

# INTRACEREBRAL PNEUMATOCELE FOLLOWING NON-PENETRATING HEAD INJURY: REPORT OF A CASE

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**Abstract** - Non-penetrating head injuries associated with skull base fractures can lead to the development of pneumocephalus upon air ingress, which leads its course in the subarachnoid space. Intracerebral air accumulation is rare and ensues when a paranasal sinus fracture is associated with a nearby parenchymal contusion. A 25-year old man is being presented with complaints of severe headaches and CSF rhinorrhea 2 months following head trauma. Intraparenchymal air entrapment was observed on computed tomogram. Surgical intervention was required to alleviate the symptoms. Surgical drainage and dural defect repair seems warranted for symptomatic intracerebral pneumatoceles to circumvent the on growing pathological sequel.

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**Key Words:** Pneumatocele, intracerebral, anterior skull base fracture

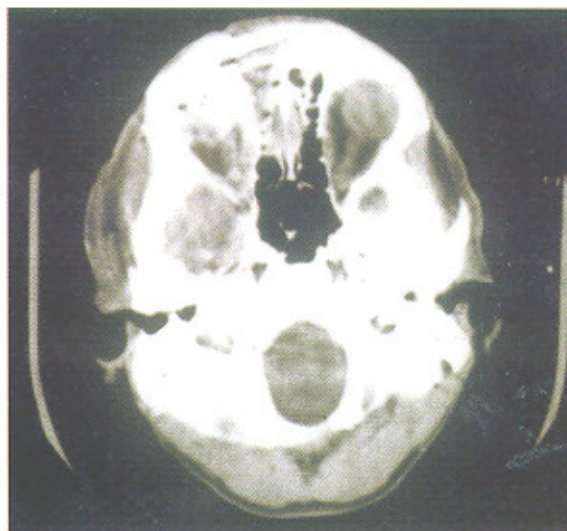
## INTRODUCTION

Post-traumatic rhinorrhea is a usual complication of skull base fracture. The resultant communication between the intracranial cavity and the surrounding atmosphere permits ingress of air loading in the subarachnoid space and ventricular system, the so called pneumocephalus (1,2). This condition is usually transient and air bubbles are resorbed through the common surface of the air and CSF due to high solubility of oxygen in the blood and nitrogen/oxygen equilibrium via diffusion through the gas fluid interface. The condition is somewhat different when pial injury allows air to enter the parenchyma (3). A case of intracerebral pneumatocele is being presented and the role of surgical intervention is emphasized.

### Case report:

A 35 years old man was referred to this center because of headache, seizures and CSF rhinorrhea. He was well until 2 months ago, when following a car accident he developed bilateral periorbital ecchymosis and anterior skull base fracture associated with right-sided anosmia. CSF rhinorrhea was present for one week but temporarily ceased after serial lumbar

punctures and administration of oral carbonic anhydrase inhibitors. However it restarted one month prior to his current admission. Neurological evaluation was normal except for some subtle personality changes and right-sided anosmia. Computed tomography (CT) showed subarachnoid as well as intracerebral air at the right frontal lobe associated with a fracture at the cribriform plate (Fig. 1,2). Elective surgical repair of the anterior skull base was contemplated. Bifrontal craniotomy was done and dura opened exposing a tense right frontal lobe, which was cannulated with air fizzling out leaving the punctured brain collapsed. Also the communication between the frontal lobe and cribriform plate defect was interrupted and the defect was packed with muscle and oxidized cellulose. An MRI scan was performed 18 months later for seizure workup which revealed a well demarcated area congruent over the air bubble location filled up with a fluid of signal intensity similar to that of CSF on T1 and T2 weighted images, corresponding to a porencephalic cyst (Fig. 3). Antiepileptic regimen was continued and the patient did well thereafter.



