



Case Report

Contemporaneous avulsion fractures of the inferior clivus and bilateral occipital condyles with injury of the tectorial membrane

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ABSTRACT

Background: Craniocervical junction (CCJ) injuries are highly variable, and there are only limited data to suggest their optimal treatment. Here, we present a rare case of concomitant bilateral occipital condyle fractures with an inferior clival avulsion fracture with concomitant focal injury of the tectorial membrane.

Case Description: Following a motor vehicle accident, a 51-year-old female sustained multiple orthopedic and soft tissue injuries. The cervical computed tomography (CT) showed a bilateral occipital condyle avulsion fractures with an avulsion of the inferior clivus. The cervical magnetic resonance imaging additionally demonstrated focal injury to the tectorial membrane with edema of both atlanto-occipital joints. Although the patient was neurologically intact, the CCJ instability warranted an emergent occiput-C2 (O-C2) posterior instrumented arthrodesis using the modular (multiple piece) occipitocervical (OC) plates/rods. The surgery was uneventful, and the patient remained neurologically intact. The 3-month follow-up cervical X-ray demonstrated continued stability/bony fusion.

Conclusion: Bilateral condyle fractures with a concomitant inferior clivus fracture are rare, and there is no known optimal strategy. Here, in an intact patient, instability of the CCJ warranted an O-C2 fusion.

Keywords: Clivus, Fracture, Fusion, Ligaments, Occipital condyle, Trauma

INTRODUCTION

Unilateral or bilateral fractures of the occipital condyles with or without the involvement of the inferior clivus are uncommon and are challenging to treat.^[1-3,5,7,12] This type of injury can be highly unstable due to the involvement of the atlanto-occipital joint (AOJ) and ligaments that stabilize the craniocervical junction (CCJ).^[2,3,7,12]

Here, we present a case of contemporaneous avulsion fractures of the inferior clivus and bilateral occipital condyles with focal tectorial membrane injury successfully treated with occipitocervical occiput-C2 (O-C2) fusion.

CASE REPORT

Following a motor vehicle accident, a 51-year-old female who presented neurologically intact with cervical magnetic resonance/computed tomography (CT) documented bilateral avulsion

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fractures of the occipital condyles (type III) and fracture of the inferior clivus [Figures 1-3]. The cervical magnetic resonance imaging (MRI) further showed a diffuse T2 signal involving the ligaments of the CCJ and AOJ with a focal tear of the tectorial membrane [Figure 4]. Due to instability of the CCJ, the patient underwent an O-C2 posterior cervical instrumented arthrodesis using a modular (multiple piece) OC plate-rod construct [Figures 5 and 6]. Postoperatively, the patient remained intact and the cervical X-rays 3 months later confirmed adequate fusion [Figure 7].

DISCUSSION

The CCJ has multiple ligaments that provide support and stability.^[6] Bilateral occipital condyle fractures with a concomitant inferior clivus fracture are extremely rare and the mechanism of injury is controversial; for example, some authors suggest a hyperflexion or hyperextension injury with distraction and axial rotation resulting in an avulsion fracture at the site of

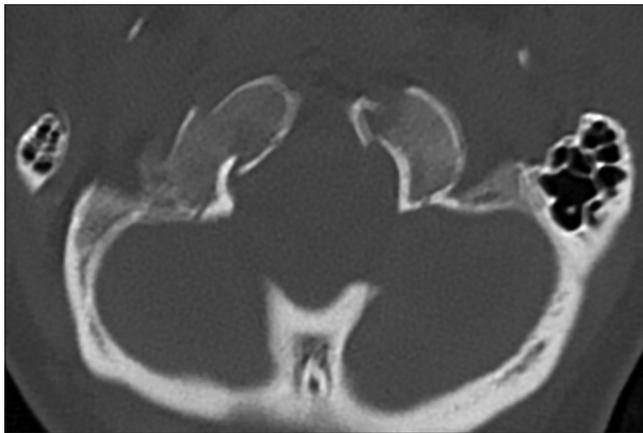


Figure 1: Computed tomography cervical spine (axial view) shows the bilateral occipital condyle fractures.

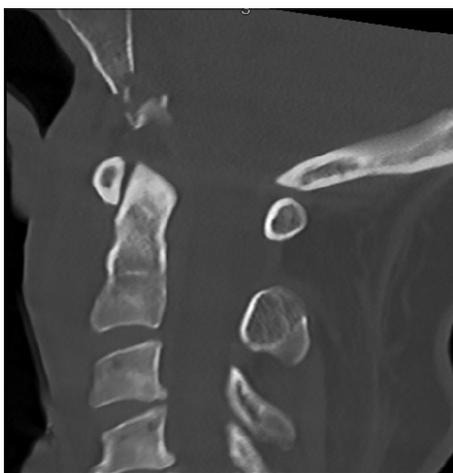


Figure 2: Computed tomography cervical spine (mid-sagittal view) shows the inferior clivus fracture.

