

Case report

Fracture violating the otic capsule following paediatric head trauma: Association of a pneumolabyrinth with a pneumo-internal auditory canal and pneumoencephaly

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ARTICLE INFO

Article history:

Received 9 April 2012

Received in revised form 12 July 2012

Accepted 13 July 2012

Available online 10 August 2012

Keywords:

Temporal bone fracture

Paediatric

Sudden sensorineural hearing loss

Perilymphatic fistula

Pneumolabyrinth

ABSTRACT

Introduction: Pneumolabyrinth is the presence air within the labyrinth and is a radiological diagnosis. A perilymphatic fistula (PLF) is an abnormal communication between the middle ear and inner ear and is usually discovered upon surgical ear exploration. These conditions could also occur following a temporal bone fracture, or in idiopathic cases. We compare air location of pneumolabyrinth between our case report and others cases reported in literature, about post-traumatic pneumolabyrinth in a paediatric population. **Case report and results:** 16 cases overall of pneumolabyrinths in the paediatric population have been described in the literature, only two of which was associated with a pneumo-internal auditory canal. We present a case of a huge pneumolabyrinth following head trauma which occurred in a 2 year-old boy. This pneumolabyrinth is managed by surgery. There was no response on brainstem auditory evoked potentials before surgery and 4 month after. **Conclusion:** A clear otorrhea after a traumatism can come from a PLF or a cerebrospinal leak. This case presents both conditions. To differentiate a cerebrospinal fluid leak from a perilymphatic fistula, new biological test could be a help.

A pneumolabyrinth visualised on a temporal bone CT-scan strongly suggests a perilymphatic fistula. Performing an exploratory tympanotomy makes the definitive diagnosis.

There are two main reasons for repairing a PLF: to improve a patient's auditory and vestibular symptoms, and to minimize the risk of developing meningitis. Patients with a pneumolabyrinth, with air present in both the scala tympani and vestibuli, had poor hearing outcomes.

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1. Introduction

Mafee et al. first introduced the concept of “pneumolabyrinth” in 1984: on computed tomography (CT), they observed a hypodensity (air) within the labyrinth associated with a fracture of the stapes footplate [1]. Thus far, other traumatic mechanisms have been reported in the literature, including:

- (1) Iatrogenic causes, such as secondary displacement of a stapes prosthesis into the vestibule, or cochleostomy with a cochlear implant [2].
- (2) Direct traumatic damage to the external ear canal and tympanic membrane, causing astapedovestibular luxation [3–5].
- (3) Barotrauma [6].

- (4) Blunt trauma and the presence of a simultaneous round and oval window perilymphatic fistula (PLF) [7].

We report the history and clinical course of a 2 year-old boy who experienced head trauma with a concurrent temporal bone fracture involving the otic capsule. Pneumolabyrinth associated with a pneumo-internal auditory canal was observed. Only one similar case has been reported in the recent literature [8]. Overall, 16 cases of pneumolabyrinth have been reported in the paediatric population. We compare air location of pneumolabyrinth in our CT and others CT findings through literature data and impact of presence of the air through the whole labyrinth on hearing loss recovery. Our work consists to definite whether air location in scalavestibuli is associated with poorer hearing results.

2. Case report and results

A 2 year-old boy with no prior history of head trauma or otologic disease fell from approximately a height of 1 m onto the tiled floor at his home. He fell directly onto the left side of his head.

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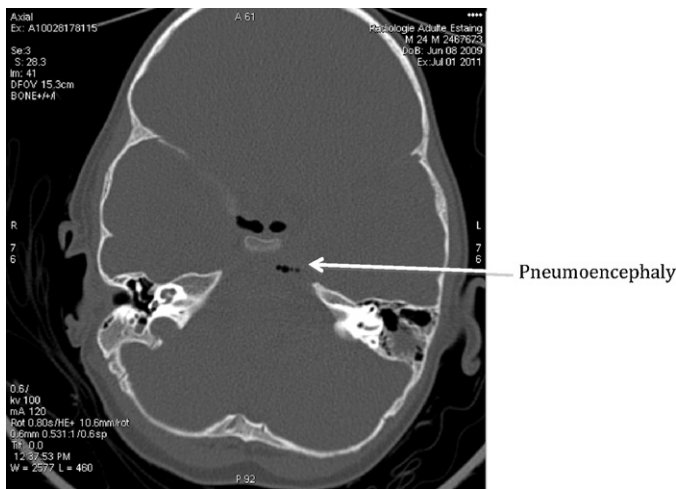


Fig. 1. Axial bone window CT-scan of skull base shows pneumoencephaly.

He started complaining of severe dizziness, associated with nausea, vomiting and left otorrhagia almost immediately after the impact. He did not lose consciousness. The child was taken to the paediatric emergency room by his parents on the same day of the accident. Comprehensive physical and neurological examination of the child was difficult due to the child's non-compliance. The neurologic examination appeared to be grossly normal, except for a mild gait deviation to the left. The child was conscious and was interacting normally with his parents and the medical staff. No focal nerve palsies were observed on cranial nerve examination. There was a haematoma anterior to the left ear, and left clear otorrhea. No sampling for beta-2-transferrin was done to confirm a cerebrospinal fluid (CSF) leak. An otologic consult was not requested immediately.