**Fig. 1.** Axial computed tomogram revealing the fractured right ethmoidal sinus.

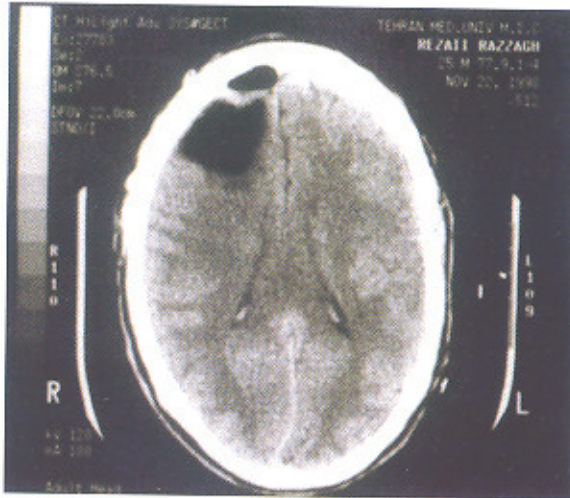


Fig. 2. Axial computed tomogram depicting the larger intra-axial bubble and smaller subarachnoid air, a thin cortical layer demarcates the two compartments.

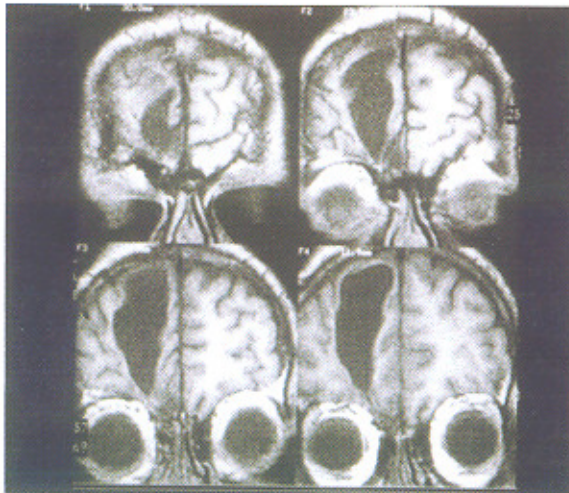


Fig. 3. Coronal T1 weighted MRI shows the air trajectory from the cribriform plate toward the frontal lobe.

## DISCUSSION

Post-traumatic pneumocephalus can occur in the epidural, subarachnoid, intracerebral, and intraventricular forms or appear in all the three. Intracerebral air is a rare occurrence and has been reported following frontobasal fractures (2,3) air insufflation with mask during anesthesia (4), and spontaneously in patients with frontal sinus osteomas (5,6). Very rarely, it might complicate ventriculoperitoneal shunt surgery (7) and medically treated prolactinomas. The most common cause however is non-penetrating craniocerebral trauma

involving anterior skull base associated with brain contusion, as was the case in our patient. The intracerebral aerocele secondary to closed head injury is reported to be due to herniation of contused brain into the craniodural defect (8).

The entrapped air typically does not dissipate with the usual modalities such as positioning and oxygen inhalation, for it is surrounded by hypovascular white matter, while the more common subarachnoid counterpart rapidly diffuses out of this compartment and surgical intervention is reserved for the rare instance of tension pneumocephalus (2). In our case the pneumatocele persisted after a lapse of two months.

The pneumatocele cavity usually communicates with the paranasal sinuses at its neighborhood, most commonly the frontals or ethmoids. The connection in our patient was with the right ethmoidal sinus. The cavity is primarily formed by the contused brain at the vicinity of the fractured sinus (9). The presence of pencephalic cyst in our patient's MRI at follow-up is a clue to assume it as an old contusion.

While diagnosis is not difficult on routine radiographs, CT is valuable for determining effects on the brain and clearly delineating the fractured site (11). CT metrizamide can furthermore demonstrate ventricular reflux and accumulation of dye within the air cyst. This phenomenon has been attributed to the transependymal penetration of air through the ventricular system to the cavity (9,12). However this study is not required routinely if the fractured site is evident on plain scans, as it was the case in our patient.

Most authorities believe in higher likelihood of tension pneumocephalus and requirement of surgical intervention in patients having symptomatic intracerebral air collections (10). According to our results, large symptomatic intracerebral air accumulations deserve close supervision especially if they are associated with CSF rhinorrhea. Surgical intervention may be indicated to ameliorate possible focal symptoms, and stop the fluid leakage.

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