Case Report

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Traumatic Tension Pneumocephalus with Mount Fuji sign and air bubble sign: A case report

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ABSTRACT

Introduction: *Tension Pneumocephalus is a rare but life-threatening neurosurgical emergency that may need urgent surgical intervention. For diagnosis, brain imaging, preferably a brain CT scan, is mandatory.*

Case Presentation: *We present a rare case of post-traumatic tension pneumocephalus in a 40-year-old Ethiopian man who sustained a road traffic accident, and clinical deterioration occurred after 12 hours. A brain CT scan shows the Mount Fuji and air bubble signs, typical signs of tension pneumocephalus. The emergency burr-hole evacuation was carried out. After the procedure, the patient was followed by a control lateral skull x-ray and then discharged after ten days of hospital stay with a GCS of 15.*

Conclusion*: Tension Pneumocephalus is a clinical diagnosis. A history with brain imaging can easily diagnose it, but invasive surgical intervention may be mandatory to overcome the problem. Knowledge of risk factors, radiographic findings, and clinical signs/symptoms associated with Tension Pneumocephalus is crucial to its prompt identification and treatment. This case shows the importance of considering tension pneumocephalus for any patient presenting with headache and altered mental status after sustained trauma.*

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1. Introduction

Pneumocephalus (Intracranial aerocele) is the presence of air within the intracranial cavity. The first description of intracranial pneumocephalus provided by Thomas in 1866 was discovered during the autopsy of a trauma patient [(1)]. Luckett used plain skull radiographs in 1913 to diagnose pneumocephalus [(2)]. The term pneumocephalus was coined and first used by Wolff in 1914 [(3)]. The gas may be located in epidural, subdural, subarachnoid, intraparenchymal, or intraventricular. The common site is frontal, followed by the occipital and temporal areas. It could be acute (<72 h) or delayed (≥72 h), or it can also be classified as simple or tension pneumocephalus (4). Anything that can cause a CSF leak can produce associated pneumocephalus like Trauma, Neurosurgical procedures, congenital skull defects, and Infections with gas-producing organisms [(5-8)]. A report of 295 cases shows that the most common cause of tension pneumocephalus is trauma, accounting for 75% of the study population [(9)]. Complications could occur when the intracranial air collection significantly increases intracranial pressure (ICP), causing subsequent neurological deterioration [(10)]. This emergency is identified as traumatic tension pneumocephalus, a serious complication that could lead to progressive brain compression, brain oxygen supply reduction, and brain herniation [(11)].

2. Case presentation

A 40-year-old presented to the emergency department following a road traffic accident. He was a pedestrian, but the details of the injury are unknown. The patient had significant bleeding from the head and slight bleeding from both ears. Following the accident, he was taken to a nearby health center, the bleeding was arrested, the laceration was repaired, and TAT was administered before he returned to his home. After 12 hours stayed at home, he developed irritability and severe headaches, prompting his family to bring him to Tikur Anbesa Hospital in Addis Ababa, Ethiopia. At Tikur Anbesa Hospital, his vital signs were unremarkable, except his Pulse rate was 112. On examination, he had pale conjunctiva, with wounds repaired on the left lateral canthus, left supraorbital area, and occipital area. His Glasgow Coma Scale (GCS) score was 13 (E=3 V=4 M=6). Pupils were midsized and reactive to light. No cranial nerves, motor, or sensory deficits were detected**.**

Laboratory findings:

RBS = 53 mg/dl, CBC (WBC = 12,500 (Neutrophil count of 84.1%), Hgb = 6.2 (MCV of 96.5 fl), Hct = 19.3, Plt =146,000, RFT: creatinine = 1.03mg/dl, urea = 24.7mg/dl, Electrolytes: Na = 140, K = 3.21, Cl = 115.2

