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Traumatic Retroclival Subdural Hematoma on Top of Stable Bilateral Occipital Condyle Fracture: Impact of Hematoma on Craniocervical Stability and Management Decision

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Abstract: Background and Importance: Bilateral occipital condyle fracture (OCF) is a rare type of injury that occurs at the occipitocervical junction, mostly due to high energy trauma to cranium with axial loading. These fractures are difficult to diagnose based on conventional cervical or cranial radiography and they have non-specific clinical manifestations. However, unstable fractures carry the most risk for morbidity and mortality due to their close relation to important neural and vascular structures. Acute retro-clival subdural hematoma (rcSDH) is a collection of blood dorsal to the tectorial membrane, which is a critical structure for maintaining occipitocervical stability, presence of posttraumatic acute retroclival subdural hematoma in the setting of non-displaced bilateral occipital condyle fractures in traumatic patients is a marker of high energy trauma with fatal course in acute setting due to compression on subarachnoid space by acute hematoma and subsequent increase intracranial pressure and a merely marker of occipitocervical instability due to injury/damage to tectorial membrane. We describe the imaging features and clinical symptoms and signs that led to the diagnosis and classification of stable bilateral OCFs with a quickly resolving rcSDH in a previously healthy man aged 25 years involved in a motor vehicle accident, allowing conservative management. The co-existing of both injuries has not been described in the literature to the best of our knowledge.

Keywords: Occipital Condyle Fractures, Subdural Hematoma, Clivus Hematoma, Occipitocervical, Severe Head Injury, Atlantooccipital Dislocation

1. Introduction

Occipital condyle fractures (OCFs) are basilar skull fractures that can indicate the presence of craniocervical dissociation. the incidence of OCFs has been estimated to be between 1% and 3% of blunt craniocervical trauma, and their treatment remain controversial [1]", and almost always occur unilaterally. Bilateral OCFs are infrequently recognized due to non-specific clinical manifestations and inadequate visualization on conventional radiographs of the skull and cervical spine without computed tomography (CT) of the head and neck. Several classification systems has been proposed for OCFs depending on the fracture morphology (Anderson and Montesano) and presence of ligamentous injury (Tuli et al), a more recent classification system postulated by Mueller et al which included Atlantoocipital dislocation, craniocervical misaligenment and neural element compression in his classification system. Simultaneous OCFs and a retro-clival subdural hematoma can occur due to injury to osseous structures at the craniocervical junction [2]". Given the possibility of the co-existence of these injuries, we believe that patients with non-displaced bilateral OCFs should be evaluated for a retro-clival subdural hematoma.

1.1. Objective

We need to highlight the presence of retro-clival subdural hematoma in the setting of non-displace bilateral occipital condyle fractures consider a new cause of instability?

1.2. Method

Extensive literature review conducted using PubMed and Google scholar search with the keywards “occipital condyle fracture” and “retroclival subdural hematoma and “atlanto-occipital dislocation”.

1.3. Result

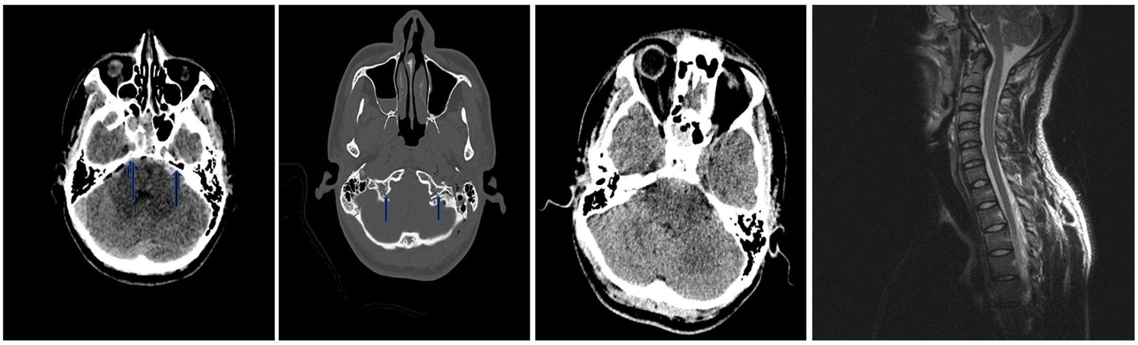
Our patient treated conservatively with hard cervical collar for eight weeks with good outcome.

Clinical Presentation: A healthy 25-year-old unrestrained driver got into a high energy motor vehicle accident and was ejected from the car. His Glasgow Coma Scale on presentation was 14 / 15, and he had no neurologic deficits. His trauma CT scans including his cervical spine, chest, abdomen, and pelvis were unremarkable. However, a brain CT with bone windows showed bilateral non-displaced OCFs and a rcSDH. The patient was followed closely and recovered uneventfully without the need for surgical intervention.

Treatment and post-treatment course

The patient was immediately admitted to the intensive-care unit and care was directed by the head-management protocol. Patient was kept NPO and on an anticonvulsant measure [epanutin IV Q8hrs] anti-ulcer measure [omeprazole 40mg IV daily], intravenous Normal saline 130ml/hr, pain management [paracetamol 1gm IV Q8hrs], and antibiotics [Ceftriaxone 2gm IV twice/day]. A further brain CT of the brain 1.5mm thickness 6 h after admission showed complete resolution of the retro-clival hematoma (Figure 1C).

A 24-hour post-admission craniocervical magnetic resonant imaging (MRI) with a slice thickness of 2mm was normal without evidence of radiologic signs of ligamentous injury or hematoma (Figure 1D). The patient was treated conservatively and discharged home with a partial left sixth cranial nerve palsy in a hard cervical collar and scheduled for outpatient follow-up in 6 weeks with new CT of his head that included C0 to C2.



