

Non-operative management of occipital condyle fracture: report of three cases and literature review

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Abstract

Occipital condyle fractures (OCF) had been difficult to diagnose, but the widespread use of computed tomography (CT) as a diagnostic tool in patients with significant cranio-cervical injury has led to increased recognition of this injury. The incidence of OCF in severely injured blunt trauma patients is estimated at 0.1 - 4.4% and as high as 16% overall when less severely injured patients are included. OCFs are important because they may be associated with instability of the occipito-atlanto-axial joint complex and there is wide variability in the clinical presentation of individuals with an OCF. This cranio-cervical injury may result in increased morbidity associated with long-term cranio-cervical pain and reduced neck mobility. Patient outcomes tend to reflect the severity of additional injuries rather than independent OCF pathology. We described three OCF cases with severe traumatic brain injury, treated without surgery with favorable outcome and we performed a literature review.

Key words: Occipital condyle fractures, traumatic brain injury, and management.

Introduction

The Scottish surgeon and anatomist Charles Bell published the first case report of an Occipital Condyle Fracture (OCF), discovered at autopsy, in 1817¹. This was a postmortem diagnosis of a hospital patient who sustained a fall at the time of discharge, when he reached down to "take up his bundle" and died suddenly. His demise was attributed to medullary compression by the condylar fragment¹⁻³.

Historically, OCFs have been difficult to diagnose, as they are rarely visible on plain radiographic studies and produce a variability of symptoms. The widespread use of computed tomography (CT) as a diagnostic tool in patients with significant cranio-cervical trauma has led to increased recognition of this injury³⁻¹⁰.

Changes to cervical spine imaging protocols for trauma patients have resulted

in CT screening of the entire cervical spine, in preference to the previous practice of targeted scanning of suspicious areas of injury. This development, coupled with the rapid evolution of CT technology, may explain the increased incidence of reported detection of OCF. In the past, plain radiography had failed to visualize such injuries with consistency, and OCF were most reliably associated with fatal atlanto-occipital dislocation detected post-mortem¹⁰. This explains why only 20 cases had been documented until 1988, while as many as 116 cases were described in the literature between 1978 and 2002 when CT imaging became widely established for diagnostics¹¹⁻¹⁴.

As the majority of cases of occipital condyle injury are reported via case studies or small series, clinical and functional follow-up has been rarely described, resulting in a dearth of litera-

ture on patient outcome¹¹. We describe four cases of OCF.

Report of the Cases

Patient 1

Patient male, 38 years-old fell from his house's roof, about, 3 meters. Neurological examination on admission showed 8 points in Glasgow Coma Scale and a paraplegia and anesthesia at level T8.

CT scans with occipital condyle fracture and T6-T7 vertebral body fracture with spinal cord transection. There was not cervical pain or cervical instability signal. This OCF was considered type I of Anderson and Montesano classification and type 1 of Tuli classification. Then, we took off cervical collar and a non-surgical management to occipital condyle fracture was adopted.

Patient 2

Patient 45 years old, male, had been hit by car, admitted in Glasgow 07, which radiologic cranial investigation showed traumatic subarachnoid hemorrhage, diffuse axonal injury and temporal bone fracture. Cervical spine CT scan was performed and shows a right occipital condyle fracture. This fracture was considered as type 1, stable, and we decide to nonsurgical management. This patient was discharged to rehabilitation due to traumatic brain injury.

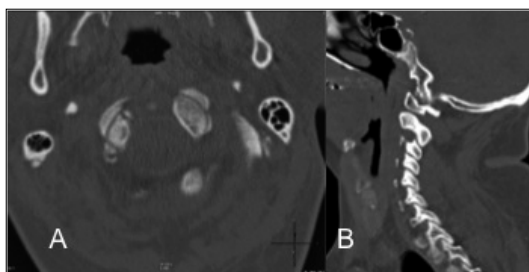


Figure 1. Cervical spine computed tomography scan in axial and sagittal plane showing an occipital condyle fracture, classified as a type I by Anderson and Montesano and type 1 of Tulli classification.

Patient 3

Patient 35 years old, male, suffered fall of stairs, admitted in our service in Glasgow 14 and signals of alcoholic abuse. No neurological deficit was identified. CT scan showed nonsurgical right frontal acute subdural hematoma, and right occipital condyle fracture with skull base extension (type II - Anderson and Montesano classification). Clinical treatment was adopted. He remained under hospital observation, there was improvement of Glasgow score, without neurological deficit or cervical pain and was discharged.

