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Operative Techniques in
Orthopaedics

Cervical Disc Replacement vs Anterior Cervical Discectomy and Fusion

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Cervical disc arthroplasty (CDA) is an option for young patients with degenerative disc disease resulting in radiculopathy or myelopathy. This new surgical technique has been compared with the gold standard of anterior cervical discectomy and fusion with similar excellent outcomes in neurologic function and resolution of pain and other radicular symptoms. CDA is attractive for the young patient because it is a motion-sparing implant, and therefore it is thought to have a decreased risk of adjacent level disease. This article reviews the literature of CDA for clinical outcomes, rates of adjacent level disease, and complications associated with the procedure.
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Introduction

Cervical disc arthroplasty (CDA) is an alternative to anterior cervical discectomy and fusion (ACDF) for cervical spondylosis, stenosis, myelopathy, and radiculopathy. Up to 3% of patients per year require a second surgery to address adjacent segment disease after ACDF.[1] Unlike ACDF, CDA is designed to preserve movement of the cervical spine and may therefore decrease the risk of adjacent level disease.[2] CDA may be particularly suited to young patients who may benefit the greatest from its theoretical advantages.

Etiology and Epidemiology

Disc fatigue initiates degeneration of the cervical spine. Collapse and desiccation of intervertebral discs may result in foraminal narrowing, herniation of disc material, buckling of spinal ligaments, and osteoarthritic changes. These processes are potentially painful, may limit motion, and may cause neural compression.[3]

Osteoarthritic degeneration of the cervical spine, that is, spondylosis, affects 50% of people by the age of 50 years,[4] and frank cervical stenosis occurs in nearly 30% of this cohort.[5] The incidence of clinically significant cervical radiculopathy is 107 per 100,000 in men and 63.5 per 100,000 in women aged 55-64 years.[6] Myelopathy occurs in a smaller number of patients. In a study, a cervical canal of less than 13 mm was found in 10% of a population with a mean age of 66.4 years and of those patients, signs of cervical myelopathy were seen in 61.9% of men and 33.3% of women.[7]

Patients with degeneration of the cervical spine have symptoms according to their specific pathology. Neck pain and shoulder stiffness are typical of spondylosis and may be present in combination with other symptoms. Dermatomal, burning pain, or paresthesias may be a sign of stenosis and radiculopathy. Gait instability, manual clumsiness, and incontinence may signal myelopathy. The onset of any of these symptoms is likely to be insidious. Most affected patients are initially able to work and participate in daily activities.[8]

Treatment Alternatives

Overall, 90% of people with isolated cervical radiculopathy respond to medications, immobilization, activity medication, or physical therapy.[9] Simple cervical spondylosis may be similarly treated. Although studies support use of these treatments in general, there are no excellent data to support use of any particular treatment regimen.[8] Patients who are treated with nonsurgical interventions vs ACDF after symptoms recalcitrant to conservative therapy face similar outcomes at 1 year.[10]

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Surgery is reserved for patients with spondylosis, radiculopathy, or myelopathy refractory to nonoperative treatment. Although historically effective,[10] ACDF may be prone to certain complications. With fusion of a vertebral segment, stress is shifted to adjacent mobile segments.[11] Hilibrand and Robbins[1] reported that 3% of patients per year required surgery for adjacent segment disease after ACDF. One-quarter of patients who have an ACDF may need a repeat intervention within 10 years of surgery to address adjacent segment disease.[12] It has been documented, however, that evolving pathology of the cervical spine occurs at both adjacent and nonadjacent levels and has equivalent frequency.[13]

CDA is an alternative to ACDF. Like its counterpart, CDA involves an anterior decompression, but an articulating prosthesis is implanted rather than a graft. Decompression must be complete and direct as indirect foraminal decompression is unpredictable in CDA. To avoid overdistraction of the disc space and painful rupture of the facet capsules, resection of the posterior longitudinal ligament with anterior foraminotomy is recommended. Generally, fluoroscopy is used to test trial components before implantation of the prosthesis.

