Section: Anatomy

Original Research Article

OPERATIVE BENEFITS OF STAND ALONE CAGE VERSUS ANTERIOR CERVICAL PLATING IN TRAUMATIC CERVICAL INJURIES

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Abstract

Background: Clinicians have used the self-locking standalone cage to treat cervical trauma. However, there haven't yet been any extensive clinical and radiological trials conducted. With self-locking stand-alone cages and cages that included the anterior cervical plating system, the efficacy and outcomes of anterior cervical discectomy and fusion (ACDF) were analyzed and compared in this retrospective study. **Materials and Methods:** In this trial, a total of 100 consecutive patients from Patna Medical College under (AKU), Patna was included. Patients in the plate group received treatment with cages and anterior plate fixation, while patients in the cage group received stand-alone self-locking cages. Records were kept on the length of the operation, intraoperative blood loss, and complications. The Neck Disability Index, and the JOA grading system, clinical outcomes were assessed. The condition of the cervical fusion, subsidence, and lordosis were evaluated using computed tomography and X-rays. **Result:** The average follow-up time for the cage group was 19.6 months and for the plate group it was 22.4 months. The cage group experienced considerably shorter surgical time, intraoperative blood loss, postoperative dysphagia, sore throat, and neighbouring segment degradation than the plate group (p 0.05). Complete interbody fusion was achieved by every patient in both groups. Both groups' postoperative JOA and NDI scores showed a clear improvement over their preoperative ones. In both groups, the postoperative cervical lordosis was successfully restored. **Conclusion:** The self-locking stand-alone cage for ACDF could effectively restore the cervical physiological curvature, cause few complications, and lead to satisfactory outcomes. Therefore, it could be used as an effective and reliable treatment for the cervical trauma.

INTRODUCTION

Anterior cervical discectomy and fusion (ACDF) has become a classic operation for treatment of cervical injuries. At present, cages are widely used for interbody fusion in clinical practice. However, patients treated with the stand-alone cages are associated with high incidences of implant subsidence and failure of fusion, leading to kyphosis and pseudoarthrosis.[1] Surgeons prefer to add an anterior cervical plate (ACP) in fusion procedures after anterior decompression and cage insertion. The addition of an ACP may decrease the micro-movement of the cervical spine, promote fusion, reduce subsidence and improve cervical sagittal alignment and stability.[2,3] However, the use of a titanium ACP may be associated with complications, such as screws backing out, the looseness of titanium plate, dysphagia and soft tissue injury.[4–6] In order to reduce the potential complications, a self-locking standalone cage (ROI-C, Zimmer Biomet, Austin, TX, USA) of the cervical spine has been clinically applied to treat the cervical injuries. Therefore, in this retrospective study, we aimed to demonstrate 2-year clinical outcomes of ACDF with ROI-C™ implant system in treating cervical injuries in comparison to plate fixation.

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MATERIALS AND METHODS

The Institutional Ethics Committee of our hospital gave its approval to this retrospective and comparative clinical study. The present study enrolled 100 patients from Patna Medical College under (AKU), Patna, who underwent ACDF treatment between April 2020 and March 2022 and had cervical injuries.

Patients with degenerative disc degeneration between C3 and C7 who also had radiculopathy and/or myelopathy and were resistant to conservative treatment for at least six weeks met the inclusion criteria.

The following conditions were not considered: (1) significant segmental instability, developmental stenosis, and the presence of ossification of the posterior longitudinal ligament (OPLL); (2) a history of cervical spine surgery; (3) a need for simultaneous anterior and posterior surgery; and (4) other cervical diseases, including fracture, tumor, and infection.

The patients were retrospectively divided into two groups according to the surgical method applied, including the cage group and plate group. A total of 50 patients receiving ACDF with the self-locking stand-alone cage were classified as the cage group. Meanwhile, another 50 patients, who underwent fusion using anterior plates, served as the plate group.

Methodology

An established anterior cervical spine technique was used to treat each patient. A Caspar cervical distractor was implanted in the neighboring vertebral bodies after verification and exposure of the proper vertebral levels. In order to adequately expose and decompress the dura mater and nerve root sources, osteophytes and other compressive factors were removed. Preoperative template setting and intraoperative evaluation utilizing a trial cage and fluoroscopic guidance were used to determine the cage size in the cage group. Graft bone was stuffed into every cage (Osteolink Biomaterial Co., Ltd., Hubei, China).

