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Pediatric temporal bone fractures: A case series

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ABSTRACT

Objectives: Temporal bone fractures are relatively common findings in patients with head trauma. The aim of this study was to evaluate the characteristics of temporal bone fractures in the pediatric population.
Study design: Retrospective case series. Tertiary care pediatric academic medical center.
Methods: The medical records of patients aged 18 years or less diagnosed with a temporal bone fracture at the Montreal Children's Hospital from January 2000 to August 2014 were reviewed. Patient demographics, clinical presentation, mechanism of injury and complications were analyzed. Imaging studies and audiograms were also evaluated.
Results: Out of 323 patients presenting to the emergency department with a skull fracture, 61 presented with a temporal bone fracture. Of these, 5 presented with bilateral fractures. 47 patients had associated fractures, and 3 patients deceased. We observed a male to female ratio of 2.8:1, and the average age was 9.5 years. Motor vehicle accidents were the primary mechanism of injury (53%), followed by falls (21%) and bicycle or skateboard accidents (10%). The most common presenting signs included hemotympanum, decreased or loss of consciousness, facial swelling and nausea and vomiting. 8 patients had otic involvement on computed tomography scans, and 30 patients had documented hearing loss near the time of accident with a majority being conductive hearing loss. 17 patients underwent surgical management of intracranial pressure.
Conclusion: In children, fractures of the temporal bone were most often caused by motor vehicle accidents and falls. It is common for these patients to have associated fractures.

1. Introduction

Temporal bone fractures are of special interest for clinicians given that they can translate into an array of complications, and that they usually arise from high impact trauma [1].

The temporal bones are complex structures forming part of the lateral skull base. They are each made up of five parts: the styloid, tympanic, squamous, mastoid and petrous portions [2]. The temporal bones articulate with other cranial bones and form part of the middle and posterior fossae. Important neural and vascular components such as the vestibulocochlear nerve, facial nerve, internal carotid artery and jugular vein, have part of their trajectories though this bone. They also contain the sensory organs of hearing and balance; the cochlea and vestibule [3]. As such, trauma to this intricate area can lead to a variety of clinical presentations including hearing loss, hemotympanum, loss of consciousness, tympanic membrane perforation, otorrhagia, facial nerve injury, cerebrospinal fluid (CSF) leakage, ecchymosis of the post-auricular skin (Battle sign) and periorbital area (raccoon sign) [4–6].

A limited amount of articles regarding temporal bone fractures in children are available in the current literature. The aim of this study was to evaluate the characteristics of temporal bone fractures in patients aged 18 years or less in a pediatric tertiary care hospital setting.

2. Methods

2.1. Ethical approval

Ethical approval for this study was obtained from the pediatric research ethics committee at the McGill University Health Centre. Study number 11-731-PED.

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2.2. Study subjects

A retrospective chart review was performed for patients aged 18 years or less presenting to the Montreal Children's Hospital (Montreal, QC, Canada), a tertiary care pediatric hospital, from January 2000 to August 2014, for a base of skull fracture. The charts were then reviewed in order to identify patients with temporal bone fractures specifically. Data such as demographics, clinical presentation, mechanism of injury and complications were analyzed. Signs and symptoms included hemotympanum, otorrhea (CSF, blood), Battle sign, raccoon eyes, amnesia, tympanic membrane perforation, CSF rhinorrhea, dizziness, tinnitus, vertigo, otalgia, facial swelling, mastoid swelling, headache, level of consciousness at the time of presentation and amnesia.

Complications included facial nerve injury (paresis or paralysis), hearing loss, and intracranial injuries. Associated skull fractures were also described. A head computed tomography confirming the fracture at the time of the injury was another inclusion criterion for selecting patients. Hearing assessments following the injury, including pure-tone audiometry or otoacoustic emissions, were evaluated when performed, as well as documented facial nerve function in medical records. Cases were excluded from analysis when relevant clinical or imaging data was missing.