Varieties of cervical disc implants are available and are similar, in many ways, to hip and knee arthroplasty implants.[14] Particles generated were comparable in size to particles found after hip and knee replacement and produced little inflammation. The authors noted less total tissue debris after CDA compared with ACDF. Worn implants maintained normal function.[15]

Outcomes

ACDF is a predictable procedure, especially when used to treat radiculopathy.[16] Several authors have reported patient pain relief, return to work, and improved quality of life.[17–22] Phillips et al[2] stated that CDA should supplant ACDF as a gold standard only if the following 6 parameters could be proven: CDA should (1) be as safe as an ACDF, (2) rival the durability of ACDF, (3) reduce the possibility of adjacent segment disease, (4) be cost-effective, (5) be easy to perform, and (6) be as effective as or more effective than ACDF.

Early reports suggest an expanded role for CDA; however, long-term outcome data to rival that in support of ACDF are lacking.[19–25] Mummaneni et al[23] found that CDA patients showed improved neurologic function, more rapid return to work, and better Neck Disability Index scores in a prospective, randomized, controlled comparison with ACDF. A 7-year follow-up by the same investigators revealed that resolution of neck pain and neurologic status after CDA may be maintained beyond the short term, and that revision surgery after CDA was less frequent.[26] Other authors have, likewise, shown decreased rates of adjacent segment diseases and a decreased need for additional surgery after CDA compared with ACDF.[21,22,27]

This work is in contradiction, however, to a recent meta-analysis[28] and a recent retrospective investigation of risk factors.[29] The latter suggested that although posterior-only procedures are a risk factor for adjacent level disease and

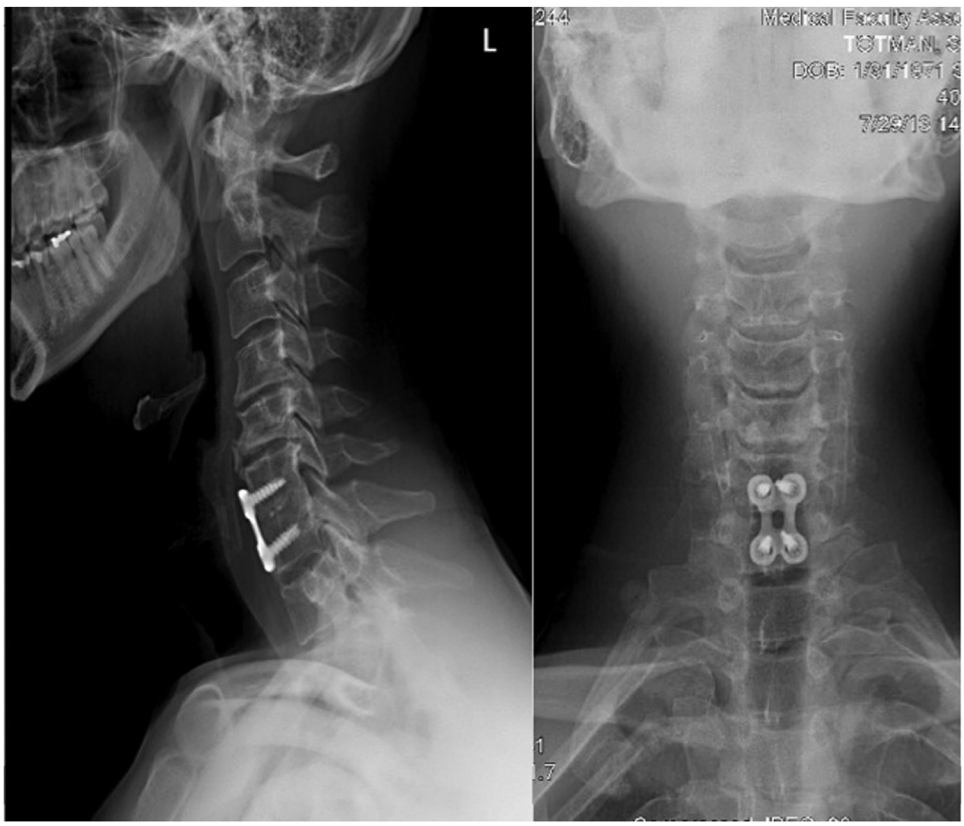

Figure 1 Preoperative x-ray images showing a C6/7 ACDF with some adjacent level degeneration at the C5/6 level and the C4/5 level. (Color version of figure is available online.)