Research article

A prospective functional outcomeof stand-alone cage in cervical disc prolapses following discectomy

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ABSTRACT

Introduction and Aim: Anterior cervical decompression and fusion (ACDF) is the go-to treatment for degenerative cervical illness that causes persistent radiculopathy. It has been suggested that a separate cage be used so that the patient's plates do not get damaged. This research aims to examine the radiological and functional results of discectomy and cage placement in patients with cervical disc prolapse.

Materials and Methods: This study prospectively assessed patients who had anterior cervical decompression and fusion using a freestanding cage. Patients' pain levels on a Visual Analog Scale (VAS) and their level of impairment as measured by the Neck impairment Index (NDI) were taken before surgery. Post-operative pain assessment, looked out for cage related complications during follow up period at 3rd and 6th month post operatively by radiological evaluation.

Results: Median age of neutral group and kyphosis was 45 and 34 respectively. Maximum number of patients had C5 - C6 IVDP. Median Cobb's angle was higher in kyphosis group as compared to neutral group. Before surgery, at 10 days, and at 3 and 6 months after surgery, the kyphosis group had a higher median VAS and NDI score than the neutral group.

Conclusion: The present study demonstrated that ACDF using a single cage successfully reduced the patient's preoperative neck pain and associated disability. The advantages of ACDF with a single cage include a shorter surgical time, better cervical lordosis and disc height, and no cage sinking. As a result, cage fusion as a stand-alone treatment option for cervical degenerative disease is likely to be regarded as a viable option.

Keywords: Anterior cervical discectomy and fusion; alignment; VAS score; Cobb's angle; NDI score.

INTRODUCTION

When dealing with cervical degenerative disease that has resulted in chronic radiculopathy or myelopathy, anterior cervical decompression, and fusion (ACDF) is the main therapy option. Bagby first utilized his now-standard solo cage in 1988. Standalone cage concepts were created to combat the problems with plating ACDF, and positive results with a low incidence of dysphagia have been recorded (1). Patients undergoing current treatments, such as anterior cervical plating, are at risk for problems such as screw loosening, esophageal damage, dysphagia, paralysis of the recurrent laryngeal nerve, and extended surgical time (2). To prevent plate related complications, use of stand-alone cage has been advocated.

The purpose of this study was to establish the usefulness of stand-alone cage, by evaluating the clinical and radiological results. We hypothesized that self-locking- standalone cage has a better clinical and radiological outcome in patients with cervical disc prolapse and disc degenerative disease following discectomy. The Aim of this study was to assess the functional and radiological outcomes in stand-alone cage in cervical disc prolapse following discectomy. The objectives of the present study were to evaluate pain and health-related quality of life in patients treated with stand- alone cage and to evaluate pre-operative and post-operative clinical and radiological evaluation.

METHODOLOGY

This is a prospective study conducted on the patients who underwent anterior cervical decompression and fusion using standalone cage in the department of Orthopedics, Justice KS Hegde Hospital, Deralakatte, Mangalore for a period of 18 months from 1st January 2019 to 30th June 2020.

Patients in the age group between 18 to 60 years with symptomatic cervical disc disease with cervical radiculopathy (including neck or arm pain and / or sensory / motor neurological deficit on clinical examination) were included in the study. 12 cases subjected to the availability of patients satisfying inclusion criteria during the period of study were enrolled in the study. Patients with multiple level cervical disc degeneration, previous cervical spine surgery, inflammatory arthropathies, cervical vertebral fracture, cervical segmental instability, and active malignancy or infection were excluded from the study.

Pre-operative assessment like clinical evaluation, radiological evaluation, visual analogue scoring of pain (VAS), neck disability index (NDI), and modified Japanese orthopedic association score (mJOA) were carried out. Post-operative assessment like clinical evaluation (pain assessment via scoring system was done on post-operative day 10), looked out for cage related complications such as subsidence and Kyphotic changes during follow up period at 3rd and 6th month post operatively by radiological evaluation. Radiological evaluation parameters like the overall cervical sagittal angle (CSA; C2-7angle), segmental angle (SA) of the treated level, and interbody height (IBH) were measured.

