

Research Article

Fusion Rate for Single Level ACDF with and without Plating in Degenerative Disc Disease, Tracing the Results

Amr Ismail, Muhammad Mohsin khan*

Resident Neurosurgery, Pakistan

***Corresponding Author:** Muhammad Mohsin khan, Resident Neurosurgery, Pakistan

Received: 22 September 2021; **Accepted:** 29 September 2021; **Published:** 14 December 2021

Citation: Amr Ismail, Muhammad Mohsin khan. Fusion Rate for Single Level ACDF with and without Plating in Degenerative Disc Disease, Tracing the Results. Journal of Spine Research and Surgery 3 (2021): 113-123.

Abstract

Background: Anterior cervical discectomy and fusion (ACDF) is one of the most common spine surgeries performed as the treatment for diverse cervical spine diseases including degenerative spondylosis, disc prolapse, trauma, infections and instability Multifarious ways to fuse have been practised: bone graft or bone graft substitute augmented by an anterior plate, stand-alone strut graft, inter-body cage with anterior plate, stand-alone cage and zero-profile cage. Of these, the most common fusion techniques include anterior cervical fusion with stand-alone cage or cage-plate construct

Methods: This is a retrospective study included ninety nine patients underwent who underwent ACDF with plating or without plating from Jan. 2009 to Dec. 2017. The data were collected from patient files. Patients had follow up cervical XRAY at 6 and 24 months to assess the fusion criteria.

Results & Conclusion: The results showed that, In the fusion only group 33 patients (75%) had a complete fusion while only 6 patients (15%) had no fusion. In the plate group 6 patients out of 8 had complete fusion (75%) and only 2 patients (25%) had no fusion. And the conclusion was that the fusion rate was more or less similar in both techniques

Keywords: ACDF; Degenerative Disc Disease

1. Introduction

Anterior cervical discectomy and fusion (ACDF) is the gold standard treatment for cervical disc herniation. Many technical modifications have been reported since its original description by Smith and Robinson [1] and the later report by Cloward in 1958 [2]. It is known that ACDF with stand alone cages is not only simple, but also effective with a high rate of success in treating single level disc disease [3, 4]. With or without a cage alone procedure ACDF-CA or ACDF with cage and plate constructs (ACDF-CPC) is still not an evidence based recommendation [5]. Despite the great advantages offered by the plate like increase the rate of fusion, decrease the chances of malunion, graft collapse, and kyphotic deformity, the process do have some disadvantages like causing a distraction at the applied level and may delay the process of healing [6]. Adding a plate for single-level ACDF cases lengthen the duration of surgery, moreover, adding a foreign body has its further dramatic implication on infection, and risk for future malposition and consequently the need for unnecessary delayed surgery [6]. In this study we tried to demonstrate the differences between the two procedure according to rate of fusion and complications based on immediate and delayed images.

2. Patients & Methods

This is a retrospective study aimed to trace the results of ACDF with and without plates. Patients included in the study were admitted to Tertiary care facility. All patients who underwent ACDF with plating or without plating from Jan. 2009 to Dec. 2017.

2.1 Inclusion criteria

- Age (20-80)
- Single level
- Degenerative
- Subaxial disease.

2.2 Exclusion criteria

- Trauma (any present/past history of trauma C1/C7)
- Malignancy (Any systemic or bony)
- Previous surgery (Same, adjacent level)
- Underlying systemic/Local bone disease

Data were collected from both computerized system and ordinary files. After collecting the data of 99 patients only 47 were found to have follow up so the rest of patients were excluded.

