



Orthopaedics

FUNCTIONAL EVALUATION OF ANTERIOR CERVICAL DISCECTOMY AND FUSION BY BONE GRAFT AND ANTERIOR CERVICAL LOCKING PLATE .

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ABSTRACT

Introduction: Cervical disc herniation often results in neck and arm pain in patients as a result of direct impingement of nerve roots and associated inflammatory processes. The clinical presentation usually corresponds with the side of herniation and ipsilateral symptoms predominate the clinical picture. Physiological changes in the nucleus are followed by progressive annular degeneration. Frank extrusion of nuclear material can occur as a complication of this normal degenerative process. As the degeneration proceeds, hypermobility of the segment can result in instability or degenerative arthritic changes or both. The goal of cervical spine disc surgery is to relieve pain, numbness, tingling, weakness and to restore normal function and prevent abnormal mobility in the spine. **Material and Methods:** Study design: prospective study. The study was conducted From October 2022 to December 2024 at Apollo Institute of Medical Sciences and research. Follow-up of these patients was done at 4 weeks, 8 weeks, 12 weeks, 16 weeks and 24 weeks. After surgery the results were compiled & analysed using Modified Japanese Orthopedic Association Score (mJOA), Odems criteria and Nurik's classification System. **Results :** The mean age of the patients was 44.9 years. Males were more commonly affected than females (16 males and 4 females). Degenerative changes occur in cervical spine early in manual labourers doing heavy work (50%). Of the 20 patients analyzed the majority of the patients were operated for C6-C7 level followed by C5-C6 level. Radiological union was achieved by the end of 12 weeks in 68.4% of the patients. Neck movements significantly improved over a period of 4 weeks. Assessment according to Odems by the end of 24 weeks excellent in 84.2% (16 patients) good in 10.5% (2 patients) and fair in 5.3% (1 patient). Nurik's grading by the end of 24 weeks is Grade 0 in 89% and grade 1 in 5% and Grade 6 in 5%. Modified Japanese scoring system statistically significant improvement noted. **Conclusion:** Anterior cervical plating with tricortical bone graft plays an important role in influencing the post operative cervical spine alignment and also the clinical outcome of the patients. The use of anterior plating after anterior cervical discectomy and fusion with tricortical bone graft generally enhances the arthrodesis, this study shows the improved clinical outcome and fusion with very low complication rate.

KEYWORDS :**INTRODUCTION**

The human neck consists of many vital neurologic, vascular, and respiratory structures as well as the cervical vertebrae and spinal cord.¹ The cervical spine gives structural support and bony protection to the spinal cord. The complex network of ligaments keeps individual bony elements moving as a single unit.² The most common disorders and processes that can affect the cervical spine are disc disorders including the Herniated Nucleus Pulposus (HNP) and Degenerative Disc Disease (DDD).³ HNP at the cervical level results from the displacement of the nucleus pulposus of the intervertebral disc at the cervical level, which may result in direct compression of the spinal cord or impingement of nerve roots. Cervical disc herniation results in radiculopathy.⁴ Cervical radiculopathy is marked by compression of the cervical nerve root.⁵ The common causes of disc herniation are degenerative process and trauma.⁶

Degenerative cervical spine disorders may result in pain, radiculopathy or myelopathy that may require surgery. Decompressive surgery may be carried out via an anterior or posterior approach and is usually combined with a fusion procedure. The anterior approach is usually preferred in the cervical spine to overcome the limitations of the posterior approach, i.e., risk of manipulation of the cord. The transoral/transpharyngeal approach helps to access to the anterior clivus, C1 and C2. The retropharyngeal technique accesses the anterior cervical spine either medial (anteromedial approach) or lateral (anterolateral approach) to the carotid space. Minimally invasive or endoscopic decompressive techniques and motion preserving cervical disc arthroplasty are newer techniques that can be used in the selected patients.⁷

