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Cervical arthroplasty for myelopathy adjacent to previous multisegmental fusion

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Abstract

In recent years, there has been increasing interest in the use of cervical arthroplasty for the treatment of degenerative cervical pathology. In its relative infancy, the applications for this technique are still being explored. In this report, we present the use of cervical arthroplasty in the treatment of progressive cervical myelopathy due to adjacent segment disease related to previous multisegmental fusion. © 2008 Elsevier Ltd. All rights reserved.

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1. Introduction

Anterior treatment of cervical pathology has classically involved three principle techniques: anterior cervical disectomy alone, anterior cervical disectomy with fusion, and anterior cervical disectomy and fusion with anterior plating.¹ Despite proven success, the shortcomings of such rigid anterior cervical arthrodesis have led to the development of alternative techniques such as artificial disc replacement.

Cervical arthroplasty for myelopathy has received little attention in the literature. This report demonstrates the use of this technique adjacent to a previous multisegmental fusion in a patient with myelopathy.

2. Case report

A 55-year-old male presented with rapidly progressive cervical myelopathy including limb numbness and paraesthesia, functional decline of his hands, urinary dysfunction and gait dysfunction with multiple falls. Relevant background history includes a C5/6 and C6/7 anterior cervical disectomy and fusion procedure with iliac crest grafting and plating performed 4 years prior to the current presentation. The original fusion was performed for 2-level radiculopathy secondary to degenerative disc disease, and there was initial complete resolution of symptoms. Examination revealed

hyper-reflexic upper extremities and gait spasticity with a sensory level at C4, confirming a myelopathic picture.

Pre-operative X-ray and MRI of the cervical spine are shown in Figs. 1 and 2, respectively. The X-ray confirms a solid fusion from C5 to C7, while the MRI demonstrates significant degenerative disc disease at C4/5 adjacent to the fused segment, with cord signal change. There is also evidence of disc degeneration at the C3/4 level with minor spinal canal impingement.

A decision was made for urgent decompression of the C4/5 level. At operation, the previous anterior plate was identified and removed to precisely “seat” the C4/5 disc prosthesis. The plate and bone overgrowth around the plate was removed to allow accurate anterior placement. Microdisectomy at this level was performed and a PRESTIGE disc replacement (Medtronic, Memphis, TN, USA) inserted. Following surgery, the patient was reviewed at 6 weeks and then at 4 months. He returned to the functional level that he experienced after his initial disectomy and fusion procedure. No operative or hardware complications were identified. Flexion and extension radiographs were obtained at the 6-week mark (Fig. 3). Follow-up MRI at 9 months did not reveal any further deterioration of the C3/4 disc above the disc arthroplasty. On review at 18 months, the patient continued to experience improvement in hand function and sensation, as well as sphincteric control, and no longer required a walking stick to mobilize. Gait spasticity, however, was unchanged.

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Fig. 1. Pre-operative lateral cervical spine X-ray showing previous instrumented fusion procedure from C5 to C7, with resulting solid fusion.



Fig. 2. Pre-operative mid-sagittal T2-weighted MRI showing significant desiccation of the C4/5 disc, with posterior herniation, spinal cord impingement and signal change. These changes are evident to a lesser degree at the C3/4 level.

3. Discussion

This report illustrates one of the unfortunate consequences of a multisegmental fusion procedures – adjacent degenerative disc disease. Mounting evidence suggests that the elimination of mobility at a spinal segment, as seen in the fusion procedure, increases stress at levels adjacent to this segment.² A clinical study by Hilibrand et al. reported

a 2.9% annual incidence of symptomatic adjacent segment disease in patients who underwent anterior cervical decompression and fusion procedures.³

A further study by Goffin et al. demonstrated radiological evidence of adjacent segment degeneration in 92% of cases with a correlation between severity and the time interval since surgery.⁴ They also demonstrated similarity in the progression to adjacent segment degeneration in patients undergoing fusion for trauma or non-traumatic degenerative disease, suggesting that biomechanical factors due to the fusion are important, and not only the natural progression of pre-existing degenerative disc disease.

Cervical arthroplasty has since been used to maintain motion and the biomechanics of the functional spinal segment in order to reduce adjacent segment stresses and recurring degeneration. Postural deformity, autograft morbidity and pseudarthrosis are also avoided and adequate decompression is achieved.