2.3 Surgical technique

Surgical procedures were performed using a standard left anterolateral approach. After insertion of a cervical spine distracter, complete discectomy and neural decompression were performed using a surgical microscope. The cartilaginous endplate was removed completely to expose the cortical endplate. The bony endplate was preserved as much as possible to prevent cage subsidence. An appropriate-sized cage (Syncage-C; Synthesis, Paoli, PA, USA) was filled with autologous cancellous bone harvested as a cylinder from the left anterior iliac crest through a mini-incision using a special device. The cage size was determined by both preoperative templating and intraoperative evaluation using a trial cage to confirm initial stability. The cage was inserted into the disc space by using an impactor and cage stability was confirmed after the distracter was removed. Patients remained in a soft collar for 4 weeks

postoperatively. Anterior plating was performed according to the Smith–Robinson technique, in which tricortical autologous iliac bone is harvested from the iliac crest and grafted between the vertebral bodies under manual traction. Supplemental anterior plate fixation was applied using an Atlantis plate system (Medtronic Sofamor Danek, Minneapolis, MN, USA).

2.4 Radiological assessment

All patient included in this study had a follow up cervical X ray film after 6 and 24 months. The films were carefully examined for fusion criteria. No other types of imaging were included in the study.

2.5 Statistical analysis of the data [7]

Data were analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) [8] Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level .

The used tests were:

- 1 Chi-square test
For categorical variables, to compare between different groups
- 2 Fisher’s Exact or Monte Carlo correction
Correction for chi-square when more than 20% of the cells have expected count less than 5
- 3 Wilcoxtest (Mann-Whitney U test)
- 4 Welch two-sample t test
For abnormally distributed quantitative variables, to compare between two studied groups

3. Results

3.1 Demographic data

The study included 72 male which represent 72.7% of the studied group and 27 females which represent 27.3 % of the studied group. The age ranged from 20 to 79 years with the largest age group from 50 to 59 consisted of 38 patients (38.4%). The mean age of the studied group was 48.87 ± 9.35 and the median was 50 (Table 1).

3.2 Admission

According to admission type, 46 patients were elective, 4 were emergency and 49 were not recorded representing 46.5 %, 4 % and 49.5 % respectively (Table 2).

3.3 Co-morbidities and risk factors

84 patients were nonsmokers and 13 smoked. 2 patients were not recorded. 80.7% of the patients were diabetics, 17.2% were not diabetics and 2% remained unknown as it was not recorded. Regarding HTN, 19.2% were hypertensive, 78.8% were not, and 2% were not recorded (Table 3).

3.4 Medications

According to medications taken by patients two drugs only were recorded NSAIDS and Corticosteroids. 17.2% used NSAIDS where 80.8% did not. While no patients at all were recorded to use steroids. 2% were unrecorded in both categories (Table 4).

3.5 Disc level

No patients were known to have level C2-3. The patients ranged from 53.5% in level C5-6 to 11.1% in level C3-4 (Table 5).

3.6 Type of fusion

63.6% of the patients had carbon cage, 36.4% had PEEK cage and no patients at all had an Auto graft (Table 6). Of 99 patients 33.3% had a cage with plate while 66.7% had a cage without plate (Table 7).

3.7 Follow up

At the 6 months follow up visit 60.2% of the patients attended and had their follow up radiological images while 39.4% of patients did not show up. At 1 year follow up visit 52.6% of patients were lost while 47.4% attended and had their images (Table 8).

3.8 Radiological findings at 1 year FU

Only 7 patients had a graft collapse less than 6mm while 40 patients had no collapse. 10 patients had a kyphotic deformity while 37 were normal. According to instrumental malposition, only 3 patients had malposition and

44 had no malposition. One patient only had a distraction more than 10mm and no patients at all had instrumental fracture (Table 9). According to post operative infection, only one patient (2.1%) had this complication. Also only one patient (2.1%) had a revision of the surgery (Table 10). Regarding fusion rate approved by XRAY at 6-24 months follow up, 39 patients had complete fusion while 8 patients had no fusion (Table 11).

3.9 Fusion rate in Fusion only and Fusion and plating groups

According to Fusion rate, In the fusion only group 33 patients (75%) had a complete fusion while only 6 patients (15%) had no fusion. In the plate group 6 patients out of 8 had complete fusion (75%) and only 2 patients (25%) had no fusion (Table 12).

