Reversal of Anterior Cervical Fusion with a Cervical Arthroplasty Prosthesis

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Abstract: This case report describes a 38-year-old-man who initially underwent a C5–C6 anterior cervical decompression and interbody fusion and plating for a right C6 radiculopathy. Within a few months of his surgery, he developed bilateral C7 radiculopathies, with imaging confirming adjacent segment foraminal stenosis. Repeat imaging suggested some subsidence of the original interbody graft but no overt pseudoarthrosis, and flexion/extension films showed no evidence of movement at the fused level. Six months after the original surgery, he underwent re-exploration. Decompression and arthroplasty were effected at the C6–C7 level. The old fusion was removed at the C5–C6 level and remobilized, and an arthroplasty was performed. At discharge, the patient's neck pain and hand symptoms had improved, and he had motion demonstrable on radiologic imaging at C5–C6. This is the first reported case of reversal of a cervical fusion with re-establishment of motion and represents an alternate acceptable management of pseudoarthrosis or recent spinal fusion.

Key Words: arthroplasty, Bryan disc, cervical myelopathy, fusion, stenosis

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Anterior cervical fusion surgery is one of the most commonly performed operations in the world for degenerative spinal disease. In recent times, the problems associated with cervical arthrodesis have been illuminated. A reduction in range of motion and increasing stress at adjacent levels are commonly accepted as pitfalls of fusion surgery.[1,2] Hilibrand et al[3] confirmed a 2.9%/year rate of developing adjacent segment disease after anterior interbody fusion requiring cervical intervention. Recently, Goffin et al[4] described a new technique of cervical arthroplasty using the Bryan Cervical Disc Prosthesis (Spinal Dynamics Corp., Mercer Island, WA) in an attempt to maintain cervical motion and avoid arthrodesis after decompression. This case describes a patient who had undergone a C5–C6 anterior cervical decompression and instrumented interbody fusion who subsequently developed progressive neurologic symptoms and signs and had successful reversal of his fusion with restoration of motion at that segment.

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CASE REPORT

This previously healthy 38-year-old man presented initially with spontaneous onset of a right C6 radiculopathy with pain and biceps weakness early in 2000. Initial computed tomography (CT) scanning and magnetic resonance (MR) studies confirmed the presence of spondylotic cord and root compression at the C5–C6 level. He underwent an anterior decompression and fusion at another institution in August 2002. An interbody allograft was placed and secured with a dynamic load-sharing plate. He was placed into a cervical collar for 6 weeks. In the days after surgery, the patient developed difficulty with hand closure and over the next 3–4 months had progressive problems with neuropathic pain in both hands, difficulty in finger movements, and neck pain. Serial radiographs and CT scanning of the cervical spine showed an apparent pseudoarthrosis at the operated level (Fig. 1). On flexion/extension x-ray films, however, he had no change in the interspinous distance at the operated level. Similarly, the Cobb angle changed from 14° in flexion to 15° in extension. He was assessed at our institution in January 2003. At the time, he was still immobilized in his cervical collar, still experienced severe mechanical neck pain with Lhermitte-type symptoms in both arms, and also had weakness in both arms in elbow flexion/extension and wrist flexion/extension (4+/5) with severe weakness in finger flexion/extension (3–4/5). Grip strength was markedly impaired. MR and CT scanning at this stage suggested residual foraminal stenosis with mild canal stenosis at the C5–C6 level with severe stenosis at the C6–C7. No gross cord compression and no signal change in the spinal cord were observed. In view of these findings, surgical intervention was offered. Because of the recurrence of C6 weakness in the face of an inadequate C6 decompression, a repeat exploration was offered for the C5–C6 level with potential arthroplasty at the C6–C7 level. If an arthroplasty could be performed at the C5–C6 level, it would be performed; if the segment was immobile, then an autograft fusion with plating would be performed.

FIGURE 1. Initial lateral C-spine radiograph, showing an instrumented fusion at the C5–C6 level, 6 months after initial surgery. There is a suggestion of pseudoarthrosis at that segment, but, in fact, the fusion was solid at the time of surgery. There was no movement on flexion or extension.

FIGURE 2. Preoperative sagittal reconstructed CT scan of the facet joints in the midcervical region, prior to the second surgery, confirming that the facet joints had not fused.

