Outcome of Anterior Cervical Discectomy and Fusion in Symptomatic Cervical Disc Herniation with Autologous Iliac Bone Graft and Metallic Implant

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Abstract

Background: *Anterior cervical discectomy and fusion (ACDF) is a challenging surgical procedure where appropriate patient selection is very important for operation outcome and choice of surgical procedure. The first-line treatment strategy for managing cervical disc herniation is conservative. In some cases, surgery is indicated either due to signs and symptoms of severe and progressive neurological deficits, or failure of proper conservative treatment. Treatment of cervical disc herniation using ACDF has been successfully reported in the literature.*

Objectives: *The aim of this study is to determine the outcome of ACDF in the treatment of symptomatic cervical disc herniation.*

Methods: *It is a retrospective study conducted in Dhaka Medical College Hospital (DMCH) and other private hospitals from January 2013 to December 2022. We evaluated 28 patients who had undergone ACDF for cervical disc herniation in 35 levels. Fusion was attained with autologous iliac bone graft with additional anterior plating or cages. Radicular pain, neck pain and patient satisfaction with the treatment were scored using the visual analogue scale (VAS), ODI and Odom's criteria.*

Results: A total of 28 patients fulfilled the inclusion criteria. Out of these, 21(75%) patients were male. The age range was from 21 to 65 with a mean age of 47.45 years. 10 patients (35.71%) had disc herniation at C5/6 level and 7(25%) patients had at C6/7 level. Regarding clinical assessment, the ODI percentage has decreased and VAS for neck and radicular pain also showed a significant reduction. Odom's criteria was applied to determine the outcome of the procedure. Excellent results were noted in 20 (71.42%) patients. 5 (17.85%) patients had good results. 3 patients (10.71%) had fair and no patient had a poor outcome.

Conclusion: *ACDF is a successful surgical technique for the management of cervical disc herniation among Bangladeshi people.*

Key word: *ACDF, Cervical disc herniation, Cervical plating, Stand alone cage.*

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Introduction

Cervical radiculopathy may be caused by disc herniation, spondylosis, instability, trauma and on rare occasions by tumors.[1] Cervical disc herniation mostly affects individuals aged between 30 and 50 years.[2] Cervical radiculopathy is a painful and relatively common condition with a reported prevalence of about 30%.[3] Patients presenting with cervical radiculopathy usually complain of pain in the neck and one arm, with a combination of sensory loss, motor function

loss, or reflex changes in the affected nerve-root distribution.[4] C5-C6 level is the most commonly involved level of herniation.[5] The vast majority of patients with symptomatic cervical disc degeneration (CDD) respond well to conservative treatment.[6] First-line treatment in management of CDH is conservative measures. Approximately 83% of patients with cervical radiculopathy respond to conservative treatment methods[3], while an approximate one-third of patients will suffer from persistent symptoms.[7] Surgery is indicated for cases that have signs/symptoms of severe/progressive neurological deficits and persistence of radicular pain despite proper conservative treatment. The gold standard for ACDF has been fusion with an Autogenous Iliac Crest Graft - AICG.[8,9,10] This is a relatively safe procedure with few complications.[11,12,13] Surgery is mostly performed via an anterior approach with or without fusion[14], although traditionally posterior approach is another method.[15] Anterior cervical decompression and fusion (ACDF) is usually considered as a better procedure.[16] We present our study and share our experience of surgical outcome of ACDF with autologous bone graft from iliac bone along with plate-screw or metallic cage application in terms of efficacy, symptom relief, graft fusion and complications.

Materials and Methods

Study Design and Setting

We conducted a prospective cohort study of patients undergoing anterior cervical discectomy and fusion (ACDF) between January 2013 and December 2022 at a tertiary care center and affiliated private hospitals in Dhaka, Bangladesh. The Institutional Review Board approved the study protocol and all participants provided written informed consent.

Participants

Inclusion Criteria:

1. Age 20-70 years
2. Persistent cervical radiculopathy or myelopathy refractory to e”6 weeks of conservative management
3. MRI-confirmed single or two-level disc herniation with corresponding neural compression

Exclusion Criteria:

1. Ossification of posterior longitudinal ligament (OPLL)
2. Cervical deformity (Cobb angle >10°)
3. Previous cervical spine surgery
4. Active infection or malignancy
5. Incomplete medical records

Preoperative Evaluation

All patients underwent:

1. Comprehensive neurological examination
2. Standard cervical spine radiographs (AP, lateral, flexion-extension)
3. 1.5T MRI with T1/T2-weighted sequences
4. CT scans for cases with suspected calcific disc pathology

Surgical Procedure

The standardized ACDF technique included:

1. **Positioning:** Supine with cervical traction (5-10 lbs)
2. **Approach:** Right-sided Smith-Robinson anteromedial approach
3. **Discectomy:** Complete removal of pathological disc material
4. **Decompression:** Uncovertebral joint osteophytectomy as needed
5. **Fusion:**

- Autologous tricortical iliac crest graft (n=22)
- PEEK cages with local bone graft (n=6)

6. **Fixation:** Titanium anterior cervical plate system
7. **Confirmation:** Intraoperative fluoroscopic verification

Postoperative Protocol

1. Rigid cervical collar immobilization for 6 weeks
2. Progressive range-of-motion exercises post-collar removal
3. Scheduled follow-ups at 6 weeks, 3 months, 6 months, and annually

Outcome Measures

Primary Endpoints:

1. Clinical improvement:

- Visual Analog Scale (VAS) for neck/arm pain
- Modified Japanese Orthopaedic Association (mJOA) score

2. Radiographic fusion:

- Bridging trabecular bone on CT scan
- <2° motion on dynamic radiographs

Secondary Endpoints:

1. Operative time and blood loss
2. Complication rates (dysphagia, hardware failure, etc.)
3. Reoperation rate

Results

Our mean follow-up time was 56.64 months (range: 06–120 months. 28 cases (35 levels) were studied. 21 cases had one level disc herniation and 7 cases had two level involvement (Table 1). 21 cases were male and 7 were female. Mean age was 47.45 years. The majority (18, 64.28%) of cases were sedentary worker. Mean preoperative VAS for neck pain and radicular pain were 8.92 and 9.57, respectively. Mean postoperative VAS (at the time of follow-up) for neck and radicular pain were 1.64 and 1.32 respectively. Most (10, 35.71%) of our cases had disc herniation at the level of C5-C6. Two-level disc herniation was mostly (4, 14.29%) encountered at C5-C6 and C6-C7 levels. Vertebral levels involvement presented in figure 1.

Table I

Different level of Disc herniation

Involved Disc	No. of Patients	Percentage
Single Level	21	14.29%
Double Level	7	35.71%

Preoperative MRI | Postoperative X-ray with Plate | Postoperative X-ray with cage and plate | Postoperative X-ray with Stand alone cage (Two levels)

Figure 2: *Different implant used.*

Autologous iliac crest graft was used for all (28) cases. Out of 28, plate and screw used was for 12 (42.86%), cage with plate system was used for 13 (46.43%) and stand alone cage was used for 3 (10.71%) presented in figure 2.

Fusion was confirmed with imaging studies in all 28 cases that came for follow-up imaging study (100% fusion rate). We had no intraoperative complications. Early postoperative complications were hoarseness (2 cases, 7.14%). During the follow-up time, none of the patients complained of symptoms recurrence. 3(10.71%) patients complained of negligible neck pain and 1 patient developed adjacent segment disease.

Odom's criteria were utilized to determine the results of the procedure. Excellent results were noted in 20 (71.42%). 5 (17.85%) patients had good results. 3(10.71%) patients had fair and no patient had a poor outcome.

Outcomes were not related to age, gender, job, duration of pain, level of disc herniation, number of levels treated, and implant used.

Discussion

The objective of putting graft into disc space is to have solid bone fusion and achieve alignment. Addition of plate prevent graft dislodgement and graft collapse, decrease the need for external orthosis and hence early mobilization.[17,18,19]

Regarding residual complaints, we observed that 3(10.71%) cases complained of minor residual symptoms at the final follow-up. Peolsson[20] reported that 70% of their study population suffered from persistent pain and disability at 6-year follow-up.

ACDF has been advocated as a safe procedure, but complications could still arise. Among its complications are nonunion, postoperative dysphagia[21], recurrent laryngeal nerve palsy, esophageal tear, carotid artery injury, vertebral artery injury, neurologic deficit, postoperative respiratory embarrassment, and disc space infection[22]. Injury to RLN was found by Flynn to be the most frequently encountered neurologic complication[23]. Two studies[24,25] reported dysphagia as the most common ACDF-related complication. We had no case of dysphagia, but the incidence of dysphagia reported in other studies that ranged between 2.5 and 21.3%.[26,27,28]

In a study conducted by Chen et al.[30] incidence of 0.16% was reported for hoarseness, while this rate was reported higher (4.9%) by Baron et al.[31] We observed 7.14% among our study population, which is even higher. An average rate of 4.3% (range: 1.6%–12.1%) has been documented in literature for the incidence of C5 root palsy after anterior decompression and fusion[32]. In our series, we had no case of C5 root palsy. We had no case of graft extrusion but, incidence of graft extrusion has ranged between 0 and 0.88%[32,25,34]. With an average follow-up duration of 18 months, Kulkarni et al.[35] reported that none of their study population had cage extrusion or migration. Cabraja et al.[36] demonstrated no cage extrusion on average follow-up period of 28.4 months. In a study conducted by Nanda et al.[25], cases with graft extrusion had persistent neurological symptoms after the operation, but we had no graft extrusion in our patients in minimum 6 months follow- up.

Incidence of adjacent segment degeneration (ASdeg) after ACDF has been reported to range from 16 to 51[37,38]. Herkowitz et al.[39] showed that 41% of their series developed ASdeg. The reported incidence for ASdeg ranges between 2%[37] and 41%[39]. One case (3.57%) with symptomatic ASdeg were observed in our series. With an average follow-up period of 6 years, Bohlman et al.[40] stated that 9% of their patients required additional surgery for ASdeg. In another series[41], 17% of the study population required additional surgery for ASdeg at an average of 4.5 years of follow-up.

Kulkarni et al.[35] reported a fusion rate of 93.33% for PEEK cage at 6 months. At a mean follow-up of 10 months, 100% fusion rate was observed by Cho et al.[42] With an average of 18 months follow-up, Kulkarni et al.'s[35] study population fusion was maintained at their last follow-up. At mean follow-up of 28.4 months, Cabraja et al.[36] achieved a fusion rate of 88.1% for PEEK cage. At mean follow-up of 25.6 months, Liu et al.[33] observed fusion rate of 72%. Song et al.[43] had 78.9% fusion. In a prospective study by Niu et al.[44] fusion rate at 12-month

follow-up was 100% for PEEK cage group. With mean follow-up period of 18.9 months, Ha et al.[45] achieved 94.5% fusion. We achieved 100% fusion rate at mean follow-up period of 56.64 months.

Conclusion

ACDF is a successful surgical technique for the management of symptomatic cervical disc herniation. ACDF with autologous iliac bone graft and metallic implant is the choice of treatment in appropriately selected patients. It increases chances of fusion and helps in early mobilization.

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