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# Anterior Cervical Discectomy and Fusion Using Cages Versus Cages and Plating

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## Abstract

**Background:** The anterior column receives rapid load-bearing support, the disk space height is restored, foraminal decompression occurs, and interbody fusion is facilitated by cervical intervertebral disk replacement with cage.

**Aim:** The aim of the work was to assess the interbody fusion rate and to assess the incidence of complications of 20 consecutive patients for the degenerative one or more level anterior cervical disk utilizing cage/s versus cage/s and plate.

**Patients and methods:** A comparative research of 20 patients with degenerated cervical disks managed by an anterior cervical discectomy procedure and fusion (ACDF) using either cage-alone (ACDF-CA) or cage and anterior plating (ACDF-CPC).

**Results:** The results show that one case (10%) in the cage-only group experienced an adjacent level as a postoperative complication.

**Conclusion:** The use of cages alone versus cages with anterior plating were two surgical techniques for cervical disk herniation that were contrasted. In terms of bringing about pain alleviation and functional improvement, both operations were equivalent. The short-term results were almost identical, despite the fact that the plate approach was better than the cage-alone method in terms of maintaining alignment and disk height accomplishment.

**Keywords:** Anterior cervical discectomy and fusion, Cages, Plating

## 1. Introduction

The 33 vertebrae that make up the human vertebral column or spine are divided into five different anatomical regions: the cervical, thoracic, lumbar, sacral, and coccygeal. But since it is so close to the head, protects the top spinal cord, and has vertebral arteries that help the brain's posterior circulation, the cervical spine might be significant. A complex and flexible framework supporting seven cervical vertebrae, cartilages, ligaments, and muscles allows for a range of head and neck motions. The intervening intervertebral disks for stress absorption and flexibility are present between cervical vertebrae, much as in other regions of the spine. To accommodate the spinal cord, blood vessels, meninges, and nerve roots, it also has a significantly broader spinal canal.<sup>1</sup>

Anterior cervical discectomy and fusion (ACDF), which was first described by Smith and Robinson in

1958, is now among the most popular spine procedures used to treat cervical degenerated disk condition, radiculopathy, and myelopathy.<sup>2</sup>

Anterior plate fixation was developed and is now often used in ACDF procedures as a result of developments such as cage subsidence, cervical dislocation that might result in cervical kyphosis, acceleration of the neighboring segment disease, and slowed fusion rate.<sup>3</sup>

The anterior column receives rapid load-bearing support, the disk space height is restored, foraminal decompression occurs, and interbody fusion is facilitated by cervical intervertebral disk substitution with cage.<sup>4</sup>

To determine the effectiveness of metal plate advancement, we compare and contrast the radiological and clinically short findings of ACDF with cage/s alone group (ACDF-CAG) and ACDF with cage/s and plate group (ACDF-CPG) for the surgical

intervention of one or more levels of degenerative cervical disk illness.

The aim of the work was to evaluate the interbody fusion rate and to assess the incidence of complications of 20 consecutive patients for degenerative one or more level anterior cervical disk utilizing cage/s versus cage/s and plate.

## 2. Patients and methods

In all, 20 patients with degenerative cervical disks had anterior cervical discectomy and fusion (ACDF) utilizing either a cage-alone (ACDF-CA) or a cage with anterior plating (ACDF-CPC), in a comparative study.

### 2.1. Inclusion criteria

Those caused by degenerative disk degeneration in the C3–C7 range: neck pain and/or brachial neuralgia and neurologic deficit, age between 20 and 65 years, and unsuccessful use of cautious measures for more than 6 six weeks.

### 2.2. Exclusion criteria

Prior cervical spine surgery, severe instability brought on by trauma, a history of malignancy or infection of the spine, and instances that responded to appropriate conservative treatment.

### 2.3. Patients and evaluation

This research had 20 participants in total. Patients were split into two equal groups at random. Ten participants who underwent ACDF-CA made up group A and ten participants from group B underwent ACDF-CPC.

### 2.4. The preoperative protocol included

Complete general and neurological examination, routine preoperative investigations, plain radiographs of the cervical spine or computed tomography, and magnetic resonance imaging (MRI).

### 2.5. Surgical procedure

According to Smith-Robinson, surgical operations were performed utilizing the standard anterolateral approach through a right-sided skin incision. Any sub-ligamentous fragments and the posterior osteophytes were eliminated. With a drill or curette, the endplates were gently decorated. Cervical cages by themselves or cages with anterior plating are

used to accomplish interbody fusion. The standard procedure for closure was followed. All patients were required to wear a rigid neck collar for 6–8 weeks after surgery.

