Radiology Case Reports 16 (2021) 3076–3080

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Missed cervical spine subluxation leading to bilateral facet dislocation with severe deformity requiring 360 fixation ☆

Sayed Samed Talibi, MBChB, BSc (Hons), MRCS (Ed), MBA, Specialist trainee in neurosurgery, Jonathan Kyaw Thant, FRCS (SN), Specialist trainee in neurosurgery, Davor Dasic, FRCS (SN), Spinal fellow, Amjad Shad Professor, FRCS (SN), Consultant neurosurgeon*

University Hospitals Coventry and Warwickshire, Warwickshire, UK

ARTICLE INFO

Article history:
Received 20 June 2021
Revised 14 July 2021
Accepted 17 July 2021

Keywords:
Cervical spine fracture
Instability
Radiology
Spinal injury
Subluxation
Trauma

ABSTRACT

A 41 year-old male that presented after a fall downstairs and the initial imaging was misinterpreted, missing a subtle abnormality, C5/6 subluxation. The patient presented later with neck pain and further imaging demonstrated bilateral facet dislocation with severe deformity requiring 360 spinal fixation.

Case study

A 41 year-old, right handed patient fell down a flight of stairs (12 steps) in December 2019. He had a loss of consciousness and unable to recall the duration. Paramedics were called and he was taken to the local A&E. On examination he was neurologically intact only reporting neck stiffness. He underwent a CT trauma series and it was misreported with no an acute cervical spine bony injury (Figs. 1A, B and C). The initial CT (Fig. 1) on retrospective review however illustrated posterior widening of the C5/6 disk space and mild but definite splaying of the spinous processes at the same level, indicative of a hyperflexion injury. There is subtle but definite kyphotic malalignment. The facets on the left are abnormal (Fig. 1B).

On discharge he complained of persisting neck pain and pain radiating to his arms without any motor or sensory disturbance. His general practitioner organized a neurophysi-

☆ Competing Interests: None

* Corresponding author.
E-mail addresses: samedtalibi@nhs.net (S.S. Talibi), amjad.shad@uhcw.nhs.uk (A. Shad Professor).

