Alemayehu Ginbo Bedada, Imran Fizzah, Sesay Sheikha, Georges Azzie. *Ethiop Med J, 2021, Vol. 59, No. 4*

CASE REPORT

TRAUMATIC TENSION PNEUMOCEPHALUS IN A 16 MONTH OLD CHILD: CASE REPORT AND REVIEW OF THE LITERATURE

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ABSTRACT

Traumatic Tension Pneumocephalus is a rare condition especially in children. It occurs most often as a result of temporal or basal skull fracture, and may cause neurological deterioration. CT scan findings are considered pathognomonic. A 16-month-old girl presented with unstable vital signs and a seizure episode after being struck by a reversing car. A day later she developed rhinorrhea and high grade fever. CT scan of the brain demonstrated a Mount Fuji sign. Her neurological status remained essentially normal. She was managed non-operatively and was discharged uneventfully eight days after the accident. In selected paediatric cases, traumatic tension pneumocephalus may be managed non-operatively.

Key words: *Child, Mount Fuji sign, Non-surgical treatment, Traumatic tension pneumocephalus*
Work done*: At Princess Marina Hospital, Department of Surgery, Gaborone, Botswana*

INTRODUCTION

Traumatic Pneumocephalus (TP) is characterized by the abnormal presence of air in the cranial cavity following traumatic injury (1-6). It has been reported in 3.9% 9.7% of head injuries (1-3). Trauma is incriminated in 67% - 74% of pneumocaphalus cases (4-7).

Tension traumatic pneumocephalus (TTP) is a clinical entity characterized by continued buildup of air within the cranial cavity, leading to abnormal pressure exerted on the brain and subsequent neurologic deterioration (2-4). TTP is classified as acute when it occurs within 72 hours of the traumatic event and as delayed when it occurs thereafter (1,2,4,5).

Two mechanisms are postulated TP: the 'inverted soda bottle effect', where CSF loss creates negative intracranial pressure, drawing air into the subarachnoid space (1-5,8), and the "ball-valve" theory where there is a unidirectional movement of air into the cranial cavity, most often the extradural space (1,2,4-7).

Clinical presentations of TP include nausea, vomiting, poor feeding in children, irritability, dizziness, headache, seizure, depressed mental status, cerebrospinal fluid rhinorrhea, pupillary abnormalities and hemodynamic changes (1,2,4,7). More serious presentations include cardiac arrest and blindness (4). Head CT remains the most accurate imaging study with the ability to detect as little as 0.5 cm^3 of air (1,2,4-8).

The CT finding of bilateral compression of the frontal lobes is called the peaking sign (5). When there is progression to TTP the increased pressure not only compresses, but separates the frontal lobes, thus creating the so-called "Mount Fuji" sign (1,2,4-7). This finding is considered virtually pathognomonic of TTP.

Uncomplicated TP tends to resolve spontaneously (2-5). Evidence of progression to TTP based on deteriorating neurological status or the Mount Fuji sign on CT scan usually mandates surgical intervention. Out team describes the rare case of traumatic tension pneumocephalus in a 16-month-old child (the "youngest" in literature), and reviewed and summarized the current knowledge on TTP.

Case Presentation

A 16-month-old girl presented to the hospital after being struck by a reversing car. The mother reported an episode of generalized seizure, however, There was no vomiting or loss of consciousness. On examination, she was alert, with a heart rate of 193 beats/min, respiratory rate 36 breaths/min, temperature 37.5 ^{0}C and oxygen saturation 99% on room air. Her Glasgow coma scale (GCS) score was 15/15 with no focal neurological deficits, and no other abnormalities. Her laboratory tests, chest, cervical and pelvic-rays were all normal. CT scan of the head demonstrated a right temporoparietal linear skull fracture, as well as cerebral edema and a right scalp hematoma.

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She received analgesics, antibiotics and seizure prophylaxis. On day two of admission, she was noted to have rhinorrhea. Her temperature rose to 39.4 ^{0}C, and her pulse rate increased to 210 beats/min. There was no hypotension, and her oxygen saturation was 98% on room air. A repeat CT scan of the head was done which demonstrated pneumocephalus, a Mount Fuji sign (**Figure 1**) and a basal skull fracture (not detected on the initial CT). A diagnosis of TTP was made. Despite this, her neurologic condition did not deteriorate. Cefotaxime (Claforan, Sanofi-Aventis) was increased to meningitis dose as there was no other explanation for the raised temperature. She was nursed in a Fowler's position (30 degrees head up). In spite of the Mount Fuji sign on CT head, we opted for a non-operative approach given her stable and otherwise normal neurological condition.