### 2.6. Assessment of postoperative results includes: clinical outcome

Taking particular note of sensory and motor status in comparison to the preoperative evaluation. **Functional outcome** was evaluated using Odom's standards (Odom *et al.*, 1958) to excellent, good, satisfactory, and poor. **Radiological outcome:** Plain X-rays of the cervical spine.

### 2.7. Radiographs were reviewed to evaluate

Cage position. The cervical spine's neutral posture was defined as having a lordotic, straight, or kyphotic form. The intervertebral disk's height, bony bridge development between the superior and inferior endplates, and the existence of the trabecular bone were the two characteristics that distinguished fusion.

### 2.8. Statistical analysis

The tabulation and analysis of the data were done using the SPSS program. Quantitative data were reported as mean and standard deviation, or median and range, and categorical variables were given as percentages and numbers. The paired *t*-test was used to compare the latter data type between the two time points. A *P* value of 0.05 or less was regarded as substantial.

## 3. Results

This was a prospective and retrospective study on 20 cases with cervical disk prolapse that need surgical treatment by anterior cervical discectomy and interbody fusion. In the period between December 2021 and November 2022 at Al-Azhar University hospitals, patients were divided into two groups: group 1 (*N* = 10), whose interbody fusion was performed using cage/s that stood alone and group 2 (*N* = 10), whose interbody fusion was performed utilizing cage/s that were supplemented by anterior cervical plating.

**Table 1:** displays demographic and medical information for the **cage-alone group**. Age ranged between 38 and 56 years with a mean value of  $45.10 \pm 6.262$  years. Half of patients were male (50%). Predisposing factors show that two patients (20.0%) had HTN and four (40.0%) were smokers.

Table 1. Distribution for cage-alone group according to demographic and medical information.

	Cage-alone group number (percent)
Age (years)	
Range	38–56
Mean $\pm$ SD	45.10 $\pm$ 6.262
Sex	
Males	5 (50.0)
Females	5 (50.0)
Predisposing factors	
HTN	2 (20.0)
DM	0 (0)
Smoking	4 (40.0)
Clinical presentation	
Radiculomyelopathy	3 (30.0)
Neck pain + radiculopathy	7 (70.0)
Myelopathy	1 (10.0)
Diagnosis	
C3–4	2 (20.0)
C4-5	5 (50.0)
C5-6	8 (80.0)
C6–7	2 (20.0)
Diagnostic image preoperative	
MRI/radiograph	10 (100)
Diagnostic image postoperative	
Radiograph	10 (100)
Improvement	
Poor	0 (0)
Satisfactory	1 (10.0)
Good	1 (10.0)
Excellent	8 (80.0)

Table 2. Distribution for cage and plate groups according to demographic data.

	Cage and plate group number (Percent)
Age (years)	
Range	38–59
Mean $\pm$ SD	50.50 $\pm$ 7.778
Sex	
Males	5 (50.0)
Females	5 (50.0)
Predisposing factors	
HTN	3 (30.0)
DM	1 (10.0)
Smoking	3 (30.0)
Clinical presentation	
Radiculomyelopathy	1 (10.0)
Neck pain + radiculopathy	8 (80.0)
Myelopathy	1 (10.0)
Diagnosis	
C3–4	4 (40.0)
C4-5	6 (60.0)
C5-6	9 (90.0)
C6–7	2 (20.0)
Diagnostic image preoperative	
MRI/radiograph	10 (100)
Diagnostic image postoperative	
Radiograph	10 (100)
Outcome	
Poor	1 (10.0)
Satisfactory	1 (10.0)
Good	2 (20.0)
Excellent	6 (60.0)

The majority of patients had neck pain + radiculopathy (70.0%) followed by radiculomyelopathy (30%). The majority show that the affected level was C5-6 DP (80.0%) followed by five patients in whom the affected level was C4-5 DP. Patient improvement shows that the majority had excellent improvement (80.0%).

**Table 2:** displays demographic and medical information for cage and plate groups. Age ranged between 38 and 59 years with a mean value of  $50.50 \pm 7.778$  years. Half of the patients were male (50%). Predisposing factors show that three (30.0%) patients had HTN, one (10.0%) had DM, and three (30.0%) were smokers. The majority of patients had neck pain + radiculopathy (80.0%). The majority show that the affected level was C5-6 (90.0%) followed by six patients in whom the affected level was C4-5 DP. Patient's improvement shows that the majority had excellent improvement (60.0%).

