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Contemporaneous Avulsion Fractures of the Inferior Clivus and Bilateral Occipital Condyles with Injury of the Tectorial Membrane

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Introduction

The cranio-cervical junction (CCJ) is a complex region both anatomically and biomechanically. It includes the atlanto-occipital joint (AOJ) in addition to the atlanto-axial joint. The physiological motion of this region includes flexion, extension, lateral bending, and axial rotation. The occipital condyles represent an integral part of the CCJ, they are responsible for a significant portion of the motion at the AOJ. Fractures of the occipital condyles are uncommon and pose a challenge to treat. They can present as unilateral or bilateral fractures with or without the involvement of the inferior clivus. Anderson and Montesano classified the condylar fractures into 3 types based on the fracture pattern, type I is a comminuted fracture of the condyle due to axial stress, type II is a linear fracture of the skull base that extends into the condyle and type III is an avulsion fracture due to rotation, lateral inclination or a combination of both. Type I and II fractures are stable, while type III is unstable due to associated ligamentous injury. Bilateral condylar fractures are rare, especially if associated with clival fracture. This type of injury can be highly unstable due to the involvement of the AOJ as well as the ligaments that stabilize the CCJ. There is no consensus on the best management strategy for this injury. We present a case of contemporaneous avulsion fractures of the inferior clivus and bilateral occipital condyles with focal tectoral membrane injury that was treated with occipito-cervical fusion.

Case Presentation

A 51-year-old female who presented with multiple orthopedic and soft tissue injuries after a motor vehicle accident. The CT of the cervical spine showed an avulsion fracture of both occipital condyles (type III) with a fracture of the inferior clivus. The patient was neurologically intact, and MRI of the cervical spine showed diffuse T2 signal involving the ligaments of the CCJ and AOJ with a focal area of tear to the tectoral membrane. The constellation of these imaging findings indicated the instability of the CCJ. The patient underwent an occipito-C2 posterior cervical instrumented arthrodesis using a modular (multiple-piece) OC plate-rod construct. The surgery was uneventful, postoperatively, the patient remained neurologically stable and x-ray of the cervical spine showed the improved alignment of the clivus and both occipital condyles. The patient was discharged to a rehabilitation facility. At the 3-month follow up, she remained neurologically intact and x-ray imaging of the CCJ showed stable instrumentation with bony fusion.

Fig. 1 CT cervical spine (axial view) shows the bilateral occipital condyle fractures.

Fig. 2 Three-dimensional reconstruction of the cervical spine that shows [A] anterior view of the CCJ fractures and [B] posterior view of the CCJ fractures.

Fig. 3 MRI cervical spine (mid-sagittal view) shows signs of injury to the ligamentous complex at the CCJ (oval figure). It also shows a focal tear in the tectoral membrane (asterisk).

Fig. 4 Postoperative CT cervical spine [A] (mid-sagittal view) shows reduction of the inferior clivus fracture. [B] (coronal view) shows reduction of both occipital condyle fractures.

Fig. 5 Postoperative (3 months) X-ray cervical spine (lateral view) shows stable instrumentation and bony fusion.

Conclusion

The CCJ is a complex region and injury can result in devastating sequel. Bilateral condyle fracture with concomitant inferior clivus fracture is rare with no consensus on the best treatment option. Although existing evidence supports the use of halo for 12-14 weeks or posterior occipito-cervical fusion as a treatment, patient characteristics and concomitant injuries should be considered for treatment selection.

References