Patients' demographic information as well as perioperative information, such as operating time, blood loss, and problems, was documented. With the help of the Japanese Orthopaedic Association (JOA) score, preoperative and postoperative neurological functioning was assessed. The formula used to get the JOA score recovery rate was recovery rate = (postoperative score-preoperative score)/ (17- preoperative score) 100%. At the conclusion of the follow-up period, an impartial observer who was not present during the surgery rated the patients' overall satisfaction with the surgical outcome using Odom's criteria [7]. Results that were excellent and good were regarded as satisfactory. The standard software system utilized at our institution for viewing and measuring angles in radiographs was used to measure digital radiographic characteristics on digitalized radiographs. Radiographs in neutral lateral and extension-flexion position were acquired at each follow-up. Two-dimensional computed tomography reconstruction was performed when evidence of bone fusion could be observed in the X-ray examination. Fusion in each level was assessed according to the previously described criteria.

Statistical Analysis

SPSS (Version 22.0) was used for analysis. The mean and standard deviation were determined for quantitative data. Independent sample t-tests were performed for the intergroup comparisons, and paired t-test was used for the comparisons between before and after operation. P values <0.05 were considered statistically significant.

RESULTS

Table 1: Demographic and Clinical data in both groups

Variables	Cagegroup	Plategroup
Meanage(years)	62.4±6.7(40–75)	64.4±3.2(38–70)
Sex(male/female)	27/23	25/25
Clinicalpresentation		
radiculopathy	18	16
myelopathy	16	18
Radiculopathyandmyelopathy	16	16
Numberoftreatedlevel Onelevel	20	21
Twolevels	17	14
Threelevels	13	15
Operatedlevel		
C3-4	18	16
C4-5	23	20
C5-6	29	27
C6-7	25	22
Follow-up (months)	19.7 ± 3.2 (17–24)	22.2 ± 1.6 (19–24)

As per table 1 shows demographic data with mean age group of 62.4 and 64.4 years. The surgeries were successfully performed in all cases. The mean follow-up period was 19.7 ± 3.2 months in the cage group and

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12.2 ± 1.6 months in the plate group. None of the patients or data was lost during the follow-up. No patient underwent repeated surgery. Patients presented with radiculopathy and myelopathy.

Table 2: Perioperative data and Complications

C age group		Plategroup	*P*-value
Blood loss(mL)			
One level	24.6±2.2	34.2±2.3	0.043*
Two levels	39.6±1.4	53.5±1.4	0.037
Three levels	56.6±1.9	82.5±3.4	0.031
Operative time(min)			
One level	69.3±9.6	83.7±7.7	0.042*
Two level	117.2±12.3	138.5±14.1	0.033*
Three level	138.5±7.9	152.6±12.4	0.028*
Surgery related complications			
Cerebrospinal fluid leakage	5(9.8%)	4(8.51%)	0.665
Epidural hematoma	0	0	1.0
Sore throat	2(3.92%)	4(8.51%)	0.046*
Hoarseness	0	0	1.0
Dysphagia			
<3months	1(1.96%)	4(8.51%)	0.041*
>3months	0	1(2.13%)	0.045*
infection	0	0	1.0
Neurological deterioration	0	0	1.0
Implant-related complications			
Implant dislodgement	0	0	1.0
Implant malposition	0	0	1.0
Hardware breakage	0	0	1.0

As per table 2 in the cage group, When compared to the plate group, the mean operating time and blood loss for single level, two levels, and three levels, respectively, were considerably decreased (P 0.05). None of the patients experienced neurological decline following surgery. Both groups were free of infections, epidural hematomas, and hoarseness. Additionally, during the follow-up period, there were no incidences of implant dislodgment, malposition, or hardware breakage in any group. Five cases in the cage group and four instances in the plate group both experienced CSF leakage. Regarding CSF leakage, there were no appreciable changes between the two groups (P > 0.05). Two patients in the cage group and four in the plate group both developed sore throats. The differences of dysphagia and sore throat rates between the two groups were statistically significant (P < 0.05).

