

# Aphasia and Upper Limb Weakness Reversed by Reabsorption of Pneumocephalus

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## Abstract

**Background:** Air in the cranial vault or pneumocephalus is a recognised complication following evacuation of chronic subdural hematoma through a burr hole. Air that develops a tension pneumocephalus has a space-occupying effect causing pressure to surrounding structures. We report a case of aphasia and upper limb weakness that followed the onset of tension pneumocephalus, and resolved when the pneumocephalus resolved.

**Case:** A 68 year old right-handed male patient attended hospital after a fall one month previously. He had headache, a limp, and recent onset right-sided upper limb weakness, with power of 4/5. Computerised tomography (CT) scan showed bilateral sub-acute subdural hematoma larger on the left, with significant midline shift. The haematomas were evacuated through four burr-holes. Drains were brought to the exterior from over both parietal regions and from an intra-cerebral ventricle. The patient was extubated immediately after surgery and breathed spontaneously. He had increased weakness in his right arm, with power 1/5, and expressive aphasia, but was obeying commands. Drains were confirmed patent. A CT scan was performed immediately. This showed bilateral parietal, and left sided frontal tension pneumocephalus with no hematoma. There was no ischemia on magnetic resonance imaging (MRI). He was laid supine and given oxygen 100% to breathe. Within six hours his arm weakness improved to power of 5/5 and he resumed talking.

**Conclusion:** Pneumocephalus may occur after burr hole drainage of a haematoma despite placing drains. In this case, a new neurological deficit with the head elevated prompted CT scan that diagnosed tension pneumocephalus. Drains remained patent; so the patient was laid supine and given oxygen 100% to breathe, after which function returned. Tension pneumocephalus should be considered as a reversible cause of deterioration after burr hole evacuation of subdural haematomas.

**Keywords:** Pneumocephalus; Aphasia; Tension pneumocephalus; Chronic subdural hematoma; Burr holes

## Introduction

Pneumocephalus, air in the cranial cavity, is seen commonly in CT brain images after neurosurgery [1-4]. When air exerts pressure on surrounding structures, causing neurological deterioration it is called tension pneumocephalus. If air enters the cranial cavity through a defect in the dural and cranium and is trapped in a space created by removal of tumour, hematoma or cerebrospinal fluid (CSF) by a ball-valve mechanism, tension pneumocephalus may develop. Tension pneumocephalus is a rare and potentially fatal complication of neurosurgery [2]. The increase in intracranial pressure can affect function. We report a case of tension pneumocephalus after evacuation of chronic subdural hematoma that presented as worsening isolated right-sided upper limb weakness and new onset expressive aphasia. Tension pneumocephalus presenting as aphasia has not been reported in the literature. The language network comprises areas of perisylvian cortex, including the classical language areas of Broca and Wernicke, located usually in the left hemisphere.

## Case Description

A 68 year old male patient had fallen one month previously in a wash room, he remained conscious without any neurological deficit and cleared from trauma centre after routine investigations and imaging at that time. He presented to the emergency department with right sided upper limb weakness for three days duration. He does not have any other symptoms except mild headache. Past medical history included only hypertension that was controlled poorly. He was previously anesthetized for appendectomy two decades ago with no anaesthesia related complications. He doesn't have any documented allergies. He was on Valsartan and prophylactic statins though previous labs showed lipid profile within normal limits His systemic pressure was 200/85 mmHg. Glasgow Coma Score was 15, E4 M6 V5 with equal and reactive pupils, right sided weakness, and power 4/5 without any sensory deficit. ECG showing normal sinus rhythm with no signs of ischemia. Bilateral equal air entry with normal

vesicular sounds. CT scan showed bilateral subdural hematoma over the fronto-parietal regions, more on the left. There was effacement of underlying sulci, compression of lateral ventricles, and slight midline shift to the right. Magnetic resonance imaging (MRI) was done to exclude haemorrhagic stroke. Magnetic resonance angiography and venography (MRA and MRV) demonstrated that all vessels were patent. His blood pressure was controlled with IV labetalol infusion, then he underwent evacuation of the hematoma under general anaesthesia with standard monitoring through four burr-holes two parietal and two frontal. At the end of the procedure, drains were introduced through the two parietal burr holes. External ventricular drainage catheters were used to drain the surface of the parietal lobes because they are soft and are considered less traumatic when the brain expands after evacuation. Immediately after surgery he was extubated and breathed spontaneously. He was maintaining SpO<sub>2</sub> 100% on 3 litre nasal cannula, he was weaned off IV labetalol and maintaining BP of 145/75. His GCS was 15 post extubation. His extremities were warm and all pulses were palpable.