https://doi.org/10.1016/j.radcr.2021.07.036

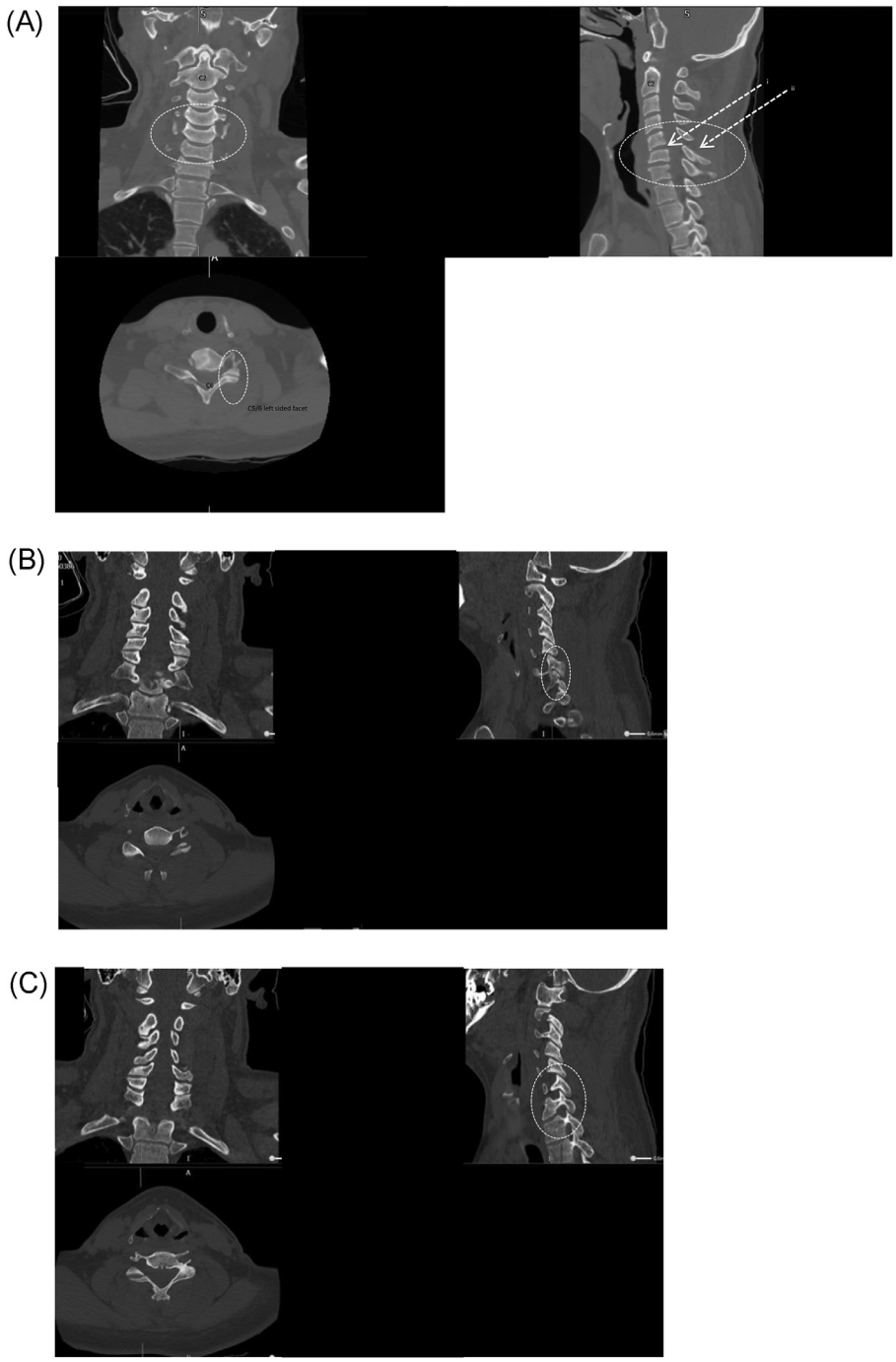

Fig. 1 – (A) Admission (December 2019) CT trauma of cervical spine (coronal, sagittal, axial) – (1) posterior widening of the C5/6 disk space, (2) mild slaying of the spinous process and subtle kyphotic malalignment. (B) Admission (December 2019) – left sided facets (C) Admission (December 2019) – right sided facets.

ology assessment in the February 2020, and a CT (Fig. 2A) and MRI (Fig. 2B) scan of the cervical spine. The patient eventually was called for his CT and MRI in May 2020, illustrating a C5/6 subluxation with bilateral facet dislocation causing canal stenosis although no cord injury (Figs 2A and B).

An examination by spinal surgical team did not demonstrate any neurological deficit; there were no features of an upper motor neuron lesion. A further CT angiogram illustrated also that both vertebral arteries were stretched at the level of anterolisthesis but remained patent.

The patient was further counselled that unless he underwent surgery, there was a risk of further deformity and subluxation, a resultant spinal cord injury which can result in paral-

