A case report of bilateral temporal bone fractures associated with bilateral sixth and seventh nerve palsies

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Citation

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Abstract

Facial nerve paralysis associated with temporal bone fractures has been well described in the literature. However, bilateral traumatic facial paralysis associated with bilateral abducens nerve palsies is very rare. As such, there is no gold standard guideline for the management of such injuries, including the indication for surgical management and timing of surgical intervention. We report a case of a previously fit and well gentleman presenting with bilateral sixth and seventh nerve palsies following a traumatic crush injury. Computed tomography (CT) imaging showed longitudinal fractures of both petrous temporal bones extending cranially as linear undisplaced fractures of the squamous temporal bone. Electroneuronography (ENoG) and audiological evaluation were also used. Notable features of this case include the mechanism of injury and the rarity of bilateral sixth and seventh nerve palsies. The patient subsequently underwent left sided facial nerve decompression via a trans-mastoid approach following discussion at a multidisciplinary meeting.

INTRODUCTION

The temporal bone is a complex bone. It encapsulates many important structures, including the cochlear and vestibular end organs, the facial nerve, the carotid artery and the jugular vein. As such, temporal bone fractures pose a challenging problem for the ENT surgeon.

Historically, temporal bone fractures have been classified into longitudinal and transverse in the proportion of 80 – 90% to 10 – 20% [1]. However, most temporal bone fractures are completely irregular and not uniform in their pathway. Therefore, rather than the type of fracture, the evaluation of function is mandatory.

There is debate concerning the indications, timing and choice of approach in the management of temporal bone fractures and associated facial nerve paralysis. Some authorities advocate limited surgical exploration of the facial nerve based on clinical, radiographic and electromyographic information. Li et al reported a good outcome with conservative management of bilateral facial nerve palsies i.e. steroids and no surgical intervention [2].

Electroneuronography (ENoG) is of increasing importance in determining the need for and the timing of surgery for facial paralysis after trauma. The widely held consensus is that the threshold for surgical intervention is reached when a 90% or greater degeneration is seen on electroneuronography [3,4]. Some investigators report this as the key indicator for surgery regardless of timing of paralysis onset.

Bilateral traumatic facial paralysis with bilateral abducens palsies is a rare clinical condition and has not been described extensively in literature. Abducens paralysis usually occurs secondary to localized damage in the area of Meckel's cave and Dorello's canal.

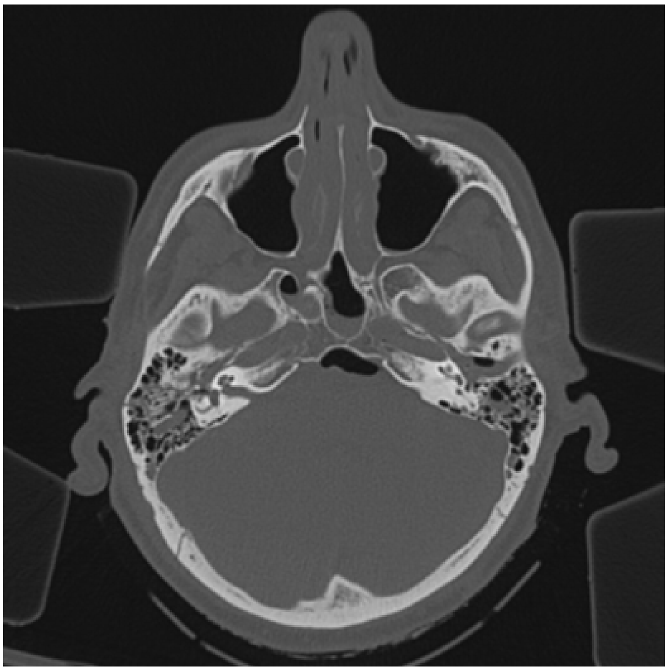
CASE REPORT

A 60 year old man was brought into the Emergency Department after an accident at work, resulting in his head being slowly crushed between a forklift truck and metal shelving. He distinctly remembered hearing a 'popping' noise from his 'head' before losing consciousness. He was intubated, had bilateral thoracostomies inserted at the scene by the immediate response team and was flown by helicopter to the Emergency Department. A primary survey revealed a moderate amount of blood in his oropharynx requiring suctioning. An ENT opinion was sought due to continuing nasopharyngeal bleeding and bilateral sanguineous otorrhoea.

