Isolated intraparenchymal tension pneumocephalus

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ABSTRACT

Pneumocephalus after trauma is not uncommon but rarely develops into tension pneumocephalus. Delayed-onset spontaneous tension pneumocephalus is rare, and delayed-onset isolated intraparenchymal/intracerebral tension pneumocephalus is even more so. We describe a 35-year-old man who presented with urinary incontinence, left eye vision loss, and nasal discharge/cerebrospinal fluid rhinorrhea 2 months after recovering from bifrontal hemorrhagic contusions following a road traffic accident. Intraparenchymal/intracerebral tension pneumocephalus was diagnosed with computed tomography and the patient was taken for an urgent decompressive surgery along with repair of the skull base defect.

KEYWORDS Intraparenchymal; pneumocele; pneumocephalus; spontaneous; tension

CASE REPORT

A 35-year-old man presented to the emergency department with complaints of left eye vision loss, nasal discharge, and urinary incontinence for 2 months after recovering from traumatic bifrontal hemorrhagic contusions. Trauma was related to a traffic accident that occurred 8 months earlier and was managed conservatively. No prior imaging was available. In the interim, the patient was doing well and was mobilizing by himself. On exam, the patient demonstrated altered sensorium and left-sided weakness. Urgent computed tomography scan without intravenous contrast revealed a large air density lesion in the left frontal region without a broad base toward the dura, confirming its intra-axial/intraparenchymal location. There was associated mild vasogenic edema at the periphery of the lesion. Mass effect was seen in the form of posterior displacement of the genu of corpus callosum and effacement of the frontal horns of bilateral lateral ventricles (*Figure 1*). Bone window settings revealed multiple fractures of the anterior skull base and frontal bone, including both inner and outer walls of the frontal sinus (*Figure 2*). A curved reformat image demonstrated communication of intracerebral air with the nasal cavity through the breach (fracture) in the left anterior skull base.

DISCUSSION

The term *pneumocephalus* was coined by Wolff in 1914¹ and is also known as *intracranial aerocele* or *pneumocele*. It refers to accumulation of air/gas in an intracranial compartment, including both extra-axial spaces (epidural, subdural, or subarachnoid) and intra-axial spaces (intraparenchymal or intraventricular).^{2,3}

Two pathophysiologic mechanisms have been postulated. The first is a “ball valve mechanism,” where there is a bone defect with dural tear adjacent to a region that has direct access to free air, that is, the paranasal sinuses. Air can enter the cranium when the patient coughs, sneezes, strains, or blows. This defect gets closed due to the tamponade effect of the swollen brain, trapping the air intracranially. Repeated coughing or straining leads to gradual accumulation of a large amount of air inside the cranium, leading to increased pressure to a point where it causes a marked mass effect (tension pneumocephalus). “Inverted bottle neck” is the second mechanism proposed, in which air enters the intracranial compartment as fluid leaves the space.^{4,5}

The most frequent site of tension pneumocephalus is the subdural compartment. However, air can also accumulate in intra-axial and other extra-axial spaces.^{3,6,7} Gonul et al described a case with intraventricular tension pneu-

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Figure 1. (a) Unenhanced computed tomography image reveals a large air density lesion in the left frontal region without a broad base toward the dura (arrow). (b) Note the mass effect on the corpus callosum and frontal horns (arrow). (c) Bone window settings reveal multiple fractures of the frontal bone, including both inner and outer walls of the frontal sinus (arrow).

Figure 2. A curved reformat image demonstrates communication of the lesion with the nasal cavity through the breach (fracture) in the left anterior skull base.

mocephalus.⁷ Another case of posterior fossa tension pneumocephalus was described by Ram et al, with the patient developing pneumocephalus after cerebrospinal fluid leakage following surgery.⁸ Tripathy et al described a case of tension pneumocephalus that developed after 1 month of trauma.³ Huang et al saw a case of tension pneumocephalus and concluded that it constitutes a surgical emergency that can be successfully treated only with early diagnosis and early treatment.⁵

Posttraumatic pneumocephalus is not uncommon and is seen in 3.9% to 9.7% of head injury cases.⁹ Delayed-onset isolated intraparenchymal/intracerebral tension pneumocephalus has rarely been reported. Tension pneumocephalus is a possible life-threatening neurosurgical emergency. Early recognition of this potentially fatal condition is necessary for early initiation of prompt and accurate emergent neurosurgical treatment.

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