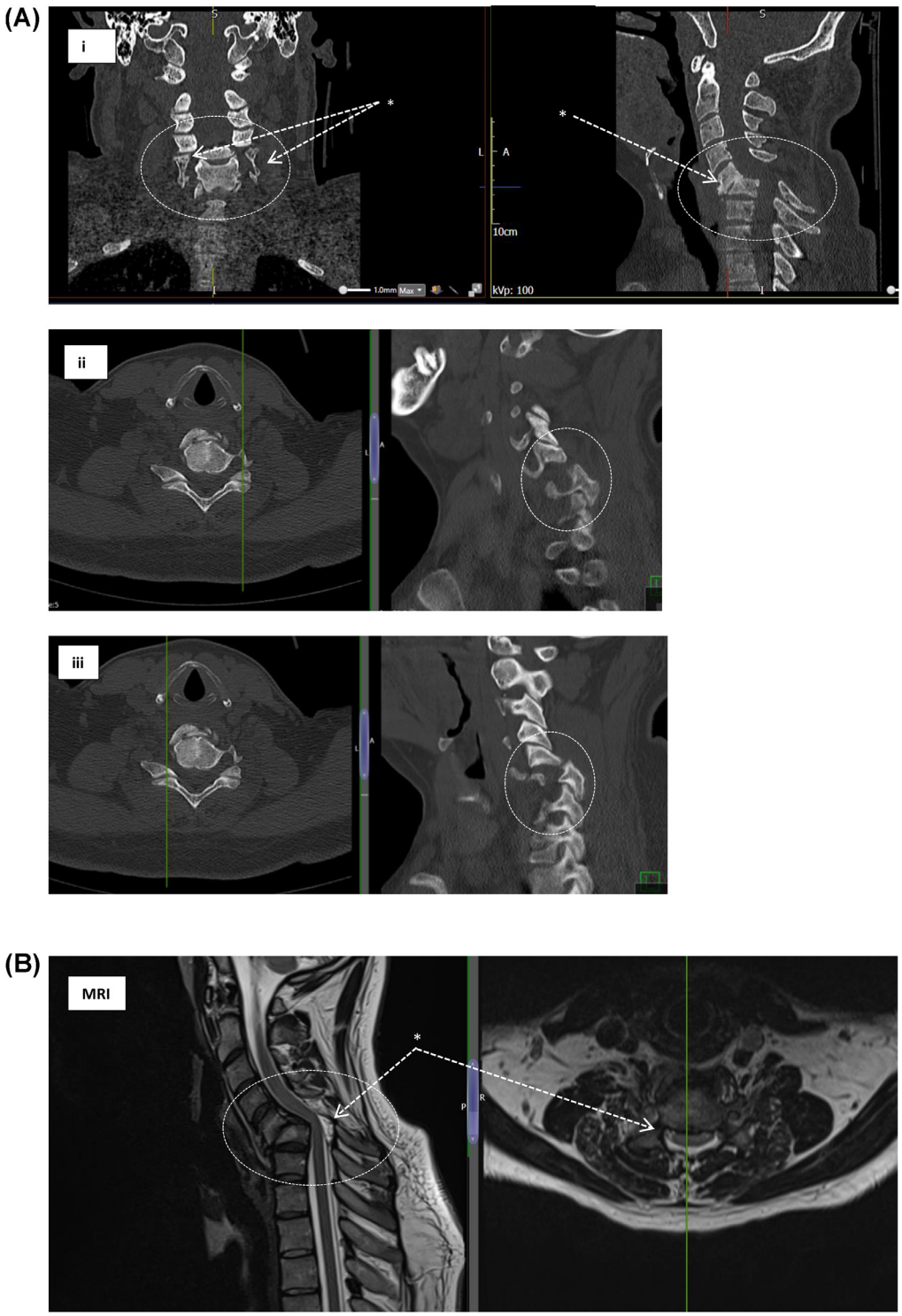

Fig. 2 – (A) Admitting (May 2020) CT cervical spine – (1) (*) midline coronal & sagittal slices, (2) left sided facets at C5/6, and (3) right sided facets at C5/6 (axial and sagittal cuts). (B) Admitting (May 2020) MRI cervical spine – (*) evidence of cord compression on the MRI.

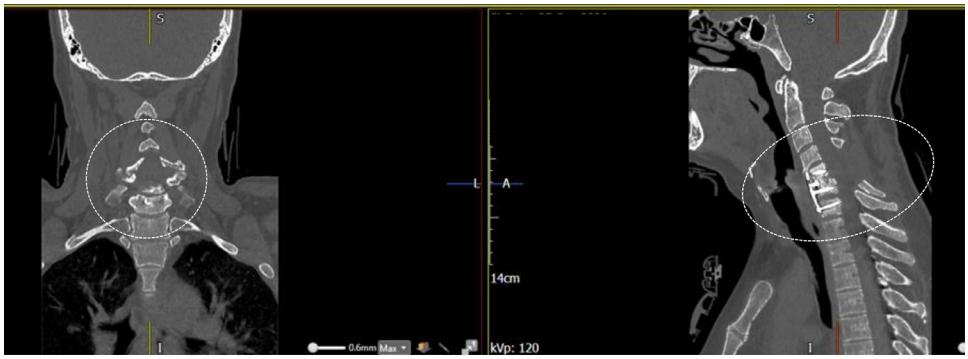

Fig. 3 – Deformity correction illustrated by the post-operative imaging (May 2020) – posterior cervical laminectomy, decompression and release of facet dislocation followed by C5/6 anterior cervical discectomy, partial C6 corpectomy with cage insertion and anterior plating C5 to C7.

ysis of arms and legs, loss of bladder and bowel control and sexual dysfunction.

