Cage with anterior plating is advantageous over the stand-alone cage for segmental lordosis in the treatment of two-level cervical degenerative spondylopathy: A retrospective study

Paolo Perrini[a,*], Federico Cagnazzo[a], Nicola Benedetto[a,b], Riccardo Morganti[b], Carlo Gambacciani[a]

[a] Department of Neurosurgery, University of Pisa, Pisa, Italy
[b] Department of Clinical and Experimental Medicine, Section of Statistics, University of Pisa, Pisa, Italy

A B S T R A C T

Objectives: To compare retrospectively the clinical and radiological outcomes in cervical spinal alignment after two consecutive levels PEEK cage-assisted ACDF when performed with or without plate fixation
Patients and methods: Seventy-eight patients underwent two consecutive levels PEEK cage-assisted ACDF without plating (56 patients) or supplemented with plating (22 patients). The average clinical follow-up was 31.40 ± 12.98 months. The authors compared clinical parameters (Neck disability index and Robinson criteria), perioperative parameters (hospital stays, complications), and radiological parameters (global lordotic curvature, segmental lordosis, segmental height).
Results: Demographic features, neurological presentation, preoperative sagittal alignment, postoperative complications, length of hospitalization and clinical improvement were not different between groups. At 12-months radiological follow-up, the global lordotic curvature was similar in both groups (P = 0.02). However, the use of anterior plate fixation versus stand-alone cage was associated with greater segmental lordosis (−7.68 ± 4.82° versus −0.02 ± 8.44°, P < 0.0001) and greater segmental height (39.51 ± 3.50 versus 36.75 ± 3.90, P = 0.005).
Conclusion: The clinical outcomes after two consecutive levels PEEK cage-assisted ACDF with and without plate fixation were similar, but the supplement of an anterior plate was advantageous for improving segmental alignment on long-term radiological follow-up.

1. Introduction

Considerable debates exist in the current literature for anterior cervical discectomy and fusion (ACDF) at two consecutive levels. Recent clinical studies reported satisfactory clinical and radiological results after multilevel ACDF using stand-alone polyetheretherketone (PEEK) cages particularly regarding improvement of preoperative pain and global lordosis [1,2]. However, cage subsidence with resultant kyphotic malalignment is a well-described morphological complication of stand-alone cages [3,4]. Postoperative cervical malalignment, such as kyphotic deformity, is of clinical interest, because it is considered responsible of symptoms recurrence and adjacent segment disease in the long term. The aim of the present retrospective study is to compare the clinical and radiological outcomes in cervical spinal alignment after two levels PEEK cage-assisted ACDF when performed with or without plate fixation.

2. Patients and methods

2.1. Patient population

We retrospectively analyzed the prospectively collected clinical records of 78 patients with of spondylotic radiculopathy or myeloradiculopathy who underwent ACDF at two consecutive levels at our department between January 2013 and December 2015. Our institutional review board approved this study and all patients provided informed, written consent. Clinical indications for ACDF were persistent cervical radiculopathy unresponsive to a minimum of 3 months of conservative treatment or signs and symptoms of myelopathy. Patients with rheumatoid arthritis, posttraumatic deformity of the cervical spine, history of previous cervical spine surgery and patients with additional posterior instrumented fusion were excluded. As is typical for retrospective studies, choice of surgical technique (plating versus no

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plating) was at the discretion of the treating surgeon. Fifty-six patients (M:F = 31:25) of mean age 51 years (range 29–77 years) underwent ACDF without plate fixation (ACDF-cage group) and 22 patients (M:F = 11:11) of mean age 55.5 years (range 42–78 years) underwent ADCF with plate fixation (ACDF-plate group).

2.2. Surgical technique

The anterior cervical approach was performed as previously described in the literature [5]. The cartilaginous endplates of the upper and lower endplates were removed after interbody distraction under microscopic view. The removal of posterior osteophytes was associated with incision of the posterior longitudinal ligament. After adequate decompression of two consecutive levels, curved or wedge-shaped PEEK cages (Cervios chronOS, DePuy Synthes) were inserted in the distracted intervertebral spaces with or without plate (Osmium, Ulrich, Ulm, Germany) under fluoroscopic control. In the ACDF-plate group all patients received a six-screw plate. All patients were maintained in a firm collar (Philadelphia collar) for 1 month.

2.3. Radiological evaluation and clinical follow-up assessment

Preoperatively, all patients underwent cervical spine MR imaging, computed tomography (CT) and plain radiographs. A cervical X-ray in upright position was obtained before discharge and repeated 1, 6 and 12 months after the operation then annually thereafter. Pre- and postoperative plain X–rays were examined by an independent neuroradiologist to determine the following radiographic measurements:

1) Cervical lordosis (i.e. global lordotic curvature), defined as the angle created by the inferior endplate of C2 and C7, using Cobb's method (Fig. 1a);
2) Segmental angle (i.e. curvature of the fused segment), defined as the angle created by drawing lines along the superior endplate of the superior vertebra and the inferior endplate of the inferior vertebra involved in the construct (Fig. 1b);
3) Segmental height, defined as the distance between the midpoint of the cranial and caudal vertebra involved in the construct [6] (Fig. 1c).

