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Case Report

Tension Pneumocephalus in a Posttraumatic Patient: Computed Tomographic Findings and Case Report

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Abstract

Tension pneumocephalus is an unusual bad life-threatening neurosurgical emergency, this is the equivalent of tension pneumothorax. This often follows head trauma, epidural injections, complicating neurological spinal, craniofacial or sinus surgery.

This is a forty-five-year-old man that was involved in a road traffic accident, was referred for a computed tomography of the brain on account of altered consciousness, irrational behavior, and restlessness.

A non-contrast enhanced computed tomography of the brain was done, this demonstrated multiple areas of cortical discontinuity in the facial and skull vaults in keeping with fractures, extensive negative density (HU: -968) hypodensity in the frontal region bilaterally causing marked inferior displacement of both frontal lobes of the brain, with associated splaying of the interhemispheric fissure likened to the 'Mount Fuji sign' of severe/tension pneumocephalus. Pockets of negative density hypodensities are also noted in both cerebral hemispheres in keeping with pneumatoceles are also demonstrated. Generalized effacement of sulci and gyri in keeping with cerebral edema is also demonstrated.

The outcome of the patient in the peripheral center was not known as at the time of this report, because all effort to get across to the patient and relations proved abortive.

We present a case of tension pneumocephalus following road transport accident, to review the computed tomographic features due to its peculiar presentation.

Keywords: pneumocephalus; fractures; cerebral edema; road traffic accident; posttraumatic patient; computed tomographic findings

Introduction

Pneumocephalus is defined as the abnormal presence of air in the cranial cavity, with many etiologies, commonest of which is head trauma, tumors, infections and post-surgical procedures of the head[1]. Pneumocephalus is seen in about 20-30% of patients with post-traumatic cerebrospinal fluid (CSF) fistula [1].

Tension pneumocephalus (TP)refers to continuous accumulation of intracranial air most likely from a ball valve mechanism, this leads to a mass effect on the brain resulting to neurological deterioration and features of herniation [2,3].

TP is a life-threatening neurological emergency that results in intracranial hypertension and mass effect with neurological symptoms, therefore an entity different from pneumocephalus [2,4,5].

TP is believed to occur when there is accumulation of about 65mls of air, although some authors believe that volume of air is an independent determinant of occurrence of tension pneumocephalus [6,8] TP may manifest and present with varying clinical presentation, these are often severe restlessness, deteriorating level of consciousness, focal neurological deficits, and cardiac arrest [9,10].

Intracranial air often suggests an open fracture or that which extends into a sinus, the location of intracranial air could either be in the extradural, subdural, subarachnoid, intraventricular, and intracerebral spaces. The presence of air in the intracerebral and intraventricular spaces indicates tears in the dura and arachnoid layers[1].

Imaging plays a vital role in the diagnosis of pneumocephalus, these are either plain radiography, computed tomography (CT) and magnetic

resonance imaging, the CT been most sensitive in detecting and localizing minute volumes of intracranial air [1,16,11].

TP most often times need surgical intervention, these include closure at the causative fracture sites, the surgical intervention could either be open or endoscopic repair [1,2].

Case Report

This is a forty-five-year-old man that was involved in a road traffic accident, was referred from a peripheral health facility for a computed tomography of the brain on account of altered consciousness, irrational behavior, restlessness.

On examination, the patient appeared restless, with labored breathing, decreased level of consciousness, irrational talks, with swellings and open injuries on the face and scalp region,

A non-contrast enhanced computed tomography of the brain was done, this demonstrated marked lucency posterior to the frontal bone in keeping with intracranial pneumatocele on the scout image (figure 1), the serial images demonstrated multiple areas of cortical discontinuity in the facial and skull vaults in keeping with fractures (figure 5), extensive negative density (HU: -968) hypodensity in the frontal region bilaterally causing marked inferior displacement of both frontal lobes of the brain, with associated splaying of the interhemispheric fissure likened to the 'Mount Fuji sign' of severe/tension pneumocephalus (figures 2-5). Pockets of negative density hypodensities were also noted in both cerebral hemispheres in keeping with pneumatoceles (figure 6). Generalized effacement of sulci and gyri in keeping with cerebral edema is also demonstrated (figures 2,4,6).