	No.	%
Sex		
Male	72	72.7
Female	27	27.3
Age (years)		
20 – 29	1	1.0
30 – 39	11	11.1
40 – 49	37	37.4
50 - 59	38	38.4
60 – 69	8	8.1
70 - 79	4	4.0
Min. – Max.	29.0 – 74.0	
Mean ± SD.	48.87 ± 9.35	
Median	50.0	

Table 1: Distribution of the studied cases according to demographic data (n = 99).

	No.	%
Elective		
Not recorded	49	49.5
Elective	46	46.5
Emergency	4	4.0

Table 2: Distribution of the studied cases according to admission (n = 99).

	No.	%
Smoking		
Not recorded	2	2.0
No	84	84.8
Yes	13	13.1
DM		
Not recorded	2	2.0
No	80	80.8
Yes	17	17.2
HTN		
Not recorded	2	2.0
No	78	78.8
Yes	19	19.2

Table 3: Distribution of the studied cases according to different parameters (n = 99).

	No.	%
NSAIDS > 1 week, within first 3 months		
Not recorded	2	2.0
No	80	80.8
Yes	17	17.2
Chronic Steroid intake		
Not recorded	2	2.0
No	97	98.0
Yes	0	0.0
Female more than 45 Y		

No	73	73.7
Yes	26	26.3

Table 4: Distribution of the studied cases according to different parameters (n = 99).

	No.	%
C2-3	0	0.0
C 3-4	11	11.1
C 4 - 5	14	14.1
C 5 - 6	53	53.5
C 6 - 7	21	21.2

Table 5: Distribution of the studied cases according to Surgical level (n = 99).

	No.	%
Carbon cage	63	63.6
PEEK cage	36	36.4
Auto graft	0	0.0

Table 6: Distribution of the studied cases according to type of fusion (n = 99).

	No.	%
Cage / Plate	33	33.3
Cage	66	66.7

Table 7: Distribution of the studied cases according to fusion with/without plating (n = 99).

Follow up	No.	%
At XR 3- 6 months		
Lost follow up	39	39.4
Follow up	60	60.2
At XR 6 months -1 Year		
Lost follow up	52	52.6
Follow up	47	47.4

Table 8: Distribution of the studied cases according to follow up (n =99).

	No.	%
Graft collapse <6mm		
No	40	85.1
Yes	7	14.9
Kyphotic deformity		
No	37	78.7
Yes	10	21.3
Instrumentation Malposition		
No	44	93.6
Yes	3	6.3
Distraction (> 10mm)		
No	46	97.9
Yes	1	2.1
Instrumentation fracture within one year		
No	47	100
Yes	0	0

Table 9: Distribution of the studied cases according to different radiological parameters within 6 M – 1 Y (n=47).

	No.	%
Post op infection		
No	46	97.9
Yes	1	2.1
Revision of surgery		
No	46	97.9
Yes	1	2.1

Table 10: Distribution of the studied cases according to different parameters within 6M – 1Y (n=47).

Fusion	No.	%
At XR 6 months -1 Year		
No	8	17.1
Yes	39	82.9.

Table 11: Distribution of the studied cases according to fusion at 6 M – 1 Y (n=47).

Fusion	No.	%
Fusion at 6 months -1 Y with fusion only		
No	6	15%
Yes	33	85%
Fusion at 6 M - 1 Y with fusion and plating		
No	2	25%
Yes	6	75%

Table 12: Distribution of the fused cases according to fusion (n=39)/fusion and plating (n=8).

4. Discussion

Standalone interbody cage is a simple procedure, requires relatively short intraoperative time and has low rates of significant bleeding . In addition to the ability to restore disc height, it also can correct cervical kyphosis [9]. Our study was not comparative, we only traced the results of both techniques and the results showed that, In the fusion only group 33 patients (75%) had a complete fusion while only 6 patients (15%) had no fusion. In the plate group 6 patients out of 8 had complete fusion (75%) and only 2 patients (25%) had no fusion. Many authors had studied the advantages and disadvantages of both techniques. One of these studies is Hacker et al [10] which is a multicenter study carried out in USA. They found similar success rate for both techniques while the complication rate associated with ACDF was 20%, which was lower than the overall complication rate of 12% for the cage. Ji et al [11] was similar to our study in that the two groups were not similar in number. They compared 22 patient underwent anterior cervical fusion with stand-alone cages to 20 patients with cage-plate construct. Like our findings, they found the same rate of fusion in the two groups. The study differs from our study in that some patients had two levels disc and the follow up was 2 years. They found also similar rates

