Myelopathy after cervical disc arthroplasty due to progression of spondylosis at the index level: case report

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Cervical disc arthroplasty (CDA) has emerged as a popular alternative to anterior cervical discectomy and fusion (ACDF) for the surgical treatment of cervical degenerative disc disease. CDA has been well studied, with efficacy reported to be equivalent to or better than that seen with ACDF, and it is associated with a consistently low incidence of adverse events. The development or progression of myelopathy after CDA is a particularly rare occurrence. In this report, the authors describe the first known case of recurrence of myelopathy at the index level of surgery after CDA implantation due to the continuation of the spondylitic process after placement of the artificial disc.

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KEY WORDS cervical disc arthroplasty; anterior cervical discectomy and fusion; cervical artificial disc; myelopathy; spinal cord compression

In recent years, cervical disc arthroplasty (CDA) has emerged as a popular alternative to anterior cervical discectomy and fusion (ACDF) for the surgical treatment of cervical degenerative disc disease. The essential advantage of CDA is the potential for reduction of the adjacent-segment degeneration encountered after ACDF. This reduction in adjacent-segment degeneration is thought to be related to the ability of CDA devices to mimic normal spinal segmental motion, which may reduce the stress transfer to adjacent levels.

CDA has been well studied, with efficacy reported to be equivalent to or better than that seen with ACDF, and it is associated with a consistently low incidence of adverse events. The development or progression of myelopathy after ACDF has been seen, and some cases have been reported to be a result of progression of the spondylitic process affecting the central canal and resulting in cord compression. We present, to the best of our knowledge, the first case of progression of spondylosis at a cervical artificial disc resulting in cord compression and myelopathy.

Case Report

History and Presentation

This 55-year-old man with a medical history that included prostate cancer, hyperlipidemia, and nephrolithiasis presented for evaluation of back pain, which had been problematic for 20 years. He denied any neurological difficulties. On examination, strength and sensation were intact. Reflexes were 2+ at the left biceps and patella, but 3+ on the right side, with a positive Hoffman’s sign on the right. The patient’s gait was normal. Because of the hyperreflexia and pathologic reflex, a cervical spine MR image was obtained. At a follow-up visit 3 weeks later, the patient reported numbness and tingling across the fingertips of the second through fifth fingers bilaterally.

MRI of the cervical spine demonstrated a prominent central disc protrusion with an associated disc/spur complex at C5–6, resulting in marked central stenosis and significant bilateral foraminal stenosis (Fig. 1). There was associated increased T2 signal in the right lateral aspect of the spinal cord at this level. There was a slightly less prominent stenosis at C6–7 causing both central and bilateral foraminal stenosis.

Initial Operation

Anterior cervical discectomies were performed at C5–6 and C6–7. At both levels, significant osteophytes and an overgrown ligament were found. The osteophytes were drilled down, the ligament was removed, and the dura was identified and decompressed at both levels. A C6–7 fusion was done using an interbody device (Medtronic Peek Pre-

ABBREVIATIONS ACDF = anterior cervical discectomy and fusion; AP = anteroposterior; CDA = cervical disc arthroplasty; HO = heterotopic ossification.


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vail) filled with local bone. No biologics were placed, and bone morphogenetic protein was not used. At C5–6, a disc arthroplasty (Prestige, Medtronic) was performed. The Prestige disc features a semiconstrained design.

Postoperative Course

The surgery was uneventful, and the immediate recovery was unremarkable. Anteroposterior (AP) and lateral cervical spine radiographs obtained 1 month after surgery demonstrated good placement of the instrumentation (Fig. 2).

One year after surgery, the patient described some right-hand “soreness” with occasional tingling as well as occasional radiation of this tingling up to the anterior arm to shoulder and associated neck stiffness. Examination findings remained unremarkable. Cervical spine radiographs at this time demonstrated bulky anterior osteophyte formation at C4–5, which was a significant increase in comparison with previous postoperative images. There was normal motion of the disc with no pathologic subluxation on flexion or extension (Fig. 3).

Six months later, the patient reported neck soreness, right-arm numbness and pain radiating from his shoulder into his hand that had persisted for 2 months. He denied any weakness, gait instability, or bowel/bladder issues. The significant findings on physical examination included hyperreflexia in the upper and lower extremities, more pronounced on the left, and bilateral Hoffman’s signs. Cervical spine radiographs once again demonstrated bulky anterior osteophyte formation at C4–5, which was a significant increase in comparison with previous postoperative images. There was normal motion of the disc with no pathologic subluxation on flexion or extension (Fig. 3).

Approximately 1 year later, after undergoing a total knee replacement, the patient had worsening gait instability. MRI findings of the cervical spine were again unremarkable but nondiagnostic at the level of the artificial disc due to extensive susceptibility artifact (Fig. 5).
has been recent work to identify MRI sequences that will have less artifact in the presence of metal.\(^4\) Because of the increasing concern for myelopathy, CT myelography was performed and revealed severe stenosis at the level of the artificial disc with decreased AP diameter of the spinal cord at C5–6 (Fig. 4A). The hardware remained in a good position, and flexion-extension cervical spine radiographs showed persistent motion of the artificial disc.