Due to the infancy of the procedure, long-term studies assessing outcomes are not available. However, short-term studies are promising, and suggest that complication rates and efficacy are at least no worse than those for fusion surgery.^{5–7} Multiple authors have published promising early and medium-term results regarding cervical disc prosthesis.^{8,9}

Regarding cervical arthroplasty adjacent to a previous fusion, Wigfield et al. presented a study that enrolled 15 patients with cervical radiculopathy and/or myelopathy, cervical disc herniation or posterior vertebral body osteophytes, and who had had previous adjacent level fusion or degenerative disc disease.¹⁰ Although results were not statistically significant, due to the power of the study, they provided early data on the safety and efficacy of cervical arthroplasty in the setting of previous fusion or concurrent adjacent segment disease.

Sekhon published two series evaluating the use of cervical arthroplasty in the treatment of spinal cord compression due to spondylotic disease or acute disc herniation, with positive outcomes at short-term and medium-term follow-up.^{5,11}

With specific regard to this report, the studies conducted by both Sekhon and Wigfield et al. lend support to the theory that cervical arthroplasty may play a role in the treatment of cervical myelopathy and adjacent segment disease related to previous fusion. A similar case report by Sekhon demonstrated the early success of cervicothoracic junction arthroplasty for adjacent segment degeneration after previous fusion at C5/6 and C6/7.¹²

4. Conclusion

The use of cervical arthroplasty adjacent to a previous fusion is a relatively new concept. Although previously not recommended in the setting of long-standing fusion,⁷ Bryan believes that for select indications, artificial disc arthroplasty can help to reduce the progressive cascade of adjacent segment degeneration. By performing an artificial

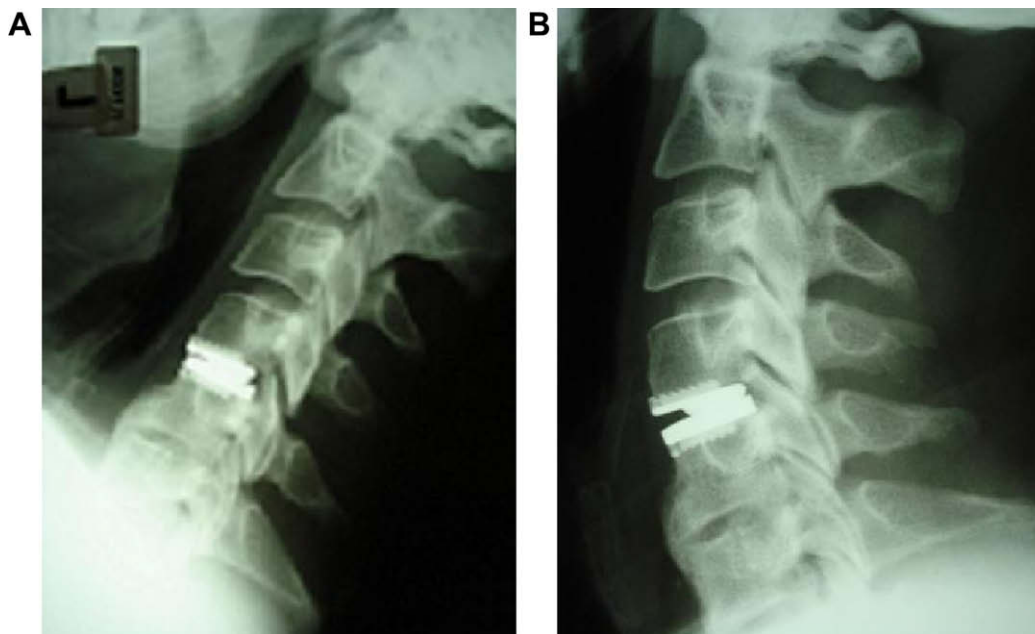


Fig. 3. (A,B) Post-operative dynamic lateral flexion/extension X-rays. The disc prosthesis has restored the physiological movement at C4/5.

disc replacement as opposed to propagating an existing fusion, as in this case, it is hoped that a physiological degree of motion will be retained in this spinal segment and further adjacent segment disease can be prevented. While initial results were overwhelmingly positive for the case presented, longer term follow-up will reveal the true success of this management option.

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Cerebellar haemorrhage associated with persistent primitive trigeminal artery

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