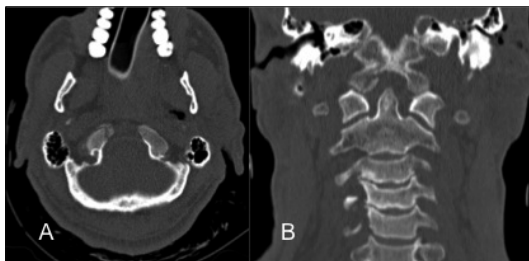


Figure 2. Cervical spine CT scan was performed and shows a right occipital condyle fracture. This fracture is a type 1 by Anderson and Montesano Classification.

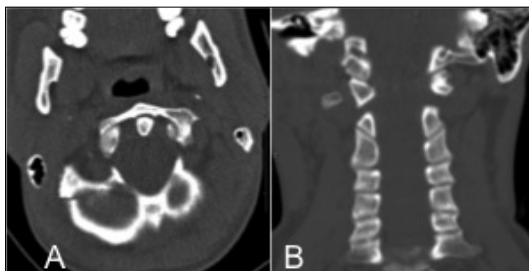


Figure 3. Cervical spine computed tomography scan showed right occipital condyle fracture with skull base extension (type II - Anderson and Montesano classification).

Discussion

The true prevalence of OCF is unknown, but most authors have concluded that OCF is probably more com-

Table 1.
Anderson and Montesano¹² Classification of Occipital Condyle Fractures

Type	Description	Biomechanics
Type I	Impaction	Results from axial loading; ipsilateral alar ligament may be compromised, but stability is maintained by contralateral alar ligament and tectorial membrane
Type II	Skull base extension	Extends from occipital bone via condyle to enter foramen magnum; stability is maintained by intact alar ligaments and tectorial membrane
Type III	Avulsion	Mediated via alar ligament tension; associated disruption of tectorial membrane and contralateral alar ligament may cause instability

Table 2.
Tulli¹⁹ Classification of Occipital Condyle Fractures

Type	Description	Biomechanics
1	Nondisplaced	Stable
2 A	Displaced*	Stable; no radiographic, CT, or MR imaging evidence of occipito-atlanto-axial instability or ligamentous disruption
2 B	Displaced*	Unstable; positive radiographic, CT, or MR imaging evidence of occipito-atlanto-axial instability or ligamentous disruption

*Defined as the presence of at least 2-mm osseous separation.

mon than is generally realized^{2,8}. The incidence of OCF in severely injured blunt trauma patients is estimated at 0.1-4.4%^{4,8} and as high as 16% overall when less severely injured patients are included⁹. The mean age of presentation is 32.4 years (range, 7 months to 88 years), and there is a male predilection of 2:1^{4,9,15}.

In 2002, Hanson et al., review the clinical and imaging findings in a series of 95 patients with 107 OCF treated at a level I trauma center over a 7-year period. This trauma center evaluates 12,000-15,000 trauma victims per year. They therefore estimate that the frequency of OCF in seriously injured patients is approximately one or two fractures per 1,000 patients. Occipital condyle fracture is thus a rare injury, and the radiology literature is limited to small case series¹⁴.

In 2009, Malham et al., investigated OCF in blunt trauma patients admitted to a level I trauma center over a 3-year period. The incidence of OCF was 1.7/1,000 per year. Traumatic brain injury was detected in 46% of study patients, and 42% had cervical spine injury¹⁰.

Although 60% of patients with OCF are reported to have an associated traumatic brain injury and 80% with loss of consciousness, a significant proportion is also detected in patients with a normal Glasgow Coma Scale (GCS)^{4,9,17-20}. In that current year, Maserati et al¹⁶ performed a retrospective review of 24,745 consecutive trauma presentations to a single Level I trauma center over a 6-year period, identifying 100 patients with 106 OCFs. The incidence of OCF in this trauma population was 0.4%.

In 2012, Mueller et al., reported a prospective investigation of incidence and outcome of OCF in a level 1 trauma centre over a period of 5 years. A total of 31 patients with OCF were identified. Based on a total of 2,616 CT scans that had been performed during this period, the incidence was 1.19%¹³.

OCFs are important because they may be associated with instability of the occipito-atlanto-axial joint complex. The integrity of this complex articulation is dependent on a number of supporting ligaments, of which the tectorial membrane and bilateral alar ligaments are the most important. OCF may therefore lead to instability of the cranio-cervical junction^{8,11-16}.

There is wide variability in the clinical presentation of individuals with an

OCF. Patients with an OCF often have concomitant head injuries that may confound the clinical and neurologic examination. Some patients are neurologically intact and present only with pain and tenderness in the posterior occipito-cervical region or torticollis, whereas others may have significant neurologic deficits^{2,3,13}. Neurological deficit including hemiparesis (attributable to contusion of ipsilateral adjacent spinal cord) is recognized. Lower cranial nerve deficits (that is IX-XII) are a "classic" sign. However they occur in only a third of cases and within this group a third of such deficits present late, sometimes as Colet-Sicard syndrome¹⁷⁻²⁰. The close anatomic association of many neural and vascular structures to the occipital condyles explains the great variety of symptoms that may occur in conjunction with an OCF².

