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Postoperative functional outcomes in patients with highly migrated cervical disc prolapse

Mohan Periyasamy[1], Edmond Jonathan Gandham[1], Jeena Joseph[1], Krishna Prabhu Raju[1]

[1]Christian Medical College, Vellore, India

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Abstract

Introduction: Cervical spondylotic myelopathy resulting from a highly migratory disc prolapse is an infrequent occurrence, typically associated with patients presenting with poor Nurick grades. The debate around the choice of therapy between discectomy versus corpectomy is a topic of contention. In this study, we describe our findings on the utilization of corpectomy as the preferred therapeutic approach.

Material and Methods: In this retrospective study a cohort of 12 patients were included during the study period. The variables studied encompassed demographic aspects, clinical presentation, radiological data, as well as the rates of recovery for both Nurick and mJOA (Modified Japanese orthopedic association) scales.

Results: The average age at presentation was 52.8 years, with a range of 42 to 64 years. The male-to-female ratio was 1:1. At presentation, the mean Nurick grade was four and the mean mJOA score was 9.8. The average duration of the symptoms was 17 months. The median follow-up period was 25 months (range:12-72 months). Based on pre operative MRI scans, the migration distance of disc prolapses ranged from 6.5-18.8 mm with mean of 9.9 mm. At follow-up, the mean Nurick grade recovery rate was 49.58 + 22.74 % and the mean mJOA recovery rate was 58.42 + 24.77% (p=0.04). There were no complications.

Conclusion: Based on our empirical observations, corpectomy appears to be an optimal surgical approach for patients presenting with highly migrated disc prolapse. This procedure offers a broader surgical field, facilitating the removal of fragments located posterior to the vertebral body and those that are adherent to the thecal sac.

Short title: Highly migrated cervical disc prolapse

Key words: cervical disc prolapse; highly migrated; corpectomy; functional outcomes

Introduction

Highly migrating cervical disc prolapses (HMDPs) are incredibly uncommon among nontraumatic cervical disc prolapses. In a case series spanning six years, 396 cases of of medicine, ensuring that their practice is informed by data, cervical disc prolapses were analyzed by Srinivasan et al.[1]; of those, only eight cases were found, yielding an incidence rate of just 2.02%. In a study conducted over a six-year period, Wang et focusing on clinical medicine and the latter covering a wider range of healthcare practices. As defined by Dr. David Sackett and colleagues, evidence-based medicine (EBM) is "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients."[1] This philosophy underpins the shift from opinion-based practices to a methodology that is systematic, patient-centered, and adaptable.

The modern clinician is not only a caregiver but also a decision-maker, a researcher, and a critical thinker. EBM equips healthcare professionals with tools to navigate the complexities al.[2] examined 578 cases of cervical disc prolapses and reported an incidence rate of 5.53%. Patients with cervical disc prolapse typically present with increasing myelopathy, radiculopathy, neck pain, or radicular pain. Patients with HMDP, on the other hand, typically have low Nurick grades and increasing myelopathy due to the large disc fragment that compresses the cord markedly.

The best method for treating HMDPs in the cervical spine is a topic of debate. Some support the posterior approach

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Address for correspondence:
Krishna Prabhu Raju
Professor of Neurosurgery
Christian Medical College, Vellore, India
Email:krishnaprabhu@cmcvellore.ac.in

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through laminectomy, which works best for the infrequent intradural and dorsally sequestered discs.[3] However, for cases involving ventral and ventrolateral migration, this approach fails to address the underlying etiology.[4] Given that the pathology and compression are ventral, the ventral approach emerges as optimal treatment strategy. Surgeons then face the crucial decision between discectomy or corpectomy for the ventral approach. In this study, we have retrospectively reviewed our experience of 12 cervical HMDPs we have addressed by anterior cervical corpectomy and fusion (ACCF). We have also discussed why we chose the same over simple discectomy and fusion.

Materials and Methods

Study population

In a retrospective analysis of the 101 cervical disc prolapse cases that were operated at our institution from January 2016 to December 2022, we identified 12 patients who met the specified inclusion criteria and thus were deemed eligible for the study.

