A comparative study for the usage of Fidji cervical cages after multilevel anterior cervical discectomy and fusion

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ARTICLE INFO

ABSTRACT

Background: Postoperative dysphagia is one major concern in the treatment for patients with cervical spine spondylosis by using anterior cervical discectomy and fusion (ACDF) with plating and cage system.
Purpose: To evaluate the influence of two types of surgery for multilevel cervical spondylotic myelopathy (CSM) on postoperative dysphagia, namely ACDF with cage alone (ACDF-CA) using Fidji cervical cages and ACDF with cage and plate fixation (ACDF-CP).
Methods: A retrospective study was performed in 62 consecutive patients with multilevel CSM, including 32 underwent ACDF-CA (group A) and 30 underwent ACDF-CP (group B). All enrolled patients were followed up at 48 h, 2 months and 6 months postoperatively, when the dysphagia rate, Swallowing-Quality of Life (SWAL-QOL) score and the thickness of prevertebral soft tissue were recorded.
Results: At 48 h and 2 months, the dysphagia rate and thickness of prevertebral soft tissue were both significantly lower in group A than in group B, while the SWAL-QOL score of group A was significantly higher than that of group B. No significant difference was observed at 6 months.
Conclusion: Fidji cervical cages could relieve postoperative dysphagia in the treatment of multilevel CSM with ACDF, especially at the first several months postoperatively.

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Introduction

Multilevel cervical spondylotic myelopathy (CSM), which is characterized by multilevel spinal cord compression because of cervical spondylotic myelopathy (CSM), ossification of the posterior longitudinal ligament (OPLL), and cervical stenotic myelopathy, is a common spinal disorder all around the world [1].When nonoperative treatment failures, surgery may be considered. However, The choice of surgical approach for multilevel CSM remains controversial. Anterior cervical discectomy and fusion (ACDF) has been widely adopted and accepted as an effective and safe procedure with satisfactory results for multilevel CSM [2–6].

In this procedure, many surgeons prefer to add an anterior plate for enhancing stabilizing properties, as several studies suggest this leads to increased fusion rates and reduced failure rates, particularly in multi-level procedures [7–9]. Nevertheless, the rate of dysphagia is high after ACDF with cage and plate fixation [10,11]. Fountas et al [5] reported that postoperative soft tissue smelling, esophageal injury, hematoma at the operative site, and adhesions around implanted cervical plate might contribute to this complication, although the exact pathophysiologic mechanism remains unknown. According to Lee et al [12], there is a correlation between plate thickness and dysphagia rate, with decreased dysphagia incidence when thinner plates were used.

In the past few years, a new stand-alone device (Fidj cervical cage, Abbott Spine, Bordeaux, France) for ACDF has been developed, with the aim to reduce the morbidity associated with traditional cervical anterior plating. This device is made of PEEK material and available in various height, and widths (Fig. 1). There is a retentive tooth on the top and the bottom, respectively, which improves the fixation of the cage to the bone [13]. In theory, application of Fidji cervical cages may reduce postoperative dysphagia in multilevel ACDF, but are under researched.

The present study analyzed clinical and radiological outcomes after application of the Fidji cervical cages and the conventional plate device with Fidji cervical cages for multilevel ACDF, and sought to compare the incidence and difference of postoperative dysphagia for both procedures.

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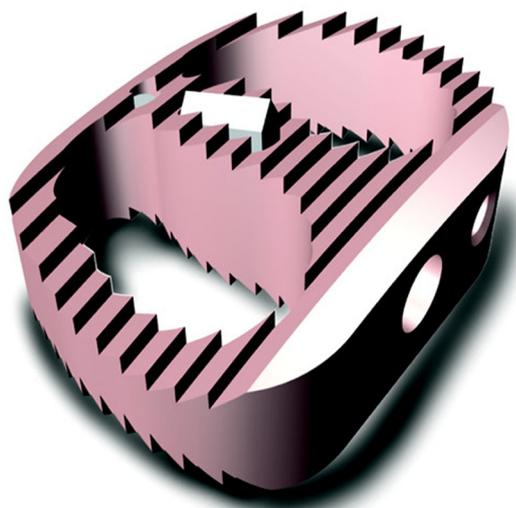E-mail address: Zwzw_zwei@163.com (W. Zhang).