The patient was brought to the operating room, and general anesthesia was administered along with intravenous antibiotic. The left side of the neck was prepped and draped in the standard fashion, and a liner horizontal incision was effected at the C6 vertebral body level. A left-sided extensile exposure was then performed to expose the previous fusion and the C6–C7 level. The previous plate and screws were removed. A decompression was first performed at the C6–C7 level with removal of the posterior longitudinal ligament and a wide bilateral foraminotomy. To effect the foraminotomy, large portions of the adjacent C6 and C7 endplates were removed. With use of the Bryan Disc Cervical Disc Replacement System (Spinal Dynamics Corp., Mercer Island, WA), a 14-mm prosthesis was then placed in a fashion previously described.[4,5] A smaller C6–C7 prosthesis was placed for two reasons. First, radiographic visualization of this level was difficult at surgery, and oversizing was to be avoided. Second, it was essential to obtain wide foraminal decompression without compromising the bed for the prosthesis, and hence a smaller overall endplate for the prosthetic bed remained. Attention then turned to the C5–C6 level. A solid fusion was present at this level despite the appearance on the preoperative CT and x-ray films. With a high-speed drill, a decompression through the grafted region was effected using fluoroscopic guidance. The posterior longitudinal ligament was found to be intact, and this was excised. Residual osteophyte was noted, causing lateral recess and foraminal stenosis. After a thorough decompression, the segment was mobilized by removing all bone to the uncovertebral joints and then through the placement of an interbody cam distractor that demonstrated movement at this level with no intraoperative evidence of a solid posterior element fusion (Fig. 2). A 15-mm Bryan Disc Prosthesis was placed at this level (Fig. 3). There were no complications with the surgery.

At the completion of the case, the patient awoke with excellent neurologic function and restoration of normal motion in his arms. He was relatively pain-free and discharged 48 hours later without a cervical collar. Postoperative imaging confirmed evidence of motion at the C5–C6 level (Fig. 4). The interspinous distance now increased by 4 mm between flexion and extension at the C5–C6 level. Angulation of the titanium shells between flexion and extension also confirmed movement at the operated level. The Cobb angle now changed from 7° in flexion to 3° degrees in extension, further confirming motion. Eight months postoperatively, the patient was doing well, although the C6–C7 arthroplasty was subsequently converted to a fusion because of persisting arm symptoms thought to be related to excessive movement at this level.

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FIGURE 3. Immediate postoperative lateral radiography, demonstrating the removal of the C5–C6 fusion and placement of arthroplasties after decompression at both the C5–C6 and the C6–C7 levels.

DISCUSSION

Pseudoarthrosis after anterior cervical interbody fusion can occur with the use of allograft rather than autograft, in smokers, in the absence of rigid immobilization in a cervical collar, or with anterior cervical plating. An incidence of between 0% and 50% has been cited in the literature.[6–8] Traditionally, pseudoarthrosis has not been managed by any attempt at remobilization, and typically the fibrous union is accepted or a revision of the fusion is attempted via either anterior or posterior approaches.[8,9] All these surgical endeavors lead to increased rigidity, loss of motion, and possibly increased adjacent segment disease in the future.

Motion in the cervical spine occurs at both the interbody region and the facet joints. Fusion techniques typically aim to stop motion at either one or both of these regions. Loss of motion either anteriorly or posteriorly can lead to subsequent ankylosis at the other motion center. If motion can be reestablished at one motion center and the other center has not ankylosed, functional cervical motion may occur. The assessment of motion used in this study is similar to that used by Goffin et al[4] in their original arthroplasty study, with >2° at the intervertebral disc space in flexion and extension, suggesting motion is present. Cannada et al[10] have also recently described an alternative method to diagnose pseudoarthrosis after spinal fusion. They suggest that if the interspinous distance increases by >2 mm from flexion to extension, motion is present. Calculation of the Cobb angles and interspinous distances between flexion and extension before and after surgery demonstrated that motion was restored in this case at the instrumented level. In this case, the interspinous distance increased by 3 mm after arthroplasty compared with 0 mm before and similarly increased by 4° after arthroplasty, whereas before surgery, there was only a 1° difference between flexion and extension.

