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Case Report

A unique approach to fixed occipito-cervico-thoracic deformity

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ABSTRACT

We discuss a unique approach to a patient who presented with severe kyphosis and laterolisthesis of the cranio-cervico-thoracic spine, following a history of neck trauma 24 months prior to presentation. The patient had organized voluntary euthanasia if no treatment could be performed. Our approach included a three-part procedure over a 3-week time interval, including: initial traction, division of anterior neck muscles, multilevel anterior fusion and, finally, posterior occipito-cervico-thoracic fusion. Follow-up at 6 months revealed a patient in neutral sagittal and coronal balance of the neck.

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1. Introduction

Cervico-thoracic kyphosis can develop in association with degenerative processes, systemic disease (ankylosing spondylitis, rheumatoid arthritis), tumour, congenital disorders, post-surgery, and after traumatic injury.¹ The kyphosis can be functionally and emotionally debilitating in terms of pain and progressive neurological deficit, and when severe can present a difficult challenge for surgical correction. We report a female patient with a severe fixed deformity who was treated using a multi-level multi-stage approach.

2. Case Report

We present a 58-year-old woman who attended our institution with a severe fixed kyphosis and “chin-on-chest” deformity (Fig. 1a). In addition, she had a neck tilt with her right ear in contact with her shoulder (Fig. 1b). Her pain was intolerable and she was taking oxycodone (240 mg twice daily) with regular breakthrough medication.

Her background history included a fall down stairs 24 months prior to presentation. She sustained multiple injuries including a Jefferson C1 fracture, right lateral mass and Type-II odontoid fracture of C2, T1/T2 endplate fracture and other peripheral injuries. She was treated in a Miami-J collar and lost to follow-up.

Neurological examination revealed global hyper-reflexia with early myelopathic features of gait and limb function. She was a smoker with a lumbar spine T-score of −1.8 (osteopenia), and was cachectic and malnourished due to swallowing difficulties

and a background of liver cirrhosis. Her current radiology revealed a gross multi-level deformity.

Sagittal CT scan (Fig. 2a) revealed increased atlanto-dental interval, non-union of the odontoid fracture and kyphosis at T1/T2 due to her previous fracture. Coronal CT scan revealed her right occipital condyle resting on the C2/3 facet joint complex with a severe lateral tilt and latero-listhesis secondary to erosion of the right C1 and C2 lateral mass post-trauma. The left occipital condyle was lodged in-between the left C1 lateral mass and the odontoid process (Fig. 2b). Three-dimensional (3D) reconstruction (Fig. 2c) demonstrated the severity of the cranio-cervical deformity.

The patient had organized voluntary euthanasia if no treatment could be performed, as she had been refused treatment at multiple other institutions. She was being cared for by family and friends, and her management could no longer be assisted in the home setting.

Given her end-stage “palliative” presentation, a decision was made to attempt a reduction of the multi-level deformity and fixation. The senior surgeon (RJM) agreed to proceed if the patient undertook a commitment to cease smoking. We adopted a three-stage approach, with 1 week between each stage.

2.1. Stage 1: Cervical traction

The patient was placed in 15 lb (6.8 kg) of Gardner Wells cervical traction for 7 days with significant straightening of her lateral deformity. However, despite the traction, she remained with a lateral neck tilt due to severe contracture of her neck muscles.

2.2. Stage 2: Division of anterior neck muscles and anterior cervical fusion

Complete division of the right sternocleidomastoid and omohyoid muscles was performed with resulting further reduction in

