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CASE REPORT

Traumatic retroclival epidural hematoma and unilateral occipital condylar fracture in an adult patient

Chu CY*, Leung WKW, Chan TM, Mak YK, Khoo JLS

Department of Radiology, Pamela Youde Nethersole Eastern Hospital, Chai Wan, Hong Kong SAR

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ABSTRACT

Retroclival epidural hematoma is rare, with fewer than 30 cases reported in the literature. Almost all of the previously reported cases occurred in children, with only a few cases affecting adults. Among these adult patients, only two suffered from the associated occipital condyle fracture (OCF), which is another rare injury. The patient involved in this study suffered from retroclival epidural hematoma and unilateral occipital condyle fracture, as demonstrated on both CT and MRI scans. The patient also suffered from an associated right brachial plexus injury without any other neurological deficits, a condition that has not previously been reported. This paper reviews the underlying mechanisms of these rare injuries and seeks to form an understanding of them before proposing the mechanism of injury in the patient involved in the study.

Keywords: Occipital condyle fracture, Retropharyngeal hematoma, Epidural hematoma, Brachial plexus, Clivus hematoma

Abbreviations: OCF – occipital condyle fracture

INTRODUCTION

Epidural hematomas are the most frequently reported traumatic mass lesion in the posterior cranial fossa [1]. However, retroclival epidural hematomas, a subgroup of the posterior cranial fossa epidural hematoma, are exceptionally rare [1, 2]. To the best of the researcher's knowledge, fewer than 30 cases of traumatic retroclival epidural hematoma have been reported in literature and the condition is almost exclusively found in the paediatric age group [1].

A occipital condylar fracture (OCF) is a rare and easily missed fracture, with a reported incidence rate of 3–4% in severely injured patients [3]. The seriousness of this fracture is due to its close proximity to important structures, including the medulla oblongata, vertebral arteries and lower cranial nerves [3]. Moreover, an OCF could be associated with instability of the occipitoatlantoaxial joint complex, the integrity of which depends on the bony articulations and a number of supporting ligaments, among which tectorial membrane and bilateral alar ligaments are the two most important supporting ligaments [3].

This study examines a patient who experienced a unilateral OCF and retroclival epidural hematoma after receiving a head injury. The patient also suffered from a basal skull fracture, fractures of right transverse processes of C6 and C7, retropharyngeal hematoma and the brachial plexus injury of the right upper limb. It is uncommon for both of these rare injuries, retroclival epidural hematoma and an OCF, to occur in the same patient. It is even more unusual that the patient involved did not exhibit any life-threatening symptoms, but only

* Corresponding author. Address: Hong Kong. E-mail: chuchiyeung@yahoo.com.hk (Chi-Yeung Chu)

