziura J, Butler WE. Laminectomy plus fusion versus laminectomy alone for lumbar spondylolisthesis. N Engl J Med. 2016;374(15):1424-1434. doi:10.1056/NEJMoa1508788.

18 Tan T, Lee H, Huang MS, Rutges J, Marion TE, Mathew J et al. Prophylactic postoperative measures to minimize surgical site infections in spine surgery: systematic review and evidence summary. The Spine J. 2020 Mar 1;20(3):435 47. DOI: 10.1016/j.spinee.2019.09.013

19 Qi M, Chen H, Liu Y, Zhang Y, Liang L, Yuan W. The use of a zero-profile device compared with an anterior plate and cage in the treatment of patients with symptomatic cervical spondylosis: a preliminary clinical investigation. The bone & joint journal. 2013 Apr 1;95(4):543-7. doi: https://doi.org/10.1302/0301-620X.95B4.30992

20 Zhang J, Wang S, Tang X, Xiong W, Wu H, Liu C et al. Clinical and radiological comparison of the zero-profile anchored cage and traditional cage-plate fixation in single-level anterior cervical discectomy and fusion. Eur J Med Res. 2022 Sep 30;27(1):189. doi: 10.1186/s40001-022-00813-w.

21 Andrews NB, Lawson HL, Odjidja TL. Elective non-instrumented anterior cervical diskectomy and fusion in Ghana: a preliminary report. West Afr J Med. 2003 Jun;22(2):128-32. doi: 10.4314/wajm.v22i2.27931.

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