Table 3: Comparison on Radio graphical and Clinical data

Cage group	Plate group	P- value
JOA scores		
Preoperative 8.23 ± 1.3	8.34 ± 1.1	0.75
Postoperative3months 12.37 ± 0.9	12.96 ± 0.6	0.53
Final follow-up 13.76 ± 1.2	13.68 ± 0.8	0.45
JOA score recovery rate (%) 63.05 ± 7.34	61.66 ± 4.51	0.73
NDI scores		
Preoperative 17.7 ± 2.	17.3 ± 1.6	0.83
Postoperative3months 11.1 ± 2.3	11.8 ± 0.9	0.75
Final follow-up 10.9 ± 1.4	11.2 ± 0.6	0.81
Odom's criteria		
excellent 27(52.94%)	23(48.94%)	0.72
Good 13(27.45%)	15(31.91%)	0.88
fair 10(19.61%)	9(19.15%)	0.82
poor 0	0	1.0
Subsidence 4cages(4.21%)	3cages(3.52%)	0.74
Fusion rate 100%	100%	1.0
Time until bony union 6.9 ± 1.4 (6–9)	7.1 ± 1.3 (5–10)	0.77
(months)		
ASD 1/51(1.96%)c	7/47(14.89%)	0.02

As per table 3 there were no discernible variations between the two groups' baseline JOA and NDI scores. The JOA and NDI ratings were considerably higher in both groups at postoperative 3 months and the final follow-up as compared to the baseline measurements. The JOA recovery rate did not differ significantly between the two groups. In the cage group, there were 10 patients (19.61%) with reasonable results, 14 patients (27.45%) with good results, and 27 patients (52.94%) with exceptional results. In the plate group, nine patients (19.15%) had reasonable results, 15 patients (31.91%) had good results, and 23 patients (48.94%) indicated exceptional results. No patients in either group had a subpar clinical outcome. There were no significant differences in the excellent and good rates between the cage group and plate group.

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DISCUSSION

When conservative treatment for symptomatic CDDD fails, ACDF is a good fallback and accepted standard of care. The use of extra plating after ACDF in the treatment of degenerative spine diseases has been extensively reported, with favorable clinical results.[2,8] The use of an extra ACP, however, is linked to a number of side effects, including as hardware failure, soft-tissue injury, persistent dysphagia, and ASD.[9,10] The new self-locking stand-alone cages (ROI-CTM) have been researched and used in ACDF procedures to prevent these issues. According to the current study, patients in the cage group experienced a significantly lower intraoperative blood loss rate and shorter surgical times. This may be explained by the fact that the ROI-CTM was reasonably easy to implant and that, in comparison to the conventional plate and cage, fewer steps were needed to achieve its locking mechanism by inserting the anchoring clips. According to reports, plate misalignment and improper positioning may be a factor in the high rate of plate failure and ASD.[11,12]Therefore, intraoperative fluoroscopy a laborious process was used in our study to determine the position of the ACP. Reduced surgical duration and intraoperative blood loss can lessen the harm surgery does and lower the chance of problems. According to the literature, when employing titanium plates, the rate of dysphagia at 3 months following anterior cervical surgery is 12–35%.[13,14] The incidence rate of dysphagia in the cage group in the current study was 1.96%, which was noticeably lower than that in the plate group (10.64%). Additionally, the postoperative dysphagia patients in the cage group recovered sooner than those in the plate group. In this study, 100% of both groups achieved radiologically successful fusion, and the mean time to bony union was 6.9 months in the cage group and 7.1 months in the plate group. Clinical success rates for the treatment of CDDD with ACDF are very high. The ACDF procedure, however, invariably reduces the range of motion of the operated segments and increases mobility of the upper and lower levels next to the fusion levels, which may cause ASD.[15]There are thought to be two elements that are frequently linked to ASD, despite the fact that the specific pathophysiologic process of the disorder is yet unknown. The primary contributing element is thought to be the altered biomechanical environment surrounding the disc following ACDF

CONCLUSION

The NDI, JOA scores, mean fusion duration, fusion rate, and restoration of cervical lordosis all improved similarly in both the cage group and the plate group according to our findings. In contrast to instances treated with the ACP and cage for ACDF, cases treated with the ROI-C cage were linked to a reduced incidence of ASD, a shorter operating time, less blood loss, and a lower risk of postoperative dysphagia and sore throat. Overall, the findings demonstrated that the self-locking standalone cage was a dependable, safe, and effective alternative to the standard care for cervical injury.

