

Enlargement of Postoperative Aqueductal Air Due to Elevated Body Temperature Case Report

ABSTRACT

Pneumocephalus has been reported after posterior fossa surgery especially with procedures performed in the sitting position. The gravitational effect is the decisive factor in the development of pneumocephalus. The entrapped air in the aqueduct may enlarge due to several factors such as elevated body temperature and may cause to deterioration in neurological status.

We report a rare case of tension pneumocephalus associated with the enlargement of massive air in aqueduct due to elevated body temperature, following removal of a cervicomedullary tumor. We believe her neurological deterioration was due to the compression of the reticular formation by dilatation of postoperative air in the aqueduct due to the elevation of her body temperature.

KEY WORDS: Tension pneumocephalus, Aqueduct, Posterior fossa surgery.

INTRODUCTION

Pneumocephalus is a postoperative complication frequently encountered in neurosurgery.

Postoperative pneumocephalus was first reported by Markham in 1967 (3). Tension pneumocephalus has been frequently observed after posterior fossa surgery, especially in procedures performed in the sitting position. In a retrospective study, the incidence of intracranial air collection was 100% in the sitting position (2). The sitting position in neurosurgical operations achieves an optimal access to lesions situated in the midline and drainage of the cerebrospinal fluid (CSF). In all posterior fossa explorations performed in the sitting position, there is always some degree of pneumocephalus. This position promotes the drainage of CSF from the intracranial cavity with a resultant entry of air in a process similar to that observed with an inverted pop bottle (1). Air may enter via the fourth ventricle into the aqueduct. The enlargement capacity and elasticity of the aqueduct regarding tension pneumocephalus is limited. In our opinion, the volume of a sealed gas-filled compartment may increase in size and expand the aqueduct with elevation of the body temperature. This expansion may cause neurological deterioration following compression of the brain stem.

Here, we present a case who developed tension pneumocephalus at the aqueductus sylvii with deterioration in neurological status following elevated body temperature after removal of a cervicomedullary tumor.

Case

A 14-year-old girl presented with a 2-week history of gait disturbance and imbalance. Neurological examination revealed ataxia, dysmetry,

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dysdiadokokinesia and bilateral end-point nystagmus. Magnetic resonance imaging (MRI) scans revealed a cervicomedullary junction mass lesion (Figure 1). Early postoperative MRI showed gross total tumor removal with air in the fourth ventricle and some air in the aqueduct (Figure 2). Her body temperature increased to 39.8 degrees Celsius 3 days after the operation and she became unconscious and agitated. Early postoperative computed tomography (CT) scan revealed enlargement of aqueduct that was associated with triventricular hydrocephalus. She underwent a shunt procedure for her hydrocephalus, but the shunt procedure did not improve her neurological status. Her neurological status improved as her fever subsided and the follow-up CTs showed that the air in the aqueduct was absorbed in three weeks (Figure 3).

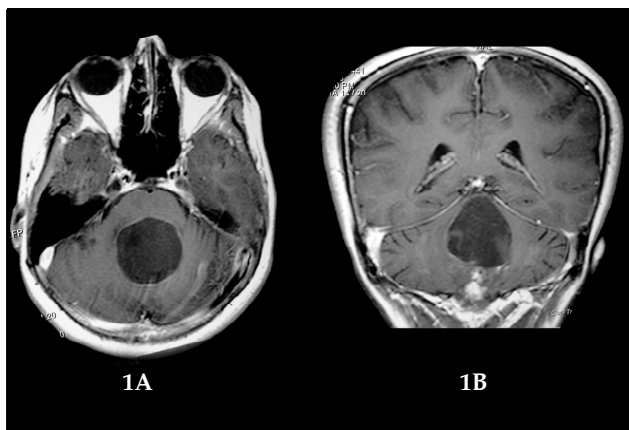


Figure 1: 14-year-old girl with a posterior fossa tumor **A)** Axial postcontrast T1-weighted MR image **B)** Coronal postcontrast T1-weighted MR image.