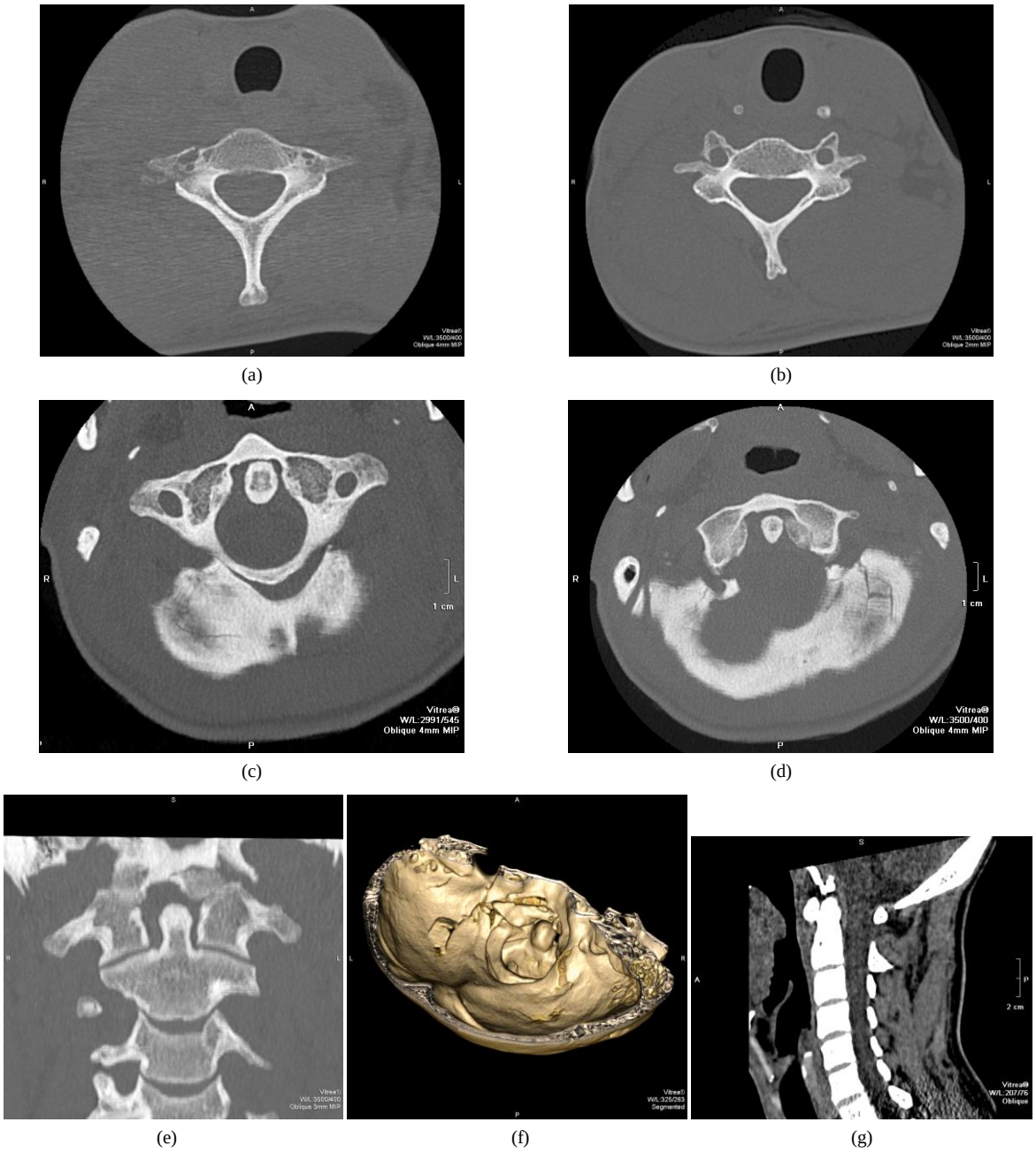

Figure 1 (a) and (b) MIP images of axial CT scan of the lower cervical spine in bone window at C7 (a) and C6 (b) levels show fractures of right transverse processes of the corresponding vertebrae (white arrows). (c) and (d) MIP images of axial CT scan of the occipital bones in bone window reveal fractures (black arrows). (e) Coronal reformatted CT scan in bone window shows fracture of left occipital condyle (open arrow). (f) 3D volume rendered image of the skull base in superior oblique view reveal fracture of left occipital bone extending into left occipital condyle (black arrowheads). (g) Sagittal image of the cervical spine in soft tissue window reveals hyperdensity just posterior to the clivus, extending down to the upper odontoid process, suggestive of acute hematoma (double white arrows).

the brachial plexus injury of the right upper limb. To the best of the researcher's knowledge, this is the first case report of a patient that suffers from both a unilateral OCF and retroclival epidural hematoma with brachial plexus injury.

CASE REPORT

A 28-year-old male construction site worker with a previously healthy history suffered from head and facial injuries in a work-based accident. He had been seated inside a slow moving freight vehicle and, after poking his head out from the window of the vehicle, had subsequently received a direct impact on the back of his head from a metallic rod. He did not lose consciousness

and his GCS was 15/15 on admission. The patient complained of neck pain over the right side in the absence of direct trauma. There was a suspicion that a traction injury had occurred. He also complained of numbness over his right arm. A physical examination revealed that he had decreased sensation, power and