**Table 3:** One case (10%) in the cage-alone group experienced dysphagia as a postoperative complication.

**Table 4:** One case (10%) in the cage-only group experienced adjacent level as a postoperative complication.

Table 3. Distribution for cage-alone group according to complication.

Complication	Cage-alone group number (Percent)
No complications	9 (90.0)
Dysphagia	1 (10.0)
Adjacent level	0 (0)
Total	10 (100)

Table 4. Distribution for cage and plate groups according to complications.

Complication	Cage and plate group number (percent)
No complications	9 (90.0)
Dysphagia	0 (0)
Adjacent level	1 (10.0)
Total	10 (100)

**Table 5:** displays a comparison of the two study groups based on demographic information and it shows no statistically significant difference regarding complications and improvement between the two studied groups.

Table 5. Comparison of the two study groups based on demographic information.

	Cage-alone group number (%)	Cage and plate group number (%)	Test of sig.	P value
Age (years)				
Range	38–59	38–59	$t = 1.710$	0.104
Mean $\pm$ S	50.50 $\pm$ 7.778	50.50 $\pm$ 7.778		
Sex				
Males	5 (50.0)	5 (50.0)	–	1.000
Females	5 (50.0)	5 (50.0)		
Predisposing factors				
HTN	2 (20.0)	3 (30.0)	–	1.000
DM	0 (0)	1 (10.0)	–	1.000
Smoking	4 (40.0)	3 (30.0)	–	1.000

### 3.1. Case 1

Male patient, 57 years old, HTN not diabetic but smoker, complaining of dull aching neck pain of gradual onset and progressive of 6 months duration increasing by manual work and especially at night. Four months ago, he developed pain and paresthesia along the lateral aspect of both forearms that extended into the thumb, index, and middle finger bilaterally but more on the right (C6,7 distribution). The patient was on medical treatment for 2 months then physiotherapy for another 1 month with no significant improvement. The patient was full power, intact sensation, reflexes, and sphincters. Hoffman's sign was negative. A patient diagnosed with multilevel CDP most prominent (C5-6, C6-7

levels). One week later he underwent ACDF using a cage and plate. Postoperatively, the patient improved (Figs. 1–4).

### 3.2. Case 2

Female patient, 40 years old, nurse, not diabetic not HTN presenting neck pain of 8 months duration; 4 months ago she developed pain in her right arm from the neck down to the forearm and into the thumb side of the hand (C5,6 distribution) of gradual onset and progressive course. There was no history of significant trauma, or joint or morning stiffness. The pain was not responding to medical treatment. The patient was in full power. Intact sphincters, sensation and diagnosed as (C4-5, C5-6