Fig. 1. An image of the Fidji cervical cage (Abbott Spine, Bordeaux, France) used in the treatment procedure.

Materials and methods

Patient population

Between January 2008 and September 2012, patients received ACDF-CA or ACDF-CP for the treatment of multilevel cervical spondylotic myelopathy (CSM). The study was approved by the Ethical Board Review of the Third Hospital of Hebei Medical University (Shijiazhuang, Hebei, China), and each patient provided informed consent. All methods were performed in accordance with the relevant guidelines and regulations. Patients received ACDF-CA or ACDF-CP treatment according to their own wishes because of the different surgical cost. Patients' baseline characteristics were summarized in Table 1.

Sixty-two patients were enrolled in this study, including 32 patients performed ACDF-CA and 30 patients performed ACDF-CP. The inclusion criteria were as follows: [1] symptoms of cervical myelopathy and/or radiculopathy [2]; the cervical spine radiography, CT, and MRI showed intervertebral disc degeneration and herniation, and the posterior vertebral body osteophyte formation [3]; cervical pathology in three or four consecutive levels; and [4] no response to at least 6 weeks of conservative treatment. Exclusion criteria were radiculopathy, trauma, tumor, OPLL, and rheumatoid arthritis. Patients who had dysphagia before surgery, and who had preoperative anterior osteophytes cephalad or caudad to the level subsequently treated with the anterior cervical plate were also excluded from the study. Finally, all enrolled patients were followed up at 48 h, 2 months, and 6 months after operation.

Table 1
Baseline characteristics of the study population.

	Group A	Group B	P value
Number	32	30	–
Age (years)[*]	60.50 ± 8.67	61.50 ± 7.90	0.682
Younger	38.91 ± 2.30	39.53 ± 2.83	0.715
Older	68.52 ± 5.81	69.75 ± 6.29	0.657
Gender (F:M)	5:3	2:1	>0.05
Duration of symptom (months)[*]	12.50 ± 2.60	13.20 ± 3.50	0.686
Operation time (minutes)[*]	175.0 ± 15.0	190.0 ± 25.0	0.825
Surgical level (3 levels/4 levels)	15:1	29:1	>0.05

[*] Values are expressed as mean ± SD; F = female; M = male.

Surgical technique

All operations were performed by a single surgeon (W.Z). Surgical procedures were carried out using the anterior approach according to Smith-Robinson via right-side skin incision. Decision-making is up to the involved segments in the sagittal and axial planes of the magnetic resonance imaging (MRI) scanning (Fig. 2), which is associated with clinical symptoms. For the ACDF-CP procedures, Fidiji cervical cages (Abbott Spine, Bordeaux, France) and the anterior plate system (Medtronic Sofamor Danek, Memphis, TN) were applied. For the ACDF-CA procedures, only Fidji cervical cages (Abbott Spine, Bordeaux, France) were used. After operation, all patients were given a Philadelphia collar for 2 weeks.

Radiological evaluation

Radiologic examinations, including plain X-ray, computed tomography (CT) and MRI, were performed preoperatively for all patients. The thickness of prevertebral soft tissue (PST) (Fig. 3), were measured in neutral-position lateral radiographs at the levels of C2-C7. All of the data were collected and reviewed by an independent observer using the picture archiving communication system (PACS). Two-time measurements of the data were performed, and the mean value was used for analysis.

Clinical evaluation

The principal author, who was not directly involved in providing patient care, reviewed and evaluated the collected data. They were followed-up at 48 h, 2 and 6 months after the operation.