The outcome of the patient in the peripheral center was not known as at the time of this report, because all effort to get across to the patient and relations proved abortive.

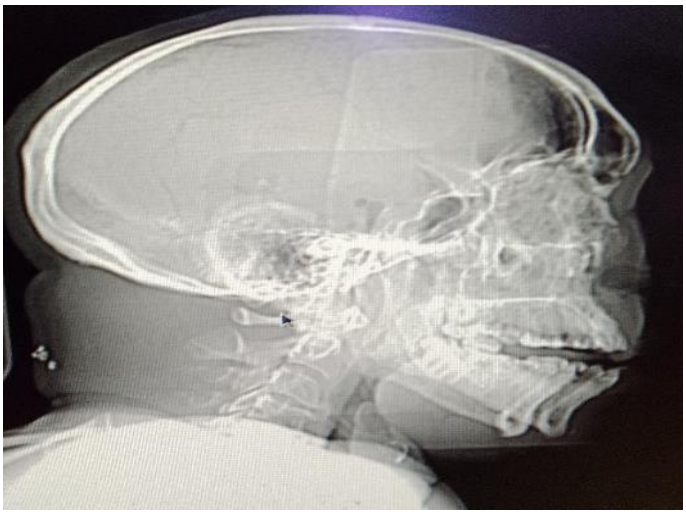

Figure 1: *A scout or scanogram CT image of the skull (lateral view) demonstrating area of lucency posterior to the frontal skull vault most likely pneumocephalus. Soft tissue fullness in the facial and scalp region, poor pneumatization in the region of the air-sinuses are also demonstrated.*

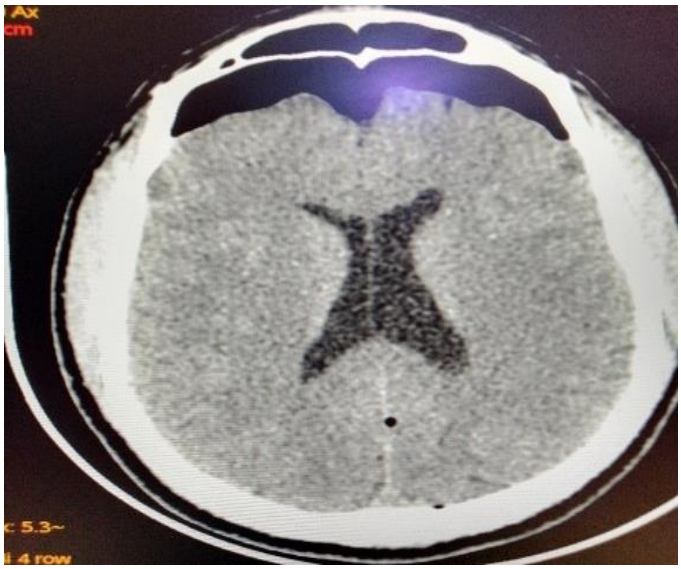

Figure 2: *Computed tomogram of the brain, axial image, at the level of the lateral ventricles demonstrating accumulation of extensive negative density hypodensity in both frontal regions causing marked compression of the frontal lobes of the brain and splaying of the interhemispheric fissure giving the "Mount Fuji sign" of tension pneumocephalus. Generalized effacement of the sulci and gyri in keeping with edema is also demonstrated.*

