Case Report

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Management of a traumatic avulsion fracture of the occipital condyle in polytrauma patient in Korea: a case report

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Avulsion fracture of the occipital condyle are rare lesion at craniovertebral junction. It is often related to high-energy traumatic injuries and show diverse clinical presentations. Neurologic deficit and instabilities may justify surgical treatment. However, the integrity of neurovascular structures is undervalued in the current literatures. In this case report, we described a 26-year-old female patient with avulsion fracture of occipital condyle following a traffic accident. On initial presentation, her Glasgow Coma Scale was 8. She presented with fracture compound comminuted depressed, on the left side of her forehead with skull base fracture extending into clivus and occipital condyle. Her left occipital condyle showed avulsion injury with displacement deep into the skull base. On her computed tomography angiography, the displaced occipital condyle compressed on the sigmoid sinus resulting in its obstruction. While she was recovering her consciousness during her stay in the hospital, the lower cranial nerves showed dysfunctions corresponding to Collet-Sicard syndrome. Due to high risk of vascular injury, the patient was conservatively treated for the occipital condyle fracture. On the 4 months postdischarge follow-up, her cranial nerve symptoms practically recovered, and the occipital condyle showed signs of fusion without further displacement. Current literatures focus on neurologic deficit and stability for the surgical decisions. However, it is also important to evaluate the neurovascular integrity to assess the risk of its manipulation as it may result in fatal outcome. This case shows, an unstable avulsion occipital condyle fracture with neurologic deficit can be treated conservatively and show a favorable outcome.

Keywords: Occipital condyle fracture; Avulsion; Computed tomography angiography; Collet-Sicard syndrome; Case reports

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INTRODUCTION

Avulsion fracture of the occipital condyle are rare lesion at craniovertebral junction. It is often related to fatal traumatic craniofacial injuries and in precomputed tomography (pre-CT) era, majority of the cases were detected in postmortem autopsies [1].

The imaging technology has improved dramatically in the recent decades and accordingly, earlier diagnosis and better prognosis of the patients can be anticipated, thanks to high resolution and quality three-dimension CT images.

High impact cranial trauma is often the mechanism leading to occipital condyle fracture (OCF) [2]. Therefore, many clinical symptoms are associated with OCF. Cervical spine fractures and traumatic brain injuries are often accompanied. In a few cases, extra-axial craniocervical hemorrhages may also occur [3]. Furthermore, Collet-Sicard syndrome is common in cases of avulsion fractures of occipital condyle, compressing on cranial nerves IX, X, XI, and XII, which result in hoarseness, dysphagia, and weakness of shoulder muscles [4].

The management of the avulsion or displaced OCFs vary in current literatures. There are reports of conservatively treated displaced OCFs, despite the neurologic symptoms including Collet-Siccard syndrome, which resulted in partial recovery of the neurologic symptoms [5,6]. Conversely, surgical treatments are often favored in patients with neural element compression with or without craniocervical misalignment [3]. However, these previous studies have not described the neurovascular integrity in their management decisions. Extra-axial hemorrhages at the craniocervical junction may result in fatal complications [7]. Therefore, adequate neurovascular evaluation and careful managements are necessary in avulsion OCF patients.

To best of our knowledge, the description of the CT angiography in avulsion OCF lack in current literatures. This case report handles the management decisions that considers the vascular integrity of the avulsion OCF patients.