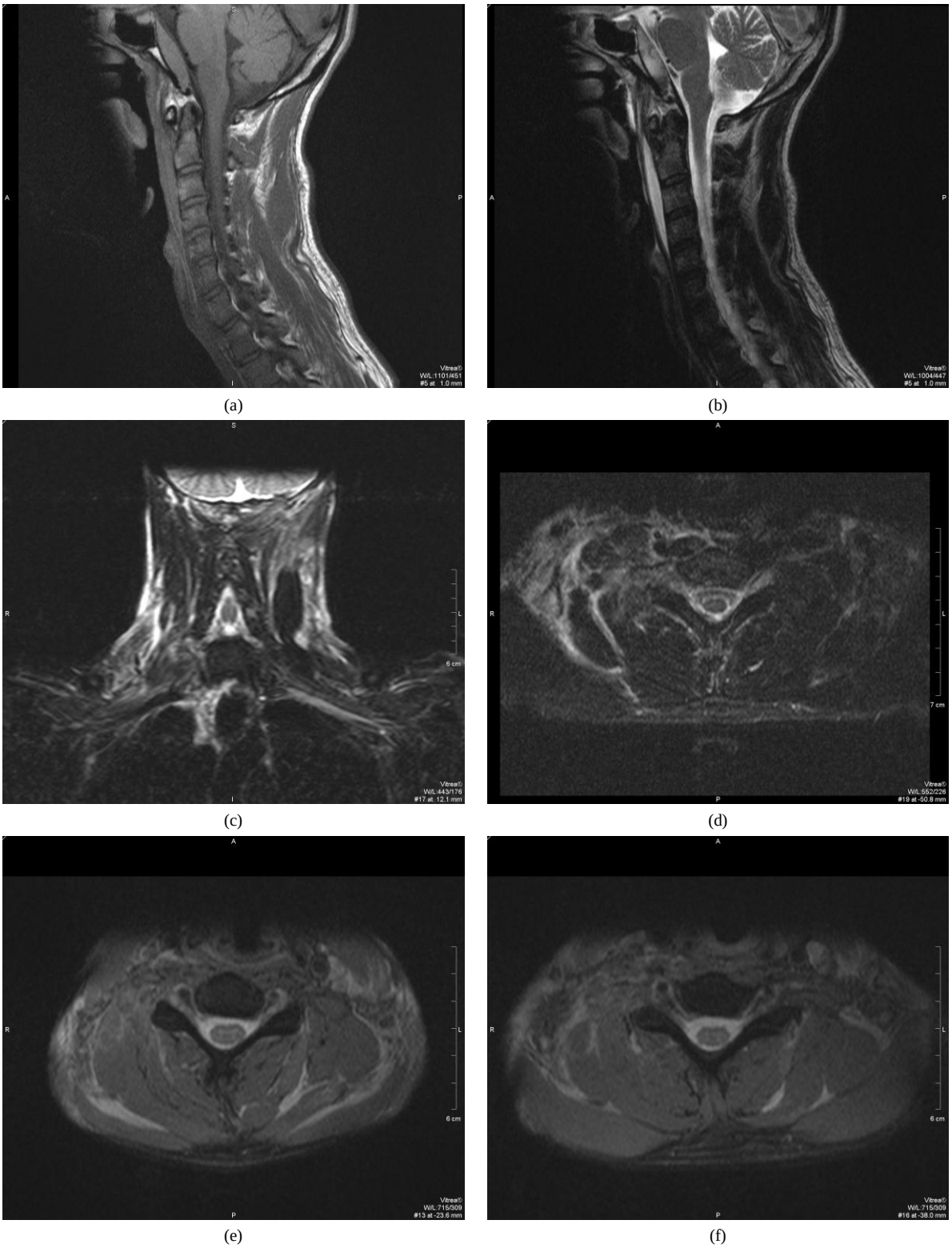

Figure 2 Sagittal MRI image of the cervical spine in (a) T1-weighted and (b) T2-weighted sequences. The images reveal a T1 slightly hyperintense and T2 hyperintense lesion just posterior to the clivus (white arrows), suggestive of a retroclival epidural hematoma. The sagittal MRI images also show a T1 slightly hyperintense and T2 hyperintense hematoma in the retropharyngeal space (white arrowheads). STIR images of the neck in coronal (c) and axial (d) views show T2 hyperintense signal over the muscles and soft tissue in right lower neck (white arrows), which could be due to traction injury. T2 hyperintense signal change is also seen in left suboccipital region (white arrowheads), likely related to the recent trauma. No pseudomeningocele is found in T2-weighted axial MRI images of the cervical spine at C6 (e) and C7 (f) levels to suggest nerve root avulsion.

hyporeflexia over the right upper limb, and the doctors suspected that he had suffered a brachial plexus injury.

