



Clinical Studies

Outcomes following cervical disc arthroplasty: A retrospective review



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ABSTRACT

Cervical disc arthroplasty has emerged as a viable technique for the treatment of cervical radiculopathy and myelopathy, with the proposed benefit of maintenance of segmental range of motion. There are relatively few, non-industry sponsored studies examining the outcomes and complications of cervical disc arthroplasty. Therefore, we set out to perform a single center evaluation of the outcomes and complications of cervical disc arthroplasty. We performed a retrospective review of all patients from a single military tertiary medical center undergoing cervical disc arthroplasty from August 2008 to August 2012. The clinical outcomes and complications associated with the procedure were evaluated. A total of 219 consecutive patients were included in the review, with an average follow-up of 11.2 (± 11.0) months. Relief of pre-operative symptoms was noted in 88.7% of patients, and 92.2% of patients were able to return to full pre-operative activity. There was a low rate of complications related to the anterior cervical approach (3.2% with recurrent laryngeal nerve injury, 8.9% with dysphagia), with no device/implant related complications. Symptomatic cervical radiculopathy is a common problem in both the civilian and active duty military populations and can cause significant disability leading to loss of work and decreased operational readiness. There exist several surgical treatment options for appropriately indicated patients. Based on our findings, cervical disc arthroplasty is a safe and effective treatment for symptomatic cervical radiculopathy and myelopathy, with a low incidence of complications and high rate of symptom relief.

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1. Introduction

Cervical radiculopathy and myelopathy are common diagnoses in adult patients that have been shown to cause significant disability and loss of productivity [1–3]. Patients commonly present with a constellation of symptoms, including dermatomal pain and paresthesias, weakness, and myelopathic signs including hyperreflexia, gait disturbance, and positive rudimentary reflexes [4–7]. In the active duty military population, cervical radiculopathy often leads to difficulty performing training or mission-specific functions, which can prevent deployment, decrease force strength and adversely affect overall unit readiness. Spine-related pain syndromes comprise a significant percentage of unit attrition, and represents the leading cause of medical discharge across all military branches of service [8].

Several surgical options are available for the treatment of cervical radiculopathy and myelopathy, following an appropriate trial of

non-operative management. These options include posterior decompression and fusion, anterior cervical discectomy and fusion (ACDF) and cervical disc arthroplasty (CDA). CDA has been espoused in the literature as a viable alternative to ACDF, with the added theoretical benefit of preventing adjacent segment degeneration, though this remains to be proved [9–13]. Currently accepted indications for CDA include foraminal osteophytosis causing radiculopathy or myelopathy, or reconstruction after neural decompression. Relative contraindications include pre-operative corticosteroids, renal failure, rheumatoid arthritis, osteoporosis, and a diagnosis of cancer. Absolute contraindications include deformity, immobile segments, instability, and facet joint degeneration [6,7]. Based on our increasing experience in performing CDA, we sought to determine the outcomes of all patients who underwent this procedure at a single institution over a 4 year period.

2. Materials and methods

Following approval from our Institutional Review Board, the surgical database at this institution was queried to identify all

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patients who had undergone CDA between August 2008 and August 2012. This search yielded a total of 316 patients. Of these, 34 were lost to follow-up, leaving 282 patients for review. All construct types (single level CDA, hybrid, and multilevel CDA) were included. All data were collected via a retrospective chart analysis, which included inpatient and outpatient clinical notes, surgical databases, and radiographs. Data collected included patient demographic information (age, sex, tobacco use, body mass index [BMI]), patient-centered outcomes (relief of pre-operative symptoms, incidence/resolution of axial neck pain in the post-operative period, return to full activity), complications (recurrent laryngeal nerve injury, dysphagia, post-operative respiratory compromise, esophageal/tracheal disruption), and radiographic parameters (increase in disc height, segment range of motion, evidence of loosening, migration, or subsidence).

3. Results

There were 219 males (77.7%) and 63 females (22.3%). The average length of follow-up was 11.2 months (standard deviation 11.0 months). The average patient age was 42.1 (± 8.4) years. The average BMI was 27.8 (± 3.7) kg/m². The most common levels addressed at the time of surgery were C5–6 and C6–7 (56.7% and 58.9%, respectively). The next most frequently diseased levels were C4–5 (19.5%), C3–4 (8.2%), and C7–T1 (2.5%). The majority of patients underwent single level CDA (59.9%), and 22.3% underwent two-level hybrid (CDA/ACDF) constructs. Twenty-five patients (8.9%) underwent two-level CDA; 11 (3.9%) of these patients had contiguous levels addressed, and 14 (5.0%) had non-contiguous levels addressed. Three patients had three-level contiguous CDA (Table 1). Of the patients studied, 73.8% (209) were on active duty at the time of surgery. The Prestige (Medtronic, Memphis, TN, USA) cervical arthroplasty system was utilized in the majority of patients (94.5%), while the ProDisc-C system (Depuy Synthes, Paoli, PA, USA) was utilized in the remainder of patients (5.5%).