The most widely used radiologic OCF classification was described in six patients by Anderson and Montesano (1988)¹²; they proposed an OCF classification scheme based on injury mechanism and CT fracture morphology. (Table 1).

Excessive axial loading can produce comminution of the occipital condyle with little or no displacement of fragments into the foramen magnum. Such a fracture is classified as type I, is considered an impaction fracture of the occipital condyle and is potentially unstable, as the ipsilateral alar ligament may be incompetent; however, if the tectorial membrane and contralateral alar ligament are preserved, sufficient ligamentous support may remain to preserve stability. Type II fractures occur as an extension of a linear basilar cranial fracture into the base of the occipital condyle. Frequently, the condyle is still at least partially attached to the base of the cranium, and craniovertebral stability is maintained. Excessive loading in rotation and/or lateral bending can result in condylar avulsion, or a type III OCF. Type I and type II injuries are considered to be stable. Type III fractures are considered to be potentially unstable. Some patients have bilateral condylar fractures, which rarely may be associated with a clivus fracture¹².

More recently, Tuli et al¹⁹ recommend an alternative classification. They propose that instability is determined more by ligamentous injury as detected by computed tomography alignment criteria and magnetic resonance imaging

findings than on fracture morphology. Type 1, nondisplaced occipital condyle fracture with intact ligaments (stable); type 2A, displaced occipital condyle fracture with intact ligaments (stable); and type 2B, displaced occipital condyle fracture with radiographic evidence of cranio-cervical junction instability. Tuli et al postulated that their classification can guide neurosurgical management: type 2B fractures require surgical instrumentation or halo traction, whereas type 2A injuries may be treated with a rigid collar, and type 1 injuries require no specific treatment. (Table 2).

Malham et al.¹⁰ and Maserati et al.¹⁶, using the Anderson and Montesano classification, diagnosed less than 30% type 3 injuries in their studies, while Hanson *et al.* found 75%. Mueller et al¹³, reported the frequency of this type of fracture was as low as 20%. However, the distinction between a noncomminuted type I and a nondisplaced type III fracture may be difficult.

Applying the Tuli et al.¹⁹ classification system, Hanson et al found that type 1 nondisplaced occipital condyle fractures are the most frequent, with displaced unstable type 2B fractures seen in 18 (19%) of 95 patients. They believe that subdividing Anderson and Montesano type III fractures into two groups - stable and unstable - could effectively combine the principles of both classification systems. Then, the authors suggest that the CT finding of bilateral occipito-atlanto-axial joint complex injury (defined as either bilateral occipital condyle fractures or unilateral occipital condyle fracture with contralateral widening of the occipitoatlantal [> 2 mm] or atlantoaxial [> 3 mm] joint) be used as a marker for instability¹⁴.

OCFs typically occur in association with multiple injuries sustained from high-energy blunt trauma. Surgical intervention is rare, and conservative management of all isolated OCFs is generally supported, even in some cases of brainstem compression with neurologic injury^{19,20}.

Optimal treatments are not fully agreed upon but most sources propose semi-rigid collar provision for stable injury and rigid immobilization of varying design for the potentially unstable injury¹⁸. The non-surgical management of patients with OCF is the standard treatment. Immobilization in a hard collar is the treatment of choice for stable and undisplaced fractures. Immobilization for approximately three months

is recommended, with a range of 1-3 months. Decompressive surgery is indicated if severe brainstem or transition spine cord-brainstem compression occurs. Surgical decompression for this type of fracture has been reported only five times⁹. Unstable fractures may be treated with immobilization in halo vest or occipito-cervical fixation²⁰⁻²⁷. OCF per se is not a fatal injury, except the cases with brainstem compression by fractured condyle⁸, and 68% of OCFs were associated with good clinical status^{3,5,6}. They are more commonly

identified on CT screening and the real incidence of these fractures is unknown. Outcome assessments are difficult, owing to the limited number of cases discussed in the literature, lack of clinical follow-up in some series, and variability of fracture descriptions and treatment approaches. In general, patients make reasonable neurologic recoveries, although they do not necessarily achieve a complete recovery^{20,28-31}. The prognosis for recovery of function when cranial nerve dysfunction presents in a delayed fashion is more fa-

vorable than when the palsy is acute². Fracture of the occipital condyles may result in increased morbidity associated with long-term cranio-cervical pain and reduced neck mobility⁴. Patient outcomes tend to reflect the severity of additional injuries rather than independent occipital condyle fracture pathology. Consistent with other bony injuries, the fractures usually heal well with a conservative approach.

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