CASE REPORT

A 26-year-old female patient arrived at the emergency department of the Focused Training Center for Trauma, Korea University Guro Hospital, following a traffic accident with Glasgow Coma Scale of 8. Her vital signs were stable, pupils were 3-mm prompt, and motor function were grossly intact. She did not have a significant medical or family history. The patient was sitting on the backseat of a taxi without fastening the seatbelt. High-speed collision with a guard-rail of a construction site caused her to collide with windshield as reported by the taxi driver, who survived the accident without severe injury. Airbag system did not deploy during the accident. Upon patient inspection, we found 15-cm-deep laceration on the left side of the forehead, raccoon-eye sign, and suspected CSF leakages. Polytrauma CT scan revealed fracture compound comminuted depressed (FCCD) on the left side of the frontal bone (Fig. 1). The fracture line was continuous along the cribriform plate and ethmoid sinuses to the clivus. Bilateral occipital condyle was found, where the left side was more severely affected—accompanying avulsion fracture and depression into skull base corresponding to the type 3 Anderson-Montesano and type 2B Tuli classification (Tables 1, 2, Fig. 1) [14]. Magnetic resonance imaging of the cervical spine revealed a type 1 atlantoaxial subluxation with intact transverse atlantal ligament. Despite the severely affected cervicocranial junction, subaxial cervical vertebrae, and their posterior ligamentous complex remained undamaged. Other findings were craniofacial CT scans were traumatic subarachnoideal hemorrhage at perimesencephalic cistern, subdural hemorrhage along cerebral falx, as well as bilateral frontal cerebral hemorrhagic contusion were noted. Scanty pneumocephalus and blow-out fracture of left orbit were also present. Additionally, mild liver laceration and lung contusion were also found. CT angiography was done for the evaluation neurovascular integrity, which included both arterial and venous phases. No evidence of stenosis or aneurysmal dilatation were found in the craniocervical arteries. However, flow void was observed in the left transverse-sigmoid sinus during the venous phase (Fig. 2).

The patient was admitted to the intensive care unit. The patient was immobilized with Miami brace and mildly sedated as preventing further vascular injury was important. FCCD with CSF leakage were managed with antibiotics administration followed by bifrontal osteoplastic craniectomy. Surgical treatment was not planned for the OCF to conserve the integrity of the sigmoid sinus and prevent devastating intracranial hemorrhage. On the 3rd day of admission, the patient slowly gained consciousness, being able to follow second-step obey command. On 12th admission day, the patient was permitted to drink water on her own and showed no signs of aspiration. However, on the 17th day, the patient developed aspiration signs and the Levine tube was applied. Patient also showed left-sided vocal cord palsy, which was manifested as hoarseness and speech difficulty as she gained consciousness. Left-sided tongue deviation was also observed. The patient was discharged on the 55th hospital day. CT scan prior to discharge showed no further displacement of the occipital condyle.

Miami brace was kept for 4 months after discharge. The patient received injection laryngoplasty in a private hospital 1-month postdischarge. Levine tube was removed within 1 month of discharge, and aspirations or dysphagia gradually im-

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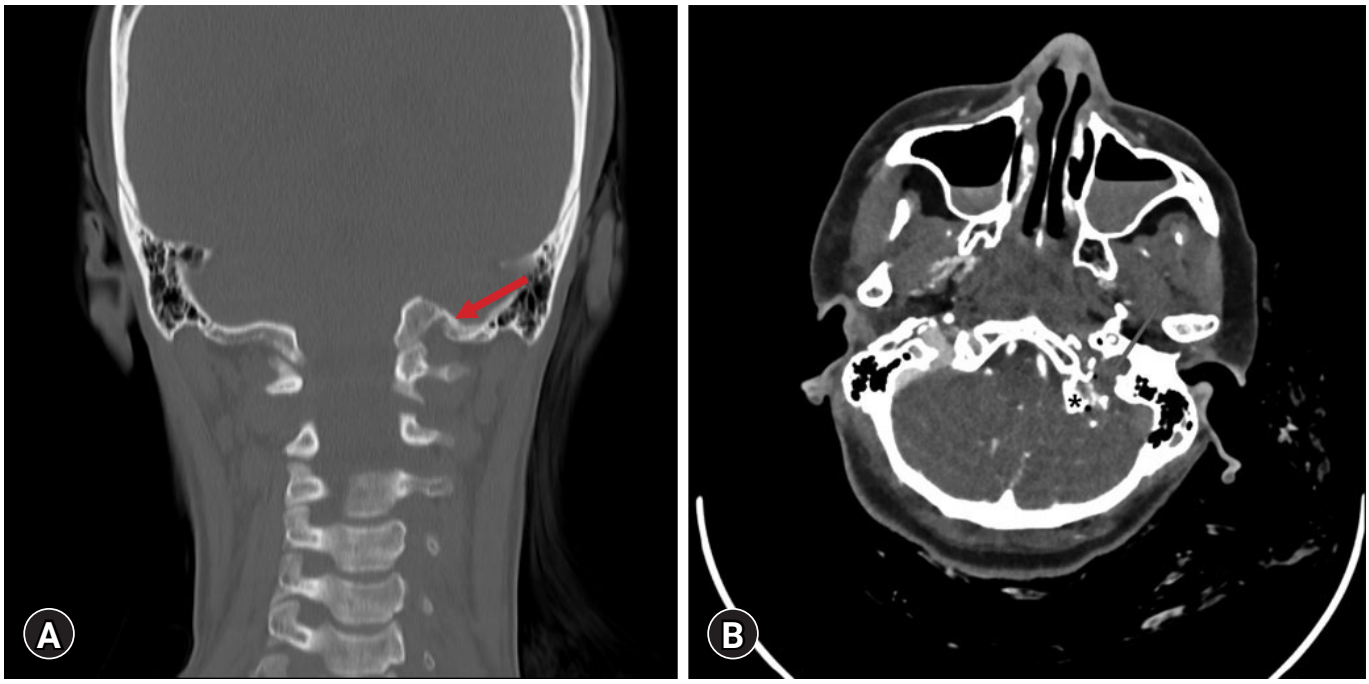

