G84 Fatal Air Embolism During Hemodialysis

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By attending this presentation, attendees will learn of this extremely rare complication of dialysis, understand the most likely cause, and the difficulties in verifying the diagnosis.

This presentation will impact the forensic science community by reminding them of this rare complication (almost exclusively related to human frailty thwarting an otherwise foolproof system), its presentation and diagnosis.

Systemic air embolization during renal dialysis is so rare it is not referenced in any major neurology text since 1976. The most recent articles found by computer search even mentioning this complication are from 1985 and 1989.[1, 2] This reflects the effectiveness of safety devices built into hemodialysis systems in recent decades. Air embolism can occur, however, in dialysis setting through improper use or technique with venous access outside the monitored system.

A 53-year-old man had undergone renal dialysis thrice weekly for three years because of end-stage renal disease. While on dialysis his general health otherwise was good. He was normotensive, without evidence of cardiac disease, and with normal blood glucose determinations. He had been evaluated and approved as a candidate for renal transplantation and was awaiting a donor organ.

Early on a Saturday morning he reported to the dialysis facility for his final session of the week, along with eleven other patients. This Saturday the facility was understaffed with one of two nurses (RNs) missing and one patient care technician (PCT) absent. Nevertheless, the preparation and dialysis proceeded normally for the patient through the rinse-back phase. Disconnected from the dialysis machine, he had a routine sitting blood pressure check recorded as 169/86. He then positioned himself for the routine standing blood pressure check but complained of lower extremity cramping (a common complaint in dialysis patients) and sat back down on the dialysis chair. The PCT hurriedly plugged in the line of a half-filled saline bag hanging on the machine. This is a routine treatment for post-dialysis cramps or hypertension (a BP of 86/47 was recorded).

It is important to note here that the patient is disconnected from the machine and its safeguards against air in the system. The saline bag (which should have been full) and its line are outside the machine and have no air alarm. The line from the bag is connected to an existing venous access in the forearm. The bag ran empty or nearly so and was hand pumped by the PCT to get every bit of saline out of it, while calling for help. A full saline bag was quickly obtained and replaced the empty one, but no one recalled having cleared the air from the new bag and its line.

The patient fell back in the chair, unconscious and unresponsive. He could not be revived. An ambulance was called and transported the patient to a hospital. There was no venous access during transport. On admission, he remained unconscious and unresponsive. A non-contrast CT of the head showed scattered small round low-density areas on the convexity of the cerebral hemispheres suggesting air embolism. On two subsequent daily CT studies, the air shadows were gone but massive swelling of the right cerebellum with subtentoral herniation consistent with acute infarction.

Electrocardiography suggested an anterior myocardial infarction. A cardiac catheterization showed ventricular changes consistent with infarction, but coronary arteriography showed a remarkably clean coronary arbotization, given his history, with only minimal to mild atherosclerosis and no occlusive disease through five and six bifurcations. Patent coronary arteries and a subendocardial infarct were confirmed at autopsy.

The mechanism and route of systemic air embolism via venous access will be discussed.

References:

1 Cohle SD, Graham MA. Sudden death in dialysis patients. J Forens Sci 1985; 30:158-166.

2 Air embolism associated with hemodialysis. Health Devices. 1989; 18(11) 406-7.

Renal Dialysis, Fatal Complication, Air Embolism

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