A CT scan of his head showed longitudinal fractures of both petrous temporal bones extending cranially as linear undisplaced fractures of the squamous temporal bones. (Figure 1) The fracture lines passed through the region of the geniculate ganglia of the seventh cranial nerve. There was pneumocephalus with intra-ventricular and subarachnoid air. There were subarachnoid and subdural haemorrhages as well as an extra-dural haematoma in the right temporal region.

Figure 1

Figure 1: COMPUTED TOMOGRAPHY IMAGE OF INJURY



Two days after admission, upon regaining consciousness, physical examination revealed bilateral abducens nerve palsies and House-Brackman grade 6 lower motor neuron facial nerve palsies. Upon further questioning, the patient revealed that he felt that the loss of control of his facial muscles started immediately after the accident.

The remainder of his cranial nerves appeared to be functioning normally. He was commenced on oral dexamethasone. Otoscopy revealed bilateral hemotympanum with a right sided perforation in association with a bilateral conductive hearing loss, worse on his left side. The patient underwent audiological evaluation including pure-tone audiometry, tympanometry, and stapedial reflex measurement.

The patient was referred for neurophysiological investigation. ENoG and electromyography (EMG) revealed a few intact distal fibres to the left obicularis oculi but greater than 90% degeneration of the facial nerve bilaterally.

It was decided that the benefits of exploration of the left ear (with the more obvious fracture on CT and poorer hearing) outweighed the smaller risks of hearing deterioration, although the patient was counseled that this was a potential complication. This was carried out via a trans-mastoid route with temporary disarticulation of the ossicular chain to access the first genu of the facial nerve.

Surgery was performed within 13 days after the injury. A bony spicule abutting the first genu was found and removed.(Figure 2 and 3). Post-operative recovery was uneventful and the patient was discharged home on a reducing dose of prednisolone.

Figure 2

Figure 2:INTRA-OPERATIVE VIEW OF FRACTURE LINE

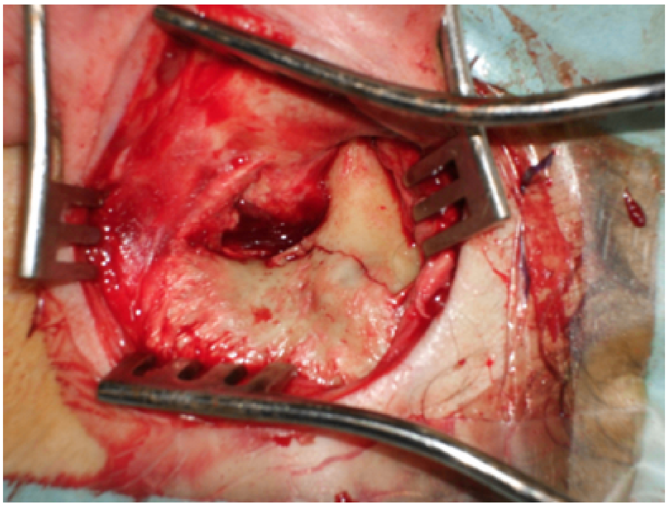
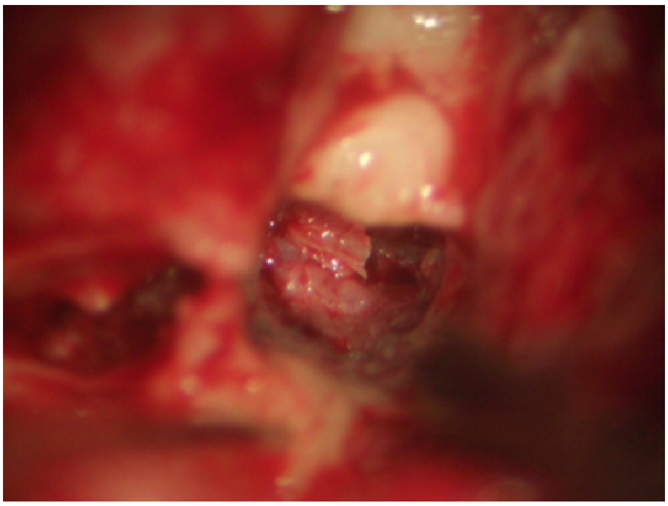


Figure 3

Figure 3:BONY SPICULE MANIPULATED FROM FIRST GENU



Follow up visits, consisting of otoscopic examination, and audiometric work up, and a facial outcome assessment, were made one week, three weeks, three months, six months and eighteen months after initial operation. Repeat neurophysiology at six months revealed no improvement, with no facial compound muscle action potentials recordable and no volitional motor units on EMG. Spontaneous EMG activity consisted of fibrillations and positive sharp waves in both orbicularis oculi and both orbicularis oris muscles.