Inclusion criteria:

1.Pre-operative magnetic resonance imaging (MRI) showed that the cervical disc prolapse has migrated cranially or caudally behind the vertebral body.

2.The migrated disc prolapse had crossed the midpoint of the vertebral body in the sagittal section.

3.The migrated disc prolapse should create an indentation over the anterior cervical cord completely obliterating the anterior subarachnoid space.

4.At least six months follow up after discharge.

Exclusion criteria:

1.Patients with OPLL (ossified posterior longitudinal ligament)

2.Pre-operative MRI showed intradural disc prolapse.

Patient evaluation

Clinical features:

All patients were assessed clinically for neurological deficits before and after surgery and at each follow-up visit. Nurick grade and mJOA score were used to assess the functional status of the patient.

Radiological features:

All patients underwent dynamic X-rays, CT scans, and plain MR imaging of the cervical spine before surgery. CT scan was obtained to rule out associated OPLL. Posterior osteophytes causing foraminal and canal compression were better visualized with a CT scan. Morphology of the migrated disc prolapse was studied with T1 and T2W MRI. Any T2Ww signal intensity changes within the spinal cord were noted. The migration distance was measured on sagittal MRI by drawing a straight line from the far end of the migrated disc prolapse to the inferior or superior end plate depending on the direction of migration (figure 1). The straight line drawn was perpendicular to the end plate.

Figure 1: The migration distance was measured on sagittal MRI by drawing a straight line from the far end of the migrated disc prolapse to the inferior or superior end plate depending on the direction of migration. The straight line drawn was perpendicular to the end plate

Surgical technique:

All patients underwent ACCF with a titanium mesh cage. After thorough preoperative evaluation, the patients were operated on under general anesthesia and positioned supine with their necks extended without traction. A Standard right-sided Smith-Robinson approach was performed. The vertebral body and adjacent intervertebral discs were removed. The posterior longitudinal ligament was excised and migrated disc fragments were fully exposed and removed. A titanium mesh cage (Medyssey) was placed in the central corpectomy defect. An anterior cervical locking plate was placed across the cage to further stabilize the construct.

Follow up:

The patients were followed up regularly in outpatient clinics. Clinical data regarding the improvement or worsening of symptoms, functional status, and examination of motor and sensory systems was done at each follow-up and documented. X-ray and MRI were done at three months follow-up and repeated if clinically indicated at subsequent follow-ups.

Nurick grade recovery rate (NGRR) and Modified Japanese orthopedic association recovery rate (mJOARR) were calculated for each patient at follow-up using the below formulas:5,6

$$\text{NGRR} = \frac{\text{Preop Nurick grade} - \text{follow-up Nurick grade}}{\text{Preoperative Nurick grade}} \times 100$$

$$\text{mJOARR} = \frac{\text{Follow-up mJOA score} - \text{Preop mJOA score}}{18 - \text{Preoperative mJOA score}} \times 100$$

The data were entered into a spreadsheet and statistical analysis was performed using SPSS Version 21.0 (IBM, Bengaluru). Descriptive statistics was presented as mean ± SD for continuous variables and median (interquartile range) for skewed variables. The frequency and percentage of categorical variables were reported. A two-independent sample t-test was used to compare means, and a p-value <0.05 was considered statistically significant.

Results

Patient demography and clinical features

The present study comprised 12 patients diagnosed with HMDP. The mean age of the patient group, comprising six males and six females, was 52.8 years. All patients exhibited spastic quadriparesis with gait disturbances at the time of presentation. Bladder disturbances were observed in approximately 50% of the patients. Almost 66% of patients experienced neck pain, and around 50% reported radicular pain. The average duration of symptoms was 17 months. At the time of presentation, the average Nurick grade was 4, and the average mJOA score was 9.8. Approximately 75% of patients had a poor functional status indicated by a Nurick grade of 4 or higher. Among the 12 patients, seven had pre-existing comorbidities, such as hypertension and diabetes mellitus.