Anterior Cervical Discectomy and Fusion (ACDF) is a standard and effective treatment for various spinal cervical deformities such as spondylosis, herniated discs, fractures, neoplastic lesion. It has excellent clinical results and relatively safe so that it has been the one of the most common procedure for degenerative spinal cervical disease.⁸ Anterior cervical discectomy is usually combined with fusion (without or with anterior plating).⁷ ACDF works by decompressing spinal cord and increasing neuroforaminal size and volume by anterior

interbody distraction in cervical spine.⁹ Interbody fusion may be carried out with an interbody graft which includes autograft (iliac crest, fibula), allograft or interbody spacer.⁷ The ideal graft should have all potentials of osteogenesis, osteoinduction and osteoconduction, and only graft which fulfils all the three properties is autologous bone graft.⁸ Cervical spine can be further stabilized with the use of Anterior Cervical Plate (ACP), standalone cage or combination of both to maintain curvature and decrease pseudoarthrosis rates.⁹ ACPs help improve the fusion rates and outcome in patients undergoing multilevel anterior cervical procedures. These plates have certain features that include earlier patient mobilization, decreased orthotic need, increased loading force applied to the graft, diminished incidence of graft dislodgment, and an improved ability to correct and/or prevent spinal deformity.¹⁰

A tricortical autograft is considered as a gold standard for fusion which provides ideal properties to graft along with mechanical strength due to cortical supports in it. But, graft has poor self-fixing characteristics and it may extrude collapse or fail to heal resulting in symptomatic pseudoarthrosis. Prevention strategy for such complications requires addition or augmentation of fixation with anterior plate system.⁹

Aims and Objectives

- 1) To Evaluate The Functional Outcome Of Anterior Cervical Discectomy And Fusion.
- 2) Post Operative Stability And Early Rehabilitation.

MATERIALS AND METHODS

This study is a hospital based prospective study conducted at Apollo Institute of Medical Sciences and Research from OCTOBER 2022 – DECEMBER 2024. The results were compiled & analysed using Modified Japanese Orthopedic Association Score (mJOA), Odems criteria and Nurik's classification system.

Inclusion Criteria

- 1) From the age of skeletal maturity
- 2) Degenerative Disc Prolapse - like cervical spondylitic myelopathy,
- 3) Cervical spondylitic radiculopathy

- 4) Traumatic Disc Prolapse – Fractures with neurocompression
- 5) Secondary to disc fragments anterior to dura, herniated intervertebral disc.

Exclusion Criteria

- 1) Below the age of skeletal maturity
- 2) Pathological Disc Herniation
- 3) Ankylosing Spondylitis
- 4) Spondylitis Disorders (DISH)
- 5) Osteoporosis
- 6) Osteopenia
- 7) Rheumatoid Arthritis
- 8) Subluxation and dislocation of cervical spine

All Patients Included in The Study Will Be Assessed Clinically With Physical Examination and confirmed by MRI.

Pre Op Investigations And Fitness Will Be Taken For Surgery. Written And Informed Consent Will Be Taken For The Surgery.

Patients subjected to surgery will be followed up at regular intervals with clinical and radiological data. Assessment will be done based on a proforma containing all necessary information regarding. Cervical Discectomy with Anterior Cervical Locking Plates with Interbody Fusion by Tricortical Bone Grafting. On Each Follow-up Visit Clinical and Radiological Evaluation Done to Assess the Functional Outcome.

Follow up will be at 4 weeks, 8 weeks, 12 weeks, 16 weeks and final follow-up at 24 weeks.

RESULTS

Demographics and Baseline Characteristics: In this observational clinical study involving 20 patients undergoing cervical spine surgery, the majority (65%) were aged between 41–60 years, with a mean age of 44.9 ± 10.3 years (range: 22–62 years). Males constituted 80% of the study population ($n = 16$), while females accounted for 20% ($n = 4$).

Occupational Distribution: Half of the study participants (50%) were farmers engaged in heavy manual labor, followed by semi-skilled workers (20%), housewives (20%), and professionals (10%). This indicates a higher prevalence of cervical degenerative changes among those performing strenuous physical activity.

