Journal of Clinical Neuroscience 19 (2012) 1673–1678

Contents lists available at SciVerse ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical Study

Outcomes of contemporary use of rectangular titanium stand-alone cages in anterior cervical discectomy and fusion: Cage subsidence and cervical alignment

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ARTICLE INFO

Article history:
Received 24 September 2011
Accepted 26 November 2011

Keywords:
Anterior cervical
Cage subsidence
Cervical alignment
Interbody fusion
Titanium cage

ABSTRACT

Cervical intervertebral disc replacement using a rectangular titanium stand-alone cage has become a standard procedure for anterior cervical discectomy and fusion (ACDF). We examined outcomes resulting from the contemporary use of rectangular titanium stand-alone cages for ACDF, particularly focusing on cage subsidence and subsequent kyphotic malalignment. Patient data were collected prospectively, and a total of 47 consecutive patients who underwent periodic follow-up of at least 1 year's duration after ACDF were studied retrospectively. Sixty-three rectangular titanium cages were implanted during 31 1-level and 16 2-level procedures. None of the patients developed surgery-related complications (including cage displacement or extrusion). Mean Neurosurgical Cervical Spine Scale scores were significantly improved at 1 year after surgery. Twelve of the 63 inserted cages (19.0%) were found to have cage subsidence, occurring in 11 of 47 patients (23.4%). There was no significant difference in functional recovery between patients with and without cage subsidence. Logistic regression analysis indicated that fusion level, cage size and cage position were significantly related to cage subsidence. The distraction ratio among patients with cage subsidence was significantly higher than that among patients without cage subsidence. Cage subsidence resulted in early deterioration of local angle and total alignment of the cervical spine. Although a longer follow-up is warranted, a good surgical outcome with negligible complications appears to justify the use of rectangular titanium stand-alone cages in 1- and 2-level ACDF. Excessive distraction at the fusion level should be avoided, and cage position should be adjusted to the anterior vertical line.

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1. Introduction

Anterior cervical discectomy and fusion (ACDF) is currently the standard procedure for treating degenerative disease of the cervical spine. Numerous refinements have been made to the procedure over the years, including changes to the graft source material and the use of instrumented construct augmentation. Currently, ACDF using a titanium stand-alone cage is one commonly used option, which has been shown to be safe and effective to date.[1–11] Cervical intervertebral disc replacement using a titanium stand-alone cage can restore physiologic disc height and provide immediate load-bearing support to the anterior column, and may promote arthrodesis.[12] On the other hand, there is also evidence that complications are frequently associated with this procedure. The most commonly reported complication is cage subsidence, resulting in kyphotic malalignment.[1,4,7,11,13–16]

The goal of the present study was to examine outcomes resulting from the contemporary use of rectangular titanium stand-alone cages in ACDF. Patient data were collected and entered prospectively, but patient stratification and data analysis were performed retrospectively.

2. Methods

2.1. Patient population

Between 2006 and 2010, we performed cervical spine surgery (both anterior and posterior) on 194 patients in our Institute and in affiliated hospitals. The anterior procedure was performed for 123 patients and the posterior procedure was performed for 71 patients. This retrospective study included 47 consecutive patients (31 males and 16 females) who underwent ACDF and completed periodic follow-up of at least 1 year's duration after surgery and whose medical records were analyzed using a computerized

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http://dx.doi.org/10.1016/j.jocn.2011.11.043

medical records system (EGMAIN-EX; Fujitsu, Tokyo, Japan). Patients ranged from 34 to 91 years of age (average: 60.7 years).

All patients presented with radiculopathy and/or myelopathy due to disc herniation, osteophyte formation or ossification of the posterior longitudinal ligament (OPLL). Patients with trauma or who had been previously treated using anterior or posterior cervical spine surgery were excluded from this study. The postoperative follow-up time ranged from 12 to 48 months (average: 32 months). Informed consent was obtained from all patients.

2.2. Surgical technique

Patients under general anesthesia were placed in the supine position. In cases of severe anterior compression, intubation was performed using a fiberoptic device. The patient's head was mildly extended and secured under fluroscopic image guidance. The anterior cervical spine was approached from the symptomatic side, with reference to imaging studies. A standard anterior cervical approach was used in cases of disc herniation or mild spondylosis. In cases of severe spondylosis or OPLL, a trans-unco-discal approach was used under intraoperative cervical traction applied using Crutchfield skull tongs.[17]

All disc tissue, including the herniated disc fragments, osteophytes and OPLL, was removed meticulously under a surgical microscope. During the decompression procedure, damage to the vertebral endplates was scrupulously avoided. The posterior longitudinal ligament was partially resected to confirm decompression of the neural structures. To accomplish interbody fusion, we used a rectangular titanium stand-alone cage (Synthes, Solothurn, Switzerland). Cage trials were used to determine the appropriate size. Cages with a curved shape were preferred. After the cage was filled with autologous cancellous bone harvested from the iliac crest, the cage was inserted into the disc space under interbody distraction or cervical traction. The cage position was aligned to the anterior vertical line as much as possible. All patients were permitted to walk soon after surgery, and were kept in a soft neck collar for 2 weeks.