Radiological features

The T1-weighted MR imaging revealed isointense signaling for the intervertebral disc in the case of the disc prolapse. Additionally, there were six cranially migrated discs, three caudally migrated discs, and three disc prolapses with migration in both directions. Specifically, there were seven instances of single disc prolapses, three at C5-6, two at C4-5, one at C6-7 and one at C3-4. There were four cases of two adjacent level disc prolapses, three at C5-6 and C6-7, and one at C4-5 and C5-6. The mean migration distance was 9.9 mm + 1.9 mm, with migration distances for the disc prolapses ranging from 6.5-18.8 mm. Notably, two patients required a two-level corpectomy due to a three-level disc prolapse at C4-5, C5-6, and C6-7 levels. Furthermore, T2-weighted hyperintensities on MRI within the spinal cord were observed in all patients.

Surgical treatment and postoperative complications

All patients underwent ACCF at our center. Ten patients had a single level corpectomy, while two patients had a two-level corpectomy. The level of corpectomy was determined by the site of cord compression, the direction of migration of disc prolapse, and the position of any associated osteophytes. The mean operative time was 116+24 minutes, and the mean operative blood loss was 120+34 ml. Epidural disc prolapse adhesion was present in all cases, and it was carefully released using a blunt hook. There were no intraoperative complications, such as dural tears or injury to the esophagus, vessels, or nerves. There was no soft tissue edema in any of the patients post-operatively. All patients were discharged on postoperative day 3 and reviewed in the outpatient clinic after one week and three months.

Outcome and follow-up

The follow-up period for the patients in this study was 25 months (range:12-72 months). All patients, except for one, demonstrated improved outcomes with reduced spasticity and improved muscle power. The X-ray conducted at three months post-operatively revealed good intervertebral fusion without the presence of pseudoarthrosis, and no subsidence of the titanium mesh was observed. At the follow-up, the mean Nurick grade recovery rate was 49.58% + 22.74% and the mean mJOA recovery rate was 58.42% + 24.77% (p=0.04). Additionally, there was no evidence of adjacent segment disease in any of the patients at the final follow-up. In seven patients who underwent post-operative MRI, the T2 w signal intensity changes completely resolved in two patients, and adequate cord decompression was achieved in all patients, resulting in a significant reduction in T2 w signal intensity changes. Two cases of HMDP treated with ACCF are illustrated in Figures 2- 3.

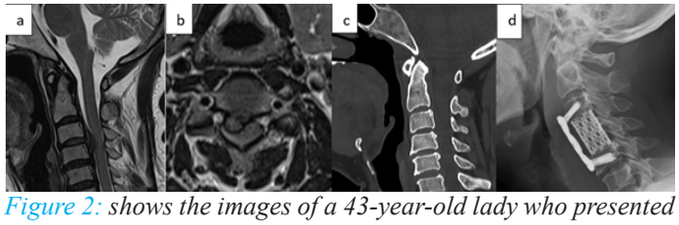

Figure 2: shows the images of a 43-year-old lady who presented with progressive spastic quadriparesis of 6 months duration with a Nurick grade of 4. T2 w MRI showed a large C3-4 inferiorly migrated disc prolapse compressing the cord and causing T2 weighted changes in the cord (2a,2b). The migration distance of the disc prolapse was 9 mm. CT ruled out OPLL (2c). She underwent a C4 corpectomy, titanium mesh cage placement, and C3-5 anterior cervical plating (2d). At 6-month follow-up, Nurick grade had improved to 1.

Figure 3: shows the images of a 58-year-old gentleman who presented with progressive spastic quadriparesis of 6 months duration with a Nurick grade of 4. T2 w MRI showed a large C5-6 inferiorly migrated disc prolapse compressing the cord and causing T2 weighted changes in the cord (3a,3b). The migration distance of the disc prolapse was 10 mm. CT ruled out OPLL (3c). He underwent a C6 corpectomy, titanium mesh cage placement, and C5-7 anterior cervical plating (2d). At 20-month follow-up, Nurick grade had improved to 1.