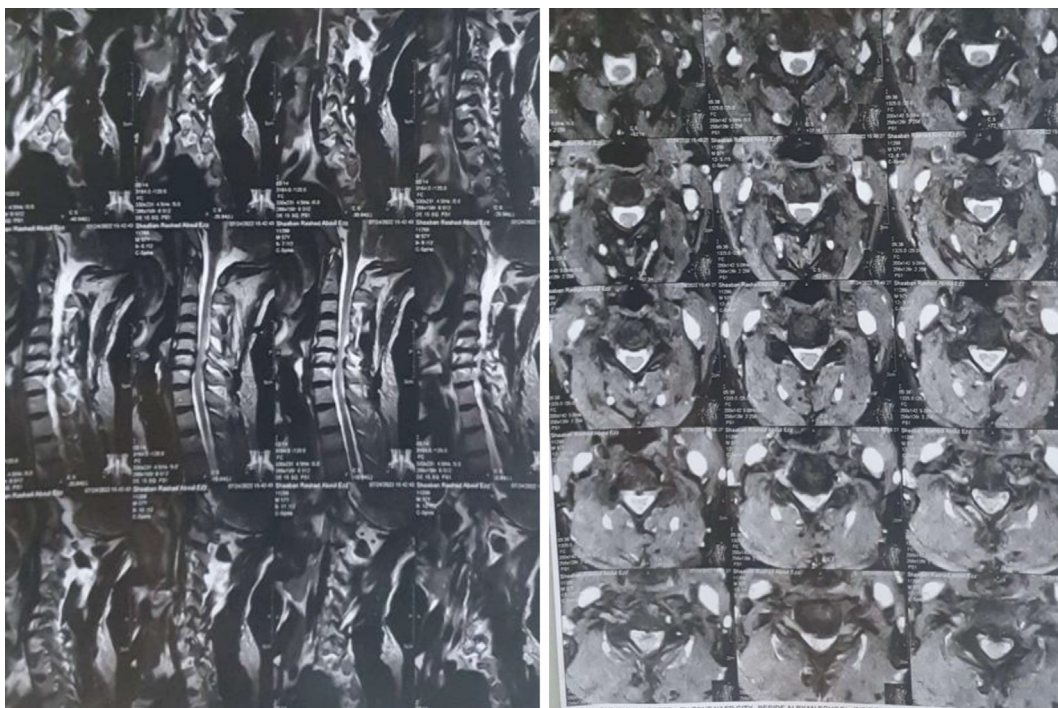


Fig. 1. Axial and sagittal T2 MRI image shows multilevel cervical disk prolapsed most prominent C5-6, C6-7 disk.

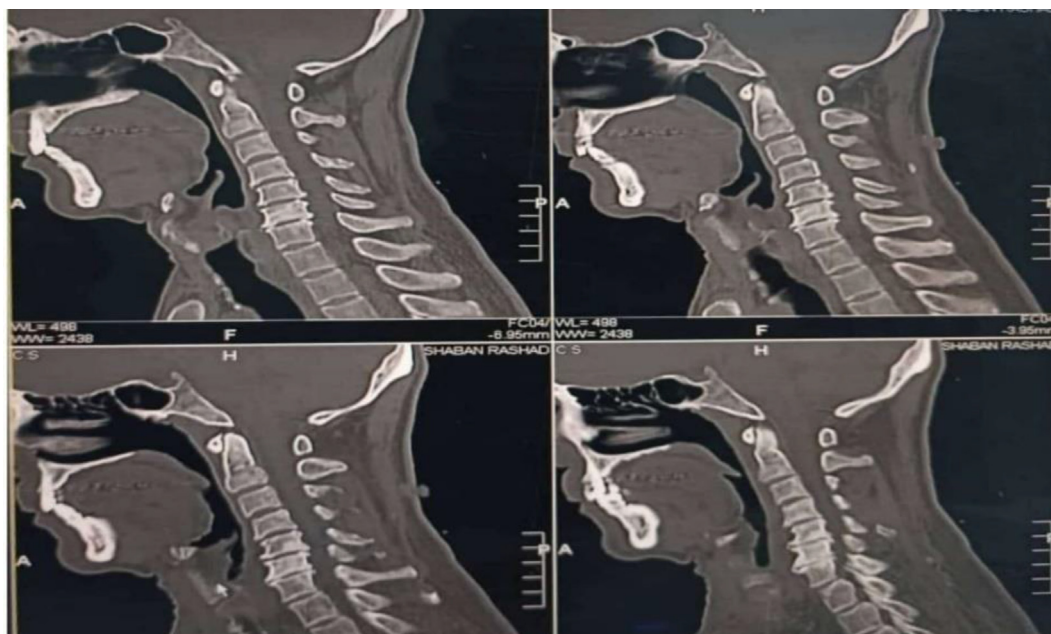


Fig. 2. Preoperative CT cervical (sagittal view) shows narrowing disk space and osteophytes at C5-6 and C6-7 levels and small osteophytes at the C4-5 level.

DP). She was advised to undergo surgical treatment as medical treatment failed. One week later she underwent ACDF using a cage-alone. Postoperatively, the brachialgia was relieved and the patient improved (Figs. 5–7).

#### 4. Discussion

Anterior cervical discectomy and fusion (ACDF) have been utilized to manage cervical degenerative disk degeneration, radiculopathy, and myelopathy since Smith and Robinson first described it in 1958.



Fig. 3. Preoperative radiograph (lateral view) showing disk space narrowing and osteophytes at C5-6 and C6-7 levels and small osteophytes at the C4-5 level.

