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Case Report

Cervical artificial disc extrusion after a paragliding accident

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Abstract

Background: Cervical total disc replacement (TDR) is an established alternative to anterior cervical discectomy and fusion (ACDF) with excellent long-term outcomes and low failure rates. Cases of implant failure and migration are scarce and primarily limited to several years postoperatively. The authors report a case of anterior extrusion of a C4-C5 ProDisc-C (DePuy Synthes, West Chester, PA, USA) cervical artificial disc (CAD) 14 months after placement due to minor trauma.

Case Description: A 33-year-old female who had undergone C4-C5 CAD implantation presented with neck pain and spasm after experiencing a paragliding accident. A 4 mm anterior protrusion of the CAD was seen on x-ray. She underwent removal of the CAD followed by anterior fusion. Other cases of CAD extrusion in the literature are discussed and the device's durability and testing are considered.

Conclusion: Overall, CAD extrusion is a rare event. This case is likely the result of insufficient osseous integration. Patients undergoing cervical TDR should avoid high-risk activities to prevent trauma that could compromise the disc's placement, and future design/research should focus on how to enhance osseous integration at the interface while minimizing excessive heterotopic ossification.

Key Words: Anterior cervical discectomy and fusion, cervical artificial disc, cervical spine trauma, osseous integration, total disc replacement

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INTRODUCTION

Cervical total disc replacement (TDR) is an alternative to anterior cervical discectomy and fusion (ACDF) for the treatment of radiculopathy that has the benefit of preserving motion and still allowing adequate neural decompression. This approach was developed to reduce the incidence of adjacent segment disease (ASD) and eliminate the adverse event of pseudarthrosis that can occur after ACDF. Multiple randomized clinical trials for the treatment of cervical radiculopathy have shown no difference between TDR and ACDF in regard to postoperative pain, disability, and neurological outcomes.[5,6] However, ACDF is associated with a higher rate of ASD and reoperation.[5,14] Long-term outcomes suggest that TDR has a low risk of adverse events such as device failure or migration, return of symptoms, ASD, and need for revision surgery.[4,14] While these results are encouraging, TDR is still a relatively new technique that has been less studied than ACDF. In this report, a case of symptomatic anterior artificial disc extrusion 14 months after cervical TDR with ProDisc-C (DePuy Synthes, West Chester, PA, USA) is presented.

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CASE REPORT

History

On 2/12/2015, a 33-year-old female presented with a 2-year history of posterior neck pain and right C5 radiculopathy that failed conservative therapies. Magnetic resonance imaging (MRI) revealed a large right posterior paracentral and foraminal C4-C5 disc herniation, and the patient underwent resection of the disc and replacement with ProDisc-C (DePuy Synthes, West Chester, PA, USA) without intraoperative complications. [Figure 1]. She was seen at postoperative clinics 2 weeks and then 6 weeks after the surgery. Her symptoms completely resolved at 2 weeks postoperative and she remained asymptomatic at 6 weeks. She refused cervical spine x-ray because she was actively attempting to conceive and wanted to avoid any forms of radiation exposure.

On 4/16/2015, she presented to the clinic with a 2-week history of neck pain and spasms without focal deficits. She had experienced a paragliding accident on 3/29/2015 during which she fell, tumbled, and severely flexed her neck upon landing. Cervical spine X-ray obtained on 4/16/2015 now demonstrated a 4 mm anterior protrusion of the artificial disc [Figure 2]. She underwent revision surgery 2 weeks later.

Revision surgery

Anterior access to the C4-C5 space was obtained through the previous incision and the extruded artificial disc was encountered. After clearing the scar tissue superficial to the disc, the vertebral body distraction pins were inserted rostral and caudal to the disc and expanded. This opened the vertebral body and allowed decompression of the central disc core. The central polyethylene core was separated and removed [Figure 3 and 4 respectively], and then the endplates were removed with an endplate osteotome. Early bone growth was seen posteriorly in the disc space and this was removed with a high-speed drill to reconstitute the endplates. Foraminotomy was performed bilaterally and an interbody device with autograft material from bone shavings was placed and secured at C4-C5 using a ventral plate.

Postoperative course

The patient's postoperative course was unremarkable. At 3-week follow-up she had no focal neurological deficits and all instrumentation was unchanged in position [Figure 5]. She was seen in clinic again at approximately 4 months postoperatively and she endorsed resolution of her neck pain and radiculopathy.

