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Surgical Management and Post-Operative Outcomes during Anterior Cervical Discectomy and Fusion among Patients presented with Degenerative Cervical Disc Disease attended at a Referral Neuroscience Hospital in Bangladesh

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Abstract

Background: Surgical management of degenerative cervical disc disease is very challenging. **Objective:** The purpose of the present study was to assess the surgical management and post-operative outcomes during anterior cervical discectomy and fusion among patients presented with degenerative cervical disc disease. **Methodology:** This non-randomized clinical trial was conducted in the Department of Neurosurgery at National Institute of Neurosciences and Hospital Dhaka, Bangladesh from January 2022 to December 2023 for a period of two periods. All the patients with the more than or equal to 18 years of age of both male and female who were presented with degenerative cervical disc disease were selected for this study. Patients were undergoing single- or two-level anterior cervical discectomy and fusion (ACDF) for degenerative cervical disc disease. **Results:** The mean age was 45.5 ± 15.6 years (range: 19 to 79 years). Majority of the patients were male (87/100). Presenting symptoms were neck pain (79.0%), limb weakness (75.0%), paresthesias (57.0%), radicular pain (47.0%), stiffness in limbs (17.0%), and bladder involvement (15.0%). During discharge, significant improvement in preoperative symptoms were reported like neck pain (61%), stiffness in limbs (81.0%), limb weakness (72.6%), radicular pain (63.0%), paresthesias (83.0%), and bladder symptoms (61.0%). There were several postoperative complications reported like dysphagia (19.0%), hoarseness of voice (29.0%), deterioration of motor power (8.0%), and postoperative hematoma (7.0%). **Conclusion:** In conclusion most of the patients show remarkable recovery after ACDF who are presented with degenerative cervical disc disease. *[Journal of National Institute of Neurosciences Bangladesh, July 2024;10(2):98-103]*

Keywords: Surgical Management; Post-Operative Outcomes; Anterior Cervical Discectomy and Fusion; Degenerative Cervical Disc Disease; Referral Neuroscience Hospital; Bangladesh

Introduction

Degenerative cervical disc disease (DCDD) is a prevalent condition, particularly among aging populations, causing pain, neurological deficits, and reduced quality of life[1]. When conservative treatments fail, surgical intervention such as anterior cervical discectomy and fusion (ACDF) is considered. ACDF is a well-established procedure designed to relieve spinal cord and nerve root compression by removing the affected disc and achieving fusion between vertebral segments[2]. This paper discusses the surgical management of ACDF and its post-operative outcomes in patients with DCDD.

Prior to surgery, a thorough clinical and radiological evaluation is critical to confirm the diagnosis and determine the extent of degenerative changes. Imaging modalities, including X-rays, MRI, and CT scans, are utilized to assess disc herniation, spinal cord compression, and osteophyte formation[3]. Patients are typically evaluated for clinical symptoms such as neck

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pain, radiculopathy, or myelopathy, which guide the decision-making process.

ACDF is performed under general anesthesia. A horizontal incision is made in the anterior part of the neck to access the cervical spine[4]. The affected disc is excised, and any osteophytes or herniated disc fragments causing compression are removed. The surgeon then inserts a bone graft, typically autograft, allograft, or a synthetic cage, into the disc space to facilitate fusion. This is often supplemented with anterior plate fixation using screws for stability. In some cases, spinal cord decompression is required if there is significant narrowing (stenosis). The primary goal of ACDF is to restore disc height, decompress neural elements, and stabilize the cervical spine[5].

Key considerations during ACDF include minimizing blood loss, ensuring proper alignment of the vertebrae, and protecting adjacent anatomical structures such as the esophagus, trachea, and recurrent laryngeal nerve[6]. Neuromonitoring may be employed to prevent iatrogenic nerve injury. Surgeons also aim to reduce the risk of adjacent segment disease (ASD), a common long-term complication where increased stress on neighboring vertebral levels can cause degeneration[7]. The purpose of the present study was to assess the surgical management and post-operative outcomes during anterior cervical discectomy and fusion among patients presented with degenerative cervical disc disease.

