



Original Article

## Functional Outcome of Anterior Cervical Discectomy for a Herniated Cervical Disc with Fusion through Standalone Titanium or Polyetheretherketone (PEEK) Cage

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### ABSTRACT

**Background & Objectives:** Discectomy followed by the fusion in the cervical spine is done for herniated cervical intervertebral disc causing neurologic symptoms when conservative management has failed. In our study, we assessed clinical presentation and functional outcomes after surgery through an anterior cervical approach.

**Materials and Methods:** This retrospective cohort study was conducted in the Neurosurgery division, Lady reading hospital Peshawar. We included 42 consecutive patients who underwent single-level anterior cervical discectomy and fusion for the herniated cervical disc. The mean follow-up was 14 months. Anterior cervical discectomy and fusion (ACDF) was done in all patients using standalone titanium or PEEK cage. Z scores and associated p values were calculated to see the difference of significance between preoperative reported symptoms and their improvements postoperatively.

**Results:** There were 37 male and 5 female patients. The mean age was  $43 \pm 9.8$  years. Disc herniation mostly occurred at C4 – 5 and C5 – 6 levels (76.16%). Preoperatively, the Neck pain was present in 36 (85.7%), upper limb weakness in 20 (47.6%), numbness/paresthesias in 25 (59.5%), upper limb pain in 18 (42.84%), lower limbs spasticity in 14 (33.32%) and bladder involvement in 3 (7.14%) patients. Statistical significant postoperative improvements in (90-100%) were reported in symptoms. Postoperative complications were observed in 5 patients. Most reported complication, the dysphagia was noted in 9.52% patients.

**Conclusions:** A significant proportion of patients with herniated cervical disc showed an excellent recovery after anterior cervical discectomy and fusion (ACDF).

**Keywords:** Anterior Cervical Discectomy & Fusion (ACDF), Radiculopathy.

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### INTRODUCTION

Neck pain due to a herniated or prolapsed cervical disc is a disabling and agonizing clinical entity that significantly compromises the quality of life. Due to the widespread availability of magnetic resonance imaging (MRI) cervical degenerative disc disease (CDDD) is diagnosed

most often in asymptomatic individuals without having any clinical effects.<sup>1,2</sup> Initial management of patients with symptomatic CDDD is conservative. The majority of patients having no neurological deficit are efficiently managed without surgery. Various surgical options are in the armamentarium of neurosurgeons to address this pathology. One of the main surgical options is anterior cervical discectomy and fusion (ACDF) and is indicated for those with intractable symptoms of nerve root pain [radiculopathy (a pathological process involving nerve root causing pain, paresthesia, numbness, burning, etc.)] or those with the progressive motor deficit. Anterior cervical surgery for a herniated disc was first described by Smith, Robinson, and Cloward in 1958, and is still one of the most commonly performed spine surgery by neurosurgeons.<sup>1,2</sup> ACDF is simple, having low surgical risks and a timely surgical approach has good results in terms of functional outcome, and therefore it is considered the gold standard procedure for a vast group of degenerative cervical spine diseases.<sup>3</sup> In a selected group of patients (i.e., patients with severe persistent upper limb pain impairing quality of the life which does not respond to conservative management, young patient with preserved alignment of cervical spine, one level disc pathology, nonsmokers, and patient with good neurological function before surgery), anterior cervical discectomy and fusion is a rewarding surgery in term of neurological and functional outcome.<sup>4,5</sup> In the current study, we assessed clinical presentation, surgical results, preoperative/postoperative symptoms, complications in patients with cervical degenerative disc disease, and overall functional outcome.

## **MATERIALS AND METHODS**

### **Study Design & Setting**

A retrospective cohort study was conducted for three years, i.e., from 1<sup>st</sup> May 2016 to 30<sup>th</sup> April 2019 in Neurosurgery Division of Medical Teaching Institution – The Lady Reading Hospital Peshawar.

### **Inclusion Criteria**

Those patients (n = 42) who were operated for a single level herniated cervical disc through anterior approach were included in the study.

### **Exclusion Criteria**

Patients with two level disc herniation, traumatic spine injuries, those having infective process or metastatic spine disease patients were excluded from the study.

### **Data Collection**

Data was entered on general designed proform. Fusion using titanium or polyetheretherketone (PEEK) cage had been performed in all cases. Pre-operative symptoms were recorded for all patients through detailed history, physical examination reports and radiological records. Post-operatively, all patients had been followed regarding symptomatic improvement and after discharge from hospital in the outpatient department.