DISCUSSION

Cervical TDR is becoming an increasingly favored approach to treating cervical radiculopathy, and initial

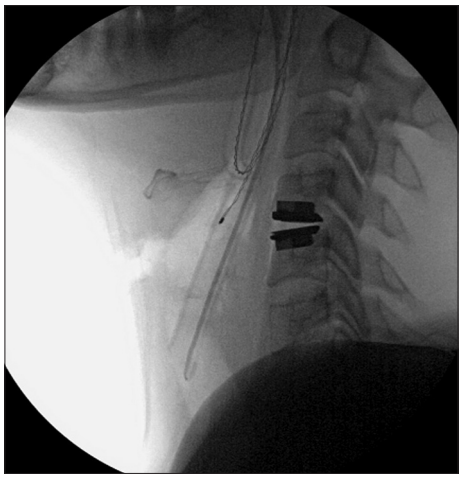

Figure 1: Lateral cervical spine intraoperative X-ray showing good placement of ProDisc-C (Depuy Synthes, West Chester, PA) at initial implantation

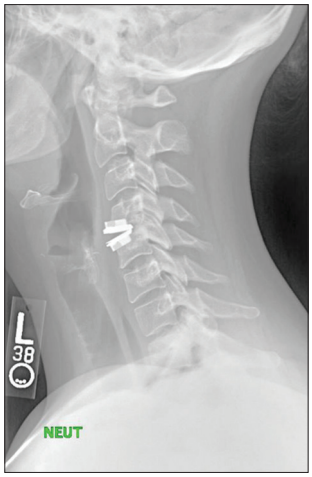

Figure 2: Lateral cervical spine X-ray showing a 4-mm anterior protrusion of the ProDisc-C (DePuy Synthes, West Chester, PA, USA) 2 months after the implantation

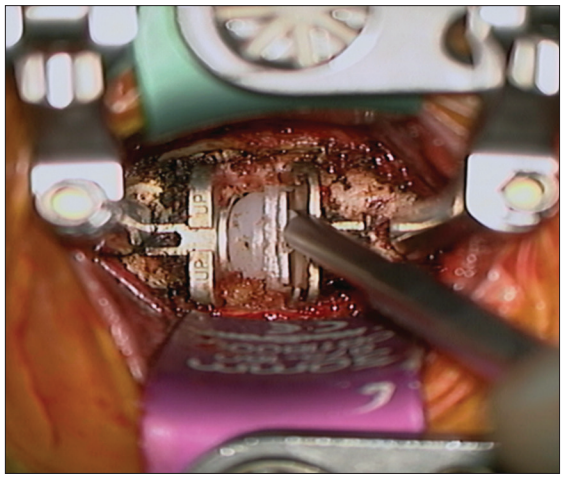

Figure 3: Intraoperative view showing separation of polyethylene core

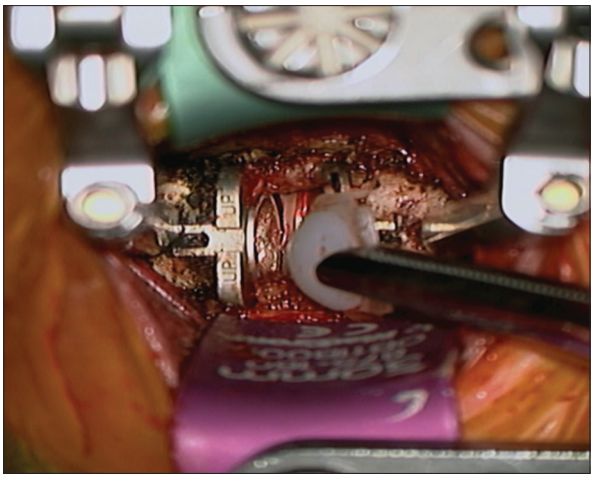

Figure 4: Intraoperative view showing the removal of polyethylene core

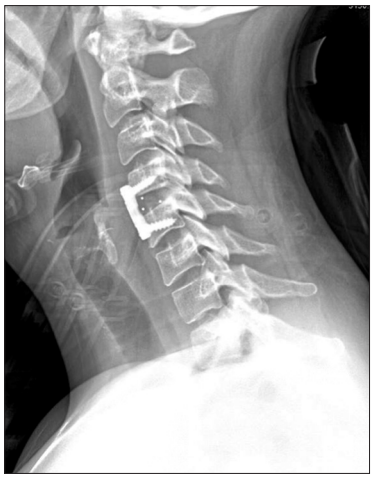

Figure 5: Lateral cervical spine X-ray taken 3 weeks after removal of artificial disc and fusion showing good alignment and placement of the interbody fusion device and ventral plate

