CASE REPORT

Mount Fuji Sign: Pneumocephalus Following Burr-hole Evacuation of Subdural Hematoma

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Abstract

Introduction: The Mount Fuji sign is a common sign of tension pneumocephalus, usually occurring after surgical evacuation of subdural hematomas (SDHs). It may be suspected when such postsurgical patients present with headache or vomiting or other neurological signs and is diagnosed by computed tomography (CT) scan of the brain. It usually occurs within the immediate postoperative period but may rarely be seen even months after the surgery.

Case report: We present the case of a 69-year-old male who developed a subdural collection of air, following surgery to evacuate a subdural hematoma.

Conclusion: The patient was successfully treated with conservative measures including administering 100% oxygen, adequate analgesia and Fowler's position. However, severe neurological symptoms such as seizure or obtundation warrants emergency decompression.

Keywords: Postneurosurgery complication, Subdural hematoma evacuation, Tension pneumocephalus.

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Case Description

A 60-year-old male, presented with headache, giddiness, vomiting, and irrelevant speech for 15 days. His heart rate was 98 beats/min, respiratory rate 18 breaths/min, blood pressure 124/70 mm Hg, temperature 98.6°F, and oxygen saturation 95% on room air. Magnetic resonance imaging brain showed an acute on chronic SDH with mass effect which was evacuated by burr-hole surgery under general anesthesia. Postoperatively, he was extubated but was slightly obtunded with Glasgow Coma Scale score of E3M5V4. He has one episode of generalized tonic-clonic seizures. Computed tomography scan of the brain (Fig. 1) showed a large subdural collection of air compressing both frontal lobes, a condition described as the Mount Fuji sign. It also showed bilateral occipital infarcts. There was no further neurosurgical intervention as there were no signs of raised intracranial pressures (ICP) or further neurological deterioration. He was managed conservatively with 20% mannitol, hypertonic saline, levetiracetam, and 100% oxygen through non-rebreather mask. A CT brain repeated 4 days later showed near spontaneous resolution of the pneumocephalus (Fig. 2). He improved neurologically over the 2 weeks and was discharged.

Discussion

Mount Fuji sign is a sign of tension pneumocephalus seen on CT brain as subdural air pockets in the frontal area on both hemispheres. It was first described by Japanese neurosurgeons as such as it creates a widened interhemispheric space between the tips of the frontal lobes, which resembled the silhouette of the volcanic eruption of Mount Fuji in Japan.[1] Symptoms include headaches, nausea and vomiting, seizures, hemiparesis, dizziness, and depressed neurological status.[2] Pneumocephalus after burr-hole evacuation of SDH is a common and often unavoidable complication, seen in about 40–44% of cases. It can also occur as a result of skull base surgery, paranasal sinus surgery, posterior fossa surgery in the sitting position, or head trauma. Other iatrogenic causes of pneumocephalus include nitrous oxide anesthesia, continuous positive pressure ventilation, hyperbaric oxygen therapy, barotrauma, spinal anesthesia, ICP monitoring, and intraoperative mannitol.

Pneumocephalus may be either simple or under tension, and the two must be differentiated. Simple pneumocephalus is more common and is caused by ambient air entering the craniotomy at the time of surgery—this is usually asymptomatic.[3] Tension pneumocephalus is characterized by compression of the frontal lobes, but is comparatively rare. However, this can lead to deterioration due to mass effect and is an emergency. The underlying pathophysiology leading to tension pneumocephalus was first explained by the "ball-valve" theory, which involves an aberrant pathway such as a dural defect, which allows air to enter the cranium but prevents it from leaving.[4] Another theory is the inverted soda bottle effect, which proposes that air may enter following a negative ICP created from a cerebrospinal fluid leak.[5] Air may also enter the cranium directly *via* penetrating trauma or by the production of gas inside the head by infection with certain bacteria.[6] Although it commonly presents acutely, it is possible for pneumocephalus to present in a delayed fashion, even a few months after surgery. Delayed pneumocephalus is defined by some authors as occurring at greater than 72 hours after the initial head trauma.

Most cases of pneumocephalus can be treated conservatively.[7,8] During the postoperative period, pneumocephalus may be treated by pure oxygen through a non-rebreather mask as in the present

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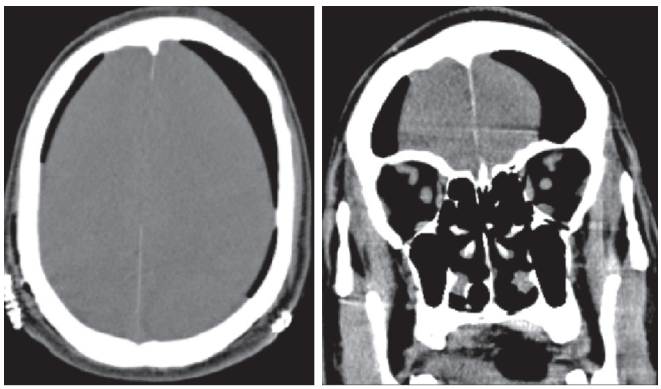

Fig. 1: Transverse and coronal sections of CT brain showing a large bilateral frontal tension pneumocephalus known as the Mount Fuji sign, following burr-hole evacuation of SDH

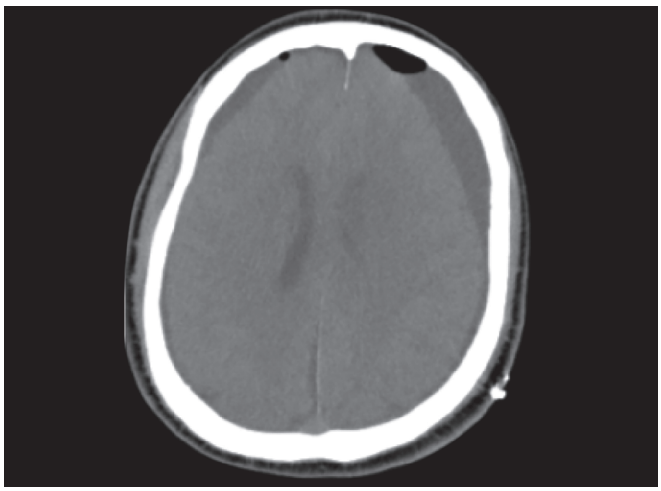

Fig. 2: Near resolution of the pneumocephalus 4 days later when conservatively managed

case, which increases the rate of absorption of pneumocephalus—inspiring 100% oxygen creates a favorable diffusion gradient to siphon off nitrogen from the aerocele and to decrease intracranial pressure.[8] Other forms of conservative treatment involve placing the patient in Fowler's position of 30°, avoiding Valsalva maneuver (coughing and sneezing), administering pain and antipyretic medications to prevent hyperthermia, and osmotic diuretics. Simple aspiration of air through the skin incision using a syringe has also shown a favorable outcome. Occasionally, in cases of tension pneumocephalus with increased intracranial pressure, emergent decompression may be required such as craniotomy, burr-hole, or placement of a subdural or external ventricular drain.

Conclusion

Pneumocephalus may be a common finding after craniotomy and should be suspected in any post-SDH evacuation surgery patients with neurological signs. Computed tomography brain is both diagnostic and can guide management. Treatment is mainly conservative, however, patients with signs of raised intracranial pressure will require emergent decompression.

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