CT scans of the head and cervical spine were performed, revealing fractures over the occipital bones. An extension of the fracture to the left occipital condyle was observed. Hyperdense blood in the retroclival region was detected and it was believed that this was suggestive of an acute hematoma. Fractures of the right transverse processes of C6 and C7 were noted and these extended to the foramen transversarium. The occipito-atlantal and atlantoaxial joints showed no instability. No fracture of the vertebral bodies of the cervical spine was identified (Figure 1). A CT angiogram was performed in view of fractures of the transverse processes, but these did not show any vertebral artery dissection.

In view of the neurologic deficits in the right upper limb, an MRI of the brachial plexus was performed. No evidence of nerve root avulsion was seen in the right cervical nerve roots. The right anterior, middle and posterior scalene muscles showed a T2 hyperintense signal, which was suggestive of edema and likely related to the recent injury. Moreover, acute retroclival epidural hematoma was noted, with no compression on the brainstem seen. A thin rim of prevertebral hematoma was seen (Figure 2).

The patient was put on conservative management with a neck collar and physiotherapy. During the follow up examinations he did not complain of any pain over the neck or shoulder. The power and sensation in the right upper limb gradually improved at each of the follow-up examinations that were completed by orthopedic surgeons over a period of 5 months after the injury. At the latest follow up only mild residual muscle weakness was identified over the patient's right upper limb.

DISCUSSION

Epidemiology of retroclival epidural hematoma and occipital condylar fracture

Fewer than 30 cases of retroclival epidural hematoma have been formally reported since the first case was described by Orrison et al in 1986 [4, 5]. Most reported cases occurred in children or adolescents [1] and only three adult patients with traumatic retroclival hematoma have ever been reported [2, 4, 6, 7].

An occipital condylar fracture (OCF) is uncommon and easily missed [3]. It is difficult to elucidate the diagnosis of an OCF because of variabilities in the presenting symptoms and the inability of plain x-ray to delineate the fracture [8]. The exact incidence is unknown, but a few studies have shown that an OCF occurs in 3–4% of patients who have suffered from severe head injuries and altered GCS [3].

Although traumatic retroclival epidural hematoma and the incidence of an OCF have been reported separately, it is exceptionally rare that both injuries occur in the same patient. Only one case of a 46-year-old woman with a bilateral OCF and retroclival hematoma has been reported [6]. In another case involving a right OCF, the presence of a retroclival hematoma was only inferred by the posterior displacement of the basilar artery [7]. The patient involved in this study is believed to represent the first case of a unilateral OCF and retroclival hematoma in an adult patient.

Anatomy

The occipital condyles, together with the atlas and axis, form an extremely complex three-unit joint, which is named the craniocervial joint or occipitoatlantoaxial complex [3]. The stability of the joint is highly dependent on the integrity of the ligamentous structures, among which the most important are the tectorial membrane and the paired alar ligaments [3]. The tectorial membrane represents the cephalic extension of the posterior longitudinal ligament and it extends from the posterior surface of the body and odontoid process of the axis to the anterolateral edge of the foramen magnum, overlying the inferior aspect of the clivus [1, 3]. The tectorial membrane helps limit flexion and extension while the alar ligaments limit axial rotation and lateral bending, thus maintaining the stability of the craniocervial joint [3, 9].

Classification of occipital condylar fracture

The OCF was classified into three types by Anderson and Montesano in 1988. These vary according to their morphology and the mechanism of the injury [9]. Type I is an impaction-type fracture that occurs as a result of axial loading of the skull onto the atlas and results in the comminuted fracture of the occipital condyle, with or without minimal fragment displacement. Type II is a basilar skull fracture that extends into one or both occipital condyles and is likely to occur as the result of a direct blow to the skull. Type III involves the avulsion fracture of the occipital condyle by the alar ligament [3, 9]. Type III is regarded as a potentially unstable injury, while Type I and II are usually stable [3, 9].