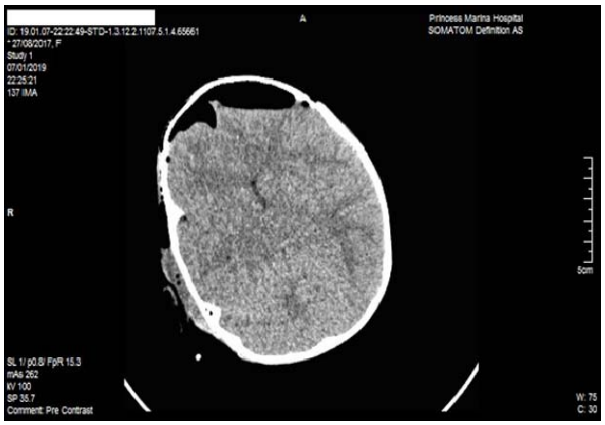

Figure 1: The second CT head demonstrating "Mount Fuji sign" (see arrow).

The patient improved: her heart rate and temperature normalized. Her rhinorrhea completely resolved by the 6th day of admission. She was discharged on the 8th day of admission. She was formally re-evaluated one and four months post discharge: she was asymptomatic and had a normal neurologic examination. The follow up CT brain at four months after discharge was within normal limits. (**Figure 2**)

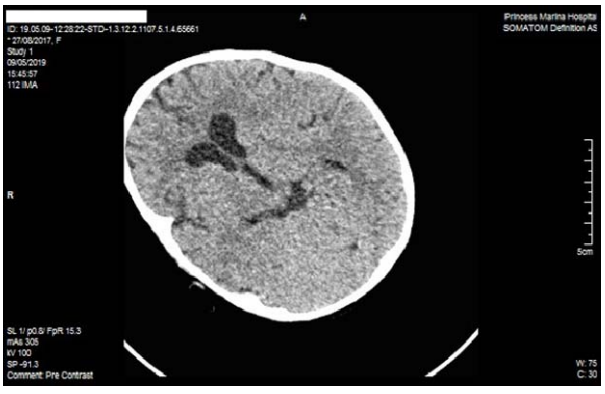

Figure 2:. The third CT head demonstrating a normal finding.

DISCUSSION

Our one year old patient is the youngest reported in the literature, and the second case reported in Africa. In the largest series reported, of 101 patients, the youngest was three and the oldest 91years (3).

The air in TP is commonly located in the subdural space (5,7) but can be found in the epidural, intraventricular and intracerebral spaces (3,5-7). The etiologic factors were motor vehicle collision in 30%, blunt assault in 25%, fall in 20% motorcycle accident in 15%, gunshot in 5%, and stabbing in 5% (4). Our patient was struck by a reversing car.

The most common symptom reported in the literature is headache (1,2,4,7). Given the age of our patient, we could not appreciate this with certainty. The predominant symptoms in our patient were agitation and feeding intolerance. The major sign was rhinorrhea. The pathognomonic finding on CT of the head was the Mount Fuji sign.

In the setting of trauma, the most common source of pneumocephalus is thought to be a temporal bone fracture (6,8). The second CT scan demonstrated a significant Mount Fuji sign, which is considered strongly suggestive of TTP. Of particular interest in this case, the alarming CT scan finding was not accompanied by any obvious deterioration in neurological status.

In the eyes of many, the finding of a Mount Fuji sign on the CT scan of a patient with a history of head trauma constitutes a neurosurgical emergency and mandates prompt operative management. There are, however, a few cases reported with Mount Fuji sign who did not require surgical intervention (1,2,5,6). Elements described in the non-operative management include adequate analgesia, Fowler position of 30^0, avoiding Valsalva maneuver, 100% oxygen, prophylactic antimicrobial therapy (especially in posttraumatic cases), frequent neurologic checks, and repeat CT scans (1,2,4). Because our patient did not have neurological deterioration, we opted for close observation and non-operative management. She was given antibiotics and pain medication, and she was placed in a Fowler position (30^0 head-up (5).

Surgical intervention is required when the air within the cranial vault causes increased pressure and deterioration in the level of consciousness (5). Surgical management targets removal of intracranial air. This may be accomplished through a burr hole, a craniotomy or a needle aspiration (3-5).

Outcomes seem best when the TP occurs solely in combination with a bony fracture of the vault (3).

This was the case in our patient. When TP occurs in combination with an acute subdural hematoma or is diagnosed in association with the presence of multiple air bubbles scattered over the basal cisterns and the posterior fossa, outcomes are less favorable (3).

Conclusion

Although vary rare, a diagnosis of TTP should be considered even in very young trauma patients. TTP may be treated non-surgically in selected patients, especially if there is no neurological deterioration. While many consider the presence of a Mount Fuji sign on CT head to be strongly suggestive of TTP, this finding in and of itself may not necessarily mandate surgical intervention.

ACKNOWLEDGMENT

We are thankful to the patient's mother who kindly agreed to share our experience with the medical fraternity.

Conflict of interest: The authors declare no conflict of interest.

Funding: No fund involved.

Ethical consideration: The mother to the child consented to the publication of this report for the purpose of education without patient identifier.

Authors' contribution: All four authors did literature review. The first draft of the manuscript was prepared by AGB, and critically revised by AGB and GA. SS reported on all CT head films. AGB and IF followed the patient. All four authors reviewed the final version of the manuscript and agreed to submit to Ethiopian Medical Journal for publication.

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