Cerebral air embolism occurring at angiography and diagnosed by computerized tomography

Case report

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A case of air embolism complicating cerebral angiography is presented. The presence of the embolism was confirmed with high-resolution computerized tomography scans using appropriate window settings.

KEY WORDS • cerebral air embolism • computerized tomography • angiography

In the past, physicians have diagnosed cerebral air embolism based on signs and symptoms occurring in a high-risk setting, such as during neurosurgical procedures performed in the sitting position. Because of the evanescent nature of air bubbles in the vasculature, neuroradiological and even postmortem confirmation of cerebral air embolism has been difficult. The advent of high-resolution computerized tomography (CT) scanning has made it possible to visualize air bubbles in the brain and establish the diagnosis correctly. A case has recently been reported with CT diagnosis of an air embolism following subclavian vein catheterization. We report a similar case in which air embolism was a complication of cerebral angiography.

Case Report

This 1-year-old boy had an episode of flaccid right hemiplegia at the age of 11 months which cleared over a 3-day period. The day after admission he underwent cerebral angiography. This was followed by a CT scan so that the same sedation could be utilized for both studies. Angiography revealed severe bilateral stenosis of the supraclinoid carotid arteries with prominence of the lenticulostriate arteries, consistent with a diagnosis of moyamoya disease.

Because of heavy sedation the patient did not awaken until the following morning, at which time a moderate left hemiparesis was noted. That afternoon the patient had three focal seizures involving the left side only, and phenytoin was given. By late afternoon the patient’s strength had improved, and by the following morning the only sequela was a preference for using his right hand. He subsequently recovered completely.

Review of his CT scan (performed immediately following angiography) revealed multiple small areas of air density, but only in the right hemisphere (Fig. 1).

Discussion

Cerebral air embolism has been reported to occur in a number of clinical settings, including trauma, hemo-
dialysis, thoracentesis, high altitude accidents, diving accidents, phlebotomy, central venous catheter placement, cardiopulmonary bypass, pneumoarthrography, and neurosurgery.\textsuperscript{1-3,5,8,9} Air enters the venous circulation and crosses over to the arterial side either through a patent foramen ovale, or through physiological shunts within the lung. In some circumstances, air enters the arterial tree directly, such as during cardiopulmonary bypass or, as in our case, as a complication of cerebral angiography.

In three large series from the literature totalling 14,262 cerebral catheter studies, embolization occurred in 0.4\% of patients.\textsuperscript{4,6,7} The neurological sequelae of these events were much milder in children, possibly because the emboli are composed of fibrin clots from the catheter tip rather than fragments of atheromatous plaques.\textsuperscript{7} Air embolism was not diagnosed in these studies.

The clinical features of cerebral air embolism include sudden depression in the level of consciousness, which may progress to coma. Focal neurological signs may be present, and seizures, usually generalized, are very common. Treatment consists of the prophylactic administration of anticonvulsant drugs and sometimes hyperbaric oxygen. Increased barometric pressure will reduce the size of any gas bubbles lodged in the circulation by compression, and high oxygen levels will further shrink the bubbles by washing out the nitrogen contained within them.

Recovery from cerebral air embolism may occur spontaneously, as in our case. Menkin and Schwartzman\textsuperscript{5} reported five patients with this complication, of whom four recovered totally or nearly so without specific treatment. On the other hand, a recent case failed to show any clinical improvement after treatment in a hyperbaric chamber.\textsuperscript{2} Nevertheless, good results have been obtained with that technique, and Mader and Hulet\textsuperscript{3} reported a dramatic response to hyperbaric therapy 29 hours after the original incident.

If the clinician suspects air embolism, a CT scan should be obtained. In the case of postoperative neurosurgical patients, care should be taken to distinguish intraparenchymal air from air in the sulci over the convexities. If intraparenchymal air is found, anticonvulsants should be given and a decision made about hyperbaric treatment. If serial neurological examinations suggest clinical improvement within the first few hours, then further close observation may be indicated. Transfer to an institution with hyperbaric facilities should be considered if there is no change or deterioration in the patient's status.

It seems likely that, if CT scans routinely followed cerebral angiography, cerebral air embolism might be seen with greater frequency. Many cases presumably produce no symptoms and are not therefore suspected. Air will be absorbed in a few hours in most instances and will no longer be demonstrable on scanning.

References


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