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10.4103/tjo.tjo_75_19

Isolated abducens nerve palsy following temporal bone fracture in a child

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Abstract:

Temporal bone fractures are often associated with damage to middle or inner ear structures, facial nerve, and cerebrospinal fluid (CSF) leak, and rarely with abducens nerve palsy. Isolated abducens nerve palsy is not known to occur following temporal bone fracture and is most commonly associated with concurrent facial nerve injury. We report a case of an 11-year-old girl who presented with isolated right abducens nerve palsy following head trauma. The child had incurred injury following a fall from a bicycle. The presence of postauricular ecchymosis was suggestive of possible temporal bone fracture. High-resolution computed tomography scan revealed undisplaced fracture of the right temporal bone at the petrous apex. Identification of temporal bone fracture prompted toward complete neurological and otological evaluation to detect life-threatening complications like CSF otorrhea. The child was managed conservatively with occlusion therapy to alleviate diplopia and showed complete resolution of the nerve palsy after 4 months. Isolated abducens nerve palsy following the temporal bone fracture is a rare finding. Additional clinical findings like postauricular ecchymosis should be looked for, and appropriate otological evaluation sought in such cases.

Keywords:

Abducens nerve palsy, cranial nerve injury, pediatric trauma, temporal bone fracture

Introduction

Head trauma or cervical injury accounts for 34%–42% of acquired abducens nerve paralysis in pediatric patients, second only to neoplasms.^[1] It is often accompanied by other cranial nerve injuries or neurological signs.^[1] Although it may occur after temporal bone fractures, it is been reported along with facial nerve palsy in most cases.^[2,3] Thus, in the absence of facial paralysis or hearing problems, the suspicion of temporal bone fracture is remotely contemplated. Temporal bone fractures may be associated with other problems such as hearing loss, cerebrospinal fluid (CSF) otorrhea, and damage to inner ear structures.^[4-6] It is important to identify and treat these complications as well. Isolated abducens nerve palsy following trauma to the temporal bone is a rare finding.

Other clinical signs such as postauricular ecchymosis or ear discharge should be looked for whenever a case with abducens nerve palsy following head trauma is encountered.

Case Report

An 11-year-old girl presented with the complaint of acute onset of binocular horizontal diplopia after a fall from her bicycle 3 days before the presentation. She also complained of pain behind the right ear. Apparently, the handle of the bicycle hit her right mastoid process during the fall. There was no history of ear or nose bleeding or discharge. There was no loss of consciousness or other neurological symptoms.

On examination, the child was conscious and well oriented. There was bruising and

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Submission: 06-08-2019
Accepted: 19-10-2019
Published: 19-02-2020

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How to cite this article: Baldev V, Tibrewal S, Rath S, Ganesh S. Isolated abducens nerve palsy following temporal bone fracture in a child. Taiwan J Ophthalmol 2020;10:306-8.

ecchymosis over the right mastoid process and abrasions over the left cheek. Her best-corrected visual acuity for distance and near was 6/6 and N6, respectively, in both eyes. Anterior segment examination and indirect funduscopy were unremarkable in both eyes. Pupils were round, regular, and reacting briskly to both direct and consensual light in both eyes. Extraocular movement examination showed abduction limitation of -5 in the right eye [Figure 1]. There was a compensatory face turn of 15° to the right side. The Prism cover test showed manifest esotropia of 35 prism diopters (PD) for distance 25 PD for near. Saccade assessment showed floating saccades during attempted abduction of the right eye. Clinical evaluation of other cranial nerves was unremarkable. A diagnosis of acute right abducens nerve palsy secondary to closed head trauma was made. The child had been examined by a physician before presentation where she was found to be neurologically stable. A computed tomography (CT) scan of the brain had been done, which did not reveal any hemorrhage or fractures. Due to the presence of ecchymosis behind the ear (Battle's sign), possible fracture of the temporal bone was suspected, and a high-resolution CT scan of the temporal bone was ordered. It showed an irregular oblique transverse fracture line in the right petrous apex with no significant displacement [Figure 2]. An immediate evaluation of the middle and internal ear was sought. It did not reveal any hemotympanum or CSF leak. The audiometric examination was also normal. She was advised right eye monocular occlusion, and a close ophthalmic follow-up was scheduled. After 3 weeks, the patient complained of persistent double vision, and clinical evaluation did not show any improvement in abduction or the angle of deviation. However, the parents refused botulinum toxin injection treatment and continued with monocular occlusion. She gradually improved, and after 4 months, she was diplopia-free in all gazes [Figure 3].