The dysphagia rate

Incidence of dysphagia-related symptoms was recorded using the system defined by Bazaz et al. [12] (Table 2) as a compensative index for clinical evaluation during the follow-up period.
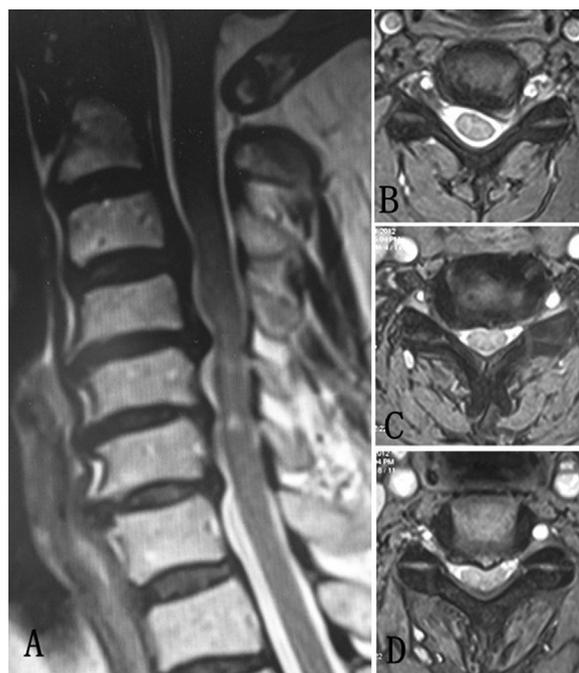

Fig. 2. MRI scanning images for decision-making. A. T2-weighted MRI in sagittal plain. B. MRI in axial plain of C3/4. C. MRI in axial plain of C4/5. D. MRI in axial plain of C5/6.
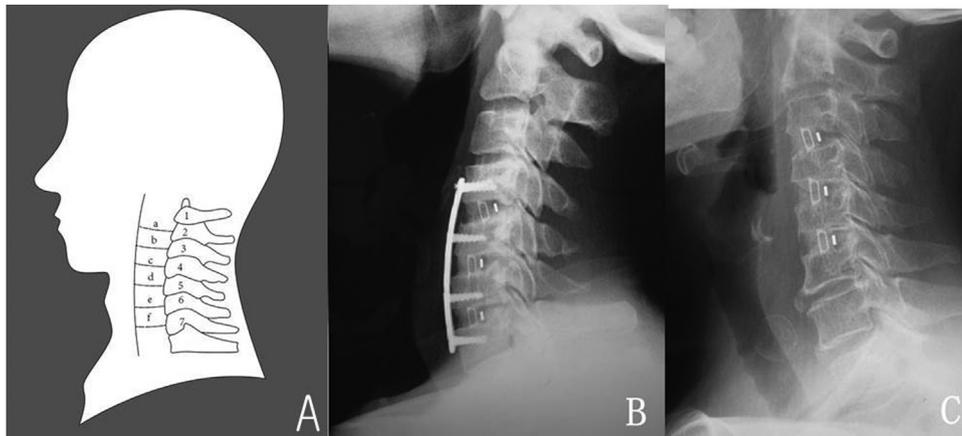
Fig. 3. Radiologic examinations. A. The measurement of thickness of anterior vertebral soft tissue: the distance from the front margin of C2-C7 vertebral bodies to the posterior margin of trachea were measured and the average value was recorded as the thickness of prevertebral soft tissue. PST=(a + b+c + d+e + f)/6. B. A 61-year-old male, diagnosed as multilevel CSM underwent ACDF-CP. After operation, he complained significant dysphagia. The postoperative SWAL-QOL score is 64. C. A 56-year-old male, diagnosed as multilevel CSM underwent ACDF-CA. After operation, he complained of mild dysphagia. The postoperative SWAL-QOL score is 56.

Table 2
Bazaz grading system for dysphagia.