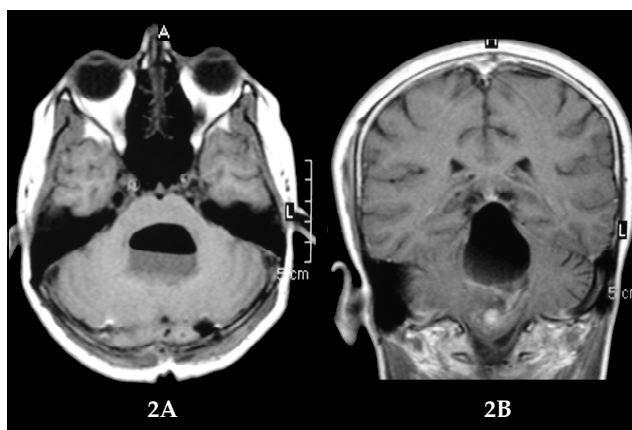


Figure 2: Postoperative aqueductal pneumocephalus was seen after gross total removal of the posterior fossa tumor **A)** Axial T1-weighted MR image **B)** Coronal T1-weighted MR image.

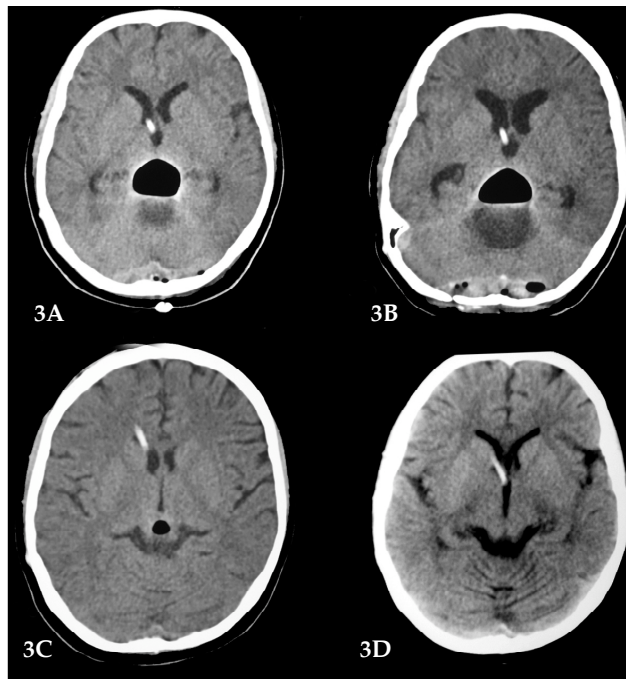


Figure 3: CT scans showed large aqueductal collection and resorption of air in 3 weeks **A)** Postoperative 3rd day when the elevation of her body temperature was maximal. **B)** Postoperative 5th day **C)** 2 weeks after the operation **D)** 3 weeks after the operation.

DISCUSSION

The aqueduct of sylvius is a pathway connecting the posteroinferior third ventricle to the superior aspect of the fourth ventricle. The cerebral aqueduct is more dilated in the embryonic brain than in the mature brain. After the initial closure of the neural tube, its lumen has a relatively uniform dimension throughout the neural axis. As the brain and spinal cord mature, the lumen of the neural tube expands in some areas, such as the cerebral ventricles, and narrows in others, such as the sylvian aqueduct. The lumen of the aqueduct decreases in size, beginning in the second month of fetal life and continuing until birth. This narrowing appears to be caused by growth pressures upon the aqueduct from adjacent mesencephalic structures (4). The normal mean cross-sectional area of the aqueduct at birth is 0.5 mm² with a range of 0.2 mm² to 1.8 mm². The size of aqueduct is focally reduced in aqueductal stenosis and the stenosis usually occurs either at the level of the superior colliculi or at the intercollicular sulcus (5).

Tension pneumocephalus is a distinct clinical entity necessitating active intervention. Tension pneumocephalus is most commonly subdural and

bifrontal, but may occur in the fourth ventricle and aqueduct. It occurs as a result of the drainage of CSF by gravity, producing negative pressure in the supratentorial compartment and thus allowing air to enter, ascend and collect. Tension pneumocephalus may present as deterioration of consciousness with or without lateralizing signs.

There is still controversy on the surgical position for posterior fossa lesions. Some advantages of the sitting position include no accumulation of blood in the surgical field and continuous drainage of CSF during the operation. However, this position has drawbacks like venous air embolism and tension pneumocephalus. On the other hand, the risk of pneumocephalus in the prone position is almost 0%. Both position are currently used depending on the surgeon's choice, and there is no obvious advantage of one position over the other.

The entrapment of massive air in the aqueduct obstructed the CSF pathway and resulted in hydrocephalus in our case. The patient underwent a shunt procedure, but the neurological condition did

not improve. We believe her neurological deterioration was due to the compression of the reticular formation by the dilatation of postoperative air in the aqueduct following elevation of her body temperature. Her neurological status improved once the body temperature decreased to normal. She was discharged with total recovery and no air in aqueduct after three weeks.

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