### **Data Analysis**

Statistical software SPSS version 22 was used for data analysis. Z score was calculated to determine the value of z as well as the associated p value to find the differences of significance between the prevalence of symptoms preoperatively and their improvements postoperatively. The population proportion for the z formula was calculated by dividing the counts of success by population

sample size. The pvalue < 0.05 was considered statistically significant.

## RESULTS

### Patients' Demographics

Out of 42 patients, there were 37 male and 5 female patients. The mean age of the patients was 43 years (range: 22 – 65). Majority of the patients were in the age range of 41 – 60 years (61.88%). History of smoking was recorded in 14 (35%) patients.

### Surgical Management

Disc herniation mostly occurred at C4 – 5 and C5 – 6 levels (76.16%). Single-level anterior cervical discectomy and fusion (ACDF) was done in all patients as depicted in **Figure 1** using titanium or PEEK cage. After discectomy, the fusion had done using titanium or PEEK cage.

### Follow-up

Postoperative complications were observed in 5 patients, all complications subsided with conservative measures. Maximum duration of post op follow-up was 26 months and minimum 6 months with an average of 14 months.



**Figure 1.A):** MRI cervical spine sagittal T2WI showing C5-6 prolapsed intervertebral disc (PIVD) causing thecal sac compression with cord edema (pre op), **B):** PEEK cage fusion in same patient (6 months post op), **C):** MRI T2WI image showing C5-6 PIVD and straightening of the spine, **D):** Post op x-ray 9 months showing Titanium cage.

**Table 1:** Distribution of age, gender and level of cervical degenerative/infective disease.

Variables	No. of Patients	Percentage (%)	
Age (years)	20 – 40	11	26.18
	41 – 60	26	61.88
	61 – 70	3	7.14
Sex	Male	37	88.06
	Female	5	11.9
Level of Degenerative Disc	C2 – 3	0	0
	C3 – 4	3	7.14
	C4 – 5	17	40.46
	C5 – 6	15	35.7
	C6 – 7	7	16.66
	C4 – 5/C5 – 6	32	76.16

### Symptoms Observed

Preoperatively, the Neck pain was present in 36 (85.7%), upper limb weakness in 20 (47.6%), numbness/paresthesias in 25 (59.5%), upper limb pain in 18 (42.84%), lower limbs spasticity in 14 (33.32%) and bladder involvement in 3 (7.14%) patients (**Table 2**). Significant postoperative improvements in (90 – 100%) were reported in following symptoms i.e. neck pain, upper limb pain, motor weakness, paresthesias, stiffness in limbs, and bladder symptoms (**Table 2**). All postoperative improvements in the mentioned symptoms were found statistically significant ( $p < 0.050$ ). The z scores and resulting p values are mentioned in Table 2.

### Postoperative Complications

We noted postoperative complications in 5 patients in our series including hoarseness of voice (2.3%), problem with eating solid food (9.52%), motor weakness (2.38%) and local infection (4.76%).

**Table 2:** Pre & Postoperative Symptoms: Incidence and Improvement.

Preoperative/Postoperative Presented Symptoms	Prevalence of Preoperative Symptoms (Out of Total Patients = 42)	Prevalence of Postoperative Improvement (out of Reported)	Z Score	P value
Neck Pain	36 (85.7%)	35 (97.2%) (out of 36)	-2.29	0.022*
Upper Limb Weakness	20 (47.6%)	18 (90%) (out of 20)	-3.20	0.0013*
Numbness/Paresthesia	25 (59.5%)	24 (96%) (out of 25)	-3.25	0.0011*
Nerve Root Pain (Radiculopathy)	18 (42.84%)	18 (100%) (out of 18)	-4.14	< 0.00001*
Lower Limb Spasticity	14 (33.32%)	12 (85.71%) (out of 14)	-3.38	0.00072*
Sphincter Dysfunction	3 (7.14%)	3 (100%) (out of 3)	-4.57	< 0.00001*