Anterior plate fixation was created and is now often used as a result of advancements in ACDF procedures to offer more stability. Unfortunately, there have been reports of adverse events related to anterior cervical plates, including dysphagia, neurovascular injuries, and soft tissue injury to the esophagus. Stand-alone interbody cages that promote stability and cervical vertebral fusion without the need for an anterior plate were created to address these issues. However, this novel approach has its drawbacks, including cervical kyphosis, cage subsidence, and cervical dislocation.<sup>5</sup>

Cage sinking is the most common issue with ACDF using a cage. Postoperative cage subsidence may happen throughout the recovery phase, which might lead to foraminal stenosis later on. After surgery, patients may have radiculopathy recurrence and axial neck discomfort. However, the presence of radiological proof of cage sinking does not always indicate that radiculopathy will return in further cases.<sup>6</sup>

As regards demographic and clinical data for the cage-alone group, age ranged between 38 and 56 years with a mean of value  $45.10 \pm 6.262$  years. Half of the patients was male (50%). Predisposing factors show that two (20.0%) had HTN and four (40.0%) were smokers. Regarding demographic and clinical data for the cage and plate group, age ranged between 38 and 59 years with a mean value of  $50.50 \pm 7.778$  years. Half of the patients was male (50%). Predisposing factors show that three (30.0%)

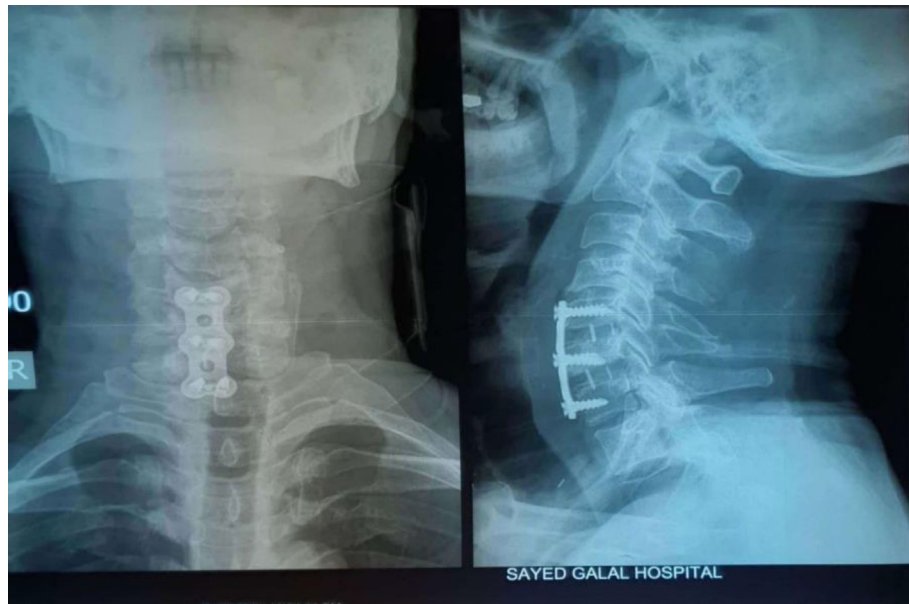


Fig. 4. Postoperative radiograph (A-P and lateral views) showing ACDF of C5-6 and C6-7 DP using cages and plate they are in place (the patient was improved).