Severity	Liquid	Solid
0- None	None	None
1- Mild	None	None
2- Moderate	None or rare	Occasionally
3- Severe	None or rare	Frequent

Swallowing-Quality of Life (SWAL-QOL) score

The modified Swallowing Quality of Life (SWAL-QOL) questionnaire was used to assess dysphagia [14–16]. This modified questionnaire comprises 14 symptoms of dysphagia, each scored from 1 to 5 as follows: 1.almost always; 2.often; 3.sometimes; 4. hardly ever; and 5. never. The score therefore ranges from 14 (most severe dysphagia) to 70 (no dysphagia). All the patients completed the SWAL-QOL questionnaire before surgery, 48 h after surgery, 2 months and 6 months post-operatively.

Statistical analysis

Data were presented as mean ± standard deviation (SD) for continuous variables and as percentages for incidence rates. The normality test and homogeneity test were performed on all measured data (The level of significance was set at 0.10). The characteristics and clinical data were compared between the groups using the *t*-test for normally distributed continuous variables and the *Chi-square* test for categorical variables. Continuous variables with non-normal distribution were analyzed with the *Mann-Whitney U* test. For quantitative variables, comparisons before and after surgery in the same group were assessed using *paired t* test. The level of significance was set at 0.05. All statistical analyses were performed using the software of SPSS (version 17.0, SPSS Inc, Chicago, IL).

Results

Preoperative comparison

There were no significant difference in preoperative age, sex, duration of symptom, surgical level and distribution of disease between the two groups (Table 1).

The dysphagia rate

At the 48-hour follow-up, The dysphagia rate in group B (46.67%) was higher than that in group A (28.13%), and there was a significant difference (P < 0.05).At the 2-mouth follow-up, The dysphagia rate in group B (16.67%) was higher than that in group A (9.38%), and there was a significant difference (P < 0.05).At the 6-mouth follow-up, The dysphagia rate in group B (6.67%) was higher than that in group A (0%), but there was not a significant difference (P > 0.05).(Table 3)

The SWAL-QOL scores

The SWAL-QOL scores before surgery were 68.10 ± 1.02 for group A and 67.98 ± 1.83 for group B (P=0.435). At the 48-hour follow-up, the SWAL-QOL scores were 58.32 ± 1.47 (group A) and 53.76 ± 1.75 (group B) (P=0.003).At the 2-mouth follow-up, the SWAL-QOL scores were 63.64 ± 1.67 (group A) and 58.41 ± 1.82 (group B) (P=0.002). At the 6-mouth follow-up, the SWAL-QOL scores were 67.21 ± 1.48 (group A) and 63.27 ± 1.57 (group B) (P=0.102). (Table 4)

The PST thickness

The PST thickness before surgery were 10.28 ± 1.57 mm for group A and 11.44 ± 1.65 mm for group B (P=0.624). At the 48-hour follow-up, the PST thickness were 12.46 ± 1.78 mm (group A) and 14.92 ± 1.49 mm (group B) (P=0.031). At the 2-month follow-up, the PST thickness were 11.83 ± 1.76 mm (group A) and 14.13 ± 1.59 mm (group B) (P=0.006). At the 6-month follow-up, the PST thickness were 11.12 ± 1.66 mm (group A) and 12.53 ± 1.87 mm (group B) (P=0.227). (Table 5)

Table 3
Incidence of postoperative dysphagia.

	Post-operative 48 h	Post-operative 2 months	Post-operative 6 months
Group A	28.13%(9/32)	9.38%(3/32)	0%(0/32)
Group B	46.67%(14/30)	16.67%(5/30)	6.67%(2/30)
P value	<0.05	<0.05	>0.05

Table 4
SWA-QOL score of two groups.

SWA-QOL score	Group A	Group B	P value
Preoperative	68.10 ± 1.02	67.98 ± 1.83	0.435
Postoperative 48 h	58.32 ± 1.47	53.76 ± 1.75	0.003
Postoperative 2 months	63.64 ± 1.67	58.41 ± 1.82	0.002
Postoperative 6 months	67.21 ± 1.48	63.27 ± 1.57	0.102

SWA-QOL= Swallowing-Quality of Life.

Table 5
The PST thickness.