2.3. Clinical evaluation

Neurological status was assessed using the Neurosurgical Cervical Spine Scale (NCSS).[18] All patients underwent a comprehensive evaluation before surgery and at 1 week, 3 weeks, 3 months and 1 year after surgery. The radiological evaluation

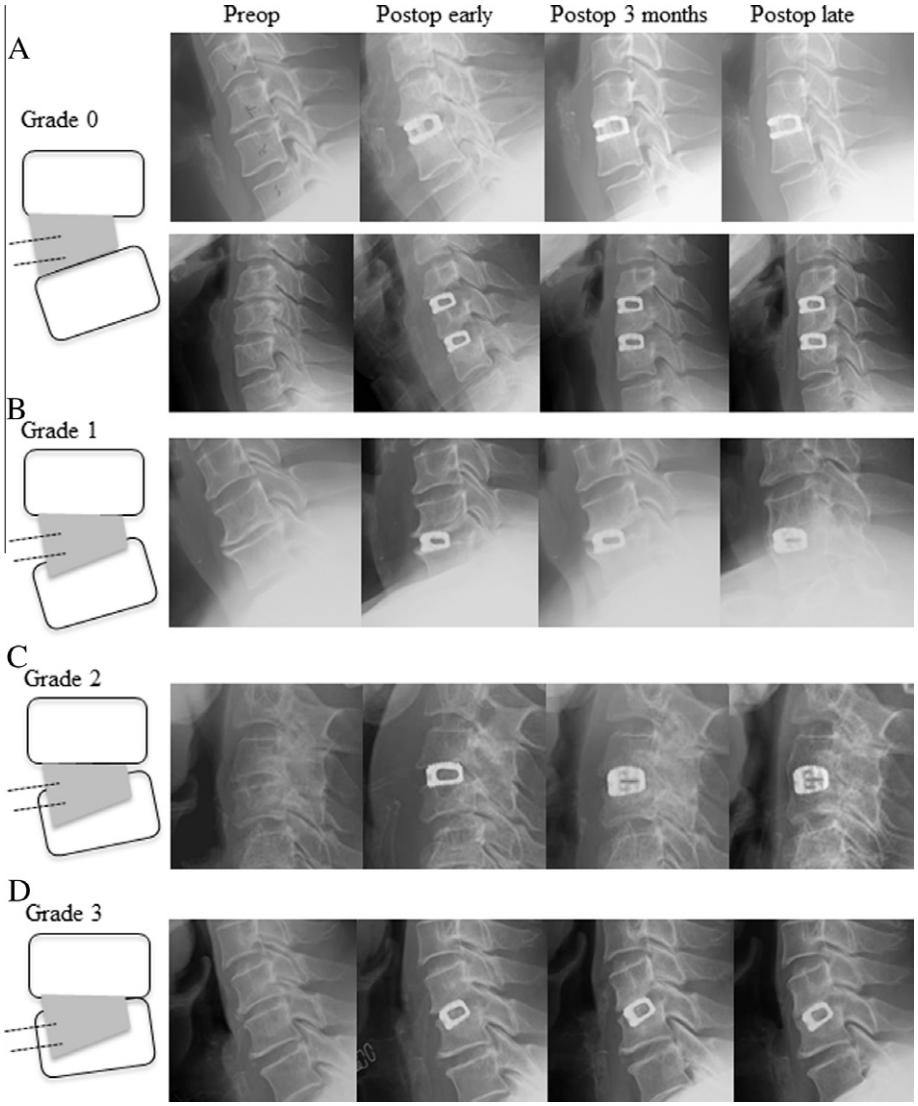

Fig. 1. The 4 grades of cage subsidence, with representative lateral plain radiographs. (A) Grade 0, no subsidence; (B) grade 1, less than one-third subsidence; (C) grade 2, less than two-thirds subsidence; (D) grade 3, more than two-thirds subsidence. Preop = preoperative; postop = postoperative.

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