Table 1
Robinson's criteria.

Rating	Description
Excellent	All preoperative symptoms relieved; abnormal physical findings unchanged or improved
Good	Minimun residual of preoperative symptoms; activities increased; abnormal physical findings unchanged or improved
Fair	Definite relief of some preoperative symptoms, with others remaining unchanged or slightly improved
Poor	Symptoms and signs unchanged from preoperative status

The global cervical curvature was defined as follows: straight ($-4°$ to $+4°$), lordotic ($< -4°$) or Kyphotic ($> +4°$) [7]. The segmental curvature was defined as follows: straight ($0°$ to $+4°$), lordotic ($< -0°$) and kyphotic ($> +4°$) [7]. Measurable subsidence was defined as a decrease of the segmental height on follow-up lateral radiographs [6].

Patients were scheduled to visit an outpatient clinic after each radiological investigation. The clinical outcomes were assessed using the Neck Disability Index (NDI) and the Robinson's criteria (Table 1) [8]. Good and excellent results were considered to be positive outcomes.

2.4. Statistical analysis

Categorical data were described by frequency and percentage, whereas continuous data by mean, median and standard deviation. To evaluate the normality of the quantitative data distributions, the Kolmogorov-Smirnov test was performed. Differences were considered significant at $P < 0.01$. The significance of differences between the cage group and the plate group for qualitative variables was analyzed using the chi square test and the Fisher exact test. The *t*-test (two-tailed) or Mann-Whitney test (two-tailed) was used to analyze continuous quantitative variables. Three within-subjects factors as Cobb, SA and H, were compared by Repeated Measures ANOVA using Plate variable (with or without plate) as between-subjects factor and to calculate the *p*-value the Wilks lambda method was used; paired data *t*-test was successively employed. Finally, to correlate NDI with radiological index the Pearson method was used. All statistical analysis were performed with SPSS version 21 (SPSS Inc. SPSS® Chicago, IL, USA).
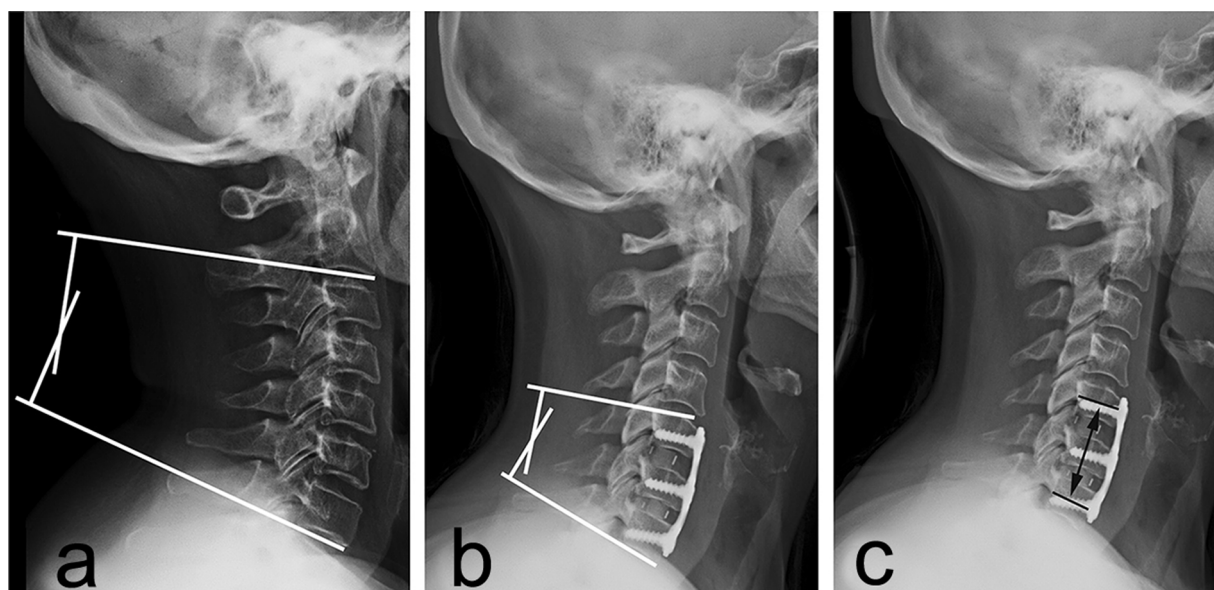

Fig. 1. Lateral radiographs showing the radiological parameters. a: The cervical lordosis was defined as the angle formed between the lower endplate of C2 and the inferior endplate of C7 using Cobb's method. b: The segmental angle was defined as the angle formed between the superior endplate of the superior vertebra and the inferior endplate of the inferior vertebra of the fused segment using Cobb's method. c: Segmental height was defined as the distance between the midpoint of the cranial and caudal vertebra involved in the construct.