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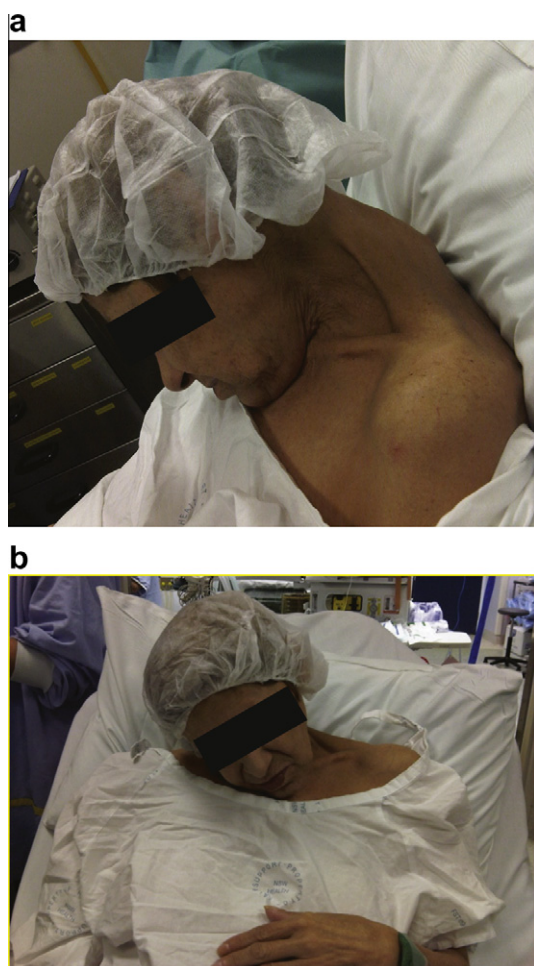


Fig. 1. Pre-operative photographs of a female patient with severe fixed occipito-cervico-thoracic deformity showing: (a) “chin-on-chest” deformity; and (b) neck tilt with her right ear on her shoulder secondary to C1/2 latero-listhesis and displacement of the occipital condyles. (This figure is available in colour at www.sciencedirect.com).

deformity. We attempted to restore the cervical spine lordosis with multi-level anterior cervical fusions from C3 to C7. Four wedge interbody cages and tricalcium phosphate bone graft (Kage RSF, Kasios, France) were placed (Fig. 3a).

2.3. Stage 3: Occipito-cervico-thoracic fusion

The final stage included further deformity reduction with occipital plate fixation (Occipital Cervical Plate, Synthes Spine, West Chester, PA, USA) and C2–T3 fixation (C2–C5 lateral mass fixation, T1–T3 pedicle screw fixation) (MESA, K2 M, Leesburg, VA, USA). Intra-operative reduction was performed for the final position (Fig. 3b).

She was placed in a cervical collar with chest extension for a further 6 weeks post-operatively. Her total hospital stay was 6 weeks, with a significant improvement in pain, swallowing and mobility at discharge.

Six months post procedure, the patient had returned to independent living with neutral sagittal and coronal balance (Fig. 3c).

3. Discussion

Post-traumatic spinal deformity is a potential complication in every instance of spinal trauma, secondary to fracture non-union,