of complications except for adjacent segment degeneration which was much lower in the stand alone cage group. Oh et al [12] Studied 54 patients with anterior cervical discectomy and reconstruction at two levels. They found that clinical and radiological outcomes were similar in both groups. However cage-plate constructs resulted in shorter fusion duration and lower subsidence rates .

According to complications of standalone cage technique, Bartels et al and Lee et al. [13, 14] founded better outcomes according to segmental kyphosis and subsidence with cage-plate constructs. However, the clinical outcome with stand-alone cage was not adverse, despite these negative radiological measures in all these studies. All other radiological outcome measures were also satisfactory with the stand-alone cage construct Barsa et al. [15] studied the Factors affecting sagittal malalignment due to cage subsidence in standalone cage assisted anterior cervical fusion. They concluded that Subsidence of rectangular, stand-alone cages in anterior cervical fusion was found in a significant number of patients in this study. The migration of the device into the adjacent vertebral body was associated with segmental loss of lordosis. Despite the kyphotisation

seen at the involved disc levels, the overall alignment between C2 and C7 did not change significantly. Both, position of the implant within the disc space and its size relative to the endplate, influenced the risk of subsequent subsidence. However they were not able to reflect the importance of end-plate integrity maintenance and the tendency to develop subsidence in intra-operatively over-distracted segments has not been proven. They found that device impaction was asymptomatic in all patients but a longer follow-up is needed to determine whether implant subsidence results in progression of degenerative process in adjacent cervical segments.

Botelho et al. [16] was a systematic review aimed to clarify the effectiveness of ACD compared with ACDF, with or without the use of anterior cervical spacer (Cage) or instrumentation with plate fixation (ACDFI). They had multiple conclusions which were There is moderate evidence that clinical results of ACD and ACDF are not significantly different. There is moderate evidence that the addition of intervertebral cage enhances clinical results. There is moderate evidence that anterior cervical plate does not change the clinical results of ACDF in one cervical spine level. There is moderate evidence that ACD produce more segmental kyphosis than ACDF and ACDFI, with the use of cage or plate. There is moderate evidence that ACD produce lower rate of fusion than ACDF and a lower rate than the use of cages. There is limited evidence of the lower capacity of PMMA to produce fusion. There is limited evidence that fused patients have a better outcome than non fused patients.

Singh et al. [17] was a study carried out on twenty patients

aimed to analyse safety and efficacy of tricortical autograft and anterior cervical plate with cylindrical titanium cage filled with cancellous bone in procedure of ACDF for single level degenerative cervical disc disease. They concluded that Use of titanium cage filled with cancellous graft is a less invasive, simple procedure for anterior cervical discectomy and fusion. It reliably alleviates cervical degenerative radiculopathy by attaining adequate interbody fusion. Authors conclude that titanium cages after cervical discectomy constitute a safe and equally efficient alternative to iliac crest autograft and anterior cervical plating by providing adequate stability. Minimally invasive harvesting of cancellous graft saves surgical time and various complications associated with other methods. HS Wang, et al. [18] was conducted to 67 patients who had undergone single level ACDF for cervical soft disc herniation from 2006 to 2008 and compared clinical and radiological results in patients with cervical disc herniations. The purpose of this study was to evaluate the efficacy of plate insertion during ACDF and determine if this could eliminate the need for external cervical braces after ACDF. They concluded that Anterior cervical fusion with plating for single level cervical disc herniation is a safe and effective treatment that can eliminate unnecessary use of an external cervical brace.

4.1 Limitations

Difficulty was encountered in retrieving information for some patients particularly those admitted before 2010 which may have implications on the interpretation of our results. Furthermore, majority of patients included in this study were non - nationals which made follow up of these patients very difficult as most of them after treatment may have travelled back to their home

country. The retrospective nature of the study may also be a limiting factor for assessing the clinical & functional outcome perioperatively. A future prospective study would probably assess the secondary outcome.