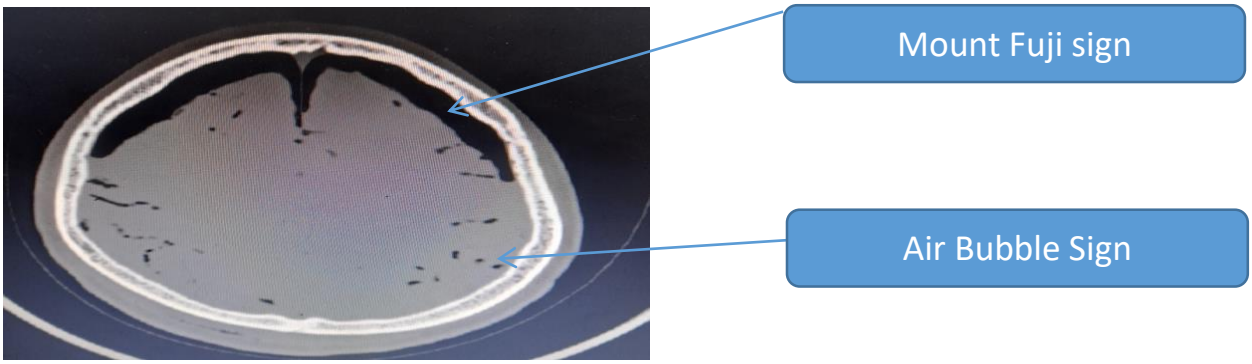

Figure 1: Mount Fuji sign and Air bubble sign, On Brain CT Scan of the Patient

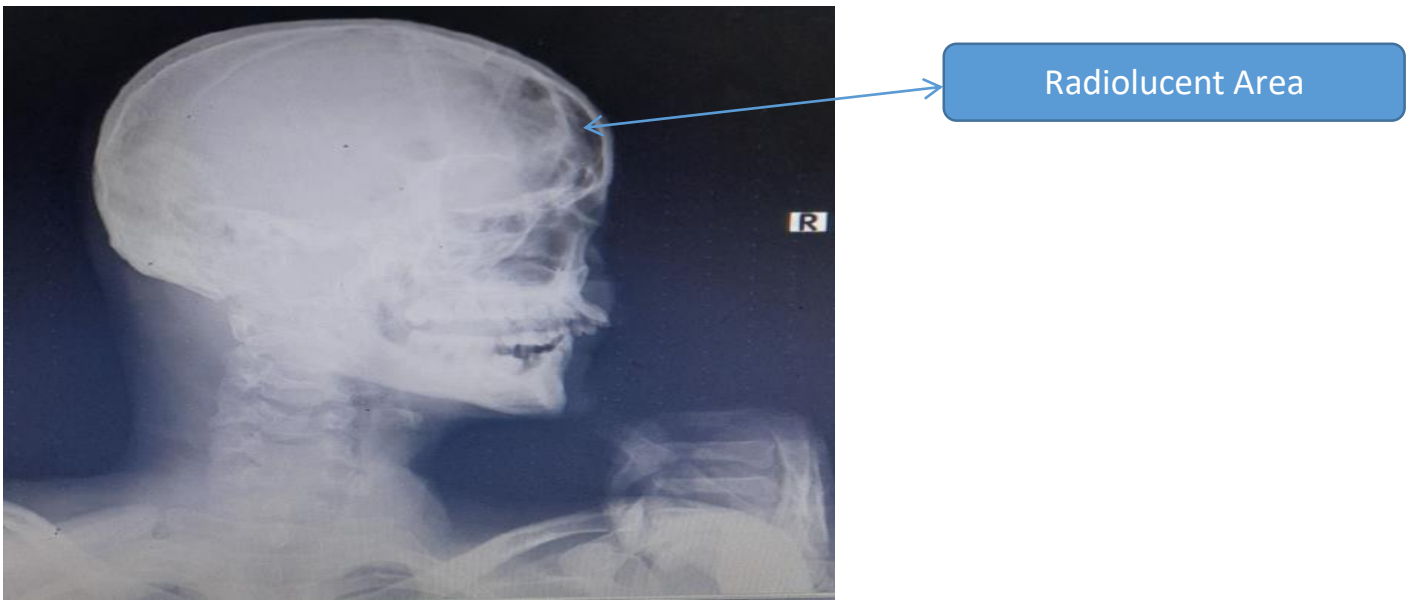

Figure 2: Control Skull radiograph taken one day post op shows a radiolucent area over the frontal region of the head in the lateral view.