Tuli et al. recently proposed a new classification system for the OCF, which is based on the presence or absence of fragment displacement and stability of the craniocervical joint and is assessed by imaging evidence of ligamentous injury [3, 8]. Type 1 is described as an undisplaced fracture, while Type 2 is a displaced fracture [3, 8]. Type 2 can be further divided into Type 2a if no ligamentous injury is detected and Type 2b if ligamentous injury is found [3, 8]. Type 1 and Type 2a are described as stable lesion, while Type 2b is unstable [3, 8].

As revealed by the CT images, the patient involved in the current study suffers from a Type II OCF according to the Anderson and Montesano classification system and a Type 1 OCF according to the new classification system suggested by Tuli et al.

Clinical Presentation

Patients with retroclival epidural hematoma have various clinical presentations, including involvement of cranial nerves (most commonly abducens nerve), hemiparesis, paraparesis and tetraplegia [1, 2]. Most of the patients exhibit impaired GCS at presentations [1, 2]. In one clinical series, the mean GCS score was only 8. The reason for this could be due to the hematoma causes compression on the cranial nerves or brainstem [1]. However, there is actually no correlation between the size of the hematoma and the presenting symptoms [1, 4]. Patients may also have a craniovertebral junction injury [4].

The clinical presentation of an OCF is also highly variable [3, 8]. Lower cranial nerve palsy is the most common neurological deficit, which was reported in a case examined by Bolender et al case [3, 7]. Patients are generally unconscious, although some may remain responsive [3, 9]. Tuli et al. reported an incidence rate of 38% of delayed presentations [3, 8].

In the only reported two cases of both an OCF and retroclival hematoma, both patients exhibited neurological deficits and cranial nerve injuries. In contrast, the patient involved in this study only suffered from right brachial plexus injury with full consciousness.

CT scans are usually the first imaging modality used to examine the majority of patients who suffer from head injuries. It is especially important in cases of an OCF because of variations in its clinical presentation and the inability to detect the condition on plain radiographs. CT scans can usually demonstrate retroclival hematoma as a hyperdense lesion just posterior to the clivus, as in our case (Figure 1g). However, an MRI may be required when the lesion is equivocal on a CT, with hematoma being demonstrated as a hyperintense lesion on T1 and T2 sequences (Figures 2a, b).

Mechanism of injury

Trauma due to motor vehicle accident is the most common cause of retroclival epidural hematoma [2, 4]. The exact mechanism is not known. However, it is believed that the detachment of the tectorial membrane from the clivus results in disruption of the local vascular structure (e.g. basilar venous plexus, dorsal meningeal branch of meningohypophyseal trunk), leading to blood accumulation in the retroclival area [1, 2, 4]. In the case reported by Ratilal et al, most patients with retroclival epidural hematomas also exhibited signs that were suggestive of occipitoatlantoacial instability in possible relation to the cervical hyperflexion/hyperextension [2]. In view of the close relationship between the occipital condyle and tectorial membrane, the occurrence of both an OCF and disruption of the tectorial membrane in the same patient may seem reasonable. Despite this, it may be surprising that only two previous cases that involve both an OCF and retroclival epidural hematoma have been reported [6, 7].

Retroclival epidural hematoma is almost exclusively found in the pediatric age group [1, 4]. It has been suggested that the unique characteristics of the craniovertebral joint in children predisposes them to the hematoma [1]. The relatively smaller occipital condyles and a more horizontally oriented atlanto-occipital articulation results in a less stable craniovertebral joint [1]. It has also been suggested that the dura is more readily detached from the skull in children [2].

Brachial plexus injuries most commonly result from a motor vehicle accident. Other causes include penetrating or sports-related injuries, falls, industrial accidents, radiation therapy and iatrogenic causes [10]. The most common mechanism of the nerve injury results from traction and this occurs in 95% of cases [10, 11]. In the majority of cases, there is involvement of the entire brachial plexus and this was the case with the patient involved in the current study [11]. The presence of right transverse process fractures of C6 and C7 vertebrae in the patient in question was also associated with brachial plexus injury. The cervical nerve roots from C3 to C7 are draped directly over the top of the transverse processes at these levels [12]. The presence of transverse process fracture may actually indicate nerve root avulsion at the same level [11]. Although the brachial plexus injury in the patient in the current study could not be directly demonstrated on an MRI scan, the clinical findings, presence of transverse process fractures and muscle edema found in the MRI do suggest the presence of a right brachial plexus injury.

