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ScienceDirect
Surgical Neurology 70 (2008) 390–397
SURGICAL NEUROLOGY
www.surgicalneurology-online.com

Spine

Threaded interbody fusion cage for adjacent segment degenerative disease after previous anterior cervical fusion

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Received 8 May 2007; accepted 9 July 2007

Abstract

Background: Anterior discectomy and fusion have been used for over 50 years in the treatment of degenerative disease of the cervical spine. However, as these procedures become more common, the long-term consequences are becoming more evident. One such consequence is degeneration of an adjacent segment, which can occur in up to 17% of patients undergoing cervical fusion. A threaded interbody fusion cage has often been used in a primary degenerative disorder of the cervical spine. However, there have been no studies in which these cages have been used in adjacent segments after previous cervical fusion. This is a retrospective review of 7 patients to determine the fusion rate, operative utility, and clinical outcomes using a threaded fusion cage construct in the treatment of cervical adjacent segment degeneration.

Methods: A standard low-profile interbody fusion cage was implanted after standard discectomy and local vertebral body bone graft in 7 patients with documented radiographic adjacent segment degeneration and clinical disease after anterior cervical fusion. Each patient underwent clinical and radiographic evaluation, and all 7 patients demonstrated signs of radiculopathy and/or myelopathy as well as radiographic signs of degeneration referable to a motion segment adjacent to previous cervical arthrodesis. These evaluations were repeated postoperatively. Patients were also asked to fill a preoperative and postoperative VAS, NDI, Prolo Economic-Functional Rating System, and CNDS for evaluation of outcome.

Results: Each procedure was performed without complication. The mean VAS pain scale decreased 58% as a result of the surgery. The CNDS improved in all patients by an average of 42%. The NDI improved in all patients, with an average increase of 42%. The Prolo Economic-Function Status showed that 4 patients had an excellent outcome and 3 patients had a good outcome. There was no incidence of pseudoarthrosis in any procedure at the 24-month follow-up.

Conclusion: These preliminary results support the use of threaded interbody cages in adjacent segment degeneration of the cervical spine after previous anterior cervical fusion. Pain and functional scores improved in all cases. This technique should be among the possibilities for surgical treatment of degeneration of adjacent segments in patients with previous cervical spinal fusion.

Keywords: BAK/C; Adjacent segment degeneration; Adjacent segment disease; Cervical fusion cage

1. Introduction

During the past several decades, ACDF has been shown to be an effective treatment for upper-extremity radicular pain, axial neck pain, and myelopathic symptoms related to degenerative disease of the cervical spine. Success rates of the procedure have been reported as high as 90% to 95% [5,14,18].

Abbreviations: ACDF, anterior cervical discectomy and fusion; ASD, adjacent segment disease; BAK/C, Bagby and Kulisch Cage; CNDS, Copenhagen Neck Disability Scale; CT, computerized tomography; NDI, Neck Disability Index; VAS, Visual Analog Scale.

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0090-3019/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.surneu.2007.07.034

There are many methods that surgeons can use to achieve fusion. One such method is the placement of autogenous bone harvested from the iliac crest between pathologic vertebral segments. However, this method, which is associated with the highest reported fusion rates [1,7,8,21,27,28,33], is associated with the many risks inherent to a second surgical wound, including donor site pain, infection, nerve injury, and hematoma [7,15,32]. A second method for achieving fusion is the use of donor bone allograft, which circumvents donor-site morbidity of autograft. However, this method is associated with an increased extrusion rate of substrate and a decreased fusion rate [1,7,8,21]. These problems may be overcome using anterior cervical fixation. However, hardware failure, a potential complication that may require additional surgery for correction, has been reported in the use of cervical fixation [8,13,23,25,34].

One other method of fusion that has been developed to achieve bony fusion between pathologic vertebral segments is the use of threaded fusion cages. One such system is the BAK/C (BAK/C Cervical Interbody Fusion System, Zimmer Spine, Minneapolis, Minn). Cervical cages involve a process known as "local autograft" to provide for bony fusion. During the implantation process, bone is gathered from drill reamings and placed within the cage. This bone thus provides the foundation for bony fusion. Rates for fusion, complication rates, and duration of hospital stay all approach those for other fusion techniques [15,16] while obviating the need for bone graft from the iliac crest and the need for subsequent surgical procedures for the alteration or removal of plates. Other potential advantages to this system include a shorter surgery time, a low-profile system, immediate fixation, and lower incidence of subsequent procedures resulting from hardware failure.

Anterior cervical discectomy and fusion are becoming an increasingly more common procedure [12,18]. Because these procedures have become so prevalent, long-term secondary sequelae have become more of a concern. One such complication is adjacent segment degeneration and disease (ASD). These degenerative processes can both be seen radiographically and have clinical symptoms. Adjacent segment disease is defined as the development of new radicular or myelopathic signs and symptoms clinically, which are referable to a motion segment adjacent to prior cervical arthrodesis [3,18]. In previous reports, the prevalence of symptomatic ASD has ranged from 7% to 17% [18,19,35].

The current study was designed to evaluate the rate of arthrodesis and successful clinical outcome when anterior cervical interbody fusion was performed using a threaded interbody fusion cage in degenerative disease of levels adjacent to a previous cervical fusion. The success of anterior interbody cervical fusion using a threaded interbody system in these patients has not been previously reported.

2. Materials and methods

2.1. Bagby and Kulisch Cage

The BAK/C interbody fusion system is a hollow, threaded, cylindrical cage that is made of titanium alloy. Each implant has multiple holes spaced evenly throughout outer surface, which allow bony growth through the holes and throughout the center of the cage. These holes are angled, and the cage has V-shaped threads that shave local bone into the graft chamber, creating the local bone graft. This local bone can also be supplemented with bone removed during decompression.

2.2. Patient data

From 2003 to 2005, 7 patients presented with ASD after anterior cervical fusion, defined as new radicular or myelopathic signs and symptoms referable to a motion segment adjacent to a prior cervical arthrodesis. Of these 7 cases, the previous procedure consisted of 3 single-level discectomies, 3 two-level discectomies, and 1 three-level discectomy. Mean duration of time between previous fusion and cage placement for ASD was 42 months. Patient preoperative demographic data are included in Table 1. Approval from the institutional review board was obtained for this study.

2.3. Preoperative evaluation/Operative indication

Preoperative evaluation consisted of a complete history and physical examination. Neurologic evaluation included

Table 1
Patient pre-operative demographic data

Case no.	Age	Sex	Previous fusion	Current fusion	NDI			Copenhagen			Prolo postoperative	Hospital days
					Preoperative	Postoperative 3 mo	Postoperative 12 mo	Preoperative	Postoperative 3 mo	Postoperative 12 mo		
1	45	Female	C4-C7	C3-C4	40	38	34	30	27	26	8	2
2	51	Male	C5-C6	C6-C7	30	22	20	17	6	12	7	2
3	52	Female	C4-C6	C3-C4	0	0	0	0	0	0	10	1
4	40	Male	C4-C6	C6-C7	41	38	38	29	28	28	7	1
5	42	Male	C6-C7	C6-C7	12	5	2	11	7	2	9	1
6	26	Female	C4-C6	C6-C7	40	24	21	28	15	9	9	1
7	53	Female	C4-C4	C3-C4	40	22	0	29	15	2	10	1