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Cervical spine fracture through a cervical disc replacement

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ABSTRACT

INTRODUCTION: We report a rare case of cervical spine trauma through a cervical disc replacement and adjacent multilevel disc fusions. Cervical disc replacement (CDR) is a viable option for the surgical treatment of degenerative disc disease however long term follow up data regarding this operative technique is poor specifically relating to traumatic complications. We know of no previous reports of bilateral cervical pedicle fractures occurring adjacent to CDR and anterior cervical spine instrumentation.
PRESENTATION OF CASE: A 46 year-old with a history of C6C7 CDR and C4-6 anterior cervical decompression and fusion was an unrestrained driver involved in a road traffic accident and suffered bilateral C7 pedicle fractures and a right C6C7 facet joint fracture-subluxation without neurological deficit. Reduction and fixation via a posterior approach achieved a satisfactory alignment and the patient made an uneventful recovery.
DISCUSSION: A significant force coupled with cervical fixation resulted in a bilateral pedicle fracture of the cervical spine with preserved neurological function.
CONCLUSION: The protective role of the CDR has not been previously demonstrated but may have played a role in this case. The authors believe the challenges encountered in the treatment of this patient provide valuable lessons in the management of complex cervical spine trauma in the setting of previous instrumentation.

1. Introduction

Cervical spine trauma in the presence of a cervical disc replacement (CDR) has not been well documented. This device is designed to maintain mobility at the affected level in the cervical spine, thus theoretically lowering the potential for future adjacent segment disease. Trauma to a degenerative cervical spine manifests at a segment of residual mobility or the point under greatest stress from adjacent stiff segments. A cervical pars fracture adjacent to a posterior cervical instrumentation construct has been described in the setting of cervical trauma [1]. Long term traumatic complications related to anterior cervical decompression and fusion (ACDF) or cervical disc replacement are not well reported in the literature.

Unilateral cervical facet fracture dislocation is an uncommon presentation following high velocity road traffic accidents. In addition, bilateral cervical pedicle fractures are rare, with 3 cases being documented in the literature [2–4].

We describe the case of a 46 year old male who suffered a cervical spine injury from a road traffic accident in the presence of both a CDR and adjacent multilevel disc fusions. We discuss the presentation and possible mechanism of this complication as well as the rationale for treatment with posterior cervical spine instrumentation. This work has been reported in line with SCARE criteria [5].

2. Presentation of case

A 46 year-old agricultural contractor was an unrestrained driver travelling in a rally car at 120 km per hour, which flipped and rolled after impact. The front air bag was deployed. On presentation he described left leg weakness, bilateral upper limb paraesthesia, and persistent neck pain. On direct questioning he reported a history of premorbid intermittent neck pain and bilateral upper limb anaesthesia. On examination bilateral upper and lower extremity motor strength was graded 5 of 5 throughout according to the American Spinal Injury Association classification of spinal cord injury [6]. Sensation to light touch and pinprick was intact in all dermatomes. Background history was significant for a C6C7 CDR 10 years previously indicated for cervical radiculopathy with adjacent C4-C6 anterior decompression and fusion 4 years previously for recalcitrant neck-greater-than-arm pain, and quiescent ulcerative colitis.

CT scan revealed a vertical fracture of the posterior aspect of the C7 vertebral body with extension into both pedicles and facet joints causing displacement (Figs. 1–5). Magnetic resonance imaging (MRI) demonstrated an epidural haematoma and cord compression at this level without cord oedema (Fig. 6). There were non-displaced superior endplate fractures of the T1 and T2 verte-

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Fig. 1. Midline sagittal CT image of the cervical spine with evidence of posterior vertebral wall fracture, intra-canal fracture fragments and loss of congruency of the posterior spinal structures.

brae. Significant oedema was noted in the posterior para-spinal soft tissues.

The patient underwent surgery 72 h after his injury. As the patient was stable with no neurological deficit, and was transferred to our hospital during a weekend it was opted to delay surgery until the Monday. At operation direct reduction was achieved. A laminectomy with posterior fusion and lateral mass screw fixation at the C5-T2 levels was performed with posterolateral bone graft (Figs. 7 and 8). Post-operative neurological assessment was unchanged from the patient's baseline assessment and he was discharged after two days in a hard cervical orthosis for 3 months with clinical and radiological follow up at 6 monthly intervals.