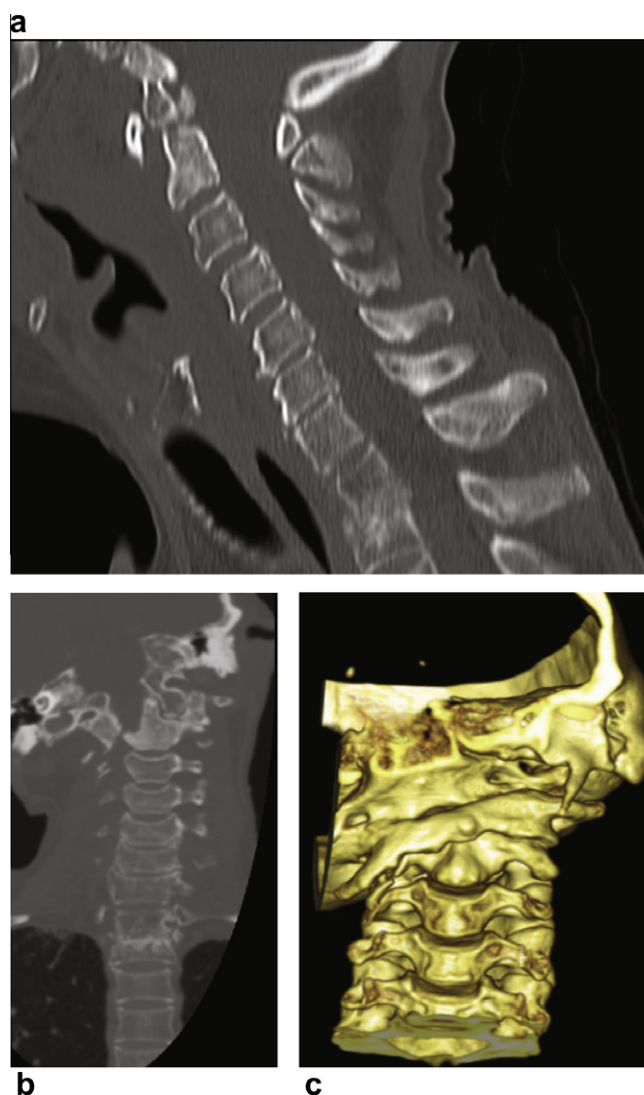


Fig. 2. (a) Sagittal CT scan showing increased atlanto-dental interval, non-union of the odontoid fracture and kyphosis at T1/T2; and (b) coronal CT scan showing severe lateral tilt with the right occipital condyle resting on the C2/3 facet joint complex and latero-listhesis secondary to erosion of the right C1 and C2 lateral mass. The left occipital condyle rests in-between the C1 lateral mass and the odontoid process. (c) Three-dimensional (3D) reconstruction of the CT scan showing the severity of the cranio-cervical deformity. (This figure is available in colour at www.sciencedirect.com).

chronic instability, inadequate or inappropriate initial non-operative treatment and even post-surgery (non-union, implant failure, technical error).² Sagittal plane deformities result in kyphosis and coronal plane deformities lead to scoliosis or latero-listhesis.¹

Spinal deformities, particularly in the cervical spine when severe kyphosis or “chin-on-chest” deformity is present, as in our patient, can lead to significant difficulties with pain, progressive neurological deficit (for example, myelopathy), progressive spinal deformity, and functional impairment. Even with the absence of neurological symptoms, significant functional disability can arise through pain, compromise of horizontal gaze, and difficulty swallowing and breathing.³ Surgical treatment is recommended to minimise progressive deformity and pain, halt or improve neurological deficit, and restore cosmesis and maximum functional ability.²

The chosen surgical approach (anterior, posterior or combined) should take into account the level and severity of coronal and kyphotic deformity, presence of non-union, presence of adjacent