3. Results

The search for base of skull fractures from January 2000 to August 2014 yielded a total of 323 patients. Of these, 61 patients presented with temporal bone fractures, and 5 of these patients presented with bilateral temporal bone fractures. Patient demographics are presented in Table 1. The majority of patients were male and age of injury ranged from the time of birth until 17 years of age. The mean age was 9.5 years and the median was 10 years.

3.1. Mechanisms of injury

Mechanisms of injury were varied and included motor vehicle accidents (MVA), falls, accidents while biking, skateboarding, tobogganing or skiing, assaults, an animal bite and presence at birth (Table 2). Of these, MVAs were responsible for 53% of the fractures (Fig. 1). Approximately one third of the MVAs occurred while the patient was on an all-terrain vehicle (ATV), driving or as a passenger (32.3%). The criminal code of Canada considers ATVs, snowmobiles, scooters and golf carts as "motor vehicles", for this reason, accidents that occurred while driving (or as a passenger) of these vehicles were included in the MVA category. If a patient was involved in a car collision, the accident was included as an MVA regardless of whether the patient was performing another activity at the time (i.e. riding a bicycle, skateboarding). A total of sixteen patients were implicated in an automobile accident with 5 of these patients being involved in a car collision. Seven patients were hit by an automobile while riding their bicycles or while skateboarding; of these, only 2 were wearing helmets. Four patients were pedestrians.

Thirteen patients had a temporal bone fracture as a result of a fall. The height from which the patients fell varied from 40 cm up to falling from a third floor. Two patients fell off a shopping cart and one fell down the stairs. Five patients were assaulted with a resultant hit to the head with a rock, a baseball bat, hitting their head against a wall or by being physically pushed to the ground. Six patients fell off their bicycles or skateboards and 5 of them were not wearing helmets as documented in the patients' charts. Other less frequent mechanisms of injury are described in Table 2.

Table 1
Patient demographics.

Patients (n)	61
Temporal bone fractures	66
Bilateral fractures	5
Age	
Range	Birth – 17
Mean ± SD	9.5 ± 5.0
Median	10
Male/female	45/16
Deceased	3

Table 2
Mechanisms of injury.

Mechanisms of injury	# of patients
Motor vehicle accident	32
Motor vehicle	16
ATV	10
Scooter	2
Golf cart	3
Snowmobile	1
Fall	13
Bicycle/skateboard	6
Assault	5
Other	5
Dog bite	1
Present at birth (pond fracture)	1
Fall of cement wall	1
Tobogganing	1
Skiing (struck a tree)	1

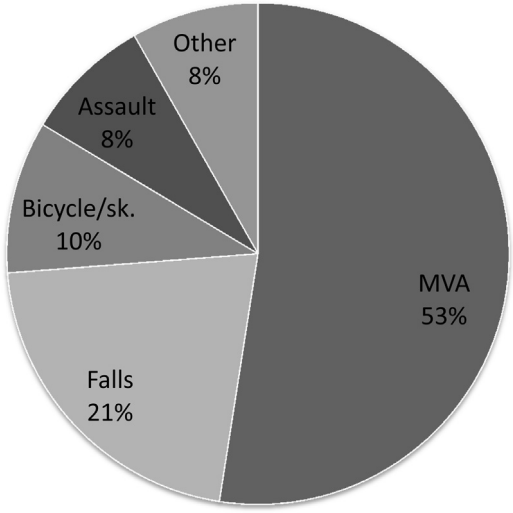

Fig. 1. Pediatric temporal bone fractures: mechanisms of injury.

3.2. Clinical presentation

Ten patients arrived at the tertiary care pediatric medical center already intubated. The most common findings on clinical presentation were the presence of hemotympanum, loss of consciousness and a decreased Glasgow coma scale (GCS) score. Headaches and nausea and/or vomiting were predominant clinical manifestations. Twelve patients also described experiencing hearing loss. Multiple lacerations, drainage of liquid from the ear, otorrhagia, CSF otorrhea, mastoid tenderness, dizziness or confusion were also observed. Other classical physical findings of basilar skull fractures such as raccoon eyes, CSF rhinorrhea and Battle sign were infrequent (see Fig. 2).