The PST thickness	Group A(mm)	Group B(mm)	P value
Preoperative	10.28 ± 1.57	11.44 ± 1.65	0.624
Postoperative 48 h	12.46 ± 1.78	14.92 ± 1.49	0.031
Postoperative 2 months	11.83 ± 1.76	14.13 ± 1.59	0.006
Postoperative 6 months	11.12 ± 1.66	2.53 ± 1.87	0.227

PST = prevertebral soft tissue.

Discussion

The incidence of postoperative dysphagia range from < 1% to 62% after ACDF with plating [17,18]. However, to our knowledge, the pathogenesis of this complication is unknown. Direct contact with the esophagus maybe a possible source of postoperative dysphagia, whose incidence is reported to be as high as 30% during the first 3 months after operation [19]. Lee et al. [12] also found that a thinner anterior cervical plate could significantly reduce the rate of dysphagia compared to a thick one.

The Fidji cervical cage, which can accomplish immediate stability of a treated segment as compared with the stand-alone concept, has been developed and used during the past few years. This implant ensures less contact with the anterior soft tissue, especially the esophagus, which may avoid mechanical irritation. Therefore, we conjectured that application of the Fidji cervical cages might reduce postoperative dysphagia after ACDF especially in multilevel procedures.

Our study is unique because we first described the correlation between Fidji cervical cages and postoperative dysphagia after multilevel ACDF procedures. In present study, the group A had a lower incidence of dysphagia (28.13%) at the 48 h postoperative, whereas the incidence was higher (46.67%) in group B (P < 0.05). At the 2-month follow-up, the rate of dysphagia in group A (9.38%) was also lower than in group B (16.67%)(P < 0.05). After 6-month postoperative, none of the patients in group A complained of dysphagia, whereas two patients in group B continued to suffer from mild dysphagia (P > 0.05).These results implied that the ACDF-CA procedure using Fidji cervical cages is associated with a lower rate of early dysphagia than the ACDF-CP procedure. Li Zh et al. [20] retrospective analyzed the clinical data of 68 patients with cervical spondylosis treated by Fidji cervical cage, and compared the results with 70 patients treated by interbody fusion cage + titanium plate. The results showed that there were no significant differences in SF-36, VAS, NDI, JOA scores, disc height, average fusion time, fusion rate and occurrence rate of ASD. However, the occurance rate of dysphagia after surgery in Fidji cervical cage group was lower, which was consistent with our result.

The SWAL-QOL questionnaire is a validated patient-based measure of dysphagia and is commonly used in otolaryngology [21]. It requires the patients to answer >60 questions at each postoperative visit. Many of the questions are, nevertheless, less applicable in spinal surgical study [16]. The modified Swallowing Quality of Life(SWAL-QOL) questionnaire was used to assess dysphagia [14]. This modified questionnaire comprises 14 symptoms of dysphagia, each scored from 1 to 5 as follows: 1, almost always; 2, often; 3, sometimes; 4, hardly ever; and 5, never. The score therefore ranges from 14 (most severe dysphagia) to 70 (no dysphagia). According to our study, The SWAL-QOL scores were significant higher in group A than that in group B, at the 48 h and 2month follow up. Meanwhile, we focused on the post-operative radiologic changes of prevertebral soft tissue swelling after ACDF in both groups. We test the hypothesis that the thickness of prevertebral soft tissue is thicker in group B than group A. Analyzing the radiologic finding of cervical plain films, Fidji cervical cages definitely had an advantage of mild post-operative prevertebral soft tissue swelling (P=0.031). These data suggest that application of Fidji cervical cages assures mild post-operative prevertebral soft tissue swelling and less dysphagia after multilevel ACDF.

We note several limitations to this study. First, as with most one-center studies, the number of patients included in our study was insufficient. Second, this study is a retrospective study. Therefore, prospective randomized trials with more patients and longer follow-up are required to confirm our hypothesis.

In summary, Fidji cervical cage in ACDF procedure is associated with a less irritation to prevertebral soft tissue and a lower dysphagia rate at the first several months postoperatively for the treatment of multilevel CSM.

Transparency document

The Transparency document associated with this article can be found in the online version.

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