(A) (B) (C) (D)

Figure 1. *Brain CT and craniocervical MRI at baseline and 6 h after admission to the intensive care unit indicating resolution of rcSDH.*

(A) Brain CT with thickness of 1mm on admission showing a retroclival subdural hematoma with maximum thickness of 2mm [block arrows] (B) CT bone windows thin multi- slice of 0.5mm showing bilateral OCFs [block arrows] (C) Repeat brain CT 6 h with multi-slice 1mm after admission showed resolution of rcSDH [block arrows]. (D) MRI of the cervical spine 24 h after admission with 2mm thickness showing no evidence of hematoma as wel as intact tectorial membrane [block arrows].

2. Discussion

Biomechanical continuity of the craniocervical junction depends on the integrity of the skull base, atlas and axis and their attaching ligaments, namely the tectorial membrane and the paired alar ligaments [3]”. The tectorial membrane is the cephalic continuation of the posterior longitudinal ligament and is continuous with the periosteum lining the anterior margin of the foramen magnum [4]”. It has a vital role in maintaining occipitocervical junction stability by limiting flexion. An intact craniocervical junction maintains the functional architecture of the midbrain and spinal cord [5]”. In view of our patient mechanism of injury, close relationship of occipital condyle and tectorial membrane, the occurrence of both injuries seem to be reasonable.

rcSDH is uncommon lesion that are mostly associated with significant head trauma. Incidence of posterior fossa extra-axial hematoma is 0.3% [6]”. It is seen more frequently in children than in adults. Irrespective of the patient’s age, the presence of rcSDH indicates a possible tectorial membrane injury [4]”. In most reported cases this type of hematoma has had a benign course with an excellent prognosis, which may be due to the rapid distribution of blood from the retro-clival to the spinal subdural space [7]”, unless the hematoma reach critical volume that amenable for surgical decompression. The exact underlying mechanism for formation of post-traumatic rcSDH is still unclear. Shear forces resulting from hyperflexion or axial loading followed by hyperextension lead rupture of the bridging petrosal and small veins near the foramen magnum [7]”. We believe this mechanism is most plausible in our case.

Bilateral OCFs are rare and may easily be missed due to non-specific clinical presentation that ranges from mild neck pain to worsening neurological manifestations and few signs on conventional radiographs [8]’’. Of the two systems used to classify OCFs, the most widely used is that of Anderson and Montesano [9]’’. They define three types of OCFs according to fracture morphology and mechanism of injury: type 1, comminuted fracture; type 2, extension from a skull base fracture into the occipital condyle; and type 3, avulsion fractures at the insertion site of the alar ligaments, which are considered to be unstable injuries. Tuli et al [10]''. later recommended a classification system for OCF based on ligamentous injury leading to misalignment on CT and MRI rather than on fracture morphology. They describe two types-non-displaced fracture (type 1) and displaced fracture (type 2). Type 2 injuries are further subdivided into no ligamentous injury, which is considered to be stable (type 2a), and ligamentous injury, which is considered unstable (type 2b). A more practicle newly classification system by Mueller et al [11]'', in which identifies atlantooccipital dialocation, cranoicervical misaligement and neural element compromise are of clinical importance in management algorithm, type 1, unilateral OCF without AOD; type 2 bilateral OCFs without AOD associated with higher comorbidity and motality than type 1 and need more rigid external immobilization by halo-vest.; type 3 unilateral or bilateral OCFs with AOD which consider unstable fracture and need for occipitocervical fusion, presence of AOD need occipitocervical fixation independently of occipital condyle fracture type. Several methods for detecting AOD has been described, Pang method had 100% specificity and sensitivity (class 1 evidence) [12]''. Our patient sustained a type 2 OCF according to the Anderson and Montesano classification, and type 1 according to Tuli et al, and type 2 according to Mueller et al classification system. Albeit, non-displaced bilateral occipital condyle fracture is survivable injury, presence of retroclival subdural hematoma make the injury potentially morbid due to pressure effect on the brain stem.

Lower cranial nerve palsies have been reported in some patients with OCFs, with the hypoglossal nerve being the most commonly affected [13]". However, the presence of a cranial nerve palsy alone is not an indication of OCF instability and can resolve with the use of an external orthosis [13]". Multi-slice CT imaging of the head including C0–C2 with 0.5mm thickness is the gold standard for precise diagnosis of OCF and for guiding treatment. Hanson et al [14]" define craniocervical instability as either bilateral OCF or a unilateral OCF with contralateral widening of the atlanto-occipital joint by more than 2 mm or the atlantoaxial joint by more than 3 mm. They recommend that unstable fractures be managed surgically [14]". MRI of the craniocervical region is useful for assessing injury to the spinal cord, soft tissue, and tectorial membrane [15]"., of note due to secondary signs of soft tissue swelling at site of trauma, MRI to be considered at first 48 hours post trauma for better visuakization of both tectorial membrane and alar ligament [16]".

3. Conclusion

Fracture pattern, the integrity of ligamentous structures and alignment are the main factors that govern the decision between surgical and non-surgical treatment. Presence of rcSDH in the setting of stable bilateral OCFs, we recommend the Mueller et al classification to direct care and management planning. The co-incidence of rcSDH and non-displaced bilateral OCFs indicates a severe injury, but does not necessarily indicate instability as in our case and can allow for conservative management.

Abbreviations

CT=computed tomorgraphy. MRI=magnetic resonance imaging; OCFs=occipital condyle fractures; rcSDH=retroclival subdural hematoma; AOD=atlantooccipital dislocation

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Written consent was taken for publication.

Disclosure of Interest

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