results are encouraging.[4,14] One of the proposed advantageous of CAD is that it allows patients to return to work sooner than ACDF.[8,9] There are also military-based studies showing that patients undergoing CAD can return to unrestricted full-active duty 10 weeks after the surgery.[10] Indeed, cervical TDR alleviated our patient's radiculopathy and allowed her to maintain an active lifestyle postoperatively. However, 2 months after the surgery a minor paragliding accident resulted in the anterior protrusion of her CAD implant.

CAD dislocation is a rare event, and documentation is primarily limited to case reports.[1,12] In a 6-year prospective retrieval analysis of 30 ProDisc-C prostheses, five removals were performed due to device migration, and two of these were following trauma.[3] Anterior migration was observed in only one case, and this occurred through atraumatic loosening in a patient with osteoporosis.[3] In the absence of trauma, most cases of CAD dislocation occur several years postoperatively and may be related to wear of the polyethylene component of the prosthesis.

The ProDisc-C TDR consists of a ball and socket design that allows for motion around a fixed center of rotation in the treated segment. It includes anterior-posterior oriented keels on the superior and inferior endplates that allow for stable fixation between both vertebral bodies. We hypothesize that our patient's CAD extrusion was the result of insufficient osseous integration at the titanium keels and end-plate interfaces as the extrusion included the endplates and the inlay. The artificial disc must achieve a fine balance between too much and too little integration. Too much osseous integration will likely result in heterotopic ossification, a well-documented dynamic phenomenon with a reported occurrence rate as high as 64.2%, that can limit motion at the treated segment.[13] Insufficient osseous integration puts the patient at higher risk for implant migration. The difficulty of osseous integration is a well-documented phenomenon in orthopedic literature, where articulating artificial implants (knee, hip, etc.) have been used much more extensively.[7]

Guidelines for the surgical management of artificial disc herniation are not available. We described our approach in detail here. Adequate decompression of the artificial disc core and careful removal is critical to avoid pushing the core posteriorly into the spinal canal and causing neurologic compromise. After core removal, the endplates can be dislodged with osteotomy. Care must be taken to ensure the osteotome does not encroach into the spinal canal during this step. ACDF has been described in other cases of CAD herniation with good results.[1,2,12] We chose to perform ACDF rather than replacing the ProDisc-C after observing ossification on the vertebral endplates intraoperatively. This would have predisposed a replaced CAD to ossification. We also chose ACDF to provide a more secure construct than TDR given the patient's lifestyle.

In summary, this case demonstrates anterior artificial disc extrusion following trauma and the surgical approach to management. This is the first detailed report of anterior extrusion of a ProDisc-C artificial disc. Furthermore, techniques for removal of the ProDisc-C device have not been described previously. The steps we have outlined can be applied to future cases of CAD removal. While cervical TDR has a generally safe adverse effect profile and has been shown in multiple studies to allow earlier return to normal activity, this case serves to emphasize the potential complications even at 2 months postoperatively. To our knowledge, there were no published anterior graft and core migration failure of the Pro-Disc C due to trauma. The uniqueness of the case report is that it occurred in the subacute setting, during a traumatic episode in which there were no fractures.

We believe that this report should be presented as the Pro-Disc C is presented as safe particularly to the athletic patient, in which our case cautions otherwise. Our patient was fortunate that the dislocation was anterior and not posterior into the spinal canal. The degree of osseous integration is an inherent difficult balance for any articulating metallic implant. Future research should focus on ways to maximize ossification at the keel-endplate interface while minimizing excess ossification at the articulating center. Patients undergoing cervical TDR should be counseled to avoid high-risk activities since *in vitro* testing[11] may not account for supraphysiologic loads experienced in trauma.

DISCLOSURE

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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Conflicts of interest

There are no conflicts of interest.

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