Methodology

Study Settings and Population: This non-randomized clinical trial was conducted in the Department of Neurosurgery at National Institute of Neurosciences and Hospital Dhaka, Bangladesh from January 2022 to December 2023 for a period of two periods. All the patients with the more than or equal to 18 years of age of both male and female who were presented with degenerative cervical disc disease were selected for this study. Patients aged bellow 20 or above 80, patients who had dysphagia and/or dysphonia preoperatively, patients who underwent combined anterior and posterior cervical spine surgeries during the same admission, patients who underwent cervical arthroplasty procedures, and patients who were treated for other indications other than degenerative pathology (e.g. Trauma, tumor, infection etc.) were excluded from the study.

Study Procedure: Patient demographics such as age, gender, BMI, smoking, and other comorbidities and operative notes including blood loss, use of drain, type of graft, number of levels involved, duration of surgery, intraoperative complications were documented. Thirty-day complication variables defined as return to ICU, revision surgery, pneumonia, hematoma, wound infection and death. Incidence of persistent dysphagia and dysphonia (post 30 days) was also assessed. After applying the standard general anesthesia technique, the patient was positioned in a supine position. A longitudinal or vertical surgical incision was made at the targeted level of decompression, followed by superficial dissections through the fascia and platysmal muscle, retraction of the esophagus medially and the sternocleidomastoid with the carotid sheath laterally. A deep dissection by splinting the longus colli muscles and anterior longitudinal ligament to expose the vertebral body was done. This was followed by decompression of the targeted level by removal of the affected disc level and osteophytes. The bone graft was then applied followed by plate and screws if planned beforehand.

Statistical Analysis: Statistical analysis was performed by Windows based software named as Statistical Package for Social Science (SPSS), versions 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Continuous data were expressed as mean, standard deviation, minimum and maximum. Categorical data were summarized in terms of frequency counts and percentages. Chi-square test was used for comparison of categorical variables and Student t test was applied for continuous variables. All efforts were made to obtain missing data. A two-sided P value of less than 0.05 was considered to indicate statistical significance. Differences between case and control were tested.

Ethical Clearance: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration 2013) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the local ethics committee. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and were analyzed using the coding system.

Results

The mean age was 45.5 ± 15.6 years (range: 19 to 79 years). Majority of the patients were in the age group of 41 to 60 years (52.0%). Most of the study population were male which was 87.0% cases. Most common

involvement in the C3-4 level which was 30.0% cases followed by C6-7 level, C5-6 level and C4-5 level which was 24.0% cases, 20.0% cases and 18.0% cases respectively (Table 1).

Table 1: Age, Gender Distribution, and Level of Cervical Degenerative Disease

Variables	Frequency	Percent
Age Group		
• 20 to 40 Years	33	33.0
• 40 to 60 Years	52	52.0
• 60 to 80 Years	15	15.0
Total	100	100.0
Mean±SD (Range)	45.5 ± 15.6	
Gender		
• Male	87	87.0
• Female	13	13.0
Level of Cervical Region		
• C2-3	3	3.0
• C3-4	30	30.0
• C3-4 and C4-5	1	1.0
• C4-5	18	18.0
• C4-5and C5-6	1	1.0
• C5-6	20	20.0
• C5-6 and C6-7	3	3.0
• C6-7	24	24.0

Clinical presentation was neck pain (77.0%), limb weakness (73.0%), paresthesias (53.0%), radicular pain (49.0%), stiffness in limbs (16.0%), and bladder involvement (13.0%). History of smoking was recorded in 35 patients and alcohol consumption in 30 patients.

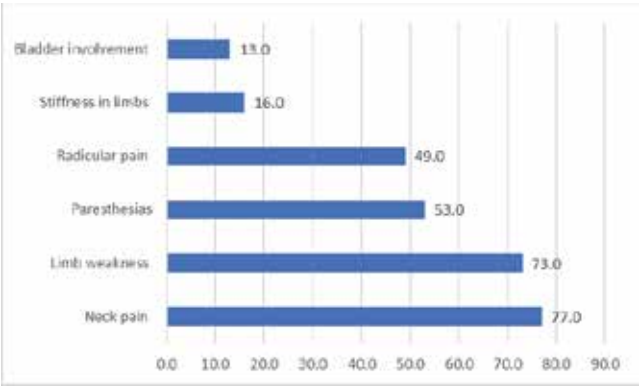

Figure I: Showing the Clinical Presentation among the Study Population

At the time of discharge, significant improvement in preoperative symptoms like neck pain (61.0%), radicular pain (63.0%), limb weakness (72.6%), paresthesias (83.0%), stiffness in limbs (81.0%), and bladder symptoms (61.0%) was reported by majority of these patients (Table 2).

