

A Case of Diffuse Pneumocephalus With Air Bubble Sign

Birat Thapa Magar¹, Mubashir Malik¹, Faiq Sheikh¹, Rizwan Masood Butt¹

¹ Department of Neurosurgery Unit -1, Punjab Institute of Neuroscience, Lahore General Hospital, Ferozepur Road, Lahore, Pakistan.

Correspondence:

Dr. Birat Thapa Magar

Department of Neurosurgery Unit -1, Punjab Institute of Neuroscience, Lahore General Hospital, Ferozepur Road, Lahore, Pakistan.

Email : endsvilebirat@gmail.com

Background: Pneumocephalus is defined as presence of intracranial gas. It can be at any site in the cranium; isolated or at different sites simultaneously. Quantity of gas along with extent of mass effect caused by it & severity of clinical symptoms will determine the modality of treatment; i.e. conservative or surgical. Among many etiologies trauma is one, which is one of the most common cause as in our case. Multiple foci of gas scattered within the subarachnoid space, especially in the cisterns seen on CT scan of brain has been described as “Air bubble sign”, indicating of subdural tension PNC. Here we have presented our case with review of management of such condition, especially conservative. **Case:** A case of 55yrs male with history of road traffic accident was referred from another hospital. CT scan of Brain done in previous center showed diffuse PNC scattered throughout the subarachnoid space. The patient was managed conservatively and successive repeat CT scan showed gradual to complete resorption of gas and simultaneous clinical improvement of the patient. **Conclusion:** “Air bubble sign” described as a sign of tension PNC can be managed conservatively in absence of significant clinical symptoms and may not only be associated with subdural tension PNC. The modality of treatment of PNC as well for tension PNC should be tailored according to the patient’s clinical status.

Key words: Pneumocephalus, Tension Pneumocephalus, Air bubble sign, Road traffic accident

Pneumatocele (PNC) or Intracranial aerocele is defined as the presence of intracranial gas, and majority of them is air. When PNC causes mass-effect with neurological deterioration, then it is termed tension PNC. The word Pneumocephalus (PC) was mentioned in earlier reports by Lecat in 1741.^{1,2} Tension PNC was first described in 1962³, which is common in mechanical trauma. It can be present in extra-axial space or intra-axial space of the brain. Ishiwata Y, et al has described “Mt. Fuji sign” in CT findings for indicating increased tension of subdural air and “Air bubble sign” for air in subarachnoid space. Here, we have presented a 55 year-old male with history of road traffic accident (RTA) with diffuse PNC and “Air bubble sign”.

Case

A 55 years male from Saragodha was referred to the neuro-emergency of this hospital with history of RTA 7 hours before the presentation. There was history of brief loss of consciousness, bleeding per mouth and nose and 3 episodes of vomiting. On examination, patient presented with Glasgow coma scale (GCS) E3V3M5, pupil bilateral 3mm

and reactive, stable vitals, a lacerated wound (4x2cm) was present on left supra-orbital ridge and a cut injury at lower inner lip region. CT Brain done at previous center (around 2 hours after the incident) showed diffuse and scattered collection of air throughout the subarachnoid space along the basal cistern, inter-hemispheric fissure, bilateral sylvian fissure and cortical sulci. Bi-frontal extra-axial air was also noted. Right frontal hypodensity also noted (Figure 1). After initial assessment and resuscitation patient was admitted to neurosurgery emergency ward and managed with intravenous antibiotics, analgesic and fluid. Patient was kept in low-Fowler position. CT scan of following morning showed no increase in size and extent of air (Figure 2). There was progressive improvement in patient’s condition. Repeat CT scan on seventh day showed complete resorption of air (Figure 3) and patient was planned discharge. At discharge, his GCS was 15/15, no motor or sensory deficit and cranial nerves were intact.



Figure 1: Presenting CT head of patient

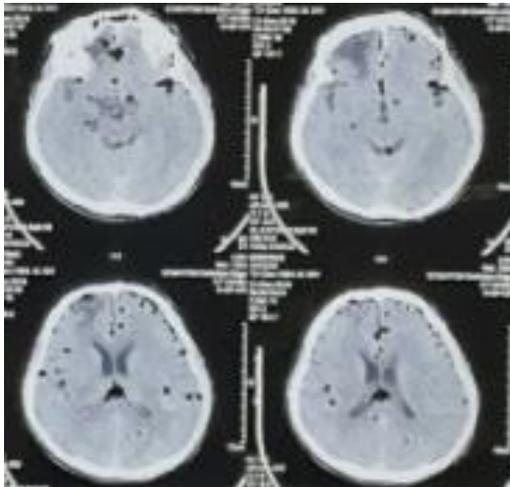


Figure 2: First follow-up CT head of patient



Figure 3: CT head just before discharge

Discussion

PC is an accumulation of intracranial gas which can be acute (<72 hours) or delayed (>72 hours)⁴.

Two mechanisms have been described in English literature.

1) Dandy theory of “ball-valve” where a development of pressure gradient occurs when extracranial pressure exceeds intracranial pressure and dural defect is present.

2) Horowitz and Lunsford “inverted soda-bottle effect” which is about negative intracranial pressure that is due to CSF leak which sucks air inside through dural tear⁵.

PNC also tends to develop after any neurosurgical procedures in sitting position,⁶ shunt insertion^{7,8} and burr-hole for chronic subdural hematoma^{9,10}. In trauma, PNC is due to fracture through air sinuses, skull base fracture or compound fracture over convexity with dural laceration. Other etiologies could be congenital skull defects like in tegmen tympani¹¹, neoplasm (osteoma, epidermoid, pituitary tumor), infection with gas-producing organisms.¹²⁻¹⁷ Patients usually have headache(38%), nausea, vomiting, and altered sensorium.¹⁸ Tension PNC may add features of mass effect and intracranial succussion splash (Bruit Hydro Aerique) may be present in 7% of the cases.¹⁸

CT is the investigation of choice which can even detect 0.5ml of air.¹⁹ Air have Hounsfield coefficient of -1000 and is dark in plain CT. Ishiwata Y et al has described CT findings of subdural tension PNC which compresses bilateral frontal lobes and is called “Mt. Fuji sign”¹⁰. Presence of multiple small air bubbles scattered through subarachnoid space, especially in the cisterns are called “Air bubble sign”.¹⁰ Here in our case, we can see multiple air bubbles scattered throughout the cisterns without significant presence of subdural air. Small extra-axial airspace was noted in bi-frontal region without features of mass.

Treatment of PNC depends upon its size, extent, and severity of symptoms produced by it. Treatment is tailored to cause if is due to infection. For noninfectious simple PNC without any CSF leak and if mass effect is not severe then it may be simply followed. In case of suspected CSF leak, it

should be treated like any CSF fistula. Treatment of significant or symptomatic post-op PNC by breathing 100% O₂ increases the rate of resorption.²⁰ There may be clinical and radiological improvement, reduction in the incidence of meningitis and hospitalization time by hyperbaric oxygen therapy.²¹ Tension PNC producing significant symptoms can be dealt with twist drill or burr holes drains. Low-Fowler position may help by preventing further increase of PNC as in our case.

Conclusion

Trauma like RTA is one of the common cause of PNC. “Air bubble sign” described as an indicator of tension PNC can be managed conservatively in absence of significant clinical symptoms. The modality of treatment of PNC as well for tension PNC should be tailored according to the patient’s clinical status. Position of patient’s head may have significant role in the management of PNC.

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