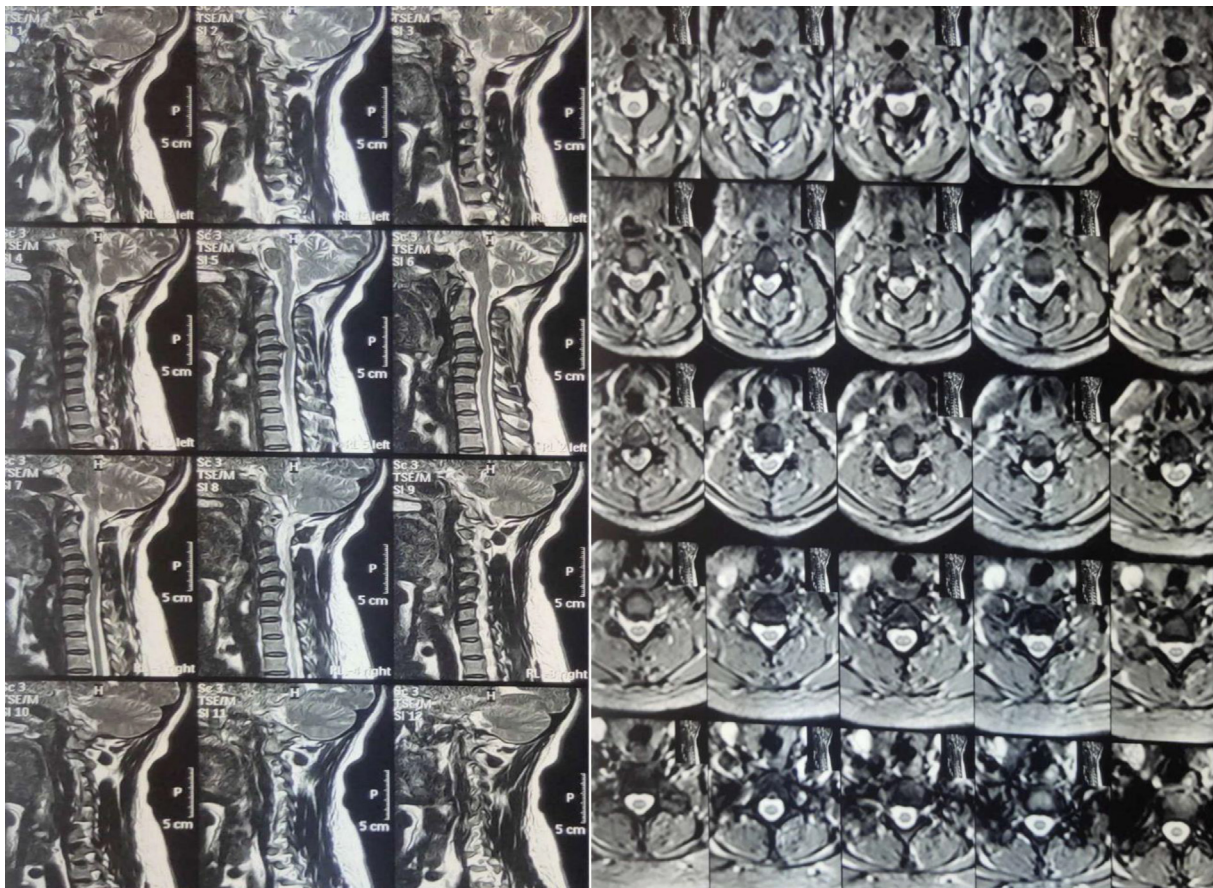


Fig. 5. Axial and sagittal T2 MRI image shows prolapsed C4-5, C5-6 disk more central and right paracentral.