The patient went back to manual work 2 months post-operatively, resuming normal function after 3 months. At six month follow up, his visual analogue score was mostly 2/10 with gradual improvement. Residual episodic arm and neck pain resumed as it had done previously. Spinal x-rays with flexion/extension views at 2 years identified good bone healing, satisfactory alignment and no hardware failure (Figs. 9 and 10).

3. Discussion

This case reflects a probable hyperextension-hyperflexion injury to the cervical spine given the history and evidence on imaging. Contribution of the airbag, axial load location, helmet effects, significance of the 2nd or 3rd impacts coupled with an inexact clinical history of the injury from the patient make the pathogenesis of this injury difficult to ascertain. The pedicle fractures were consistent with a compression-hyperextension injury and the anterior endplate fractures coupled with the posterior ligamentous injuries as seen on MRI were consistent with distraction-hyperflexion [7].

The history of a CDR with adjacent segment degeneration and fusion yielded an unusual injury pattern in this case. It can be assumed that auto-fusion gradually occurred across the CDR level with resultant adjacent segment disease and cervical fusion thereafter [8–12]. The fracture occurred at the CDR level as it was the weak point along the entire fusion segment.

Bilateral pedicle fracture of the cervical spine is uncommon with 3 known cases reported in the literature – two cases as a result of high velocity road traffic accidents and one case as a result of low energy axial loading injury [2–4]. In one case of a grossly unstable cervical spine injury following a high velocity road traffic accident, treatment of multilevel bilateral pedicle fractures required stabilisation using a combined anterior followed by posterior approach. The second case of bilateral pedicle fracture following a road traffic accident failed non-operative management with traction necessitating a posterior reduction and stabilisation. In the case of bi-pedicle cervical fracture as a result of low energy trauma, definitive management with hard collar orthosis was successful. These cervical bi-pedicle fractures have been reported with compression extension injuries, and in those cases the disconnection between anterior and posterior elements of the vertebrae widened the spinal canal. While the canal was widened in this injury, fracture fragments from the posterior vertebral wall were displaced into the

Fig. 2. Para-median sagittal CT image of the cervical spine with evidence of facet fracture and entrapment of the inferior facet of C6 with the fractured facet of C7.

Fig. 3. Transverse CT image of the cervical spine revealing a displaced fracture of the posterior part of the C7 vertebral body with extension into the pedicles and base of the left sided superior articular process.

Fig. 4. Transverse CT image of the cervical spine revealing a dislocation of the right facet joint between C6 and C7.