Clinical Presentation and Level of Involvement: Neck pain was the predominant symptom, with 60% of patients presenting within one month of symptom onset. Cervical involvement was most commonly noted at the C6–C7 level (30%), followed by C5–C6 (25%) and combined C5–C6 & C6–C7 involvement (25%).

Radiculopathy and Neurological Deficits: Radiculopathy affected the right upper limb in 35% of patients, left upper limb in 30%, and was bilateral in another 35%. Neurological deficits were most commonly observed in the right upper limb (40%), followed by the left (25%), bilateral involvement (20%), and quadriplegia in 10% of patients. No deficits were observed in 10%.

Surgical Intervention Details: Locking plates of varying lengths were used, with 29 mm being the most commonly used (35%). Four screws were used in 85% of the procedures, while 15% required five screws.

Comorbidities and Postoperative Complications: Only two patients had comorbidities (one with hypertension, one with both diabetes and hypertension). There were no postoperative complications reported in any of the cases.

Follow-up, Radiological Union, and Implant Stability: Radiological union was achieved in 68.4% of patients by 12 weeks and in 31.6% by 16 weeks. One patient (5.3%) experienced implant failure. One patient was lost to follow-up, resulting in a 95% follow-up completion rate at 24 weeks.

Nurick's Grading: A significant improvement in Nurick's grading was observed postoperatively ($p < 0.001$). Preoperatively, 89.4% of patients were classified as Grade 2, which improved to 89.4% being classified as Grade 0 postoperatively. One patient with Grade 6 preoperatively remained unchanged postoperatively due to fracture with disc prolapse.

Modified Japanese Orthopaedic Association (mJOA) Score: There

was a statistically significant improvement in total mJOA scores postoperatively (Pre-op: 15.63 ± 3.70 vs. Post-op: 17.37 ± 2.52 ; $p < 0.001$). Significant improvements were also observed in:

- Motor Lower Limb function ($p = 0.04$),
- Sensory Upper Limb function ($p < 0.001$).

Motor upper limb and sphincter scores showed improvement, though not statistically significant.

mJOA Grading: Mild myelopathy increased from 84.2% preoperatively to 94.7% postoperatively ($p = 0.01$). Two patients with moderate myelopathy improved to mild, while one patient with severe myelopathy showed no significant change.

Odom's Outcome Criteria: At the end of 24 weeks, outcomes based on Odom's criteria were:

- Excellent in 84.2% of patients ($n = 16$),
- Good in 10.5% ($n = 2$),
- Fair in 5.3% ($n = 1$).

CONCLUSION

In the present study out of 20 patients majority of the patients belong to 40–60 years age, with the mean age of 44.9. Fraser et al in their study found that The mean age of the patients was 46.7 years⁴¹ which can be compared to our study.

