Kidney Medicine

Undetected Air Embolism During Hemodialysis from a Defective Central Venous Catheter Causing Intradialytic Cardiac Arrest: An Imaging Teaching Case

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Air embolism was a well-recognized and dreaded complication of hemodialysis in the early stages of the therapy.[1] With the use of air detection alarm systems in dialysis circuits; however, intradialytic air embolism has become exceedingly rare in modern dialysis.[2,3] Nonetheless, there are still occasional reports of hemodialysis-related air embolism today. A man in his 60s with end-stage kidney disease and chronic systolic heart failure had been receiving thrice weekly intermittent hemodialysis (HD) via a tunneled dialysis catheter because of failed access creation. The catheter was last exchanged 4 years prior. During the 6 months leading up to presentation, he experienced multiple episodes of unexplained intradialytic cardiopulmonary collapse including asystole and pulseless electric activity despite placement of a permanent pacemaker. He had successful return of spontaneous circulation each time, but due to multiple episodes of intra-dialytic cardiopulmonary collapse, HD was deemed risky to continue. The patient withdrew from HD and opted to pursue hospice at home. However, he presented with hypervolemia and hyperkalemia 2 weeks later, reconsidering HD. HD was resumed, and he tolerated inpatient HD sessions with low blood flow rates. Because of an existing recall,[4,5] his tunneled dialysis catheter was examined for recirculation. The catheter was clamped between the hub and exit site. Saline was flushed through the venous Luer to check for fluid circulation to the arterial side through a potential internal hub defect (Fig 1A). However, in the absence of hub defect, the saline pressurized and disconnected the venous Luer-hub extension tubing unit (Fig 1B). Given the compromised integrity of the venous Luer to the extension tubing connection,

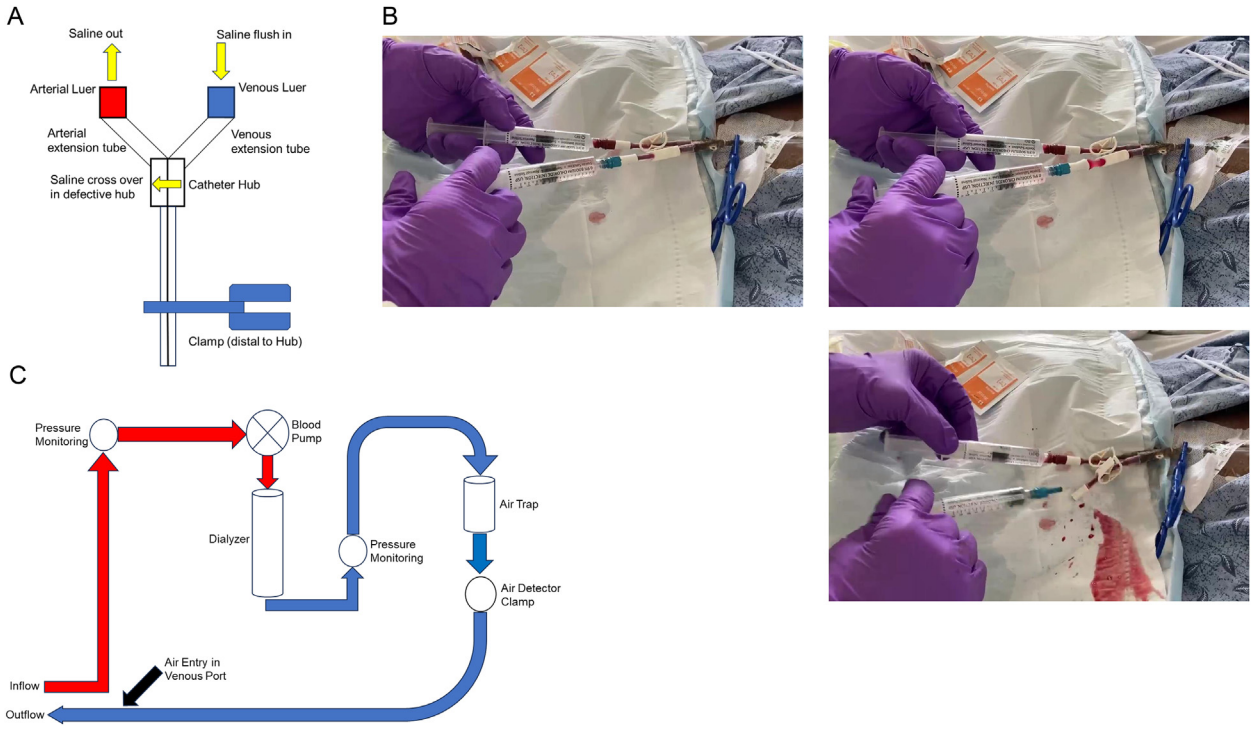

Figure 1. Testing the integrity of the tunneled dialysis catheter hub and the schematic of dialysis circuit. (A) Diagram of components of dialysis catheter. Arrow: expected flow of saline during the test of a catheter with hub defect. (B) Catheter was clamped between the hub and exit site, and saline was flushed from the venous Luer (blue top). Photos show that the flush distended the venous hub connection, and the venous Luer disconnected from the deteriorated white rubber sleeve. (C) Schematic of dialysis circuit. As shown in the diagram, the venous air trap detects air entry from arterial port but does not detect air generated from the venous port.

concern arose about a flow (drag dependent) air leak and potential air emboli because air entry from the venous side of the catheter would not be detected by the HD circuit air alarm (Fig 1C). Catheter ports were reversed at the next HD session, and the air detector alarmed immediately, confirming the suspicion of air leak originating from the venous hub defect. HD was aborted, and the tunneled dialysis catheter was replaced the next day (Fig S1). Air emboli to the right heart and pulmonary arteries was suggested to be the culprit of his prior cardiac arrests. He tolerated subsequent HD at gradually higher blood flow rates without recurrence of cardiopulmonary collapse.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Figure S1: Exchange procedure of a "stuck" long-term dialysis catheter. The aging catheter of our patient could only be exchanged after the balloon angioplasty of the calcified fibrinous sheath. (A-C) Old catheter with angioplasty balloon in skin tunnel segment, vein entry at apex and near tip (red lines). (D) Balloon angioplasty of the fibrin sheath and left brachiocephalic vein stenosis (arrow). (E) Catheter tract/central vein with residual fibrin sheath after the balloon angioplasty. (F) New TDC, tip in the right atrium (arrow).

ARTICLE INFORMATION

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