REFERENCES

1. R. Bazaz, M.J. Lee, J.U. Yoo, Incidence of dysphagia after anterior cervical spine surgery: a prospective study, Spine 27 (2002) 2453–2458.
2. J.Y. Chung, S.K. Kim, S.T. Jung, K.B. Lee, Clinical adjacentsegment pathology after anterior cervical discectomy and fusion: results after a minimum of 10-year followup, Spine J. 14 (2014) 2290–2298.
3. K.N. Fountas, E.Z. Kapsalaki, L.G. Nikolakakos, H.F. Smisson, K.W. Johnston, A.A. Grigorian, et al., Anterior cervical discectomy and fusion associated complications, Spine 32 (2007) 2310–2317.
4. J.F. Fraser, R. Hartl, Anterior approaches to fusion of the cervical spine: a metaanalysis of fusion rates, J. Neurosurg. Spine 6 (2007) 298–303.
5. Y. Gao, M. Liu, T. Li, F. Huang, T. Tang, Z. Xiang, A meta-analysis comparing the results of cervical disc arthroplasty with anterior cervical discectomy and fusion (ACDF) for the treatment of symptomatic cervical disc disease, J. Bone. Jt. Surg. Am. 95 (2013) 555–561.
6. J. Jagannathan, C.L. Shaffrey, R.J. Oskouian, A.S. Dumont, C. Herrold, C.A. Sansur, et al., Radiographic and clinical outcomes following single-level anterior cervical discectomy and allograft fusion without plate placement or cervical collar, J. Neurosurg. Spine 8 (2008) 420–428.
7. M.J. Lee, R. Bazaz, C.G. Furey, J. Yoo, Influence of anterior cervical plate design on dysphagia: a 2-year prospective longitudinal follow-up study, J. Spinal Disord. Tech. 18 (2005) 406–409.
8. J.B. Park, Y.S. Cho, K.D. Riew, Development of adjacent-level ossification in patients with an anterior cervical plate, J. Bone Jt. Surg. Am. 87 (2005) 558–563.
9. J.A. Rihn, J. Kane, T.J. Albert, A.R. Vaccaro, A.S. Hilibrand, What is the incidence and severity of dysphagia after anterior cervical surgery? Clin. Orthop. Relat. Res. 469 (2011) 658–665.
10. S. Shi, Z.D. Liu, X.F. Li, L. Qian, G.B. Zhong, F.J. Chen, Comparison of plate-cage construct and stand-alone anchored spacer in the surgical treatment of three level cervical spondylotic myelopathy: a preliminary clinical study, Spine J. 15 (2015) 1973–1980.
11. K.R. Chin, V.B. Cumming, M. Henson, B. Murrell, F.W. Chan, Effects of misalignment on static torsional strength of anterior cervical plate systems, Spine J. 13 (2013) 1544–1548.
12. Z. Wang, W. Jiang, X. Li, H. Wang, J. Shi, J. Chen, et al., The application of zeroprofile anchored spacer in anterior cervical discectomy and fusion, Eur. Spine J. 24 (2015) 148–154.
13. K.J. Song, B.W. Choi, T.S. Jeon, K.B. Lee, H. Chang, Adjacent segment degenerative disease: is it due to disease progression or a fusion-associated phenomenon? Comparison between segments adjacent to the fused and non-fused segments, Eur. Spine J. 20 (2011) 1940–1945.
14. K.J. Song, C.E. Taghavi, K.B. Lee, J.H. Song, J.P. Eun, The efficacy of plate construct augmentation versus cage alone in anterior cervical fusion, Spine 34 (2009) 2886–2892.
15. J.S. Uribe, J.R. Sangala, E.A. Duckworth, F.L. Vale, Comparison between anterior cervical discectomy fusion and cervical corpectomy fusion using titanium cages for reconstruction: analysis of outcome and long-term follow-up, Eur. Spine J. 18 (2009) 654–662.

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