Given the progression of myelopathic symptoms and the stenosis, the artificial disc was removed and converted to a fusion. The surgery was uneventful. Surgical findings were consistent with the myelography findings: significant osteophytes and a hypertrophied ligament with some scarring of the soft tissue to the dura. Postoperatively, the patient was unchanged neurologically, and radiographs revealed that the hardware was in a satisfactory position (Fig. 6). At follow-up 10 months after the revision surgery, the patient had only minimal improvement, but the gradual deterioration that was seen prior to revision surgery was halted.

**Discussion**

Myelopathy after CDA due to cord compression at the index level has been described, but rarely. In a case report and literature review of cervical myelopathy after CDA, Chen et al. reported one case of myelopathy due to residual compression and another occurring as a result of the development of postoperative kyphosis.\(^3\) Hacker et al. described the development of myelopathy in one patient due to posterior subsidence of the CDA device, and neck pain with radiculopathy in another due to segmental collapse and retropulsion of bone.\(^5\) In a series of 74 patients undergoing CDA reported by Pickett et al., one patient was reported to have progressive myelopathy postoperatively, which was attributed to an inadequate posterior osteophyte resection and subsequent development of kyphosis.\(^11\) One case of progressive myelopathy after CDA with absence of radiographic compression was reported in the 2-year Frenchay CDA trial.\(^16\) In all of these cases, the myelopathy was caused by inadequate initial surgery, device failure/migration, or alignment changes.

There is limited discussion in the literature regarding CDA in the setting of central stenosis and/or cord signal. In a recent article, Chang et al. demonstrated that CDA was safe and effective in cases of T2-weighted cord changes.\(^1\) Another group demonstrated that multilevel CDA was safe and effective in cases of stenosis due to a congenitally small canal, at least over the short term. However, the long-term outcomes and results needed to be monitored.\(^2\)

There have also been reports on progression of facet disease at the level where the disc has been replaced. Wenger and Markwalder reported on 3 patients who de-
developed radiculopathy more than a year after CDA with the Bryan disc.\textsuperscript{15} Myelography/CT was performed in all cases to confirm the recurrent root compression. In the case described here, the cord compression was the result of progression of the spondylotic process in the disc at the level of the CDA itself. It is not clear what factors contributed to this occurrence, whether individual, technical, or device related. The initial compression was due to spondylolisthesis and not a gross herniated disc, but CDA devices are indicated and frequently placed in cases of compression from spondylitic changes. As can be seen on the CT scan, our patient developed a large anterior osteophyte at the level above the CDA, perhaps indicating a predilection for excessive bone growth. He also required lumbar fusion for spondylolisthesis 1 year after his initial surgery. Perhaps a significant contribution was the patient’s spondylitic inclination.

The device was positioned well and remained mobile. Although difficult to assess due to the artifact, there does not appear to be a significant amount of heterotopic ossification (HO). Perhaps more HO in this case would have been beneficial in limiting the amount of movement, resulting in a diminution of the spondylitic process. The device also covers an adequate amount of the disc endplate. Inadequate coverage has been cited as a possible contributing factor to HO.

There does not appear to have been a device failure, and as noted it continued to function well as a motion preservation device. We have not been able to identify any characteristics of this particular disc that would have contributed to the outcome.

The incidence of adverse events after CDA has been reported to be universally low, and the development of new myelopathic symptoms after CDA is very rare in the literature. We describe here the first reported case of new-onset myelopathy at the index level of surgery after CDA device implantation due to the development of posterior osteophytes. The importance of this report is not just the documentation of a potential late outcome to be tracked. The usual diagnostic test for patients with myelopathy is MRI. However, current CDA devices produce significant artifact, making the MR images nondiagnostic at the level of the CDA. It might be a common assumption that stenosis does not recur at the CDA level. With that assumption, an MR image showing no stenosis at the other levels of the cervical spine but inadequately visualizing the index level might be assumed to be adequate to rule out a compressive myelopathy. This could result in a failure to diagnose a compressive myelopathy or a delay in diagnosis, possibly resulting in preventable neurological deterioration. Recurrent cord compression due to progression of spondylolisthesis should be kept in mind as a possible etiology of recurrent myelopathy in patients with a CDA device.

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**References**


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**FIG. 6.** Cervical spine radiograph showing stable and unremarkable results with unchanged vertebral contours after placement of anterior fixation hardware spanning C5-C6-C7.
15. Wenger M, Markwalder TM: Posterior decompression salvages Bryan total disc arthroplasty in post-operatively recur-

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**Disclosures**

Dr. Musacchio: consultant for Paradigm Spine and Medtronic.

**Author Contributions**

Conception and design: Stadlan. Acquisition of data: Stadlan, Bhansali. Analysis and interpretation of data: all authors. Drafting the article: all authors. Critically revising the article: Stadlan. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Stadlan. Study supervision: Stadlan.

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