His right upper limb weakness had worsened, with power of 1/5, and he had developed expressive aphasia. He was able to move his other limbs. He was obeying commands and was oriented and alert. The closed drain systems were checked they were found patent and functional. Repeat CT scan demonstrated bilateral fronto-parietal pneumocephalus with midline shift (Figure 1).



**Figure 1:** Initial CT-scan showing tension pneumocephalus.

He was admitted to the surgical intensive care unit, laid supine and breathed a high inspired oxygen concentration. MRI scan excluded brain ischemia. Within six hours of conservative treatment his symptoms improved. He regained

his power of right arm to power 5/5 and resumed talking. He remained haemodynamically stable and was discharged to the general ward within twenty-four hours. A further CT scan showed no air in the cranial vault (Figure 2). He was discharged home on the fourth day.



**Figure 2:** Pneumocephalus resolved.

## Discussion

Language function resides usually in the left hemisphere. This patient was right handed, so his left hemisphere would be expected to be dominant. Cerebral dominance is influenced by handedness of 90-95% of people who are right handed, more than 95% have left sided language dominance [5]. Broca's area is in the posterior inferior frontal gyrus. It innervates adjacent motor neurons supplying the mouth and larynx, and controls the output of spoken language. We suggest that air causing tension pneumocephalus seen on CT scan compressing frontal and temporal areas on the left explains this patient's transient aphasia and right sided limb weakness.

The term pneumocephalus and tension pneumocephalus were proposed by Wolff and Ectors [1]. Intracranial air is found most commonly in the epidural, subarachnoid, intraventricular, intracerebral, and subdural spaces. The usual site is frontal, followed by occipital and temporal areas [1].

Pneumocephalus can be a benign finding on CT scan. Distinguishing benign post-surgical pneumocephalus from tension pneumocephalus is important clinically [6]. Chronically compressed brain and elevation of the head contribute to the ingress of air. The increase in the brain bulk and gradual re-expansion of the brain in the early postoperative period competes with the trapped subdural air resulting in a rise in intracranial pressure and neurological deterioration [7].

The reported incidence of tension pneumocephalus varies from 2.5%-16% [4,7,8]. Risk factors include evacuation of subdural hematoma [2,4,8] prolonged surgery, sitting and lateral positions, [9,10] intra operative administration of

mannitol or furosemide, [7] nitrous oxide, ventriculo-peritoneal drains, [9] and malposition of cranial and lumbar drains [11].

Correct diagnosis requires considering pneumocephalus as a cause of new onset neurological deficit or deterioration. CT scan is a sensitive test. It will detect as little as 0.55 ml air, and will distinguish between simple and tension pneumocephalus [1,2]. The Mount fuji sign on CT scan is characteristic, but not essential to diagnose tension pneumocephalus.

Tension pneumocephalus causes a wide range of clinical presentations including severe restlessness, deteriorating consciousness, focal neurological deficits and cardiac arrest [1,2,4]. This is a first report of transient aphasia and isolated one sided limb weakness due to pneumocephalus.

Transient aphasia may occur with transient cerebral ischemia. Transient aphasia has been reported after clipping of an internal carotid artery-posterior communicating artery aneurysm. This was associated with amnesia. Resolution of oedema surrounding the left fronto-temporal lobe was proposed to explain the transient nature of the aphasia [6].

The most common aetiology for aphasia is ischemic stroke. Other structural causes include haemorrhagic stroke, neoplasm, cerebral abscess, encephalitis and central nervous system infections, and traumatic brain injury.

Management of tension pneumocephalus requires release of intracranial pressure. When clinical signs of intracranial hypertension occur and consciousness is impaired, the airway should be secured and then decompression performed to relieve intracranial pressure. Various methods have been described: craniotomy, and aspiration of air using brain cannulae with three way connections, [7] surgical wound exploration, [11] burr holes, [3] and craniostomy with lumbar subarachnoid infusion [4]. Air in the extra axial space around the brainstem after evacuation of chronic subdural haematoma in the supine position can cause compression of vital centres [12]. Conservative treatment involves high inspired oxygen concentrations through a non-rebreathing mask. This increases the rate of absorption of post craniotomy pneumocephalus compared to breathing room air [13]. Also, sitting the patient 30 degrees head up, avoiding coughing and sneezing against a closed glottis, and giving analgesics and antipyretics have been used [1].

## Conclusion

Tension pneumocephalus should be considered as a reversible cause of deterioration after burr-hole evacuation of subdural hematomas. In this case drains remained patent, so the patient was laid supine and given 100% oxygen to breathe, after which function returned. Tension pneumocephalus presenting as aphasia has not been reported in the literature.

## Competing Interests

The authors declare that they have no competing interests

## Informed Consent

We have taken informed consent from the patient and this case report submission is being approved by medical research committee.

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