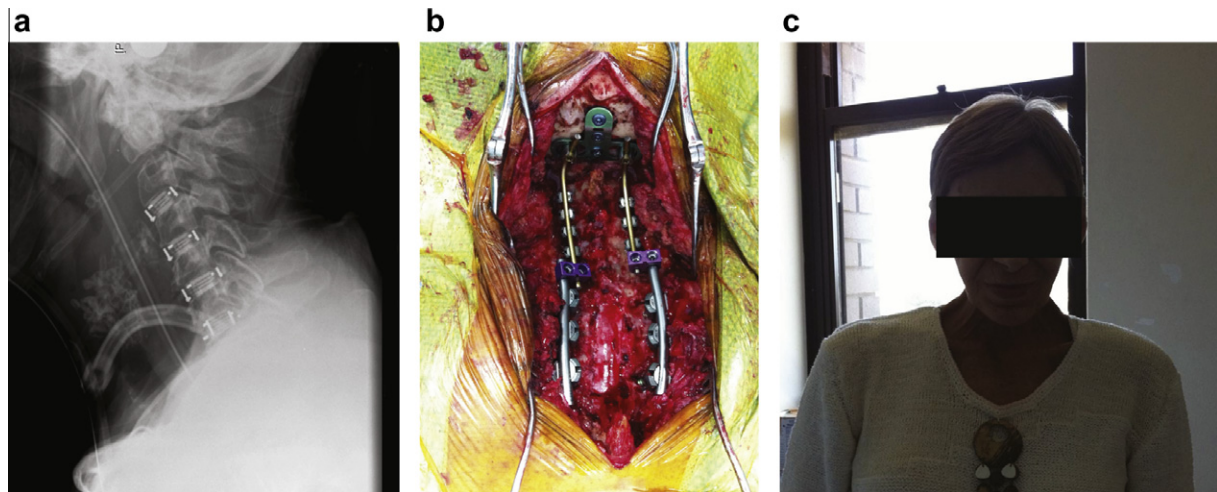


Fig. 3. (a) Post-operative Stage 2 lateral x-ray showing anterior cervical fusion from C3 to C7 and restoration of cervical lordosis; (b) intra-operative photograph of the occipito-cervical plate, C2–C5 lateral mass fixation and T1–T3 pedicle screw fixation; and (c) post-operative photograph at 6 months showing neutral sagittal and coronal balance. (This figure is available in colour at www.sciencedirect.com).

compensatory deformity, as well as individual patient factors such as age and bone quality.⁴

Deformity correction and spinal fusion utilising only the posterior approach via pedicle or lateral mass fixation may be carried out if the deformity is relatively flexible; however, anterior release and anterior column reconstruction (either through segmental decompression and discectomy, or multi-level corpectomy) allows greater manipulation of spinal alignment and improved fusion healing, especially in patients where the deformity is rigid.² Importantly, single approaches in extensive deformity correction can result in excessive stresses on the construct and subsequent construct failure.^{1,2}

In our patient the goal of anterior fixation was to restore cervical lordosis rather than decompress any significant canal stenosis. Lengthening of the anterior spinal column was achieved through placement of multiple anterior interbody cages to create increased anterior column height. Further kyphotic deformity reduction was achieved without using an anterior plate and performing the final correction using posterior instrumentation.

Occipito-cervical instability includes dislocation of the atlanto-occipital joint as well as complex fractures of the occipital condyles, atlas and axis secondary to trauma. Patients may present with neck pain, varying degrees of myelopathy, lower cranial nerve dysfunction, and/or flexion deformities of the occipito-cervical region as in our patient. Posterior fusion of the occiput to the upper cervical spine is also required in irreducible displaced fractures of the atlanto-axial complex or where fusion of the atlanto-axial junction is difficult because of disruption of the atlas and axis. Rigid fixation of the occiput combined with lateral mass fixation provides a secure point of attachment and long-term stability.⁵

Our patient had gross occipito-cervical instability due to complete erosion of the right C1/2 facet and lateral mass, and frank displacement of the bilateral occipital condyles. No instrumenta-

tion was able to be placed at C1 and C2 and the presence of an old T1/T2 fracture with associated kyphosis meant that an extended posterior occipito-cervical-thoracic fusion with fixation points at the occiput, mid-cervical and upper thoracic spine was required.

Here, a combined multi-stage approach was necessary for a deformity of this extreme nature; the coronal deformity in particular required gradual reduction over a longer time due to the chronicity of the deformity and contracture of anterior neck musculature. The degree of deformity reduction would not have been possible with a single-stage approach. However, a multi-stage procedure also involves all the inherent risks of prolonged hospitalisation and multiple anaesthetics.

4. Conclusion

Surgical treatment of any post-traumatic spinal deformity can be challenging and requires intimate knowledge and awareness of normal spine biomechanics to determine the best technique that will provide the patient with the most successful surgical and functional outcome.

References

1. Steinmetz MP, Stewart TJ, Kager CD, et al. Cervical deformity correction. *Neurosurgery* 2007;**60**:S-90–7.
2. Vaccaro AR, Silber JS. Post traumatic spinal deformity. *Spine* 2001;**26**:S111–8.
3. Etame AB, Wang AC, Than KD, et al. Outcomes after surgery for cervical spine deformity- review of the literature. *Neurosurg Focus* 2010;**28**:E14.
4. Munting E. Surgical treatment of post-traumatic kyphosis in the thoracolumbar spine: indications and technical aspects. *Eur Spine J* 2010;**19**:S69–73.
5. Nockels RP, Shaffrey CI, Kanter AS, et al. Occipitocervical fusion with rigid internal fixation: long term follow-up data in 69 patients. *J Neurosurg Spine* 2007;**7**:117–23.