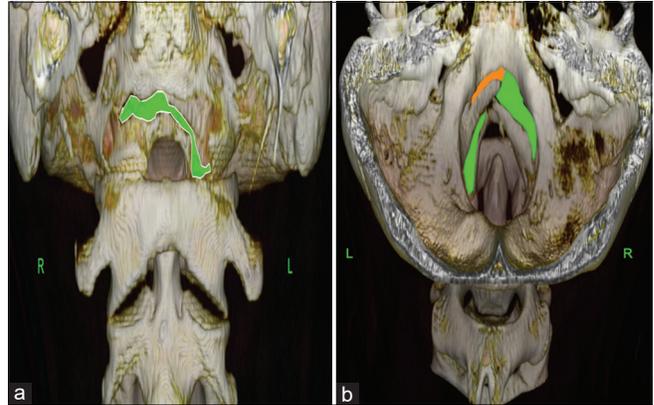


Figure 3: Three-dimensional reconstruction of the cervical spine that shows (a) anterior view of the CCJ fractures and (b) posterior view of the CCJ fractures.

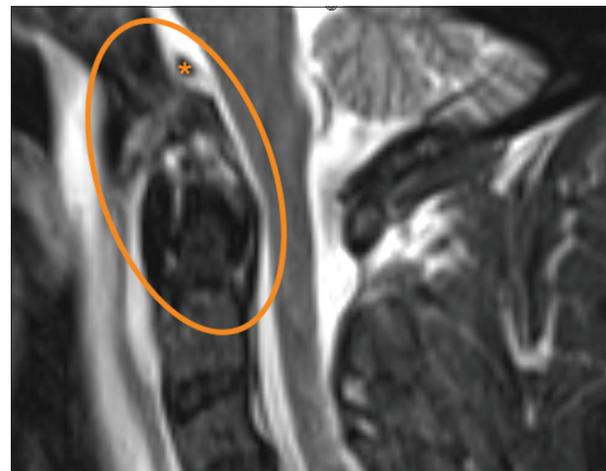


Figure 4: Magnetic resonance imaging cervical spine (mid-sagittal view) shows signs of injury to the ligamentous complex at the craniocervical junction (oval figure). It also shows a focal tear in the tectorial membrane (asterisk).

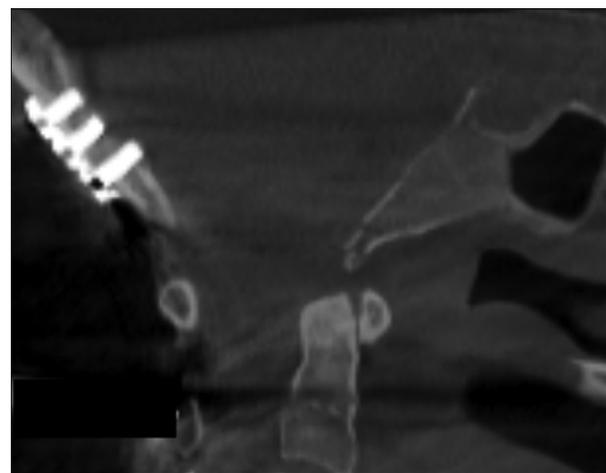


Figure 5: Postoperative computed tomography cervical spine (mid-sagittal view) shows reduction of the inferior clivus fracture.

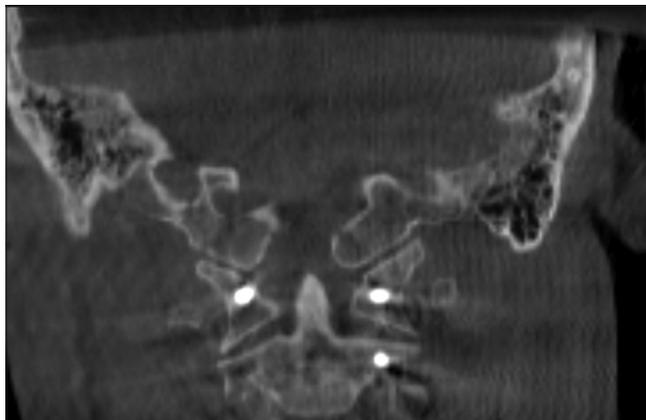


Figure 6: Postoperative computed tomography cervical spine (coronal view) shows reduction of both occipital condyle fractures.



