



M6-C cervical disc replacement failure associated with late onset infection

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Abstract: Cervical disc replacements are commonly used to treat degenerative disc disease. We present a case an M6-C disc replacement failure associated with *Propionibacterium acnes* infection three years post implantation.

Keywords: M6-C; cervical disc replacement; infection; failure

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Introduction

Anterior cervical discectomy and fusion (ACDF) has been considered the gold standard for the treatment of degenerative cervical disc disease (1). Recently, cervical disc arthroplasty (CDA) has been developed as an alternative to fusion as they aim to maintain the natural biomechanics of the spine, reducing the risk of adjacent segment degeneration, a known side effect of spinal fusions (1,2). We present the first reported case of a CDA failure in an M6-C cervical disc (Spinal Kinetics, Sunnyvale, CA, USA), associated with an infection presenting three years post-implantation.

Case presentation

Presentation

A 59-year-old male, who was a keen swimmer and surfer, presented with a six-week history of neck pain and left upper limb pain in a C7 distribution, without associated sensory disturbance. Clinical examination revealed positive Spurling sign with subtle weakness of the left triceps and pectoralis with a depressed triceps jerk. MRI cervical spine showed a large left C6/7 paracentral and foraminal disc protrusion with impingement of the C7 nerve root.

Management

The patient was initially managed non-operatively, with oral analgesia supplemented by a left C7 peri-radicular injection. Although temporarily effective, the patient developed worsening radicular pain and left upper limb weakness, prompting the decision to proceed with surgery via a C6/7 disc replacement.

Operation

A routine anterior cervical approach was utilised. A C6/7 discectomy was performed and the posterior longitudinal ligament divided to achieve satisfactory decompression of the thecal sac and C7 nerve roots. Following endplate preparation, a 7×17×14 mm³ M6-C disc replacement was inserted with intraoperative imaging being utilised to ensure appropriate implant positioning.

Post-operative course

Following surgery, the patient reported immediate symptom resolution and had an uncomplicated hospital admission. Follow-up with serial imaging was undertaken at 3, 6 and 12 months post-operation, at which time the patient

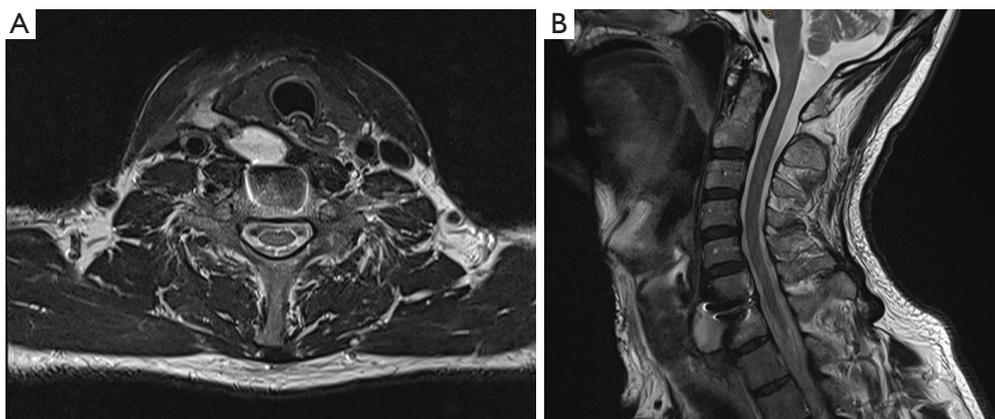
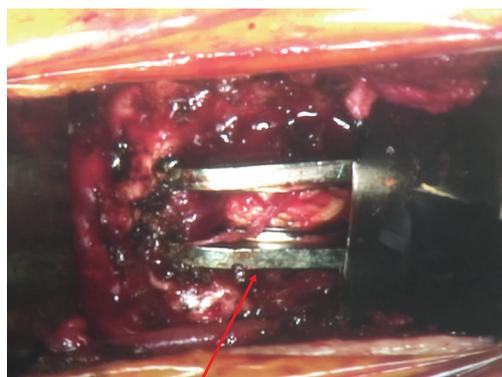


Figure 1 Pre-operative MRI showing prevertebral fluid collection. (A) Axial T2, (B) sagittal T2.



Disintegrated sheath and polyethylene annulus

Figure 2 Intraoperative picture showing M6 implant disintegration.

remained asymptomatic.

Three years post-operatively, the patient presented with one month of dysphagia associated with a palpable neck mass. There were no associated neck or radicular pain or systemic features of infection. CT and MRI cervical spine identified a contrast enhancing right prevertebral collection adjacent to the prosthesis (*Figure 1*). Routine blood tests were unremarkable, with normal white cell count and C-reactive protein. An imaging-guided fine needle aspirate was undertaken for culture, with no organisms identified. Progress imaging showed reaccumulating of this collection and the decision was made to proceed with surgical exploration.

