

Diffuse cerebral venous air embolism following subarachnoid hemorrhage

Case illustration

MOHAN R. SHARMA, M.D., DAVID W. NEWELL, M.D., AND GERALD A. GRANT, M.D.

Department of Neurological Surgery, University of Washington and Harborview Medical Center, Seattle, Washington

KEY WORDS • cardiopulmonary resuscitation • air embolism • subarachnoid hemorrhage

This 33-year-old previously healthy woman was transferred to our institution with a 4-hour history of unresponsiveness. The patient had received cardiopulmonary resuscitation (CPR) in the field and was hemodynamically unstable during transfer. On arrival, she was comatose with fixed and dilated pupils and equivocal corneal reflexes. The initial computerized tomography (CT) scans (Fig. 1) revealed widespread subarachnoid hemorrhage (SAH), as well as diffuse air in the superior sagittal sinus, the straight sinus, and the cavernous sinuses. Infusion CT scans (Fig. 2) revealed a 5 × 8-mm basilar tip aneurysm and a heart-shaped air bubble in the region of the torcular herophili. The patient was admitted to the neurosurgical intensive care unit for supportive care in accordance with her family's wishes. She died approximately 8 hours after the ictus.

Few cases of intracranial air following CPR have been reported in the literature.^{1,2} Rarely, a cerebral arterial air embolism has been documented to occur following trauma or by movement of air through peripheral or central venous lines.^{1,3,4} To our knowledge, however, the presence of air in the intracranial venous sinuses in the setting of SAH has not been described previously. The mechanism of how air enters the intracranial venous sinuses remains unclear. While CPR is being performed, gas from a peripheral or central venous site can be sucked into major veins in the thoracic cavity; during chest compressions,

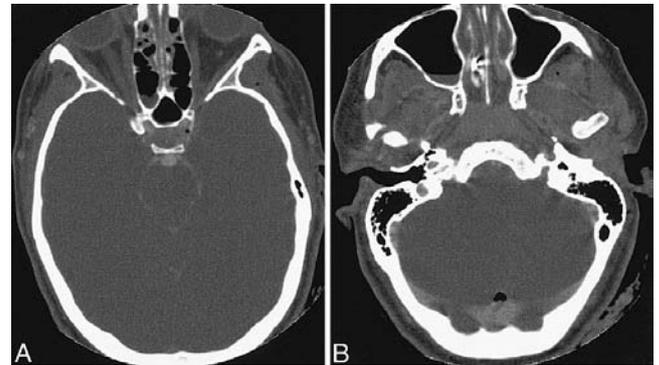


FIG. 2. Axial infusion CT scans revealing a 5 × 8-mm basilar tip aneurysm (A) and an impressive heart-shaped air bubble in the region of the torcular herophili (B).

the air can then be regurgitated into the superior vena cava, internal jugular vein, and into the intracranial venous sinuses.² Because circulation is marginal during and immediately after CPR, some air may become trapped in the venous sinuses.

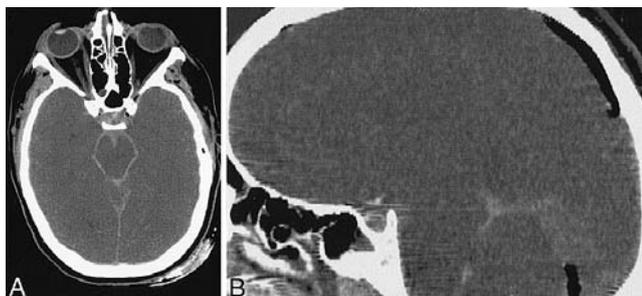


FIG. 1. Unenhanced CT scans of the head. A: Axial view, revealing widespread SAH plus air in the cavernous sinuses. B: Sagittal reconstruction demonstrating air in the superior sagittal sinus and the straight sinus.

References

1. Hashimoto Y, Yamaki T, Sakakibara T, et al: Cerebral air embolism caused by cardiopulmonary resuscitation after cardiopulmonary arrest on arrival. *J Trauma* **48**:975–977, 2000
2. Imanishi M, Nishimura A, Tabuse H, et al: Intracranial gas on CT after cardiopulmonary resuscitation: 4 cases. *Neuroradiology* **40**:154–157, 1998
3. Iwama T, Andon H, Murase S, et al: Diffuse cerebral air embolism following trauma: striking postmortem CT findings. *Neuroradiology* **36**:33–34, 1994
4. Rubinstein D, Symonds D: Gas in the cavernous sinus. *AJNR* **15**:561–566, 1994

Manuscript received December 5, 2002.

Address reprint requests to: David W. Newell, M.D., Department of Neurological Surgery, University of Washington and Harborview Medical Center, Box 359766, 700 Ninth Avenue, Seattle, Washington 98104. email: dwn@u.washington.edu.