He subsequently underwent a posterior cervical decompression and release, C5/6 anterior cervical discectomy and fusion with cage, partial C6 corpectomy and anterior plating of C5 to C7 with intraoperative neurophysiological monitoring. His post-operative imaging was satisfactory, and his pain resolved with no deficits (Fig. 3).

Discussion

The accurate diagnosis of cervical spine fractures remains a significant concern when evaluating trauma patients in emergency departments. The incidence of cervical spine injury is in the range of 2%-4% and in the obtunded patient rising to 34.4% [1,2]. In the UK this would be proportion of more than 1200 new spinal cord injuries per year. The morbidity attached is significant and long-term, with the economic mean cost of £1.12 million (median £0.72 million) per case of spinal cord injury [3]. The economic cost of spinal cord injury in the UK is £1.43 billion adding to the already £212 billion cost of delivering health and social care [4-7]. This economic calculation does not include the potential medicolegal fallout from claims made for a missed spinal cord injury and devastating sequalae of paralysis [8].

In the case report the initial imaging was misinterpreted and the patient later reported neck pain. Further imaging demonstrated bilateral dislocation with severe deformity requiring anterior and posterior fixation and left untreated patient the consequences would be catastrophic.

In the asymptomatic patient, level 1 evidence supports clearance based on clinical examination and imaging is not required. The Canadian C-spine Rule (CCR) was developed as a tool to prevent missing C-spine injuries and limiting radiation exposure from unnecessary examination. If there is any suspicion of cervical spine injury, it is important to immobilize the spine during assessment to prevent any damage. The continuation of immobilization may however unnecessarily lead to adverse effects including discomfort or skin ulceration [9].

The more complex patient presentations or having an altered level of consciousness are offered CT as it provides a quick and efficient method to identify fractures including non-displaced type. The NICE has provided emergency departments with a clear guideline in the early management of major trauma [10]. The purpose is to reduce deaths and disabilities in people with serious injuries by improving the quality of their immediate care. The standardized use of cervical spine CT has been proven to be cost-effective especially if other organ systems are also imaged [11,12].

A cervical spine CT has been calculated to have a sensitivity of 94%, specificity of 99.5% in detecting cervical spine injuries, with an overall negative predictive value (NPV) of 99.5% and a positive predictive value (PPV) and sensitivity was 93.7% [13,14]. MRI in spite of its wide availability and access is not indicated for primary clearance, only useful where there is neurological deficit present. It has a greater negative predictive value approaching 100% although its positive predictive value is less impressive compared to CT [15,16]. It is important to quantify that the discrepancy rates for interpretation of spinal CTs is (0.7%; 95% CI: 0.2%, 2.7%), lower for CT cervical spine at 0.30% [17,18]. The NICE guidelines provide a clear instruction and pathway for the initial management of major trauma including the indication for imaging if in the high-risk category [19].

There is no clear description of how facet subluxation should be managed, rather it is grouped into the broad category of facet fractures. The therapeutic options include early functional conservative management with external immobilization using a cervical collar with different degrees of rigidity, halo vest immobilization as well as anterior and/or posterior stabilization with decompression if indicated [20,21].

A patient with spinal cord injury associated with facet dislocation tend to present with a more severe degree of initial injury and later display less potential for motor recovery at one-year follow-up [9].

There is still yet potential to improve diagnostic performance and reduce harm by identifying and learning from these errors. Diagnostic errors are predictable events with readily identifiable contributing factors [18]. The value proposition here is to incorporate a systemic methodology for inter-

preting cervical spine CT's in a similar way to cervical spine radiography to reduce the interobserver bias [22,23].

Conclusion

The availability of CT imaging has superseded plain radiography by providing more accurate and rapid assessment of the cervical spine. The case report emphases proper interpretation is crucial to avert the rare instances injuries are be missed. The assessment of the imaging must be systematic and adequate, as any misinterpretation even of subtle abnormalities can place the patient at risk of catastrophic consequences.

Patient consent

The patient has kindly consented for the case report – evidenced with a signed form.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2021.07.036.

REFERENCES

[1] Grossman MD, Reilly PM, Gillett Tracy BS, Gillett D. National survey of the incidence of cervical spine injury and approach to cervical spine clearance in U.S trauma centers. J Trauma 1999;47:684.

[2] Berne JD, Velmahos GC, El-Tawil Q, Demetriades D, Asensio M, James A. Value of complete cervical helical computed tomographic scanning in identifying cervical spine injury in the unevaluable blunt trauma patient with multiple injuries: a prospective study. J Trauma 1999;47:896–903.