Fig. 1. Avulsion fracture of the occipital condyle. (A) Initial computed tomography image shows displacement of the left occipital condyle deep into the skull base (arrow). (B) Computed tomography image of 4-month follow-up shows fusion of the occipital condyle without further displacement.

Table 1. The Anderson-Montesano classification of occipital condyle fractures

Type	Description	Stability
I	Impacted fracture	Axial stress, stability from the contralateral alar ligament and tectorial membrane
II	Fracture of the base of the skull extending into the condyle	Stability from the intact alar ligament and tectorial membrane
III	Avulsion fracture	Tear of bony attachment of the alar ligament Instability due to associated injuries of the tectorial membrane

Table 2. The Tuli classification of occipital condyle fractures

Type	Description	Stability
I	Not displaced (<2 mm)	Stable
II	Displaced without AOD	Stable
III	Displaced with AOD	Unstable

AOD, atlanto-occipital dislocation.

proved. On the 6th month of the outpatient's follow-up, the patient significantly improved in speech, with less hoarseness. CT scan revealed bony fusion without further displacement of the occipital condyle (Fig. 1).

Ethics statements

The patient provided written informed consent for publication of the research details and clinical images.

DISCUSSION

Avulsion fracture of the occipital condyle is a clinically alarming situation. It often occurs in the setting of polytraumatic injuries of variable mechanisms such as axial compression and/or distraction or lateral skull compression, making it difficult for clinician to manage. Furthermore, it is anatomically located adjacent to many vitally important structures such as medulla oblongata and their neurovascular structures, cranial nerves controlling airways, and cranial venous sinuses [8]. Therefore, varying degrees of clinical symptoms are presented from fatal injuries to clinically dormant situations. Nevertheless, meticulous investigations are necessary for management. In the current literatures, decisions are often made in terms of neurologic deficits and misalignments associated with the injury. Neurologic deficit with concomitant

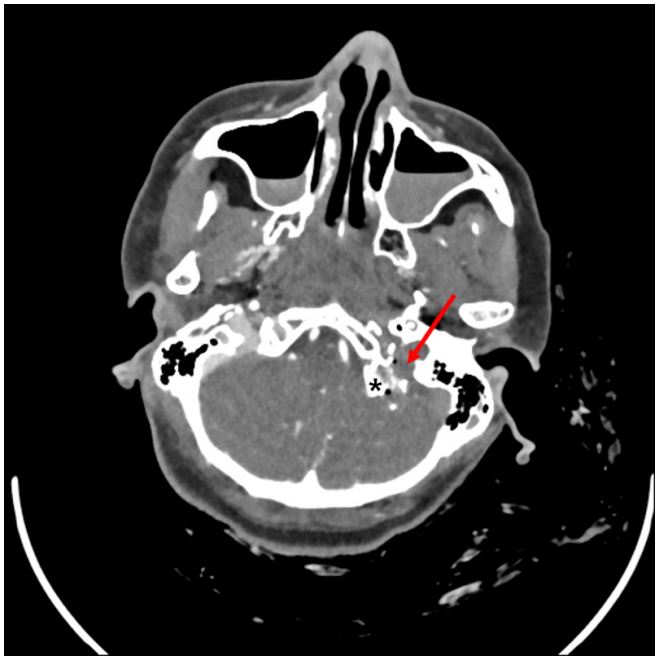

Fig. 2. Cranial computed tomography angiography with venous phase. Left-sided transverse-sigmoid sinus seems obstructed (arrow) with displaced occipital condyle (asterisk).