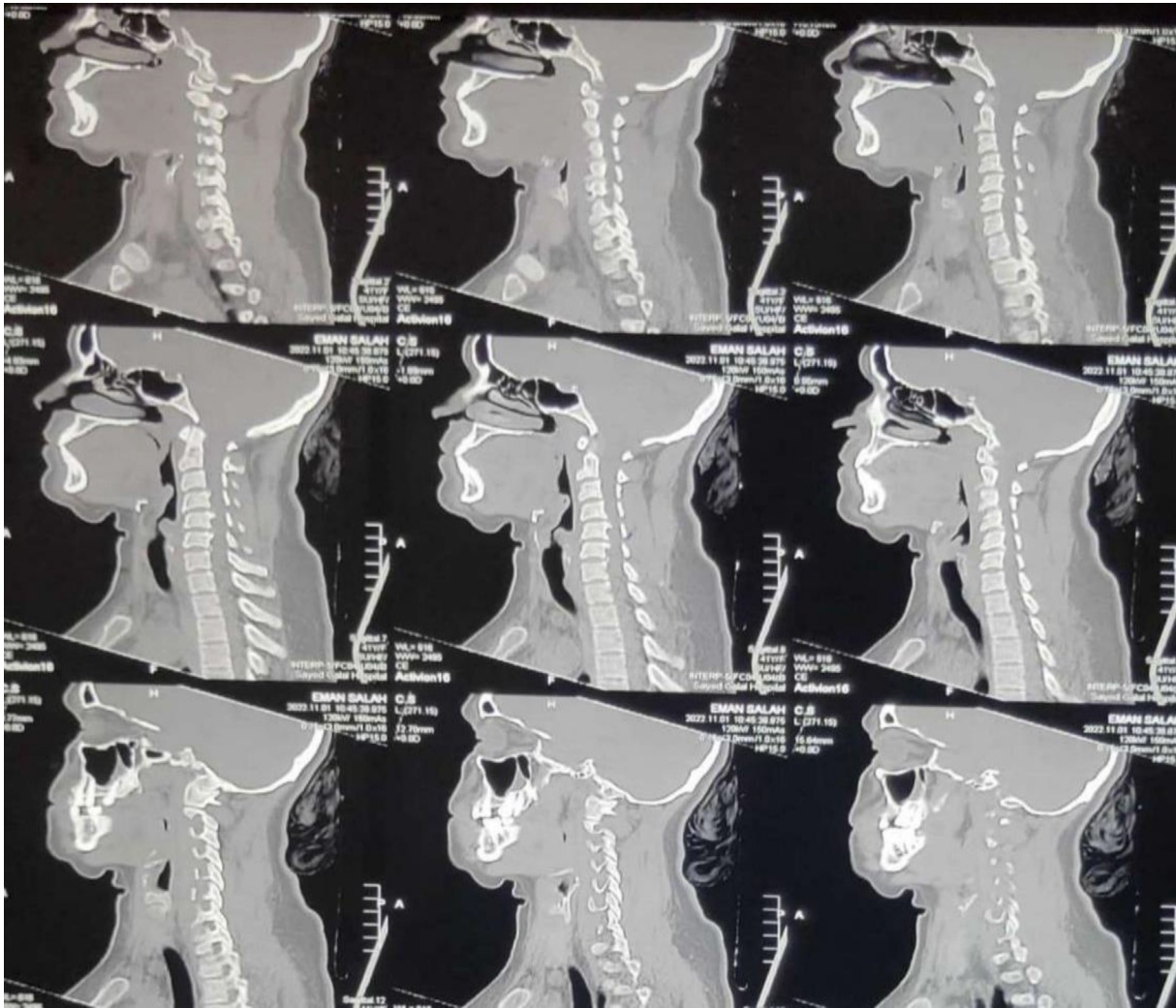


Fig. 6. Preoperative CT cervical (sagittal view) showing narrowing disk space and small osteophytes at C4-5, C5-6 levels.

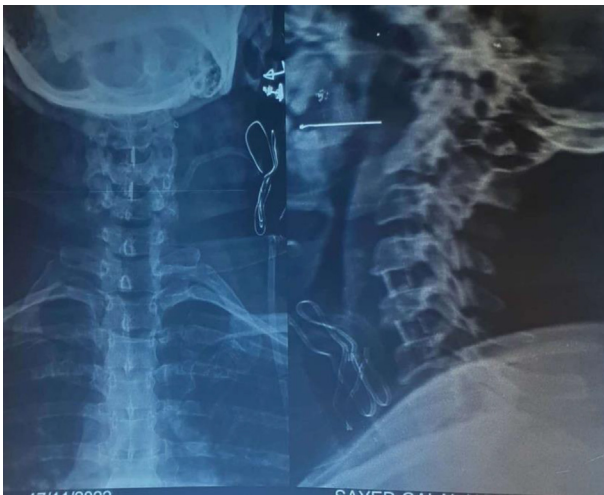


Fig. 7. Postoperative radiograph (A-P and lateral views) showing ACDF of C4-5, C5-6 DP using cage-alone. A cage is in place (the patient was improved).

patients had HTN, one (10.0%) had DM, and three (30.0%) were smokers. Regarding the demographic comparison of the two examined groups, there are no statistically substantial variations between the two researched groups.

Our results were supported by the study of Elsayed & Sakr,<sup>3</sup> which reported that < AQ: Pls check whether text incomplete > There were 33 patients involved. The patients were split into two groups: group A got 19 instances of ACDF, while group B got 14 cases of ACDF plus plate fixation. Eleven men and eight women in group A had ACDF with a peep interbody cage filled with allograft and synthetic bone graft, and the average patient age was 54.6 years (with a range of 39–76 years). There were 14 patients in group B, 8 of whom were men and 6 of whom were women; their average age ranged from 43 to 68 years, with no discernible variation between the two groups.



The current study showed that in the cage group; the majority show that the affected level was C5-6 DP (80.0%) followed by five patients; the affected level was C4-5 DP. In the cage and plate group, the majority show that the affected level was C5-6 (90.0%) followed by six patients with an affected level of C4-5 DP. Regarding the comparison between the two studied groups according to the affected level and it shows no statistically significant differences between the two studied groups.

Our findings were corroborated by a research of Yun *et al.*,<sup>7</sup> as they reported that the study's inclusion criteria were satisfied by 63 patients in total (31 cases in the zero-profile, freestanding device (Zero P) group and 32 instances in the cage with plate construct (CP) group). The majority of operations in both groups happened at C5/6 and C6/7, and there was no discernible difference ( $P = 0.185$ ).