The IBH was segmented in the front, in the center, and at the back, based on the vertical distance between pairs of adjacent vertebrae. Patients' outcomes were evaluated based on the presence or absence of subsidence, defined as a reduction in IBH by >2.5mm as measured by comparing lateral radiographs at any of the three sites or any of the treated levels.

Once information on the patient's discomfort and diagnostic imaging had been collected, descriptive statistics were utilized to provide a summary of the study's results. Undergraduates' claims of pain during medical procedures were analyzed using a t-test. The Wilcoxon signed-rank test was used if the data did not follow a normal distribution. If the p-value was less than 0.05, it was deemed statistically significant.

RESULTS

A test for data normality (the Shapiro-Wilk test) was performed. The data did not follow a normal distribution. Therefore, non-parametric tests were used. Out of the five patients in the neutral group who had anterior cervical decompression and fusion utilizing a solo cage, four (80%) were male and one (20%) was female. Out of 3 kyphosis subjects, 2 (66.7%) were females and 1 (33.3%) was male. Median age of neutral group and kyphosis was 45 and 34 respectively.

Maximum number of patients had C5-C6 IVDP *i.e*., out of 5 subjects in neutral group, 2 (40%) each had C5-C6 IVDP and C5-C6, C6-C7 IVDP. Out of 3 kyphosis subjects, 2 (66.7%) had C5-C6 IVDP. “However, Chi-square test showed no significant association between diagnosis and alignment (χ^2 = 3.73; p=0.29). In the control group, three patients (60%) had C5-C6 anterior cervical discectomy and fusion with a stand-alone cage. Two (66.7%) of the three kyphosis patients who underwent C5-C6 anterior cervical discectomy and fusion with a standalone-cage had successful outcomes (Table 1).

Table 1: Cross-tabulation of procedure and alignment

Procedure		Alignment		Total
		Neutral	Kyphosis	
C4 - C5 Anterior Cervical Discectomy and Fusion with stand-alone cage	Count	0	1	1
	Percent	0.0%	33.3%	12.5%
C5 - C6 Anterior Cervical Discectomy and Fusion with stand-alone cage	Count	3	2	5
	Percent	60.0%	66.7%	62.5%
C6 - C7 Anterior Cervical Decompression with stand-alone cage	Count	1	0	1
	Percent	20.0%	0.0%	12.5%
C6 - C7 Anterior Cervical Discectomy and Fusion with stand-alone cage	Count	1	0	1
	Percent	20.0%	0.0%	12.5%
Total	Count	5	3	8
	Percent	100.0%	100.0%	100.0%
Chi-square value- 2.88				
P value- 0.41				

Median Cobb’s angle was higher in kyphosis group (19.03) as compared to neutral group (17.08) at 3rd month whereas, at 6th month, neutral group had higher median cobb’s angle (21.4) as compared to neutral group (11.36). Wilcoxon sign test showed significant difference for neutral group (p=0.043), Whereas there was no significant difference between 3rd and 6th month for kyphosis group (p=0.109; Table 3).

Median VAS score was higher in kyphosis group (9, 8, 6, and 4) as compared to neutral group (8, 7, 4, and 2) at pre-op, post-op at 10 days, 3rd month and at 6 months respectively. Statistically significant difference was seen within the neutral group between all the time intervals except between 3rd and 6th month (p=0.102; Table 4) Whereas there was no significant difference seen for kyphosis group (Table 2).

Table 2: Comparison of VAS scores based on alignment using Mann-Whitney test

VAS	Alignment	Minimum	Maximum	Median	IQR	P value
Pre-op	**Neutral**	8	10	8	2	0.52
	Kyphosis	8	10	9	-	
POD-10	**Neutral**	6	8	7	2	0.43
	Kyphosis	6	9	8	-	
3rd month	**Neutral**	2	6	4	2	0.06
	Kyphosis	5	8	6	-	
6th month	**Neutral**	0	4	2	3	0.07
	Kyphosis	4	6	4	-	

IQR= Interquartile range

The median NDI score was higher in kyphosis group (84, 78, 60, and 56) as compared to neutral group (62, 58, 38, and 24) at pre-op, post-op at 10 days, 3rd monthand 6 months respectively. Mann-Whitney test showed significant difference between the groups post-op 10 days (p=0.036) and at 3rd month (p=0.023) except between 3rd and 6th month (p=0.223; Table 5). Whereas there was no significant difference seen for kyphosis group (Fig. 1).