Suk Ha Lee et al⁴² concluded that All the patients had a complete recovery of clinical symptoms after surgery. Postoperative score according to Odom's criteria was excellent in six patients and good in remaining six. Bony union was achieved in all the patients with average union time of 12 weeks (8–20 weeks). Which can be compared to our study which has an union of 68.4% in 12 weeks Fehlings et al - 85 (30.6%) of the 278 enrolled patients had mild cervical spondylotic myelopathy, 110 (39.6%) had moderate disease, and 83 (29.9%) had severe disease preoperatively. One-year follow-up data were available for 222 (85.4%) of 260 patients. There was a significant improvement postoperatively ($p < 0.05$) in the mJOA score, Nurick grade, NDI score, and all SF-36v2 health dimensions (including the mental and physical health composite scores) except general health. With the exception of the change in the mJOA, the degree of improvement did not depend on the severity of the preoperative symptoms. These results remained unchanged after adjusting for relevant confounders in the multivariate analysis. Fifty-two patients experienced complications (prevalence, 18.7%), with no significant differences among the severity groups. 44 in our study has similar improvement in relief of symptoms post operatively but did not have any post operative complications In a study conducted by Sharma et al⁴³, The correlation between duration of symptoms (months) to pre-operative MJOA scores was statistically significant (p -value=0.015). The correlation between duration of symptoms (months) to post-operative MJOA scores was statistically significant. (p -value=0.013) which can be compared to our study with a mean difference of -1.74 with a P value of <0.01 which is statistically significant. Silber JS al Anterior cervical discectomy and fusion procedures frequently use autologous anterior ICBG (Iliac crest bone Graft) to facilitate osseous union. Although autologous ICBG offers several advantages over alternative grafting materials, donor site morbidity can be significant. Acute and chronic complications of donor sites have been reported, yet there are currently no reports of long-term functional outcomes after autologous anterior ICBG (Iliac crest bone Graft) donation after single-level ACDF which was contrary to our study since there was no complications of donor sites have been reported. The rate of fusion was 97%. Complete pain relief occurred in 78%, partial in 18% and little or no pain relief in 4%. There were no serious complications, and none of the patients thought they were made worse by surgery⁴⁵. Which can be compared to our study with good fusion rate and no complications. Bohlman et al evaluated the results of the Robinson method of anterior cervical discectomy and arthrodesis with use of autogenous iliac-crest bone graft. At the time of the most recent follow-up, fifty-three of the fifty-five patients who had had a motor deficit had had a complete recovery, and the two remaining patients had had a partial recovery. Seventy-one of the seventy-seven patients who had had a sensory loss had regained sensation. None of the patients had an increased neurological deficit postoperatively. Our results suggest that the Robinson anterior cervical discectomy and arthrodesis with an autogenous iliac-crest bone graft for cervical radiculopathy is a safe procedure that can relieve pain and lead to resolution of neurological deficits in a high percentage of patients 46. Which can be compared to our study with no post operative complications and there was relief from pain and resolution of neurological deficits. Thiago Pereira Coutinho et al Evaluated and

correlated the functional response of patients with cervical myelopathy with the current clinical scores in patients who underwent surgical treatment. Methods: they analyzed medical records of 34 patients with cervical myelopathy who underwent four different types of surgery. All patients were evaluated preoperatively and postoperatively with the application of the JOA and Nurick questionnaires. Results: Functional clinical improvement was statistically significant. The mean preoperative JOA was 8.5 ± 3.06 and 10.7 ± 3.9 in the postoperative; Nurick was 3.2 ± 1.1 preoperatively and 2.8 ± 1.3 postoperatively.

Summary

There is benefit with the surgical procedure in patients with cervical myelopathy. The neurological function after surgery depends on the previous function (the higher the duration of the previous symptoms, the greater the progression of the disease and, therefore, worse the neurological function) and the age is not a relevant factor of improvement, as already shown in other series. The clinical functional improvement of patients is visible with surgical treatment, regardless of surgical technique,⁴⁷ which can be compared to our study with statistically significant improvement in both nurick p value <0.01 and MJOA – which was 15.63 preoperatively and 17.37 post operatively.

In a study by Wright IP et al All surgery was performed at no more than 2 contiguous levels, by one surgeon (S.M.E.). After anterior discectomy alone, or combined with posterior vertebral body margin osteophyctomy, anterior bone grafting (Smith-Robinson) was performed at each level using a tricortical autogenous iliac crest bone block inserted under compression. In the interests of maximizing resource allocation and minimizing potential complications, all surgery was completed without internal fixation. A postoperative semirigid cervical collar was prescribed for 2 months. These results tend to confirm published reports of high pseudarthrosis rates in anterior cervical fusions carried out at 2 or more levels without fixation, as against improved fusion rates when internal fixation is applied. The authors are inclined to change their practice to include internal fixation in the form of anterior plating for fusions carried out at more than one level. Patients with technically successful fusions were less likely to have postoperative neck pain. Donor site pain was not a significant postoperative complication.⁴⁸ Which can be compared to our study where in smith Robinson technique was used and donor site pain and complications were nil and their study also concluded that anterior plating is very essential for fusion and to prevent post operative complications like pseudarthrosis.

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