atlanto-occipital instability is regarded as an indication for surgery [3]. However, neurovascular integrity also plays a great role in this situation as it may result in devastating outcome. Furthermore, surgical treatment often involves the fusion of the occiput and upper cervical vertebrae. This greatly reduces the range of motion in the cervical spine including rotation, flexion and extension, and lateral flexion movements [9]. Additionally, occipital condyle fusion may result in dyspnea and/or dysphagia postoperatively [10].

In this case report, we presented a polytrauma patient with avulsion OCF, who was treated conservatively. The patient was in a minimally conscious state on the 1st week of admission, making it difficult to examine the cranial nerves that are functionally important—dysphagia, dyspnea, and vocal phonation. Immediate polytrauma CT scan showed misalignment of craniocervical junction but no impingement on medulla oblongata or high cervical spinal cord. CT angiography showed obstruction of left-sided transverse-sigmoid sinus due to displacement of left occipital condyle. This situation sets the clinicians in dilemma of making surgical decisions, as injury to this venous sinus may result in unexpected fatal outcome. In this case, we decided to observe the patient by externally fixating the craniocervical junction with Miami brace. The decision was made due to uncertain consciousness and other managements in priority, such as CSF leak and intracranial pressure monitoring. During the admission she slowly gained consciousness and orientations and after the discharge, during the follow-up, the displaced occipital condyle fused in place without further dislocation. The patient also gradually improved in terms of dysphagia and hoarseness. Functional recoveries of unilateral Collet-Sicard syndrome had also been reported with the conservative management by Cirak et al. [11].

Another issue that should be discussed from this case is the obstruction of transverse-sigmoid sinus due to the displaced occipital condyle. Sigmoid sinus drains into internal jugular vein that leaves the cranial vault through jugular foramen, which is located immediately lateral to occipital condyle. Any displacement of occipital condyle may cause obstruction of internal jugular vein or sigmoid sinus. Yet, current reports on avulsion OCFs rarely describe the neurovascular integrity. However, this is an important issue because depending on anatomic variations of torcular Herophili, the consequence can be fatal. Furthermore, the clinical manifestation of obstructed venous drainage is often delayed. Early discharge in patients that are seemingly symptomless may face an irreversible devastating outcome [12]. CT angiography is a convenient image work-up to detect such a lesion. Fortunately, the patient tolerated the acute obstruction of unilateral transverse-sigmoid sinus without developing any sequelae. Nevertheless, we have closely observed her for delayed onset of possible venous infarction of the brain with serial brain CT scans. Currently, the Anderson-Montesano and the Tuli classifications are commonly used mainly to assess the stability of the OCFs [13], but the integrity of the vasculature is incorporated into the classification. For the surgical decision making it is also important to consider vascular work-up in addition to the usual work-up to assess stability, alignment, and neurologic deficit.

To conclude, this case demonstrates a patient with an unstable OCF with neurologic deficit who is conservatively treated due to high risk of vascular damage with obstructed sigmoid sinus. Eventually, the patient practically recovered from Collet-Sicard syndrome, and the occipital condyle fused without further displacement. Therefore, conservative treatment can be a treatment option even in case of unstable and maligned OCF, if high risk of vascular damage is suspected.

NOTES

Conflicts of interest

The authors have no conflicts of interest to declare.

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Author contributions

Conceptualization: all authors; Data curation: CHH, JHK; Formal analysis: CHH, JHK; Methodology: all authors; Project administration: CHH, WKK, JHK; Visualization: CHH; Writing–original draft: CHH; Writing–review & editing: all authors. All authors read and approved the final manuscript.

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