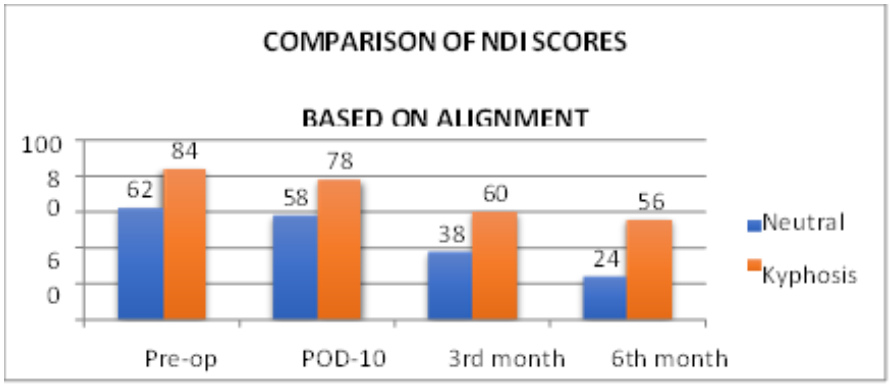

Fig. 1: Comparison of NDI scores based on alignment using Mann-Whitney test

Median mJOA score was higher in kyphosis group (15, 16, and 17) as compared to neutral group (14, 15, and 16) at pre-operative, post-operative at 10 days, and 3rd month respectively, whereas median mJOA scores were equal (17) for both neutral and kyphosis group at 6 months. However, Mann-Whitney test showed no significant difference (p=0.45) between the groups at all the time intervals.

Table 3: Comparison of Cobb's angle within the group using Wilcoxon sign test

Alignment	Cobb's angle	3rd to 6th month
Neutral	Z value	-2.02
	p value	0.043*
Kyphosis	Z value	-1.60
	p value	.109

Table 4: Comparison of VAS within the group using Wilcoxon sign test

Alignment	VAS	Pre-op v/s PO-10	Pre-op v/s 3rd m	Pre-op v/s 6th m	POD-10 v/s 3rd m	POD-10 v/s 6th m	3rd m v/s6th m
Neutral	Z value	-2.07	-2.12	-2.03	-2.06	-2.03	-1.63
	p value	.038*	.034*	.042*	.039*	.042*	0.102
Kyphosis	Z value	-1.63	-1.63	-1.63	-1.63	-1.60	-1.63
	p value	.102	.102	.102	.102	.109	.102

Table 5: Comparison of NDI within the group using Wilcoxon sign test

Alignment	VAS	Pre-op v/s PO-10	Pre-op v/s 3rd m	Pre-op v/s 6th m	POD-10 v/s 3rd m	POD-10 v/s 6th m	3rd m v/s 6th m
Neutral	Z value	-2.12	-2.02	-2.02	-2.03	-2.02	-1.21
	p value	.034*	.043*	.043*	.042*	.043*	0.223
Kyphosis	Z value	-1.60	-1.60	-1.60	-1.60	-1.60	-1.06
	p value	.109	.109	.109	.109	.109	.285

*Significant

DISCUSSION

Whether it is radiculopathy, myelopathy, or both, degenerative cervical spine illness may cause serious symptoms. The front technique is the preferred system for root decompression because of its simplicity in a forgiving stance and meticulous strategy of obtuse analysis through physical planes. Some plate designs have been associated with an increased risk of esophageal injury and irritation, dysphagia, overhang that causes surrounding segment illness, and plate adhesions that induce neck discomfort, as reported in the medical literature (1-3).

Most of the people in our research fell into two age groups: those with neutral posture (33–59 years old, median age 46.20) and those with kyphosis (28-43 years old, median age 34). The findings were in line with those reported by Azimi *et al.,* who found a range of 54 8.3 years (4). Our investigation found that C5-C6 IVDP was the most prevalent level of disc prolapse, with 4 cases (50%) reported, like Ali *et al.,*'s series (5). The most common procedure and alignment performed was C5-C6 anterior cervical discectomy and fusion with standalone cage (5/62.5%).