Discussion

The long intracranial course of the abducens nerve makes it vulnerable to injury following closed head trauma. Abducens nerve leaves the brainstem at the junction of pons and medulla, medial to the facial nerve. It runs upward and forward from this position into the subarachnoid space between the pons and clivus. It courses anteriorly and runs superiorly along the clivus enclosed within a fibrous sheath called Dorello's canal, and then pierces the dura mater. At the tip of the petrous part of the temporal bone, it makes a sharp turn forward to enter the cavernous sinus. Within the cavernous sinus, it runs alongside the internal carotid artery and enters the orbit through the middle part of the superior orbital fissure and innervates the lateral rectus muscle.^[7] In the

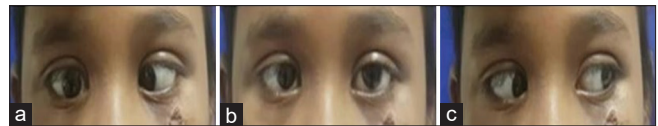


Figure 1: Clinical photographs at presentation showing (a) abduction limitation in the right eye (b) esotropia in primary position in the right eye (c) normal adduction movement in the right eye

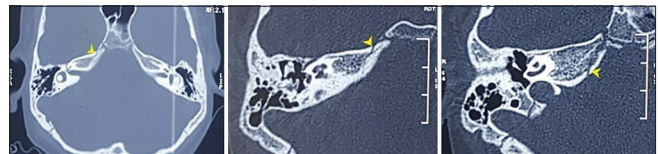


Figure 2: High-resolution axial computed tomography scan of temporal bone showing irregular oblique transverse nondisplaced fracture in right petrous apex (arrowheads). Note the extreme medial location of the fracture, sparing the middle and inner ear structures and facial nerve located more temporally within the bone

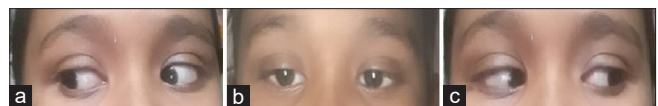


Figure 3: Clinical photographs after 4 months of trauma showing (a) completely recovered abduction in right eye (b) orthotropia in primary position (c) normal adduction movement in right eye

absence of hematoma or fracture, the mechanism of injury to the abducens nerve is believed to be stretching against the apex of the temporal bone just before it enters the Dorello's canal.^[8]

Temporal bone fractures in pediatric patients are commonly seen after the severe head injury, most following motor vehicle accidents or falls.^[4,5] The common presenting features are postauricular ecchymosis (Battle's sign), hearing loss, bleeding from the ear, balancing issues, or facial paralysis. The fractures are classified into longitudinal, transverse or mixed, based on the relationship of the fracture line with the long axis of the petrous bone.^[6,9] Studies have shown that although temporal bone fracture may be common after the head injury, the frequency of complications, as mentioned above, maybe low in pediatric patients.^[4,5] This is attributed to the increased flexibility of the pediatric skull owing to less ossification.^[10] The most dreaded complication is CSF otorrhea, which predisposes one to life-threatening meningitis.^[5]

In our patient, the only clinical sign suggesting a possible temporal bone fracture was bruising and ecchymosis over the mastoid process. We believe that the temporal bone fracture may have resulted from direct injury to the mastoid process by the bicycle handle, as they fall from the bicycle *per se* was not a very severe one. The mechanism of sixth nerve injury in our case could be the transmission of forces directly through the petrous apex to the nerve.

Conclusion

Isolated abducens nerve palsy following fracture of the temporal bone is a rare occurrence. Children may not complain of unilateral hearing loss or discharge. Thus, in the absence of facial nerve palsy or hearing loss, the presence of Battle's sign should prompt toward suspicion of temporal bone fracture, and detailed otological evaluation to detect subclinical CSF leak or ear involvement should be sought. This case highlights the importance of detailed systemic evaluation when patients present with posttraumatic abducens nerve palsy to an ophthalmologist.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, patient's parents consented to the use of deidentified photographs of the child for possible publication. They have given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

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