[3] McDaid D, Park AL, Gall A. Understanding and modelling the economic impact of spinal cord injuries in the United Kingdom. Spinal Cord 2019;57:778–88.

[4] Available at: https://www.wrighthassall.co.uk/expertise/neck-injury-compensation [Accessed 1st May 2021], 2020.

[5] Available at: https://www.duncanlewis.co.uk/Legal_News/NHS_pays_millions_in_compensation_for_failing_to_identify_broken_bones_(10_May_2017).html [Accessed 1st May 2021], 2020.

[6] Available at: https://www.legalexpert.co.uk/compensation-amounts/100000-compensation-for-a-broken-neck-injury. [Accessed 1st May 2021], 2020.

[7] Available at: https://www.kingsfund.org.uk/projects/nhs-in-a-nutshell/nhs-budget [Accessed 1st May 2021], 2020.

[8] Mukherjee S, Pringle C, Crocker M. A nine-year review of medicolegal claims in neurosurgery. Ann R Coll Surg Engl 2014;96(4):266–70.

[9] Wilson JR, Vaccaro A, Harrop JS, Aarabi B, Shaffrey C, Dvorak M, et al. The impact of facet dislocation on clinical outcomes after cervical spinal cord injury: results of a multicenter North American prospective cohort study. Spine 2013;15:97–103 (Phila Pa 1976)38(2).

[10] Available at: https://www.nice.org.uk/guidance/ng39 [Accessed 1st May 2021], 2020.

[11] McCulloch PT, France J, Jones DL. Helical computed tomography alone compared with plain radiographs with adjunct computed tomography to evaluate the cervical spine after high-energy trauma. J of Bone and Joint Surg 2005;87:2388–94.

[12] Grogan EL, Morris JA Jr, Dittus RS. Cervical spine evaluation in urban trauma centers: lowering institutional costs and complications through helical CT scan. J of Am Coll of Surg 2005;200:160–5.

[13] Bush L, Brookshire R, Roche B. Evaluation of cervical spine clearance by computed tomographic Scan alone in intoxicated patients with blunt trauma. JAMA Surg 2016;151(9):807–13.

[14] Martin MJ, Bush LD, Inaba K, Byerly S, Schreiber M, Peck KA, et al. WTA C-Spine Study Group. Cervical spine evaluation and clearance in the intoxicated patient: a prospective Western Trauma Association Multi-Institutional Trial and Survey. J of Trauma Acute Care Surg 2017;83(6):1032–40.

[15] Vaccaro AR, Kreidl KO, Pan W, Cotler JM, Schweitzer ME. Usefulness of MRI in isolated upper cervical spine fractures in adults. J Spinal Disord 1998;11:289–93.

[16] Muchow RD, Resnick DK, Abdel MP, Munoz A, Anderson PA. Magnetic resonance imaging (MRI) in the clearance of the cervical spine in blunt trauma: a meta-analysis. J Trauma 2008;64:179–89.

[17] Wu MZ, McInnes MD, Macdonald DB, Kielar AZ, Duigenan S. CT in adults: systematic review and meta-analysis of interpretation discrepancy rates. Radiology 2014;270(3):717–35.

[18] Itri J.N., Tappounin R.R., McEachern R.O., Pesch A.J., Patel S.H. Fundamentals of diagnostic error in imaging radiographics. 2018 38 :6, 1845-1865

[19] Available at: https://www.nice.org.uk/guidance/ng41/evidence/full-guideline-2358425776 [Accessed 1st May 2021], 2020.

[20] Schleicher P, Pingel A, Kandziora F. Safe management of acute cervical spine injuries. EFORT Open Reviews 2018;3(5):347–57.

[21] Del Curto D, Tamaoki MJ, Martins DE, Puertas EB, Belloti JC. Surgical approaches for cervical spine facet dislocations in adults. Cochrane Database Syst Rev 2014(10) CD008129.

[22] Matthew R, Skalski MR, Matcuk GR Jr, Gibbs WB. The art of interpreting cervical spine radiographs. Radiographics 2019;39(3):820–1.

[23] Coats AC, Nies SN, Rispler D. Cervical spine computed tomography imaging artifact affecting clinical decision-making in the traumatized patient. The Open Orthop J 2014;8:372–4.