Similarly, Barakat *et al.*<sup>8</sup> demonstrated that regarding the most frequently operated levels, C5-6 (60%) and C4-5 (30%) were the two most frequent levels in the plate group, while C5-6 (70%) and C6-7 level (20%) were the two most frequent levels in the cage group. However, there was no statistically significant difference between the two groups. In the plate group, the most often used operating levels were C5-6. The concentration of pressures during neck flexion at that level and the reduction in canal diameter relative to cord diameter, which renders this level more susceptible to disc prolapse, may both be used to explain this predominance.

In accordance with our results, the study of Barakat *et al.*<sup>8</sup> reported that based on functional results, the plate group had six patients who had excellent results, two patients who had good results, one patient who had satisfactory results, and one patient who had a poor result, while the cage group had seven patients who had excellent results, one patient who had good results, one patient who had satisfactory results, and one patient who had a poor result, with no statistically substantial variation between the two groups.

Also, Elsayed and Sakr<sup>3</sup> revealed that in group A, seven patients (36.8%) had outstanding healing, six patients (31.6%) had good healing, three patients (15.8%) had fair healing, and three patients (15.8%) had poor healing. Patient satisfaction was evaluated using Odom's criteria for result grading. Six patients (42.9%) in group B recovered very well, three (21.4%) recovered well, two (14.3%) recovered quite well, and three (21.4%) recovered poorly. There were no statistically substantial variations between the two groups ( $P = 0.19$ ).

Our results show that regarding complications' one case (10%) in the cage-alone group experienced

dysphagia as a postoperative complication. In the cage and plate group one case (10%) in the cage-only group experienced an adjacent level as a postoperative complication. There are no statistically substantial variations between the two investigated groups when complications are compared between the two groups.

Our results were supported by the study of Barakat *et al.*,<sup>8</sup> which reported that regarding complications, there were no patients with postoperative vocal cord dysfunction. There were two patients who suffered from dysphagia (transient), one in each group. There was no postoperative infection. No patients suffered from neurological deterioration and there was no keloid formation. No cage-related issues such as extrusion occurred in their investigation; however, there was one instance of a cage sinking at the vertebral bodies. No patient's implants needed to be taken out. Since there was no standard scale for all the photos, they did not apply the established method to estimate cage sinking. Between the two study groups, there were no statistically substantial variations.

Similarly, Cheung *et al.*<sup>9</sup> demonstrated that other substantial variations in results or postoperative consequences were nonexistent. In the study of Li *et al.*<sup>10</sup>, neither group had any negative effects from the implant or implant procedure.

Also, the study of Elsayed & Sakr<sup>3</sup> revealed that temporary dysphagia and temporary hoarseness were identified as problems in their research, both of which subsided with time. Each of the following conditions happened once and was treated conservatively: infection, hematoma, dural rupture, and spinal cord damage. Seven occurrences of cage sinking were documented, none of which required further care as there were no signs of nerve root compression. By wearing the neck collar for at least 6 weeks and receiving conservative therapy, the loosening of a screw and pseudoarthrosis were treated. Between the two study groups, there were no statistically substantial variations.

In addition, Li *et al.*<sup>11</sup> stated that although postoperative consequences were comparable across the two surgery groups, postoperative dysphagia showed a clear difference. In the cage group, 5.9% of patients and 12.9% of patients in the plate group had transient postoperative dysphagia (<3 months). Just one patient in the cage group continued to have dysphagia concerns after 3 months, and four patients in the plate group had such complaints. Therefore, compared with patients who get the stand-alone Fidji cervical cage, individuals with ACDF incorporating an extra anterior plate had dysphagia substantially more often ( $P = 0.049$ ). The

great majority of patients had moderate dysphagia with a duration of >3 months. Mild dysphagia that lasted longer than 3 months after surgery, which affected one patient in the cage group and two patients in the plate group. Another patient struggled to swallow liquids due to mild dysphagia. One patient in the plate group had severe dysphagia and often had trouble swallowing solid meals. A swallow examination indicated that he had partially aspirated some food.

#### 4.1. Conclusion

The use of cages alone versus cages with anterior plating were two surgical techniques for cervical disk herniation that were contrasted. In terms of bringing about pain alleviation and functional improvement, both operations were equivalent. Although the plate approach outperformed the cage-alone method in terms of maintaining alignment and disk height accomplishment and reducing the issue of cage extrusion and collapse, the short-term result was almost identical.

#### Authorship

All authors have a substantial contribution to the article.

#### Disclosure

The authors have no financial interest to declare in relation to the content of this article.

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#### Conflicts of interest

The authors declared that there were no conflicts of interest.

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