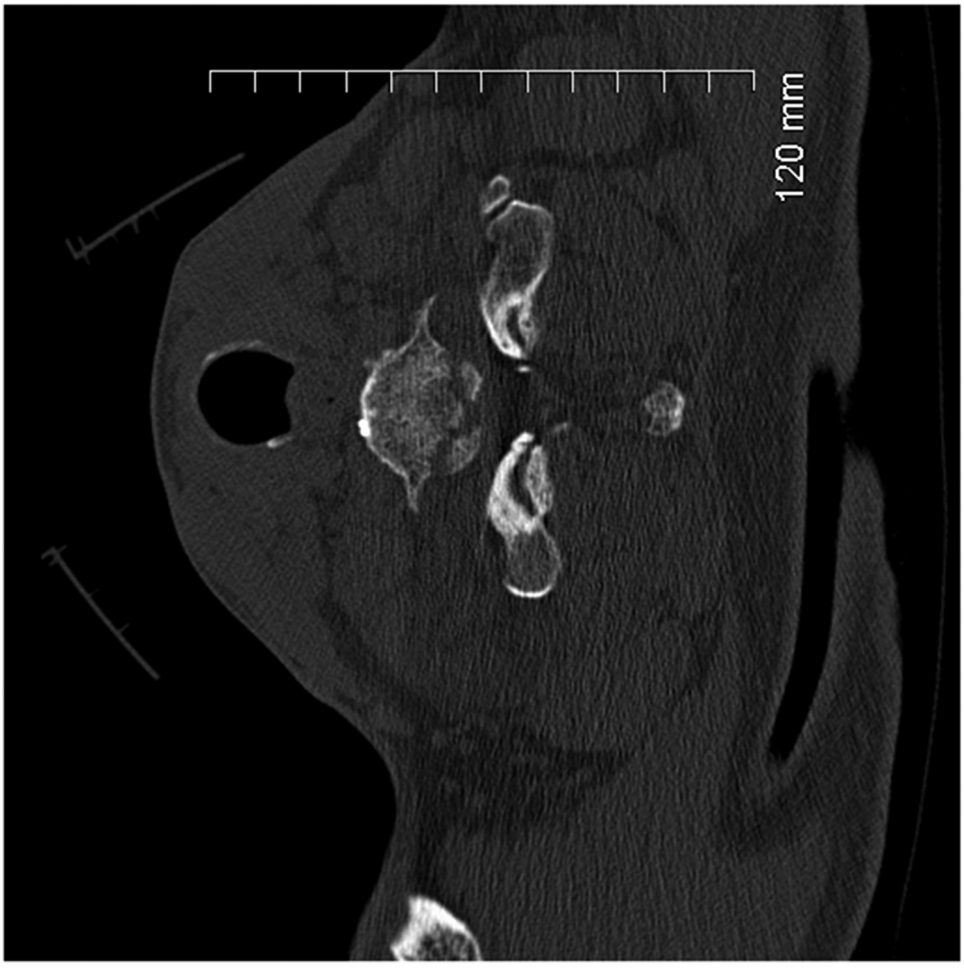


Fig. 5. Posterior wall was not preserved in keeping with unstable spinal fracture. Bone fragments identified within the spinal canal.