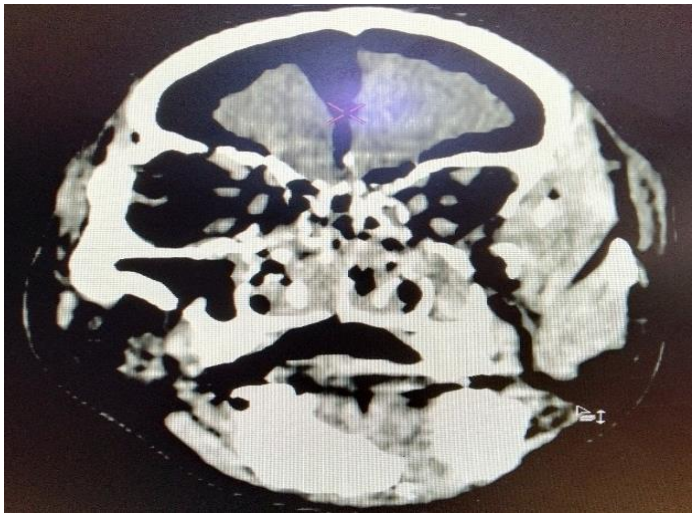

Figure 3: *Reconstructed CT coronal image of the brain demonstrating extensive negative density hypodensity in the frontal region causing compression of the frontal lobes of the brain, splaying of the interhemispheric fissure, and fractured facial bones.*

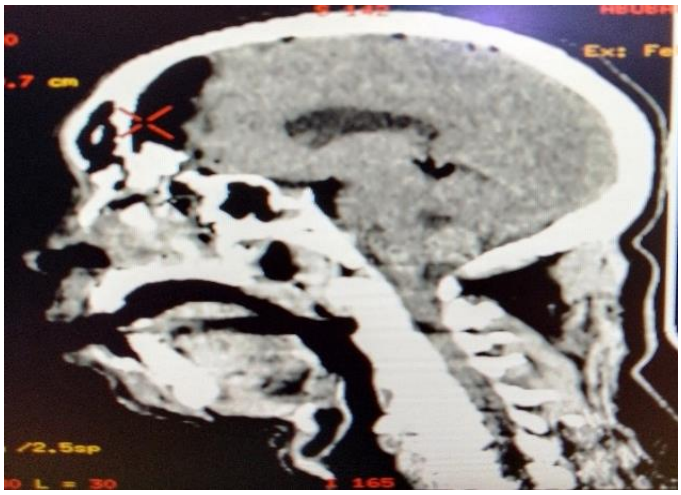

Figure 4: *Reconstructed CT sagittal image of the brain demonstrating accumulation of negative density hypodensity beneath the frontal skull bone causing compression and displacement of the frontal lobe of the brain, generalized effacement of the sulci and gyri in keeping with edema, and pockets of negative density hypodensity (pneumatoceles) superiorly.*

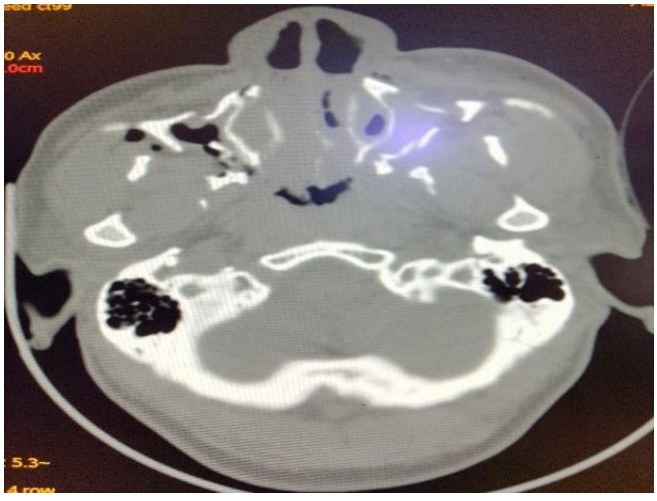

Figure 5: *CT axial image at the level of the maxillary sinuses in bone window demonstrating multiple areas of cortical discontinuity in the walls of the sinuses and nasal cavity bilaterally in keeping with multiple fractures.*