The advent of artificial cervical disc prostheses now provides surgeons with an acceptable alternative to address pathologies that previously led to a restriction of motion and exposed patients to risks associated with bone graft harvesting[11–13] or potential disease transmission from allograft.[14] It is important for the surgeon to demonstrate motion at the time of surgery once the discectomy has been performed, and preexisting facet joint disease may lead to a less favorable outcome. Meticulous attention to detail is needed for a good outcome with this technique. In the case of the C6–C7 disc space, undersizing may have led to hypermobility, with resultant clinical failure and the need to later fuse that level. Initial results with myelopathy are encouraging,[5] but again, the long-term implications of arthroplasty in terms of particle debris and other complications and protection from adjacent segment disease are still to be realized. This is, however, the first demonstration of remobilization of a fused intervertebral disc space with an increase in motion achieved at the instrumented level.

CONCLUSION

This case demonstrates the exciting application of the new technique of cervical arthroplasty to restore motion at a level that was previously grafted, instrumented, and fused. It is imperative that preoperatively a lack of fusion of the facet joints be demonstrated on reconstructed CT scanning. Intraoperative demonstration of mobility is essential as the final arbiter in deciding if motion can be re-established. The use of arthroplasty in longstanding fusions is probably not advisable, but in select cases or in the management of pseudoarthrosis,

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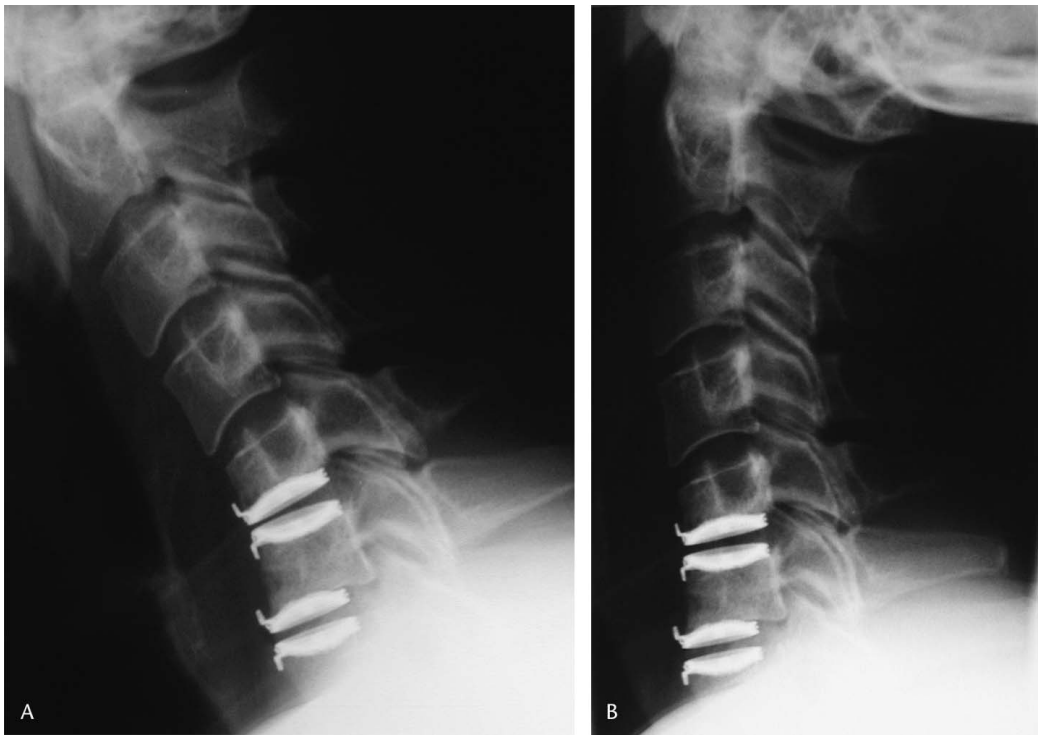

FIGURE 4. A and B, Immediate postoperative dynamic flexion/extension radiographs, confirming >2° of motion at C5–C6 with restoration of motion at this level.

artificial disc placement represents a reasonable alternative to a repeated attempt at fusion. This may then maintain some degree of motion and, it is hoped, prevent subsequent adjacent segment disease.

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