

## CASE REPORT

**Cerebral Air Embolism during Hemodialysis: a case report**

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**ABSTRACT**

Air embolism is a dreadful complication of hemodialysis, with bad prognosis. We reported the case of a 49-year-old woman with a medical history of hypertension, and renal failure treated by regular hemodialysis via a right jugular catheter who admitted to the emergency department (ED) for altering her state of consciousness right at the end of the hemodialysis session. A brain computer tomography (CT) scan was performed, showing gas within the right frontal lobe, suggesting an intravascular location of air bubbles. The patient was intubated and she was then transferred for a hyperbaric oxygen therapy, but was dead within 24 hours.

**Keywords:** Hemodialysis, Cerebral air embolism, Hemodialysis catheter, Hyperbaric oxygen therapy, Case report.

**INTRODUCTION**

Due to the abnormal communication between the atmosphere and the veins due to the presence of a central venous catheter, as well as an air-to-blood pressure gradient, air can enter blood circulation and cause air embolism among patients having hemodialysis. The air emboli enter blood circulation through three main routes: pulmonary circulation, paradoxical embolism and retrograde ascension to the cerebral venous system [1]. Improper patient positioning as well as wrong manipulation of the cervical catheter during hemodialysis are the facilitating factors to the occurrence of this dreadful phenomena. Jugular venous valvular insufficiency may also play a major role in facilitating the retrograde migration of the emboli to cerebral venous system. Clinical features depend on where the air emboli had migrated [2].

**CASE PRESENTATION**

A 49-year-old woman with a medical history of hypertension, and renal failure treated by regular hemodialysis via a right jugular catheter was admitted to the ED right after her regular hemodialysis session for altering her state of consciousness right at the end of the session. The patient was brought by her treating doctor who reported assisting to a partial seizure of her

left arm, after a short period of altering her state of consciousness. They also reported a severe hypoglycemia of 0.3g/l. They patient received 50 ml of 30% glucose before being admitted to the emergency department, with no returning to baseline. On medical examination at the emergency department, the patient was dyspneic. Her respiratory rate was at 35 cpm with signs of respiratory struggle and 75% oxygen saturation on room air. The blood pressure was at 130/70 mmHg, and the heart rate was at 80 bpm. There were no signs of right heart failure, nor peripheral signs of shock. The patient was unconscious with a Glasgow Coma Scale of seven (EO:1, MR:4, VR:1) with right hemiplegia, left-sided deviation of the labial commissure, and left gaze preference. Capillary blood glucose level was at 2.6 g/dl. Remarkably, the patient had petechial lesions all of recent appearance, on her right shoulder (Figure1), right hemithorax, her right thigh, as well as her right ankle(Figure2). The right jugular catheter was in place and presented no abnormalities. Laboratory tests showed: hematocrit 32.9%; hemoglobin 10.6 mg/dl; TAP 83%; INR 1.12; urea 7.1 mg/l; creatinine 313 µmol/l; lipase 108 UI/l; total bilirubin 7.4mg/dl; troponin 28 ng/ml. There were no ionic disorders. A brain CT scan was precociously practiced, showing gas within the right frontal lobe in

distribution, suggesting an intravascular location (Figure 3-4). The patient was intubated; a rapid sequence induction intubation technique was performed using etomidate and succinylcholine. The patient was then transferred for a hyperbaric oxygen therapy, but she was dead 24 hours later.

## DISCUSSION

Air embolism is a rare pathology, mostly of iatrogenic origin related to improper manipulation of blood vessels during certain therapeutic procedures [1,2]. Cerebral air embolism can have different clinical manifestations such as focal neurological deficits, mental status changes and seizures, as well as death occurrence [3,4]. Once the diagnosis of air embolism is suspected, diagnostic tests should be initiated to locate the gas embolism. If the imaging does not show air bubbles, the diagnosis of a cerebral air embolism should not be ruled out because the fact that air bubbles can be rapidly absorbed in a matter of few hours [5]. That is why imagery should be performed rapidly in order to confirm cerebral air embolism. While waiting for the results of the diagnostic test, life saving measures should be started right. These measures include adequate oxygenation by high flow oxygen and mechanical ventilation should be considered in the occurrence of life-threatening respiratory or neurological failure. Fluid resuscitation and vasopressor administration are also needed most of the times in order to maintain hemodynamic stability. However, specific recommendations have not yet been firmly established [6,7]. Hyperbaric oxygen treatment is the only therapeutic measure that has been proven to be effective in patients with cerebral air embolism [8]. This procedure, due to high barometric pressure reduces the volume of air emboli and also helps to maintain high level oxygenation of ischemic tissues as well as cerebral oedema by reducing intracranial pressure [9]. If the treatment is started within 1–6 h, better consequences have been noticed [8,9]. However, preventive measures in avoiding iatrogenic venous air embolism have much better results than treating an actually-occurred cerebral air embolism. These preventive measures include improvements in dialysis technology that have reduced the occurrence of cerebral air embolism in a magnificent way. However, some sporadic cases have still being reported [10]. In this case report, the patient presented focal neurological deficits, mental status changes and seizures right at the end of her hemodialysis session that has been performed via a right jugular venous catheter. She was intubated performing rapid sequence

induction for presenting a life-threatening respiratory failure. A cerebral CT scan was performed in the first hours confirming the presence of air bubbles in the brain. The patient received adjunctive hyperbaric oxygen therapy session without clinical improvement and she was dead 24 hours later.

## CONCLUSION

Air embolism is a rare and serious complication of hemodialysis, with bad prognosis. The emergency doctor should have a flair for recognizing the symptoms in order to conduct early appropriate management to improve the patient's prognosis including imaging exploration and life saving measures such as early hyperbaric oxygen therapy.

Conflict of interest: The authors declare no conflict of interest.

Consent: The oral consent of the family was obtained.

Data availability

All data underlying the results are available as part of the article and no additional source data are required.

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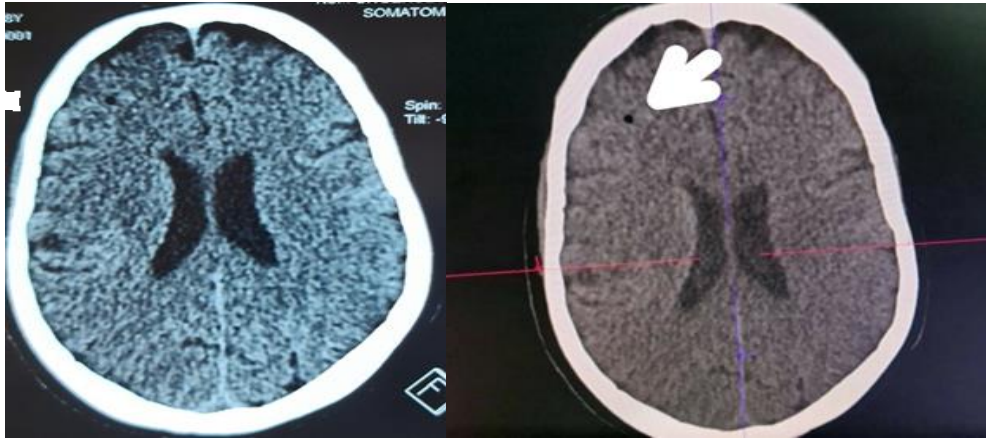
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**Figure 1:** Petechial lesions of recent appearance on the patient's right shoulder



**Figure 2:** Petechial lesions of recent appearance on the patient's right ankle



**Figure 3:** Patient's brain CT scan showing gas within the right frontal lobe in distribution, suggesting an intravascular location.