The patient's cervical spine was imaged in a neutral posture and in full flexion-extension before and after surgery. Using the Cobb method, we calculated the amount of cervical lordosis in both neutral and sagittal ROM between C2 and C7. Having a cervical lordosis of less than 20° has been linked by McAviney *et al.,* to experiencing neck pain (6). Additionally, according to Wu *et al.,* (7). The long-term clinical prognosis is affected by whether a satisfactory cervical lordosis is restored or maintained following ACDF. Having a smaller cervical lordotic angle tends to foreshadow nearby degenerative alterations (8).

To evaluate neck and shoulder (radicular) pain before to surgery and at each follow-up, a 10-point visual analogue scale (VAS) was used, with ‘no pain’ at one end and "worst pain" at the other. We found that the average VAS score for arm pain after surgery was much lower than the score before surgery, Liu and colleagues' series found the same thing (9).

To the same extent as other clinical series with comparable sample sizes and durations of follow-up (10-12). After surgery, the NDI score significantly increased, as shown by our data. Our results, showing a substantial reduction in both neck and arm pain mean scores and the NDI mean scores, might be explained in this way. Multiple research projects support the idea that reducing NDI is related with less postoperative discomfort (13-16) and the findings of our research corroborate this notion.

Subsidence of the cage after surgery might cause foraminal stenosis if left untreated over time. Surgery is not a guarantee that radiculopathy and axial neck discomfort won't return (17). Using human cadaver spines, Stein *et al.,* compared the biomechanical stability of the integrated screw and cage system to that of locked anterior plate fixation at C5-C6. They found that the integrated screw and cage method offered almost the same level of biomechanical stability (18). Multilevel anterior cervical discectomy and fusion using the anchored spacer and anterior plate fixation: a radiological and clinical analysis by Yang *et al.,* The clinical result was positive, and osseous fusion was accomplished. In both groups, lordosis improved significantly and remained stable during the final follow-up. There was no evidence of kyphosis due to segmental fusion or cage sinking. The restoration of disc height was shown to be responsible for this enhancement (19). Similarly, in our study median immediate subsidence scores were higher in kyphosis group as compared to neutral group.

For independent cage fusions, our findings are on par with those of recently published works. A fusion rate of 87% was found during a mean follow-up of 5 years in research by Marotta *et al.,* Dunn *et al.,* found a 92% fusion rate after 2 years of follow-up in 34 patients. Additionally, Fraser et al. conducted a meta-analysis comparing anterior fusion procedures and fusion rates. They discovered that the fusion rate with anterior cervical decompression was 84.9 percent, with anterior cervical decompression with fusion being 92.1 percent, and with anterior plating being 97.1 percent (20).

With an 80 percent success rate in relieving symptoms and improving patients' neurological condition, Hassler and coworkers concluded that ACDF was a viable treatment option for degenerative cervical disc degeneration (21). Ali *et al.,* authors of another study, performed ACDF on 129 patients, and found that 71.43 percent of them had great outcomes (5). Shiban *et al.,* anterior cervical discectomy with fusion has a high fusion rate but a poor follow-up rate, according to the literature (22). Moreover, our results jived with those of numerous other clinical series studies already published in the literature. Most of our patients reported much less neck and arm discomfort upon hospital release, according to our most recent statistics. Furthermore, this impact persisted even after 18 months of follow-up.

Limitations

Whether we want to know if the results of this prospective research will hold up in the long run, we need further randomized controlled studies with longer follow-up periods. Additionally, the groups' fusion rates have not been analyzed. Finally, complications from employing a standalone cage for a multi-level ACDF need to be considered. These complications include neighboring segment degeneration, non-union, and corrective loss.

CONCLUSION

The following inferences may be made considering the findings of the current investigation.

1. The patients' preoperative impairment and neck/radicular discomfort were significantly alleviated after ACDF was performed using a stand-alone cage.
2. The lordosis of the neck is alleviated.
3. The operating time for ACDF with a solitary cage is shorter, the patients' cervical lordosis is restored, the patient's disc height is preserved, and there is no cage sinking.
4. The results of this research back up the idea that freestanding cage fusion is a viable option for treating cervical degenerative disease, both radiographically and clinically.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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