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Occipital condyle fractures: report of five cases and literature review

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Abstract Occipital condyle fractures (OCFs) are uncommon and potentially fatal lesions. After the advent of CT, prompt diagnosis can be readily made and consequently better prognosis of these patients is expected. Early recognition of some types of OCF is imperative to avoid fatal results. We analyzed 121 cases of OCF (116 from the literature and five of our own). Rarely patients with a deficit of the lower cranial nerves make a complete recovery. However, quoad vitam prognosis of patients with “pure OCFs” remains good. Immobilization provides good recovery of most OCFs, but delay of treatment can lead to serious morbidity. We want to emphasize that not only an OCF with instability of O–C1–C2 can be a fatal injury unless prompt surgical intervention, but a displacement and migration of the fractured condylar fragment can also result in a fatal outcome. A high level of suspicion is fundamental for

the early diagnosis of these fractures, so that when a posterior basal cranial or occipital squama fracture occurs, a CT study of the occipital condyles becomes imperative.

Keywords Head injury · Imaging · Lower cranial nerve palsy · Occipital condyle fracture · Treatment

Introduction

Occipital condyle fracture (OCF) rarely comes to clinical observation, often being associated with fatal trauma [2]. In a large autopsic series of victims of head trauma, OCFs ranged from 0.6 to 4.2% [3, 12]. These fractures were originally described only in autopsy series [1, 2, 13, 29, 48]. In the pre-CT era most of the literature concerning OCF in survivors consisted only of sporadic case reports. The first au-

thors to utilise CT in diagnosis of a OCF case were Bolender et al. in 1978 [9]. With the introduction of CT, the number of published cases in the literature has notably increased.

We have analyzed 116 cases collected from the literature between 1978 and 2002 [4, 6–11, 14–18, 20–28, 30–39, 41–47, 49–64], and report a further five personal cases with six OCFs.

The aim of the present report is not only to raise suspicion for OCFs in patients involved in craniocervical

Table 1 Characteristics of five occipital condyle fracture cases

Associated injury	Treatment	Follow-up
Bulbar contusion	Halo vest for 2 months	Slight improvement of Collet–Sicard syndrome
None	Hard collar for 3 months	Modest reduction of neck rotation at 12 months
None	Hard collar for 3 months	Complete recovery at 3 months
Thoracic and abdominal trauma	Hard collar for 3 months	Complete recovery at 5 months
None	Hard collar for 3 months	Deficit of XII cranial nerve at 50 months

trauma, but also to discuss the possible therapeutic options.

Materials and methods

Since 1978 an overview of the world literature, accessible to us by a Medline search, discovered 116 cases; together with the five present cases, these made a total to 121 cases available for our analysis. In the present survey, some cases lacked complete information [7, 18, 21, 28, 38, 39, 52] and were not included in appropriate parts of our analysis.

The data about our five cases are summarized up in Table 1. One case of our series is reported below in detail, because he presented a rare condition of major interest.

Case history of one patient

A 34-year-old man involved in a motor vehicle crash was admitted to our institution comatose with a GCS score of 9. A CT of the atlanto-occipital joint showed an avulsion fracture of the left occipital condyle with supero-medial displacement of the fragment (Type III according to the Anderson–Montesano classification) (Fig. 1A, B). MRI demonstrated a compression of the medulla oblongata (Fig. 1C, D). The patient regained consciousness 24 h after the accident. The neurologic examination revealed a Collet–Sicard syndrome. He was immobilized with a Halo vest for 2 months. At follow-up examination 8 months after injury the Collet–Sicard syndrome had improved slightly.

Analysis of the data from literature and our small series

The male/female ratio was 2.3:1. This male prevalence is consistent with the epidemiologic data of trauma.

Mean age was 32.3 years (range 3–88 years).

For 20 patients, information was not provided about clinical condition on admission [7, 18, 21, 28, 38, 39, 52]. Fifty-five patients were awake on admission or had minor disturbances (54%); 46 patients had impaired consciousness (45%). Loss of consciousness for a short

time occurred in 15 (14%) patients. Twenty-two patients were comatose or had GCS ≤ 8 . Nine patients had GCS between 9 and 14. Of the patients with impaired of consciousness, 12 (26%) presented associated intracranial lesions (five subdural hematoma, five ponto-bulbar or cerebral contusion, three epidural hematoma, one brainstem infarction). Early or delayed involvement of lower cranial nerves was present in 43 (40%) patients. The most involved cranial nerve was XII. Collet–Sicard syndrome was present in eight cases.

Only six of the 43 patients with lower cranial nerve involvement had a complete recovery, 19 had a partial recovery, five remained stable, and for 13 patients follow-up was not given.

In five patients a surgical decompression was performed, and in one of these patients also an occipito-cervical fixation was performed [10, 25, 27, 52, 58]. Only two patients died: one presented a brainstem injury secondary to a displaced OCF and the other patient had a clival fractures with brainstem infarction [4, 49]. Data about the survival were not available for 67 patients, but in the 59 remainder patients quoad vitam prognosis was good.