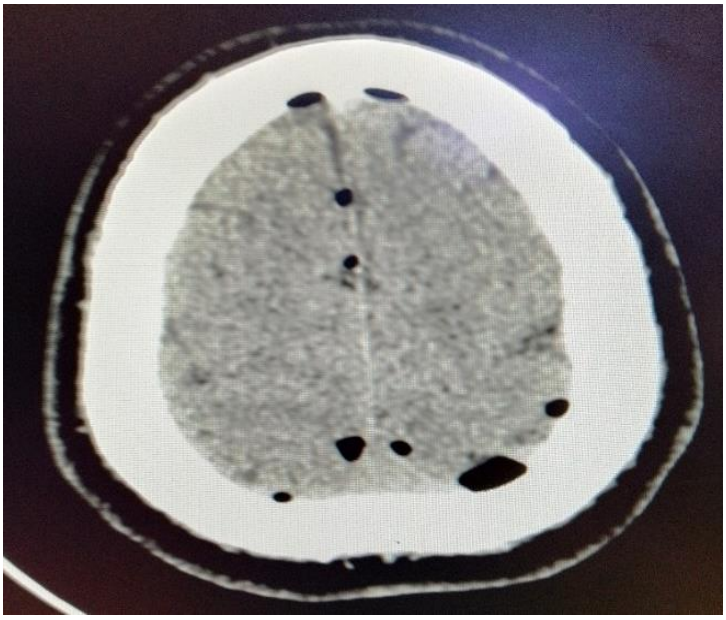

Figure 6: *CT axial image of the brain demonstrating multiple pockets of negative density hypodensities in both hemispheres peripherally in keeping with pneumatoceles. Generalized effacement of the sulci and gyri in keeping with edema is also demonstrated.*

Discussion

Pneumocephalus is defined as the abnormal presence of air in the cranial cavity, with many etiologies, commonest of which is head trauma, tumors, infections and post-surgical procedures of the head[1]. Pneumocephalus is seen in about 20-30% of patients with post-traumatic cerebrospinal fluid (CSF) fistulas[1]. The case under study had enormous amount of air within the intracranial cavity and was involved in a road traffic accident that lead to multiple fractures and injuries, thereby conforming to this literature.

Tension pneumocephalus (TP)refers to continuous accumulation of intracranial air most likely from a ball valve mechanism, this leads to a mass effect on the brain resulting to neurological deterioration and features of herniation [2,3]. The index case had multiple open skull fractures, and fractures involving the sinuses causing continuous movement of air into the cranial cavity without a route of escaping out of the cranium likened to the ball-valve mechanism, the case also had marked downward compression of the frontal lobes and he also presented with features of neurological deterioration, thereby conforming to these literatures.

TP is believed to occur when there is accumulation of about 65mls of air, although some authors believe that volume of air is an independent determinant of occurrence of tension pneumocephalus [6-8]. The case under review had more than 250mls of intracranial air, he also had clinical and imaging features to suggest tension pneumocephalus, thereby conforming to these literatures.

TP may manifest and present with varying clinical presentation, these are often severe restlessness, deteriorating level of consciousness, focal neurological deficits, and cardiac arrest[9,10]. The index case presented with most of these symptoms and signs, among which are CSF rhinorrhea, bleeding from orifices, deteriorating Glasgow coma scale, irrational talks, and facial with skull injuries. These are also in conformity to these literatures.

Imaging plays a vital role in the diagnosis of pneumocephalus, these are either plain radiography, computed tomography (CT) and magnetic resonance imaging, the CT been most sensitive in detecting and localizing minute volumes of intracranial air[1,6,11]. The index case had CT scan of the head and brain where intracranial air was detected, thereby conforming to these literatures.

The main CT finding in a patient with TP are presence of negative density hypodensity in the region causing downward compression of the frontal lobes likened to the 'Mount Fuji sign' is considered a critical finding in TP[6-8,13]. This feature was also demonstrated in the index case, thereby conforming to these literatures. Other CT findings may include pneumatoceles, features of coning, skull bone and air containing spaces fractures to mention but a few[1,6,8], these features were also demonstrated in the index case.

TP most often times need surgical intervention and maybe lifesaving if instituted early[1,6,12,14]. As at the time of the report no information from the peripheral facility as whether such treatment was done for the index case.

Conclusion

Computed tomographic imaging should be promptly instituted on most cases of head trauma with deteriorating clinical and neurological features to rule out tension pneumocephalus for prompt institution of management to save the lives of these patients.

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