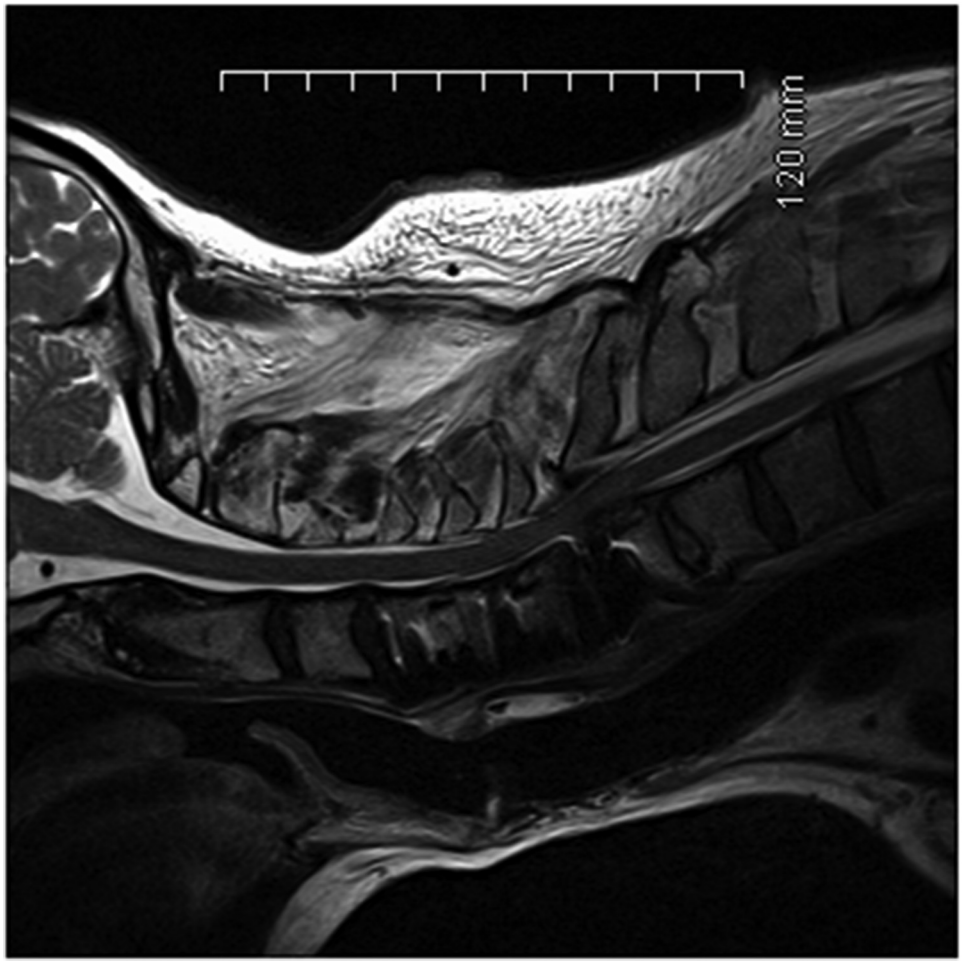
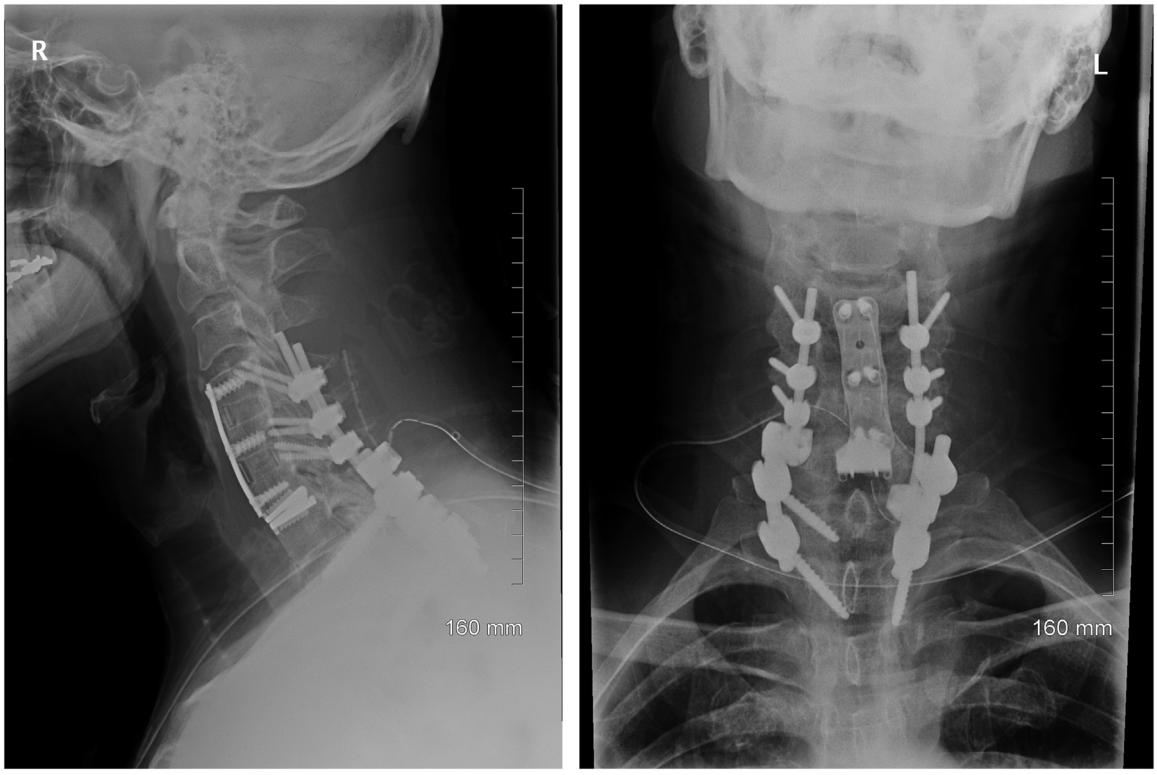
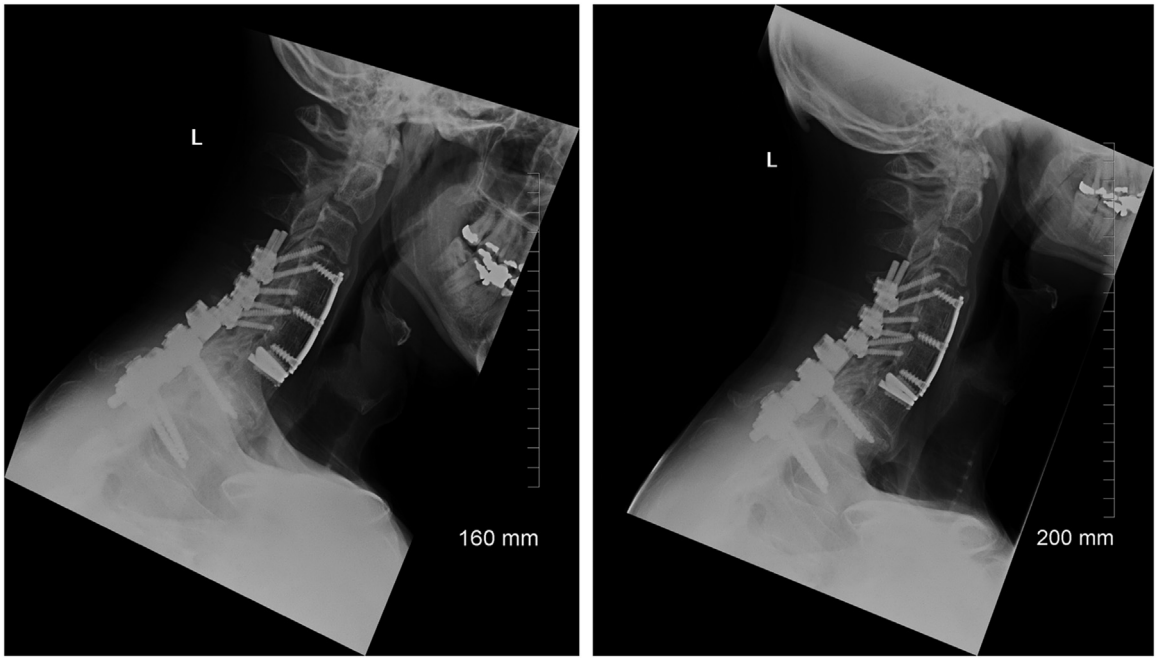