Discussion

The first description of OCF was given in 1817 by Bell [5]. In 1992, Bozboga and co-workers were the first to report the surgical treatment of an OCF [10].

The high incidence of severe head trauma in patients with OCF is mainly described in autopsic series that collect cases associated with fatal atlanto-occipital dislocations or avulsion fractures [12, 34]. From our review of clinical reports, 68% of OCFs were associated with a good clinical status. In these cases OCF was “pure”; i.e., without associated intracranial lesions. Then, OCF per se is not a fatal injury, except the cases with brainstem compression by fractured condyle.

OCF is often seen in association with palsies of lower cranial nerve. The 12th cranial nerve is most commonly involved (74% of cases), it is due to fracture extension through the hypoglossal canal. Because of the proximity of the jugular foramen to the occipital condyle, the IX, X, XI cranial nerves can also be involved. In some cases, unilateral palsy of the last four nerves develops; this

Fig. 1 **A** Case 1 CT showing left occipital condyle fracture and dislocation. **B** Case 1 CT coronal reconstruction: left occipital condyle is dislocated supero-medially. **C** Case 1 MRI. Brainstem is compressed by dislocated bone fragment. **D** Case 1 MRI: subarachnoid spaces are disappeared and brainstem is compressed

condition is referred to as Collet-Sicard syndrome (18% of cases) [11, 36, 51]. Cranial nerve palsies can occur in patients with a minor head injury and in delayed fashion [22, 36, 45, 51]. From our analysis we have found 22 such cases with a delay until 9 weeks from trauma [22]. The delayed nerve damage is most likely caused either by the formation of osseous callus during the healing processes or subsequent dislocation of the bony fragments. The latter mechanism emphasizes the importance of early diagnosis of OCF and careful follow-up of asymptomatic patients.

Anderson and Montesano [4] have subdivided OCFs into three types according to the mechanism of injury:

- Type I is an impacted fracture resulting from axial loading and is stable. The fragments are generally comminuted with minimal displacement.

- Type II occurs as part of a basilar skull fracture resulting from a direct blow on the skull. This fracture is stable.
- Type III fracture is considered potentially unstable as a result of lateral flexion or rotary forces pulling the alar ligaments. This is an avulsion fracture.

Recently, Tuli et al. [58] proposed the following new classification of the OCFs:

- Type 1 nondisplaced OCF (stable).
- Type 2A displaced OCF with intact ligaments (stable).
- Type 2B displaced OCF with radiographic evidence of craniocervical junction instability (unstable).

Tuli et al. [58] noted that distinction between Type I and II according to the classification proposed by Anderson and Montesano does not add any information, because the treatment is not different. The new classification proposed by Tuli et al. [58] consider the Type 2 fractures as a potential element of a more extensive injury involving the occipito-atlanto-axial joint complex, so that these authors subclassified these frac-

tures into A and B, depending on the stability or instability of the O–C1–C2 complex. The classification proposed by Tuli and co-workers is a guide for surgical management of OCFs: Type 1 fractures require no specific treatment, Type 2A fractures may be treated with a rigid collar, and Type 2B fractures require surgical instrumentation or Halo traction. This new classification allows an easy and rational approach to treating patients with OCF. However, we would remind that not only an condylar fracture with instability of O–C1–C2 can be a fatal injury, but a displacement and migration of the fractured condylar fragment can compress the brain stem resulting in fatal outcome. The first description of OCF [5] was based on the postmortem examination that revealed an avulsion fracture of the occipital condyle. This case of sudden death at discharge occurred as the patient turned to take up his bundle. The death was due to bulbar compression by the fractured occipital condyle. This rare and insidious occurrence is likely due to the fact that in some fractures, the tip of the occipital condyle is not widely dislocated. In these cases a sudden rotation of the head may cause a dislocation of the condyle and brainstem compression. Tuli and co-workers in their classification have not considered this rare condition that requires a treatment by Halo traction (as in our first case) or decompressive surgery. We think that immobilization with a hard collar is also recommendable in stable OCF without bone fragment

displacement because it could migrate with head movements.

Presence of persistent neck pain, limitation of cervical motion or lower cranial nerves deficits associated with head trauma or basal cranial fracture suggest the possibility of OCF.

When a posterior basal cranial or occipital squama fracture are detected, it is imperative to include the occipital condyles in the radiologic study. CT is the diagnostic procedure of choice for depiction of OCF [45, 64]. Two-dimensional reconstruction is also required to assess atlanto-occipital and atlanto-axial relationship [38]. MRI remains an essential tool for the study of the nervous structures.

A conservative management of patients with OCF is the standard of care. Immobilization in hard collar is the treatment of choice for stable and undisplaced fractures. The duration of immobilization is recommend for 3 months, with a range of 1–3 months [19, 33, 40, 51, 55, 58]. Decompressive surgery is indicated if severe brainstem compression occurs. Surgical decompression for this type of fractures has been reported only five times [10, 25, 27, 52, 58]. Unstable fractures may be treated with immobilization in Halo vest or occipito-cervical fixation [58].

Complete functional recovery in patients with lower cranial nerve involvement is rare. However, quoad vitam prognosis of patients with “pure OCFs” remains good.

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