The primary indications for surgery were radiculopathy (86.5%), myelo-radiculopathy (9.2%), and myelopathy (1.8%). Flexion and

Table 1
Summary of all patient demographic data, surgical indications and general outcomes measures

Total patients, n	282
Men	71.7% (219)
Women	22.3% (63)
Age (mean \pm SD)	42.1 \pm 8.4 years
Body mass index (mean \pm SD)	27.8 \pm 3.7 kg/m ²
Tobacco use	26.6% (75)
Active military duty	73.8% (208)
Revision surgery	5.7% (16)
Average follow-up (mean \pm SD)	11.2 \pm 11.0 months
Levels of disease	
C3–4	8.2% (23)
C4–5	19.5% (55)
C5–6	56.7% (160)
C6–7	58.9% (166)
C7–T1	2.5% (7)
Primary indication for surgery	
Myelopathy	1.8% (5)
Radiculopathy	86.5% (244)
Myelo-radiculopathy	9.2% (26)
Neck pain	0.7% (2)
Outcomes	
Relief of neurologic symptoms	92.9% (262)
Complete relief of symptoms	88.7% (250)
Persistent axial neck pain (>3 months)	18.4% (52)
Return to full activity	92.2% (260)
Return to active military duty	90.4% (189/209)

Data are presented as percentage (number of patients) unless otherwise specified. SD = standard deviation.

extension lateral radiographs were available in 199 patients (60.9%), and the mean range of motion at the CDA levels was 7.5 (± 4.1) degrees at latest follow-up. Out of the 282 patients reviewed, 250 (88.7%) experienced complete relief of pre-operative complaints. Twenty-six patients (9.2%) had incomplete relief of their symptoms, to include complaints of persistent axial neck pain, residual paresthesias, or radiculopathy. Some patients (2.1%) experienced initial relief of symptoms, but later developed recurrence during follow-up. We found 52 (18.4%) patients complained of axial neck pain at 3 months or afterwards, but that eight (15.3%) had resolution of their pain at 1 year follow-up with conservative therapy, and 11 (21.2%) stated that their pain did not require treatment or affect their return to activity. A vast majority of patients were able to return to full activity (92.2%). In the active duty population, there was a 90.4% rate of return to full activity. Of the 24 patients who did not return to full activity, 20 were on active duty at the time of surgery and required a Medical Board for inability to perform their job in the necessary capacity (Table 1).

The complication rate was 14.5%, which included dysphagia (8.9%), recurrent laryngeal nerve injury (3.2%), post-operative hematoma (0.4%), nerve root injury (0.4%), spinal cord injury (0.4%), and superficial infection (0.4%). There was a 5.3% re-operation rate, including conversion of CDA to ACDF, revision of ACDF or CDA, posterior decompressions, adjacent segment degeneration, and hematoma decompression (Table 2).

When the data were analyzed based on construct type, we found similar outcomes between single level, two-level hybrids, and two and three-level CDA (Table 3). The multi-level hybrid constructs (most commonly CDA/ACDF/CDA) showed a decreased rate of symptom relief and return to full activity (77.8% and 72.2%, respectively), and higher rates of persistent axial neck pain (50%) and dysphagia (22.2%) (Table 3).

4. Discussion

To our knowledge, this is the largest, non-funded, single center review of CDA. When analyzing all construct types that included CDA at our institution, we found an 88.7% rate of complete pre-operative symptom relief and a 92.2% rate of return to full activity, with maintenance of 7.5 degrees at each CDA level on average. This included a majority subset population of active duty service members, which demonstrated a 90.4% rate of return to active duty. Furthermore, our review demonstrates a low complication rate with regard to post-operative dysphagia (8.9%) and recurrent laryngeal nerve injury (3.2%).

The rate of dysphagia in this review (8.9%) is lower than that reported in the literature (28–57%) [14–18], which is most likely

Table 2
Overall cervical disc arthroplasty complication rates, categorized by complication type

Complications	
Recurrent laryngeal nerve injury	3.2% (9)
Dysphagia	8.9% (25)
Post-operative hematoma	0.4% (1)
Infection	0.4% (1, superficial)
Spinal cord injury	0.4% (1)
Dural tear	0.4% (1)
Recurrence of neurologic symptoms	2.1% (6)
Reoperation during follow-up	5.3% (15)
Posterior decompression	2.1% (6)
Adjacent level	1.8% (5)
Conversion to ACDF	0.7% (2)
Hematoma decompression	0.4% (1)

Data are presented as percentage (number of patients). ACDF = anterior cervical discectomy and fusion.

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