Figure 7: Postoperative (3 months) X-ray cervical spine (lateral view) shows stable instrumentation and bony fusion.

attachment of alar ligaments and tectorial membrane.^[4,9] Dashti *et al.*^[2] proposed that pure axial loading and compression could lead to impaction of both occipital condyles and the clivus, leading to their fracture and displacement.

Radiological analysis

Isolated fractures with/without ligamentous injury can lead to instability of the CCJ and subsequently devastating vascular and/or neurologic complications. To assess both components, it is important to obtain an initial cervical CT and CT angiogram followed by a cervical MRI. Of note, 72 h after an injury, the tissue edema decreases, and ligamentous injury can be missed on MRI.^[2,3,5-12]

Surgical considerations

There are not enough data to guide the selection between surgical and nonsurgical treatment for these injuries.

Maughan *et al.*^[7] reported a case of bilateral occipital condyle fracture with a concomitant inferior clivus fracture that was treated with occiput-C1 fusion; this resulted in good outcomes. Dashti *et al.*^[2] reported a similar fracture pattern with an injury of the atlanto-occipital membrane, treated with a halo for 12 weeks with adequate results. Further, Tanabe *et al.*^[9] reported an injury of the tectorial membrane managed with a halo for 16 weeks also with good results. In our case, our patient with a CCJ injury characterized by bilateral condylar avulsion fractures and a tectorial membrane injury, the patient warranted a posterior O-C2 fusion.

CONCLUSION

Bilateral occipital condyle fractures with inferior clivus fractures are rare, and there is no definitive treatment algorithm for these simultaneous lesions. Here, our patient with these multiple injuries and CCJ instability warranted an O-C2 fusion.

Declaration of patient consent

A patient consent was not obtained as this case report is retrospective in nature with no identifying information patient consent is not needed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Anderson PA, Montesano PX. Morphology and treatment of occipital condyle fractures. *Spine (Phila Pa 1976)* 1988;13:731-6.
2. Dashti R, Ulu MO, Albayram S, Aydin S, Ulusoy L, Hanci M. Concomitant fracture of bilateral occipital condyle and inferior clivus: What is the mechanism of injury? *Eur Spine J* 2007;16 Suppl 3:261-4.
3. Evers JJ, Vieth VV, Hartensuer RR, Raschke MM, Vordemvenne TT. Management of an extended clivus fracture: A case report. *BMC Res Notes* 2013;6:554.
4. Jones DN, Knox AM, Sage MR. Traumatic avulsion fracture of the occipital condyles and clivus with associated unilateral atlantooccipital distraction. *AJNR Am J Neuroradiol* 1990;11:1181-3.
5. Krüger A, Oberkircher L, Frangen T, Ruchholtz S, Kühne C, Junge A. Fractures of the occipital condyle clinical spectrum and course in eight patients. *J Craniovertebr Junction Spine* 2013;4:49-55.
6. Lopez AJ, Scheer JK, Leibl KE, Smith ZA, Dlouhy BJ, Dahdaleh NS. Anatomy and biomechanics of the craniovertebral junction. *Neurosurg Focus* 2015;38:E2.

7. Maughan PH, Horn EM, Theodore N, Feiz-Erfan I, Sonntag VK. Avulsion fracture of the foramen magnum treated with occiput-to-c1 fusion: Technical case report. *Neurosurgery* 2005;57:E600.
8. Steinmetz MP, Mroz TE, Benzel EC. Craniovertebral junction: Biomechanical considerations. *Neurosurgery* 2010;66:7-12.
9. Tanabe M, Watanabe T, Matsumoto S, Okamoto H, Shirakashi K. Avulsion fracture of the anterior half of the foramen magnum involving the bilateral occipital condyles and the inferior clivus--case report. *Neurol Med Chir (Tokyo)* 1999;39:358-61.
10. Tubbs RS, Grabb P, Spooner A, Wilson W, Oakes WJ. The apical ligament: Anatomy and functional significance. *J Neurosurg* 2000;92:197-200.
11. Tubbs RS, Kelly DR, Humphrey ER, Chua GD, Shoja MM, Salter EG, *et al.* The tectorial membrane: Anatomical, biomechanical, and histological analysis. *Clin Anat* 2007;20:382-6.
12. Vaicys C, Hunt CD. An unstable circumferential skull base fracture. *J Trauma* 2001;51:577-8.

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