Table 2: Evaluation of Symptoms pre- and Postoperatively following Anterior Cervical Discectomy and Fusion

Variables	Frequency		P value
	Yes	No	
Neck Pain Preoperative			
• Yes	30	47	<0.001 (S)
• No	3	20	
Radicular Pain Preoperative			
• Yes	18	31	<0.001 (S)
• No	0	51	
Limb Weakness Preoperative			
• Yes	20	53	<0.001 (S)
• No	5	22	
Tingling Sensation Preoperative			
• Yes	9	44	<0.001 (S)
• No	4	43	
Tightness in Limb Preoperative			
• Yes	3	13	0.007 (S)
• No	2	82	
Bladder Involvement Preoperative			
• Yes	5	8	0.999 (NS)
• No	7	80	

Improvement in the preoperative symptoms and new postoperative symptoms is summarized in Table 3. Majority of the patients also reported improvement in their preoperative sensory deficits.

Table 3: Evaluation of Sensory Deficits in the Upper and Lower Limbs pre- and Postoperatively following Anterior Cervical Discectomy and Fusion

Preoperative Sensory Deficits*	Postoperative Sensory Deficits		P value
	Yes	No	
Right Upper Limb			
• Yes (13)	2	11	0.481
• No (87)	7	80	
Right Lower Limb			
• Yes (11)	1	10	0.454
• No (89)	6	83	
Left Upper Limb			
• Yes (15)	1	14	0.191
• No (85)	7	78	
Left Lower Limb			
• Yes (10)	0	10	0.453
• No (89)	6	83	

Postoperative complications were hoarseness of voice (22.0%), dysphagia (16.0%), deterioration of motor power (8.0%), and postoperative hematoma (7.0%)

(Figure II).

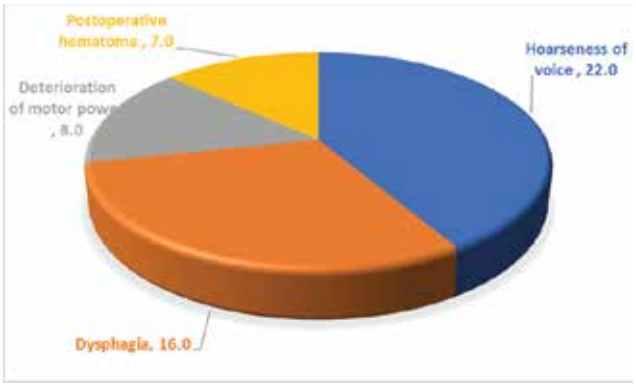

Figure II: Showing the Postoperative complications among Study Population

Discussion

Degenerative cervical disc disease (DCDD) is a common condition characterized by disc degeneration, herniation, or osteophyte formation, leading to neural compression and neck pain[8]. Anterior cervical discectomy and fusion (ACDF) is a widely accepted surgical treatment for symptomatic DCDD that has failed to respond to conservative management[9]. ACDF is performed under general anesthesia. A small incision is made in the anterior neck to access the cervical spine. The surgeon removes the diseased disc and any compressive structures such as bone spurs. A bone graft or an interbody spacer is inserted into the disc space to promote fusion between the vertebrae[10]. The graft may be an autograft (patient's own bone), allograft (donor bone), or a synthetic cage filled with bone graft material. For added stability, an anterior plate and screws are often applied to secure the vertebral bodies in place[11].

Intraoperative care involves minimizing complications such as injury to the recurrent laryngeal nerve, esophagus, and trachea[7]. Surgeons must also take precautions to avoid excessive blood loss and ensure proper alignment of the spine. Neuromonitoring techniques are often employed to minimize the risk of nerve injury. Additionally, meticulous dissection around the anterior cervical anatomy is required to prevent complications related to dysphagia[12].