Discussion

Anterior cervical discectomy and fusion (ACDF) is considered as the primary treatment for non-traumatic cervical disc prolapse. However, challenges arise when the disc prolapse has migrated cranially or caudally instead of lying against the disc space. A highly migrated disc prolapse is defined as one that extends beyond the midpoint of the vertebral body in either direction. These prolapses may be sequestered and have no connection to the disc space or may be in two or three fragments. Removing highly migrated disc prolapses through

the narrow, constrained space of a discectomy is risky.[4] The large disc fragments are often adhered to the dura, and releasing these adhesions blindly can lead to additional morbidity such as cerebrospinal fluid leak and damage to an already compromised cord. In contrast to the anterior cervical discectomy, the anterior cervical corpectomy affords the surgeon the opportunity to directly visualize the prolapsed disc fragments, effectively release the dural adhesions, and completely remove the prolapsed disc fragments in a safe manner. [1,2,4,7] This approach also provides better lateral decompression and removal of any osteophytes. The use of newer implants has significantly reduced the risk of pseudoarthrosis and cage subsidence. [8,9,10]

In our small-scale study of 12 patients over a period of six years, we were able to successfully treat highly migrated cervical disc prolapses. Our study group is distinct in that the mean migration distance was 9.9 mm. In a study by Wang et al. 2, which reviewed 32 cases of highly migrated disc prolapse and debated whether ACDF was sufficient, the mean migration distance in the ACDF group was 7.3 mm. Notably, 75% of our patients had a Nurick grade of 4 or above, indicating a severely compromised spinal cord. T2w signal intensity changes were observed in all of our patients. Attempting to remove these large disc prolapses through a discectomy without proper guidance would likely result in secondary injury to the already fragile spinal cord and compromise the patient's postoperative functional outcome.

In a review conducted by Manabe et al.[4] on the surgical treatment for epidural migration of extruded cervical disc sequestration, they recommend corpectomy specifically for sequestered disc fragments positioned beyond the intervertebral disc space. The authors observed that corpectomy is less traumatic to the spinal cord compared to trans discal removal, leading to more favorable neurological outcomes.4,7 They suggest that opting for corpectomy ensures the removal of disc fragments responsible for myelopathy and facilitates better lateral decompression, resulting in relief from radiculopathy.4 Srinivasan et al.1 underline the rarity of highly migrated cervical disc prolapse in a study of eight cases with epidurally migrated cervical disc prolapse. In the six individuals who received surgical intervention, anterior cervical corpectomy and fusion was the preferred technique . Alternate approaches described for managing highly migrated cervical disc are transvertebral herniotomy and posterior endoscopy. Nakai et al.11 first described the transvertebral herniotomy as a surgical approach for managing herniated cervical discs. This technique involves removing the herniated disc through drilling into the adjacent vertebral body. It is particularly well-suited for cases with large, localized disc herniations without accompanying spinal stenosis. Posterior endoscopic cervical discectomy has been described to tackle highly migrated cervical disc prolapse located laterally and paramedian but cannot be used for central and medially located disc prolapse.[12,13] Additionally, this approach demands a high level of endoscopic surgical expertise to ensure both safety and effectiveness. To the best of our knowledge, our study represents the largest cohort reported in the literature concerning the management of significantly migrating cervical disc prolapse.[1,2,4]. Based on our limited experience, we believe that ACCF is the most suitable surgical option for these patients. There were no reported instances of cage subsidence or adjacent segment disease in our study. Our patients achieved favorable neurological outcomes, which is the primary objective in cervical disc surgery. The primary objective in these cases should be to prioritize patient safety and minimize avoidable morbidity, rather than focusing solely on operational time or blood loss reduction.

Conclusion

Highly migrated cervical disc prolapse is unusual and requires careful preoperative imaging. Anterior cervical corpectomy and fusion should be chosen to reduce morbidity and optimize neurological results.