Fig. 6. Dislocation of right C6C7 facet joint, fracture both C7 pedicles with left pedicle fracture fragment retropulsed and medialised, indenting the cervical cord without cord oedema and a small epidural haematoma.



Figs. 7 and 8. Post-operative plain films demonstrate good alignment.



Figs. 9 and 10. Plain films at 2 year follow up identified good bone healing, satisfactory alignment and no hardware failure.

canal, without significant spinal cord injury. Another feature similar to bi-pedicle fracture cases was the vertical coronal vertebral body split. In cases of vertebral fracture in the presence of a CDR, the fracture has alternatively consisted of a sagittal orientation which has been attributed to the sagittal single keel orientation on the CDR [13]. As the CDR in this case has two keels as opposed to one, it may explain this difference. With the anterior compartment fixed across 4 levels, the transmitted forces were maximal across the base of the fixation at C7 and caudal to this. The involvement of T1 and T2 illustrate the anterior, albeit oblique component of the fracture line from the compression-hyperextension injury.

The role of an anterior approach here is debatable. Posterior oedema indicated ligamentous instability mandating posterior instrumentation [14–16]. Laminectomy was felt to decompress the spinal cord given the presence of intra-canal fragments and potential for peri-operative cord compression. Osseous apposition was

evident at the anterior fracture sites. An anterior based approach has long been accepted as the optimal approach for decompressing the cord from potential disc herniation [17], which was not required here. End-plate compression fractures in association with a facet fracture, subluxation, or dislocation display significantly greater potential for instability and are often an indication for anterior-posterior fixation [18]. Pre-operative imaging demonstrated that the CDR was congruent and thus relatively stable at that level. The posterior stabilisation yielded a satisfactory clinical and radiological result.

The protective effect of the CDR in this case is debatable. Like any ball and socket construct, distraction of this prosthesis would have yielded a disengagement of the CDR [19]. Translational elements of the compressive nature of the injury may have been limited by the congruency of the CDR components. In the case of an isolated CDR, the injury level would have depended on the stiffness of adjacent levels. Stiffness at the C5C6 level may have yielded a similar injury pattern. Absence of any adjacent disc degeneration or stiffness would have pre-disposed to a similar injury consistent with hyperextension-hyperflexion. The protective role of the CDR, particularly for those engaging in collision or motor sports has not been demonstrated but may have played a role in this case.

4. Conclusion

This case describes a cervical spine injury in the setting of a CDR and a degenerative neck. It highlights the decompressive nature of bi-pedicle fractures and a satisfactory outcome with posterior stabilisation. We believe that the challenges encountered in the treatment of this patient provide valuable lessons in the management of complex cervical spine trauma in the setting of previous instrumentation.

Conflicts of interest

None.

Funding

None.

Ethical approval

The patient described in this case report has given written consent to permit our institution to publish the details pertaining to the incident and treatment thereafter for educational benefit. For this reason ethical approval was exempted from our institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Michael F. was responsible for data collection, data analysis and writing the paper, Derek C was responsible for study design and Noelle C. was responsible for study concept.

Guarantor

Ms. Noelle Cassidy.

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