A standard anterior cervical approach via the previous incision was performed revealing encapsulated necrotic

debris. This extended to the disc replacement and appeared contiguous. On inspection of the implant, there appeared to be obvious failure with disintegration of the sheath and polyethylene artificial annulus and exposure of the artificial nucleus (*Figure 2*). The residual prosthesis was removed and the surgical field aggressively debrided and washed. A 9 mm, 9-degree lordotic cage with cadaveric bone was inserted into the disc space. Empirical antibiotics were started following the operation.

Post-operative course was unremarkable with improvement of his dysphagia. Multiple intraoperative swabs grew *Propionibacterium acnes* (*P. acnes*) sensitive to penicillins and moxifloxacin. Intravenous benzylpenicillin and moxifloxacin was continued for six weeks with ongoing amoxicillin. Serial imaging showed no recurrence of the collection and solid bony union (*Figure 3*).

Discussion

CDA surgery has become more popular in its use for degenerative disc disease as an alternative to the gold standard of an ACDF (1). The main benefit of a disc replacement is to provide a device that mimics the natural movements of a native disc preserving the normal biomechanics of the spine and thus avoiding adjacent segment disease (2). The M6-C cervical disc replacement is a novel device composed of a polycarbonate urethane polymeric core surrounded by a polyethylene woven fibre construct that is specifically designed to replicate the anatomical, physiological and biomechanical characteristics of a native disc (3).