References

1. Srinivasan US, Kumar GS, Mahesha KB. Posterior epidural migration of sequestrated cervical disc fragment: case series. Asian Spine J. 2011 Dec;5(4):220-7. doi: 10.4184/asj.2011.5.4.220. Epub 2011 Nov 28. PMID: 22164316; PMCID: PMC3230649.
2. Wang Y, Qian Y, Wang J, Zhu M, Wang J, Teng H. Anterior discectomy could still be an alternative to corpectomy in highly migrated cervical disc herniation. Br J Neurosurg. 2017 Dec;31(6):709-713. doi: 10.1080/02688697.2017.1348487. Epub 2017 Jul 26. PMID: 28745533.
3. Tofuku K, Koga H, Kawabata N, Yuasa S, Yone K, Komiya S. Dorsally sequestered cervical disc herniation. Spine (Phila Pa 1976). 2007 Dec 15;32(26):E837-40. doi: 10.1097/BRS.0b013e31815ce6c4. PMID: 3824063.
4. Manabe S, Tateishi A. Epidural migration of extruded cervical disc and its surgical treatment. Spine (Phila Pa 1976). 1986 Nov;11(9):873-8. doi: 10.1097/00007632-198611000-00005. PMID: 3824063.
5. Rajshekhar V, Muliyil J. Patient perceived outcome after central corpectomy for cervical spondylotic myelopathy. Surg Neurol. 2007 Aug;68(2):185-90; discussion 190-1. doi: 10.1016/j.surneu.2006.10.071. PMID: 17662358.
6. Hirabayashi K, Miyakawa J, Satomi K, Maruyama T, Wakano K. Operative results and postoperative progression of ossification among patients with ossification of cervical posterior longitudinal ligament. Spine (Phila Pa 1976). 1981 Jul-Aug;6(4):354-64. doi: 10.1097/00007632-198107000-00005. PMID: 6792717.
7. Verbiest H. Chapter 23. The management of cervical spondylosis. Clin Neurosurg. 1973;20:262-94. doi: 10.1093/neurosurgery/20.cn_suppl_1.262. PMID: 4762815.
8. Wen Z, Lu T, Wang Y, Liang H, Gao Z, He X. Anterior Cervical Corpectomy and Fusion and Anterior Cervical Discectomy and Fusion Using Titanium Mesh Cages for Treatment of Degenerative Cervical Pathologies: A Literature Review. Med Sci Monit. 2018 Sep 12;24:6398-6404. doi: 10.12659/MSM.910269. PMID: 30208015; PMCID: PMC6147051.
9. Liu X, Chen Y, Yang H, et al. The application of a new type of titanium mesh cage in hybrid anterior decompression and fusion technique for the treatment of continuously three-level cervical spondylotic myelopathy. Eur Spine J. 2017;1:122–30. doi: 10.1007/s00586-013-2976-1. Epub 2013 Sep 3.

PMID: 24000074; PMCID: PMC3843776.
10. Fengbin Y, Jinhao M, Xinyuan L, et al. Evaluation of a new type of titanium mesh cage versus the traditional titanium mesh cage for single-level, anterior cervical corpectomy and fusion. Eur Spine J. 2013;12:2891–96. doi: 10.1007/s00586-013-2976-1. Epub 2013 Sep 3. PMID: 24000074; PMCID: PMC3843776.
11. Nakai S, Yoshizawa H, Kobayashi S, Hayakawa K. Anterior transvertebral herniotomy for cervical disk herniation. J Spinal Disord. 2000;13:16–21. doi: 10.1097/00002517-200002000-00003.
12. Ou SW, Lee JH, Chen CM, Lin YH. How I do it? Posterior full-endoscopic cervical discectomy with retrocorporeal technique and hemilaminectomy for highly migrated cervical disk herniation. Acta Neurochir (Wien). 2023 Jan;165(1):159-163. doi: 10.1007/s00701-022-05425-1.
13. Ishibashi K, Yanagisawa K, Tominaga R, Inomata Y, Takebayashi K, Mizutani T, Iwai H, Koga H. Posterior endoscopic cervical discectomy with partial pediculotomy for management of highly down-migrated cervical disc herniation: A case report. Surg Neurol Int. 2025 Feb 28;16:75. doi: 10.25259/SNI_990_2024.