\*significant result

## DISCUSSION

Cervical degenerative disc disease with a subsequent nerve root or spinal cord compression can present as neck pain, radiculopathy, myelopathy, or in combination. Cervical degenerative disc disease mostly affects the middle age population (35 – 55 years). The majority of the patients in the current study were in the age of 41 – 60 years.<sup>3,4</sup> Male patients were more susceptible to cervical degenerative disc disease (CDDD). Early postoperative complications and morbidity are mostly present in the elderly group or in those patients who present with co-morbid conditions. Higher incidences of degenerative changes are encountered in people with increasing age. Males are more predisposed to cervical degenerative spine disease leading to disc herniation as reported by Hukuda and Kojima.<sup>7</sup> Age and gender are important risk factors identified for having cervical disc herniation.<sup>7</sup> In our study, the majority of the patients were males and in the age group of 41 – 60 years. Cervical disc herniation mostly occurs at C4/5, C5/6, and C6/7. In our study, the majority of the patients had a cervical disc herniation at C4 – 5 and C5 – 6 level. Smoking accelerates the degenerative process in the disc and is an important risk factor for the development of disc herniation and can also affect the postoperative course of the patient in

terms of functional recovery.<sup>8</sup>

A significant postoperative improvement was observed in the following symptoms i.e. neck pain, upper limb pain, motor weakness, paresthesias, stiffness in limbs, and bladder symptoms. This proves the efficacy of an anterior cervical discectomy for a herniated cervical disc followed by fusion. We observed that the neck pain subsided in 35 patients out of 36, the upper limb pain was improved in 18 patients out of 20, numbness receded in 24 patients out of 25, nerve root pain and sphincter dysfunction were subsided in all patients and the lower limb spasticity improved in 12 out of 14 patients.

We noted the history of smoking 35% patients. Grisdela et al, reported in their study the detrimental effects of smoking on intervertebral disc resulting in a herniation at a younger age as compared to non-smokers.<sup>9</sup> Perioperative complications are also high in the smoker population as compared to nonsmokers. Fusion is also inversely affected by smoking increasing chances of pseudoarthrosis.<sup>7,8</sup> To predict functional outcome smoking history is mandatory. Surgical complications reported in the literature range from 4.4 – 20% following the ACDF. Various per-operative and postoperative complications can be encountered following ACDF surgery including exposure injuries to the esophagus, trachea, and other soft tissues in the neck. Vascular injury to the carotid artery and

jugular vein is rare but life-threatening. Injury to neural tissues like cord injury or sympathetic chain injury is a rare occurrence. Dural tear leading to cerebrospinal fluid leakage can occur during removal of post osteophytes removal. Wound hematoma can compromise the airway and needs emergent exploration of the wound if occurs. Infection, bone graft extrusion, instrumentation failure (screw breakage, subsidence or cage dislodgement from disc place), pseudoarthrosis, etc. can also complicate a small number of patients post-operatively.<sup>10,11,12</sup>

In the current study, the postoperative complications in the form of hoarseness of voice, problem in eating solid food, and motor weakness, were reported in only 5 patients. We noted postoperative complications in 5 patients in our series including hoarseness of voice in 1 (2.3%) patient, dysphagia in 3 (9.52%) patients, and motor weakness in 1 (2.38%) patients. A local infection occurred in 4.76% of patients. We managed all complications with conservative measures. Patients with infection were treated with appropriate antibiotics. C5 radiculopathy was common in anterior and posterior approaches to the cervical spine.<sup>16</sup> Infection was fortunately rare after anterior cervical surgery due to rich blood supply in this region.<sup>13,16</sup> Patients with comorbid especially diabetes and those having prolonged surgical time are usually affected by microorganisms. Wound hematoma is a feared complication requiring emergent wound exploration (incidence ranges from 0.2 – 1.9%) as it can be proved fatal due to airway compromise.<sup>14,15,17</sup> Neck pain, radiculopathy, and motor/sensory deficits following the ACDF, were improved in most of the patients.

## CONCLUSION & RECOMMENDATIONS

Anterior cervical discectomy for a herniated cervical disc followed by fusion is a rewarding surgical procedure having a good functional outcome in most patients. A long follow-up

period and large sample size can address this in the future in our population.

## Limitations

The study conducted on a smaller sample size with a short post-operative follow-up.

## Additional Information

This was the retrospective study, therefore, no IRB and informed consents were required. However, norms of the institutional ethics were followed.

**Disclosures:** Authors report no conflict of interest.

## Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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### AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Ihsanullah	Study design and methodology.
2.	Ihsanullah, Akhtar Muneer	Paper writing, referencing, and data calculations.
3.	Ihsanullah, Akhtar Muneer	Data collection and calculations.
4.	Bakht Jamal	Analysis of data and interpretation of results.
5.	Ihsanullah, Akhtar Muneer	Literature review and manuscript writing.
6.	Khalid Khanzada	Analysis of data and quality insurer.