It is actually unusual for patients to present both a left OCF and retroclival epidural hematoma, as was the case of the 28-year-old man involved in the current study. It is even more unusual that such a patient exhibits a brachial plexus injury of the right upper limb but no other neurological deficit. To the best of our knowledge, such a condition has never been reported before.

The patient in this study suffered from traumatic retropharyngeal hematoma, which is also rare [13]. Despite its rarity, this condition can be caused by numerous factors: cervical fractures, violent coughing, pharyngeal foreign bodies, and injury of great vessels, anticoagulation therapy and so on [13]. Hyperflexion and hyperextension of the neck with contusion during falls or motor vehicle accidents is one of the most common causes of this state [13]. Moreover, there is an association between retropharyngeal hematoma and occipital condyle fracture, both of which occurred in our patient [13].

After a review of the underlying mechanisms of all the rare conditions, we may now propose the mechanism of injury of the patient involved in the current study. According to the Anderson and Montesano classification, the Type II left occipital condyle fracture in our patient could be the result of a direct impact to the skull base over the occipital region. The direct impact to the occipital bones could result in a sudden flexion and subsequent extension of the neck. Such movement may result in a hyperflexion/hyperextension injury to the neck, causing retroclival hematoma. However, the presence of right brachial plexus injury and fractures of right transverse processes of C6 and C7 vertebrae may imply the underlying mechanism is more than a pure hyperflexion/hyperextension injury of the neck. Lateral

bending of the neck towards the left side during injury should have occurred, leading to a traction injury of the right brachial plexus. The retropharyngeal hematoma in our patient may result from either a hyperflexion/hyperextension injury or a left occipital condyle fracture.

Management

Past research indicates that most patients who experience retroclival hematoma were treated conservatively and, in the majority of cases, the outcomes of this treatment were positive [1, 2, 14]. Although some of the reported patients with retroclival hematomas had impaired GCS, no correlation between the presenting GCS and the final outcome was found [2]. Therefore, conservative treatment seems to be the treatment of choice in the absence of progressive neurological deterioration [14]. However, evacuation of the hematoma and stabilization of the cervical spine should be considered in patients who exhibit critical compression of the brainstem or instability of the craniocervical joint [14].

The treatment for an OCF is generally conservative, although the management strategy has not been well established [3]. Most authors treat an Anderson and Montesano Type I and II OCF with semirigid or rigid cervical collar [3]. Tuli et al. proposed that an undisplaced OCF does not require immobilization [8]. It is only when an OCF is associated with unstable craniocervical joint that a halo traction vest, external fixation or surgical fixation is required [3]. If surgical fixation of the craniocervical joint is performed, it is usually by means of posterior fusion of the spine [3].

Observation may be the only necessary treatment for retropharyngeal hematoma when there is no dyspnea or major dysphagia [13]. The hematoma will normally completely resolve within 3 to 4 weeks [13]. However, there may be delayed occurrence of dyspnea in patients without immediate presence of airway compromise [13]. Therefore, close observation is necessary during the first few days [13].

For the treatment of a brachial plexus injury, the initial management includes observation, pain control and physiotherapy if there isn't any open wound or life-threatening injury [10]. The aims of non-surgical management are to maintain passive motion, strengthen the remaining functional muscles, protect anaesthetic skin areas and control pain [10]. If function fails to return, or if the initial neurological recovery ceases, then surgical exploration should be performed at around 3–6 months [10]. However, the management algorithm of brachial plexus injury has not been established [10]. In our patient, there was a gradual recovery of the plexus injury on conservative management and therefore surgery was not deemed to be necessary.

CONCLUSION

It is unusual for all the rare injuries to occur in the same patient, especially with regards to the presence of a Tuli Type I OCF and a retroclival hematoma. Moreover, it is even more unusual for a patient to present only a right brachial plexus injury with no other neurological deficits or loss of consciousness, as was the case with the patient involved in this study. Completing a review of the underlying mechanisms of all the rare injuries is important in gaining an understanding of the mechanism of injury in the patient. The knowledge of these conditions can also guide subsequent management of the condition.

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