Preoperative evaluation is crucial in determining the suitability of ACDF. Clinical symptoms, including radiculopathy, myelopathy, and axial neck pain, are confirmed with imaging such as MRI, which identifies nerve compression or spinal cord involvement[13]. The decision to operate is typically based on the severity of symptoms, failure of conservative treatment, and radiographic evidence of disc degeneration or herniation. ACDF is associated with significant post-operative relief from neck pain and radiculopathy. Studies report that 80-90% of patients experience marked symptom relief and improvement in functional status[14]. Most patients return to daily activities within weeks, although complete recovery of strength and neurological function may take several months. Most patients report significant improvement in neck and arm pain following ACDF. Decompression of nerve roots and spinal cord leads to enhanced neurological function, with a reduction in symptoms such as numbness, tingling, or weakness[11]. Post-operative rehabilitation plays a key role in optimizing recovery, including physical therapy to restore neck mobility and strength.

Fusion is a critical determinant of success after ACDF. Solid fusion rates vary between 90.0% to 95.0% cases, depending on the graft material and technique used10. Modern instrumentation and biologics have improved fusion outcomes, though pseudoarthrosis (failure to achieve fusion) remains a concern in a minority of patients. Pseudoarthrosis may lead to persistent pain or require revision surgery[12]. Achieving a solid fusion is critical for long-term success. Fusion rates with ACDF are generally high, typically ranging between 90 to 95% cases[9]. The use of advanced graft materials and fixation techniques has improved fusion outcomes. Non-union (pseudoarthrosis), while rare, can occur and may require revision surgery.

Complications following ACDF are generally low. Dysphagia is the most common post-operative complaint, occurring in up to 50% of patients, but it is usually transient and resolves within a few weeks[14]. Other potential complications include hoarseness, due to injury of the recurrent laryngeal nerve, and rare cases of cerebrospinal fluid leakage or infection. Hardware failure or graft displacement is uncommon but may necessitate further surgical intervention[12]. Complications of ACDF are relatively uncommon but can include infection, dysphagia (difficulty swallowing), hoarseness due to injury to the recurrent laryngeal nerve, and cerebrospinal fluid leaks[7]. Dysphagia is a transient symptom in most cases, resolving within weeks to months. In rare instances, hardware failure or graft displacement can occur, necessitating further intervention.

Adjacent segment disease (ASD) is a recognized long-term complication of ACDF. Fusion of the operated levels alters the biomechanics of the spine, potentially accelerating degeneration in adjacent

segments. Studies report that approximately 25.0% of patients develop symptomatic ASD within 10 years of surgery, which may require additional surgery[13]. Long-term outcomes are generally favorable; however, ASD is a recognized complication following ACDF. The fusion of cervical segments alters the biomechanics of the spine, leading to accelerated degeneration at adjacent levels. This can result in the need for additional surgery in the future.

Conclusion

ACDF remains a highly effective surgical intervention for patients with DCDD, offering significant pain relief and improved neurological outcomes. While the procedure has high success and fusion rates, complications such as ASD, dysphagia, and nerve injury are potential risks. Early intervention, careful surgical technique, and comprehensive post-operative care contribute to favorable outcomes, enhancing the quality of life for patients afflicted with this degenerative condition. ACDF is a highly effective surgical intervention for managing DCDD, offering significant pain relief, functional improvement, and high fusion rates. While short-term outcomes are favorable, long-term issues like ASD pose a challenge. Careful patient selection, meticulous surgical technique, and attentive post-operative care are essential for optimizing outcomes and minimizing complications.

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Conflict of interest
Other than technical and logistic support from the scientific partner the investigators did not have any conflict of interest in any means.

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Contribution to authors
Islam MR, Talukder MMH, Hoque MA conceived and designed the study, analyzed the data, interpreted the results, and wrote up the draft manuscript. Moureen A, Yusuf MA, Razzaque SS, Laizu IA involved in the manuscript review and editing. All authors read and approved the final manuscript.

Data Availability
Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate
Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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