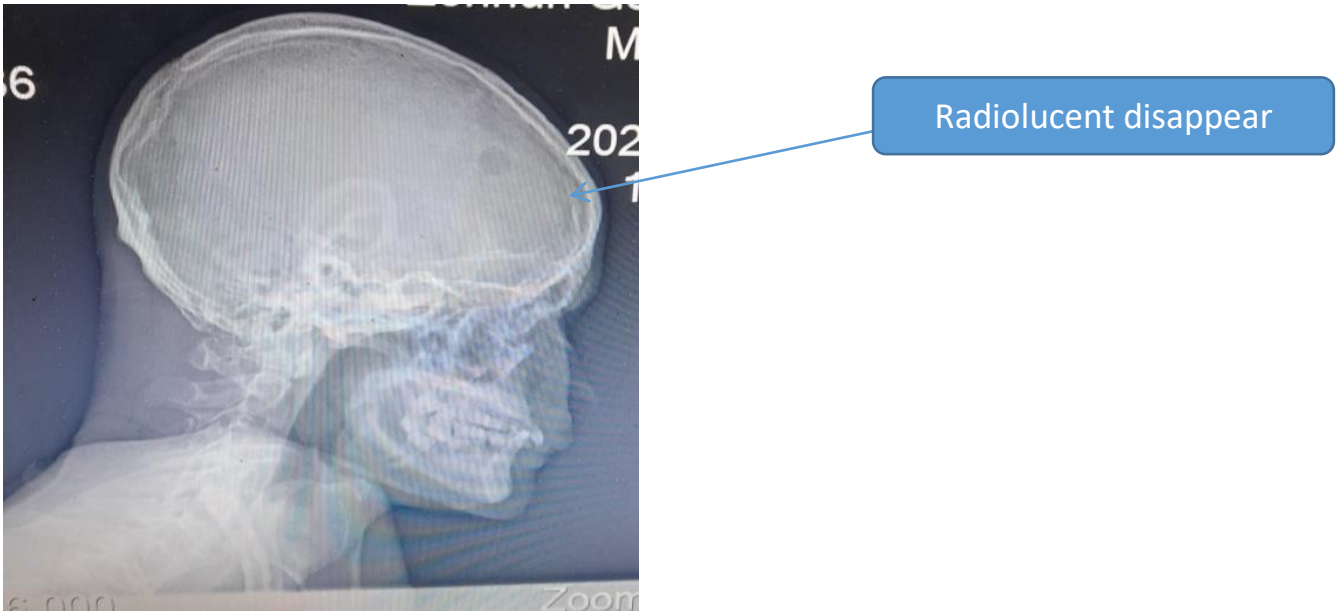

Figure 3: Control lateral skull x-ray of the patient 3 days after the operation shows a radiolucent area disappear

3. Discussion

This report presents 12 hours after a sustained road traffic accident, and the patient had developed tension pneumocephalus. We present this case to increase awareness about Tension Pneumocephalus. If not recognized early, tension pneumocephalus can be devastating, leading to poor neurologic outcomes and mortality. Tension Pneumocephalus is a rare but life-threatening neurosurgical emergency that is intracranial equivalent of Tension pneumothorax. It is a type of pneumocephalus in which intracranial air causes mass effect and increased intracranial

pressure. The ball valve theory of Dandy and Horowitz's inverted soda bottle effect are among the well-known pathophysiological mechanisms of tension pneumocephalus; first, one describes a unidirectional air movement from outside into the cranial cavity, which then gets trapped. The second theory tells that negative intracranial pressure (ICP) occurs as a result of excessive CSF loss due to any mechanism, for example, drainage in a physiological way during the Valsalva maneuver or through the iatrogenic lumbar drain [12-14].

Tension pneumocephalus is diagnosed by a combination of typical CT brain findings, neurological deterioration, the hissing sound of air escaping during the procedure, and immediate improvement in the neurological status upon aspiration of/letting out air. If patient safety measures are meticulously adapted by care providers without compromising steps, such neurosurgical emergencies can be avoided [15].

Patients with Tension pneumocephalus usually present with severe headaches, Nausea and Vomiting, seizures, dizziness, and altered mental status [16]. An intracranial succussion splash is a rare but pathognomonic finding. A minority of patients describe 'bruit hydroaerique' (a splashing noise on head movement, equivalent to the succession splash of pyloric stenosis). Others may present with signs and symptoms like any mass, which may cause focal deficit or increased ICP. CT scan is the primary imaging modality used to diagnose tension pneumocephalus, where air appears darker than CSF, with attenuation values of 1000 Hounsfield units. On a CT scan, tension pneumocephalus may present with several characteristic signs. Mount Fuji signs and air bubble signs are among them. "The Mount Fuji sign" refers to the appearance of an air-fluid level inside the sphenoid sinus, which resembles the silhouette of Japan's iconic Mount Fuji, a symmetrical volcanic mountain. The "air bubble sign" refers to identifying a well-defined air pocket or bubble within the brain parenchyma mainly caused by a tear in the arachnoid membrane. This air pocket can be visualized as a rounded or oval-shaped area of decreased density on CT images, surrounded by brain tissue [17, 18]. On skull x-ray, tension pneumocephalus may appear as radiolucent (dark) areas within the cranial vault, representing the presence of air. Management of tension pneumocephalus starts with recognizing the symptoms [19].

Make sure that you stabilize the patient with the ABC approach. Elevate the head of the bed to 30 degrees; administering high-flow oxygen and surgical decompression are very important parts of management. Surgical decompression options include needle aspiration, drilling of burr holes, craniotomy, ventriculostomy, and closure of dural defects. Anesthetic implications in patients with tension pneumocephalus include (a) avoidance of nitrous oxide, as the blood–gas partition coefficient of nitrous oxide is 34 times greater than that of nitrogen, allowing nitrous oxide to diffuse into the cranial vault faster than the nitrogen/air can exit; (b) avoidance of hyperventilation, which can lead to decreased cerebral blood flow causing enlargement of the subdural space potentially entraining additional air; and (c) avoidance of high airway pressures during ventilation, because increased intrathoracic pressure impedes cerebral venous return, further increasing intracranial pressure. Additionally, normobaric hyperoxia with 100% inspired oxygen facilitates faster resolution of pneumocephalus [20, 21].

4. Conclusions

Tension pneumocephalus is a rare neurosurgical emergency that can occur as a result of trauma or iatrogenic. Patients with Tension pneumocephalus usually present with severe headaches, al-

tered mental status, seizures, Nausea, and Vomiting. Because of the potential for rapid clinical deterioration and death, prompt brain imaging is warranted to rule out the diagnosis, and urgent neurosurgical consultation is indicated for definitive management.

Conflict of Interest

The authors declare that they have no competing interest

Consent

Written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-Chief of this journal.

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