Common complications relating to the approach to CDA

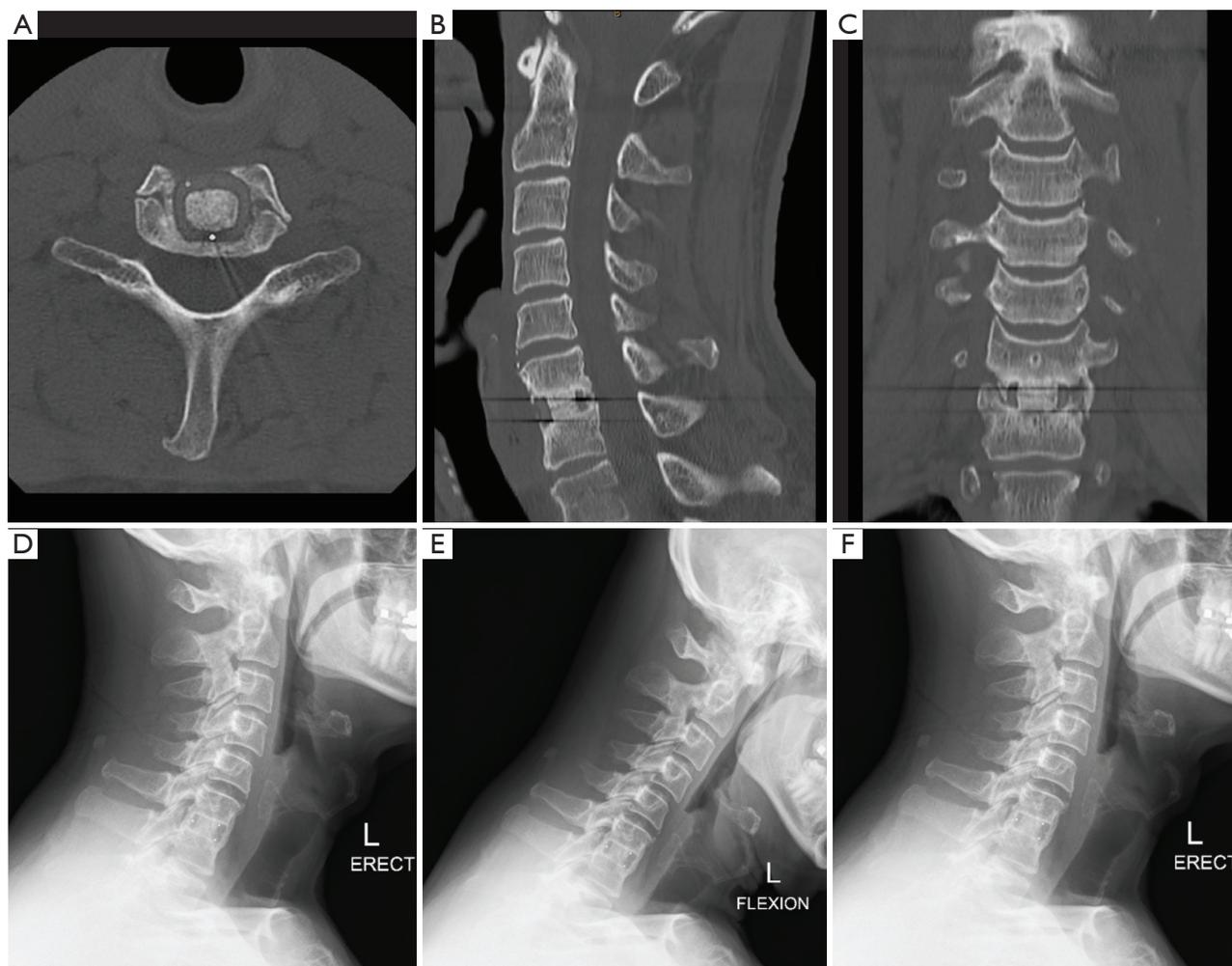


Figure 3 Post-operative CT at seven months showing evidence of bony fusion with the replacement cage implant. (A) Axial, (B) sagittal, (C) coronal. Post-operative XR at 28 months showing solid bony fusion with replacement cage implant. (D) Sagittal neutral, (E) sagittal flexion, (F) sagittal extension.

were similar to that of ACDF (4). These include superficial or deep infections, dysphagia, wound haematoma, epidural haematoma, oesophageal or laryngeal injuries, recurrent laryngeal palsy, dural laceration, cerebrospinal fluid leak, Horner's syndrome, vertebral artery, carotid artery or jugular vein injury and thoracic duct injury (4). Dysphagia and cervical wound infections are the most common with rates reported up to 27.2% and 22.5% respectively (5).

Cervical infections discussed in the literature on common complications of CDA frequently present as superficial skin infection and commonly early in the post-operative period (5). Overall, anterior cervical spine approach operations have low infection rates given the use of blunt dissection in avascular planes avoiding direct muscular

tissue trauma and the extensive lymphatic drainage in the region (6). Our case is unusual due to its delayed presentation. Literature suggests late infections are typically associated with oesophageal perforations, implant migration, Zenker's diverticulum and bacterial seeding from another surgical site or bacteremia (7).

Christiano *et al.* describes a case with a patient who presents with delayed dysphagia with raised white cell count and C-reactive protein and a deep peri-prosthesis abscess two years following an ACDF (8). The patient underwent surgical exploration and *Streptococcus intermedius*, a commensal of the mouth and upper respiratory tract (9), was cultured. In our case, *P. acnes* was isolated suggesting a different source of infection.

It has been hypothesized over the last 15 years that subclinical, chronic *P. acnes*, a common skin commensal, infection within the intervertebral disc space causes disc degeneration and the accompanying chronic lower back pain (10). Animal models have shown a direct correlation of *P. acnes* and disc degeneration (10). Ganko *et al.* published a systematic review and meta-analysis of data correlating *P. acnes* to degenerative disc disease (11). They concluded that the pooled prevalence of disc infection in 602 patients was 36.2% (11) and *P. acnes* was found in the majority of the disc infections accounting for 59.6% (11). Capoor *et al.* also looked at the correlation of *P. acnes* with disc degeneration (10). They found bacterial biofilm detected *in situ* via confocal scanning laser microscopy and this was present within the body of the herniated disc, not on the surface (which would be expected in cases of contamination) (10). *P. acnes* biofilm were also detected by fluorescence *in situ* hybridization (10). This microscopic evidence of a *P. acnes* biofilm supports the notion that there may be an association between chronic disc infection and disc degeneration.

Implant failure following the M6-C cervical disc replacement is infrequently reported. Gradual collapse of the endplate and subsidence has been described in two patients as well as prosthesis loosening in a patient involved in a motor vehicle accident four months post-operation (1). Brenke *et al.* reported a case of the M6-C artificial disc replacement prosthesis which had herniated its core contents causing spinal cord compression and myelopathy (12). No distinctive patient features such as increased mechanical stress was identified and the authors speculated the scenario of fatigue to the surrounding sheath leading to the breakdown (12).

In our case two hypotheses exists. The first is that *P. acnes* was present in the native disc at the time of surgery and an indolent infection produced a prosthesis biofilm leading to destruction of the surrounding sheath and mechanical failure of the prosthesis. The other is that fatigue of the surrounding sheath and mechanical failure of the device occurred first and the fragmented parts led to the infection.

In cases of anterior disc replacements with associated infection, the literature supports explantation of such device followed by a fusion (4). A corpectomy may be necessary if too much bone is removed during the procedure (4). For patients with malalignment or subsidence in the absence of neurological symptoms, another option would be to leave the disc intact and perform a posterior fusion (13). The choice of bone substitute for cervical fusions are variable. A comparison of fusion rates of allograft and autologous

bone graft showed no significant difference in fusion rates for one and two level anterior cervical fusions, although the allograft group did take longer for fusion to occur (14).

Conclusions

CDA is recognized as a good alternative to ACDF. We present an interesting case of a patient with a delayed presentation of dysphagia leading to the discovery of a concurrent *P. acnes* infection and implant failure. Revision surgery with an anterior fusion and long-term antibiotics resulted in resolution of his symptoms and treatment of his infection.

Acknowledgments

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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