Interestingly, the patient suffered only a mild sensorineural hearing loss and a moderate conductive hearing loss despite clear signs of air in the labyrinth on CT scan. The patient was reviewed at 18 months post event and found to have good bilateral facial tone. He had House-Brackman grade 3 function in his left facial muscles and House-Brackman grade 4 function in his right facial muscles. He continues to improve.

DISCUSSION

Approximately 4-30% of head injuries involve a skull base fracture, and 18-40% occurs with temporal bone involvement. Most of these fractures are unilateral, with bilateral fractures reported in just 9-20% [5].

In a review of 82 temporal bone fractures in 75 patients, Ghorayeb and Yeakley presented complications of temporal bone fractures [6]. Temporal bone fractures may result in palsies to cranial nerves other than the facial nerve. These include abducens nerve palsies. The abducens nerve has the longest intracranial course of any cranial nerve and is closely associated with the facial nerve and the trigeminal nerve. Due to the complex anatomy of the abducens nerve the exact mechanism of injury is often unclear and may result from stretching and contusion alone. Injury to cranial nerve VI occurs with an incidence of 5% to 7% in fractures involving the petrous apex [7].

The use of the terms ‘longitudinal’ and ‘transverse’ is limited and does not accurately correlate to clinical sequelae. Hence, new descriptors such as ‘oblique’ and ‘mixed’ have been introduced. However, the classification of fractures using the ‘otic capsule violating’ or ‘otic capsule sparing’ system appears to be a more accurate predictor of clinical outcome [8]. A retrospective dissection of 100 temporal bones found that the gravest damage to the facial nerve occurred in fractures involving the otic capsule [9].

Imaging plays a crucial role in the contemporary evaluation and management of temporal bone fractures. Non-contrast high resolution CT of the temporal bone, with cuts no more than 1.5mm is the diagnostic imaging standard for evaluating temporal bone fractures [5].

Approximately 10 - 25% of longitudinal fractures and 38 - 50% of transverse fractures result in a facial nerve palsy [10,11]. This derives from oedema, intra-neural haemorrhage, bony fragment impingement and dehiscence of the nerve.

Determining if the facial nerve is severed is difficult and sometimes impossible without surgical exploration. Electro-diagnostic studies help the clinician differentiate the different types of nerve lesion and can determine the degree of degeneration on the traumatized side as compared with the normal side. The timing of onset of facial paralysis has an important bearing on outcome. Immediate paralysis may indicate a transection of the nerve with loss of neural continuity, whereas delayed onset paralysis usually occurs in the context of an intact nerve and denotes the development of neural oedema or an expanding haematoma with neural compression inside a non-expanding bony canal.

The evaluation of a patient’s facial paralysis from temporal bone fractures begins with early diagnosis. Several tests are available, with ENoG and EMG being most commonly used. In ENoG, results are presented as a percentage of the amplitude of the compound muscle action potential on the paralysed side as compared to that of the non-paralyzed side. The results correlate well with the percentage of nerve degeneration. Ulug and Arif Ulubil advocate the early use of ENoG in the first six days after the onset of facial paralysis [12].

The controversies regarding facial nerve paralysis involve the decision to operate, the timing of the operation and the preferred surgical approach to the injured segment. Incomplete paralysis implies a functional non-severed facial nerve with good prognosis. Recovery rates are slower for immediate onset paralysis, a fact that generates controversy. In 1944, Turner studied the prognosis of facial palsy in 70 consecutive cases of closed head injury and noted that more people with delayed onset facial palsy made a good recovery than patients with immediate onset facial nerve palsy – 94% in the first group compared to 75% in the second [13].

CONCLUSION

There is some dispute in the literature concerning the role, the timing, and the type of surgery in the management of traumatic facial paralysis. Electroneuronography (ENoG) has radically changed the evaluation and management of facial nerve lesions associated with temporal bone fractures. The next major innovation in the management of these lesions was the advent of high resolution CT, but the significance of this diagnostic tool has not been significantly extrapolated in the literature.

Bilateral sixth and seventh nerve palsies are recognised but rare complications of traumatic bilateral temporal bone fractures. This case report emphasises the importance of ENoG and HRCT and the consideration of surgery in the management of such a case.

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