A non-contrast CT scan of the head with 5 mm sections was performed on the day of accident. The images demonstrated a left longitudinal temporal bone fracture through the middle ear with pneumoencephaly. No extracranial or intracranial haematomas were observed in parenchymal windows. There was no mention of any possible damage to the left inner ear in the radiology report (Fig. 1).

The patient was hospitalised a few days under medical supervision in a paediatric department, where antibiotic prophylaxis was initiated for a total duration of 6 days. Additionally, the patient received anti-pneumococcal vaccination to minimize the risk of developing meningitis.

The patient was evaluated by neurosurgeons and several lumbar punctures were performed, which caused the otorrhea to stop.

The patient was discharged home after approximately 2 days in the hospital, however, the vertigo persisted. The boy experienced difficulty standing up and walking in a straight line. This prompted the parents to bring the child to the paediatric emergency room 7 days after the initial accident.

An otolaryngological consultation was performed approximately 1 week after the initial accident. The child was still demonstrating left gait deviation. Rotatory chair test demonstrated severe hypofunction on left side. Otoloscopic examination revealed a large infero-posterior perforation of the left tympanic membrane. Audiological assessment with a pure tone audiogram was impossible to perform due to the child's non-compliance. A free-field hearing test was performed, and revealed no abnormalities. On cranial nerve evaluation, a right-beating nystagmus was observed bilaterally. However, since this was not documented in the child's initial assessment in the emergency room, it was impossible to know whether this was a pre-existing condition, or

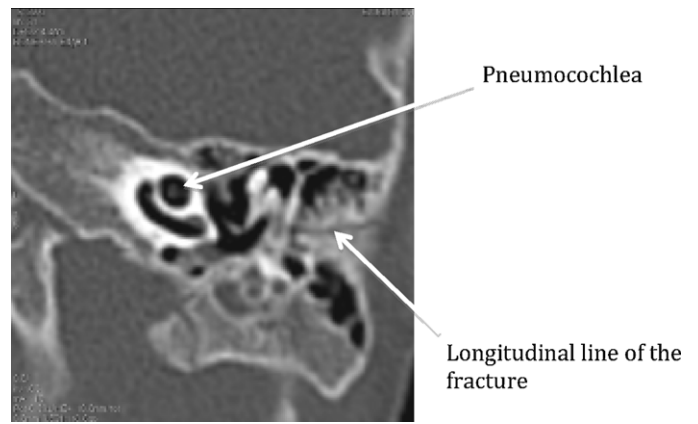


Fig. 2. Reconstructive axial bone window CT-scan left longitudinal bone fracture. Pneumocochlea.

whether it resulted from the child's trauma. Otherwise, the cranial nerve examination was unremarkable and no focal nerve palsies were observed.

A neuroradiologist reviewed the CT-scan of the skull, and reconstructed images in axial and coronal planes, zooming on left temporal bone. A very large presence of air was observed within the left cochlea, vestibular apparatus and internal auditory canal, confirming a large perilymphatic fistula (Figs. 2 and 3).

Additionally, there was a dislocation between the head of the malleus and the incus (Fig. 4). A round window density was

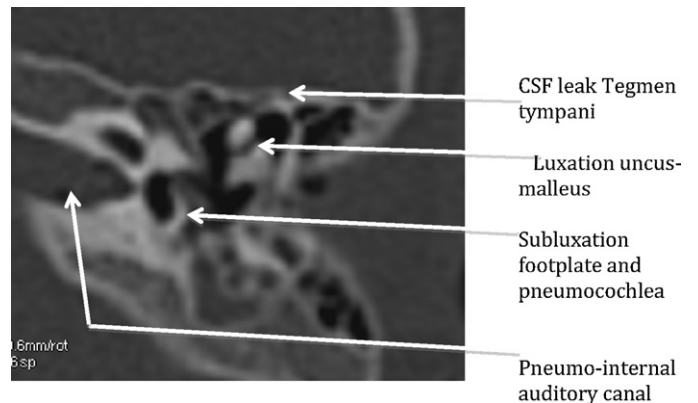


Fig. 3. Axial bone window CT-scan: association of a CSF leak and a PLF (pneumocochlea and pneumo-internal auditory canal combined).

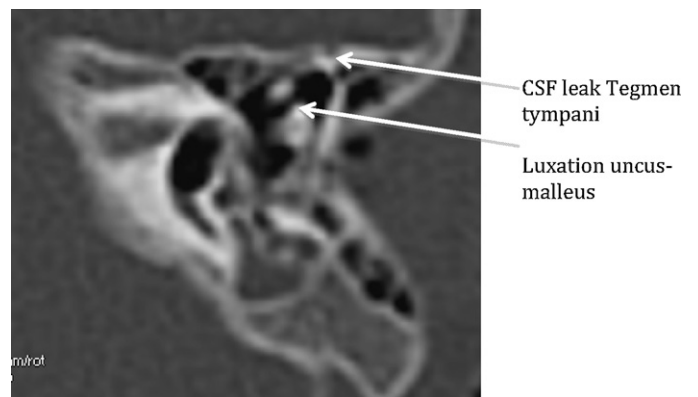


Fig. 4. Axial CT-scan left temporal bone. Dislocation between the incus and head of the malleus. We see the fracture line situated on the tegmen tympani.

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