References

1. Smith GW, Robinson RA. The treatment of certain cervical-spine disorders by anterior removal of the intervertebral disc and interbodyfusion. *J Bone Joint Surg Am* 40 (1958): 607-624.
2. Cloward RB. The anterior approach for removal of ruptured cervical disks. *J Neurosurg* 15 (1958): 602-617.
3. Heidecke V, Rainov NG, Marx T, et al. Outcome in Cloward anterior fusion for degenerative cervical spinal disease. *Acta Neurochir* 142 (2000): 283-291.
4. Vavruch L, Hedlund R, Javid D, et al. A prospective randomized comparison between the cloward procedure and a carbon fiber cage in the cervical spine: a clinical and radiologic study. *Spine (Phila Pa 1976)* 27 (2002): 1694-1701.
5. Hacker RJ. Threaded cages for degenerative cervical disease. *Clin Orthop Relat Res* 394 (2002): 39-46
6. .Majd ME, Vadhva M, Holt RT. Anterior cervical reconstruction using titanium cages with anterior plating. *Spine* 24 (1999): 1604-1610.
7. Kotz S, Balakrishnan N, Read CB, et al. *Encyclopedia of statistical sciences*. 2nd ed. Hoboken, N.J.: Wiley-Interscience (2006).
8. Kirkpatrick LA, Feeney BC. A simple guide to IBM SPSS statistics for version 20.0. Student ed. Belmont, Calif.: Wadsworth, Cengage Learning (2013).
9. Song KJ, Taghavi CE, Lee KB, et al. *Eun JPSpine* 34 (2009): 2886-2892.
10. Hacker RJ, Cauthen JC, Gilbert TJ, et al. A prospective randomized multicenter clinical evaluation of an anterior cervical fusion cage. *Spine* 25 (2000): 2646-2655.
11. Ji GY, Oh CH, Shin DA, et al. Stand-alone Cervical Cages Versus Anterior Cervical Plates in 2-Level Cervical Anterior Interbody Fusion Patients *J Spinal Disord Tech* 28 (2015): E433-E438.
12. Oh JK, Kim TY, Lee HS, et al. Stand-alone cervical cages versus anterior cervical plate in 2-level cervical anterior interbody fusion patients: clinical outcomes and radiologic changes. *J Spinal Disord Tech* (2013): 415-420.
13. Lee CH, Hyun SJ, Kim MJ, et al. Comparative analysis of 3 different construct systems for single-level anterior cervical discectomy and fusion: stand-alone cage, iliac graft plus plate augmentation, and cage plus plating. *J Spinal Disord Tech* 26 (2013): 112-118.
14. Bartels RH, Donk R, van Azn RD. Height of cervical foramina after anterior discectomy and implantation of a carbon fiber cage. *J Neurosurg* 95 (2001): 40-42.
15. Barsa P, Suchomel P. Factors affecting sagittal malalignment due to cage subsidence in stand-alone cage assisted anterior cervical fusion. *Eur Spine J* 16 (2007): 1395-1400.
16. Botelho RV, Dos Santos Buscariolli Y, de Barros Vasconcelos Fernandes Serra MV, et al. The choice of the best surgery after single level

- anterior cervical spine discectomy: a systematic review. *Open Orthop J* 6 (2012): 121-128.
17. Singh P, Kumar A, Shekhawat V. Comparative analysis of interbody cages versus tricortical graft with anterior plate fixation for anterior cervical discectomy and fusion in degenerative cervical disc disease. *J Clin Diagn Res* 10 (2016): RC05-RC08
 18. Hui Sun Wang, Hee Yul Kim, Seok Won Kim, et al. Advantages of the Plating for Anterior Cervical Discectomy and fusion: Comparison with Wearing Cervical Collar Without Plate 8 (2011): 161-164.



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC-BY\) license 4.0](https://creativecommons.org/licenses/by/4.0/)