ICNSJ Case Report

Air in Straight Sinus after Closed Head Injury Surgery

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ABSTRACT

Air in the intracranial vascular compartment is rare and only few case reports are published in the literature. Without surgery or open head trauma, the origin of air bubbles in the venous sinus is still debated. We report an admitted patient in the emergency room one hour after a severe closed head injury, and in whom, the post-surgical cranial CT scan demonstrated feature of air embolism along the straight sinus. Mechanisms explaining how air reaches the venous compartment is discussed.

Keywords: Head injury; Air; Venous sinus

ICNSJ 2016; 3 (2):124-126 www.journals.sbmu.ac.ir/neuroscience

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Received: April 19, 2016 **Accepted:** May 4, 2016

CASE PRESENTATION

A 29-year-old man was admitted in the emergency room after having straight head trauma by carrying back on a vehicle. At arrival, there was an entrance wound 2 cm above the ear and bilateral periorbital edema and ecchymosis were present. There was no evidence of cerebrospinal fluid leak. He was confused and agitated and both pupils were midsize and reactive to light. No new neurological deficit was detected. A cranial CT scan, was performed immediately that showed right frontoparietal epidural hematoma about 9 mm in diameter and depressed bone with cerebral edema. He underwent emergent surgery and we evacuated hematoma and pull up depressed bone and hemostasis of one of middle meningeal artery branches and one of bleeding veins was done. Dura which was lacerated by one of fragmented bone pieces was repaired (duraplasty). Postoporatively brain CT revealed air in straight sinus but the patient had no significant complication and was discharged 3 days later.

DISCUSSION

Intracranial cavity free air can often be detected on CT after cranial trauma [6-10], craniotomy, barotrauma, tumors, infections, some surgical procedures, craniofacial

Figure 1. Right frontoparietal epidural hematoma and depressed bone fragment.

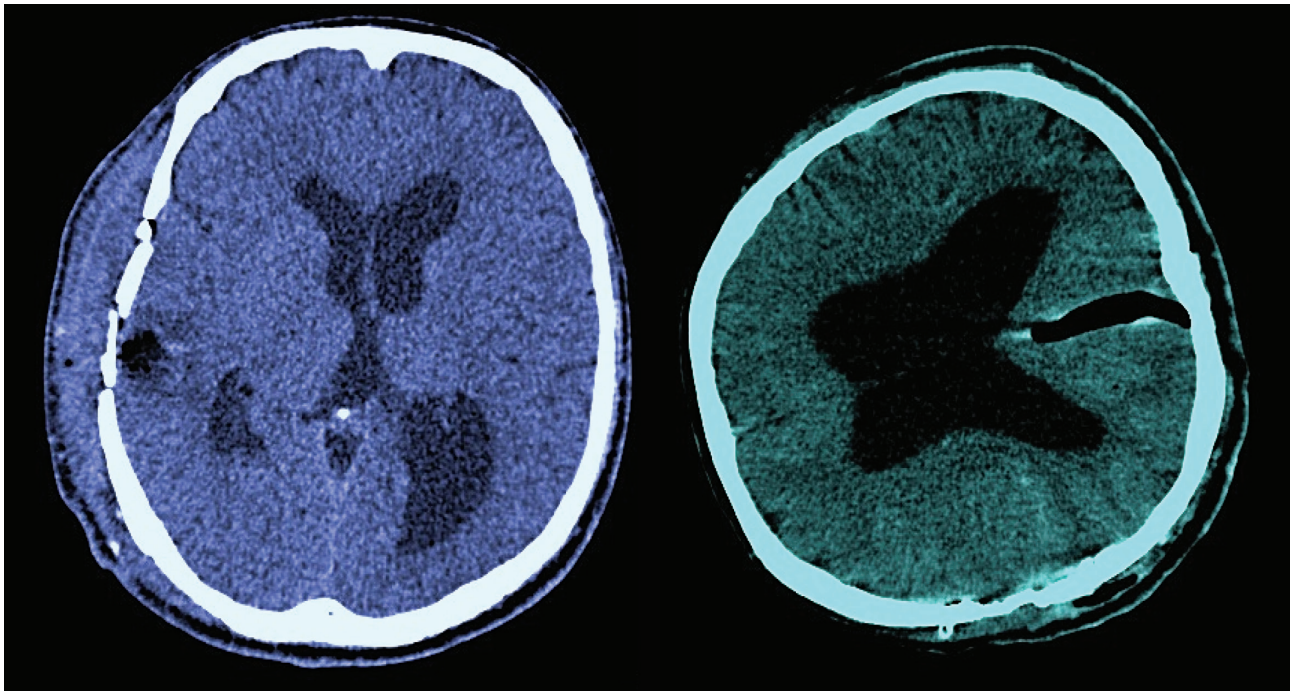

Figure 2. Air along straight sinus postoperatively.

reconstruction, posterior fossa operations in the sitting position, some interventional procedures such as lumbar puncture and insertion of arterial or venous catheters [11-13], nitrous oxide anesthesia, and congenital cranium defects [1]. Posttraumatic air embolism in the cerebral venous sinuses is an uncommon finding in closed injury [1-5]. Different theories have been considered to describe intravascular pneumocephalus. One theory proposed that peripherally injected air climb passively within the venous system in response to gravitational forces opposite circulation to jugular venous flow [5,10]. Air may also be found in the scalp veins, infratemporal fossa, carotid canal, straight sinus, superior ophthalmic vein, superior sagittal sinus, cavernous sinus, veins around the foramen magnum and the inferior petrosal sinus [4,6]. In other hand, as air access the central venous circulation, the lower specific weight of air bubbles as compared to blood will always cause the bubbles to climb to the cranium in a patient with upright position. The air bubbles move at a velocity greater than that of the opposing blood flow in the vein [1,3,4]. The second theory is about defect of dura and arachnoid due to fracture created and therefore, the difference between intracranial pressure and atmospheric pressure could result in intake of air through fracture line, and then check-valve mechanism entraps air [2]. In the present case it was difficult to describe the origin of air in the intracranial venous sinus. However, the air embolism might rich more regularly the intracranial venous portion, arterial air embolus was previously described. It may be resulted from paradoxical embolism, even in the lack of an intracardiac shunt, as has been reported earlier in humans and approved in dog models [2,4,5]. Air is considered to move from the venous to the arterial circulation either via pre pulmonary arteriovenous shunts or directly via crossing the pulmonary capillary bed. The recognition of cranial intravascular air in a patient with cranial trauma could be dependent on the timing of the imaging [1,3]. Brain CT is diagnostic only if be done immediately because air is quickly resorbed from the brain arterioles. This unanticipated radiographic finding should not essentially be considered dangerous. There is no document that intravenous pneumocephalus alone is destructive since intravascular pneumocephalus is different from intraparenchymal pneumocephalus [1,2]. Diffusion weighted imaging modality of magnetic resonance imaging in the few hours might show several areas of restricted diffusion involving cortical areas predominantly [2,4].

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