



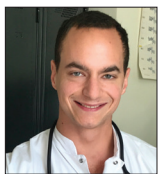
Case Report

When ventriculoatrial shunt gets lost

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ABSTRACT

Ventriculoatrial shunt is a medical device used to treat chronic hydrocephalus, with a distal catheter inserted in the internal jugular vein using the Seldinger technique. We report the case of a 40-year-old male with disconnection and migration of the distal catheter in the pulmonary arteries 3 years after its implantation, revealed by the recurrence of Hakim-Adams syndrome. The migrated catheter was urgently extracted using an endovascular procedure with a pigtail catheter and a lasso snare retrieval device. The patient benefited from the implantation of a contralateral ventriculoperitoneal shunt. The patient's case highlights that interventional radiology should be consulted to remove migrated endovascular foreign material, in the absence of cardiac or pulmonary complications.

Keywords: Interventional radiology, Ventriculoatrial shunt, Migrated distal catheter, Endovascular procedure

INTRODUCTION

A 40-year-old male, with a medical history of subarachnoid hemorrhage (SAH) from aneurysm rupture complicated by chronic hydrocephalus treated with the ventriculoperitoneal shunt (VPS), presented to the emergency room for recurrence of Hakim-Adams syndrome for the past 2 months. Three years ago, he underwent revision surgery with implantation of a ventriculoatrial shunt (VAS).

CASE REPORT

The patient was afebrile and clinical examination showed no focal neurologic deficits and no meningismus. The computed tomography (CT) scan of the head revealed a recurrence of chronic hydrocephalus [Figure 1]. The cervicothoracic CT scan revealed that the catheter was disconnected from the valve and had migrated through the right heart chambers in the pulmonary arteries. The patient denied chest pain and dyspnea. Cardiac auscultation was normal. Blood tests revealed no sign of infection (WBC 8.6G/L, CRP 0.9 mg/L) and there was no sign of pulmonary embolism (D-dimer 0.36 µg/mL).

One day after admission, the patient was taken to the interventional radiology suite. A 7F sheath (Radifocus Terumo®, Somerset, NJ 08873 USA) was placed through right femoral venous access. A 5F pigtail catheter (Radifocus Terumo®) was introduced through a 0.035 guidewire (Terumo®) until the catheterization of the right heart: this allowed us to reach the pulmonary arteries. The migrated silicone shunt was stuck, looping in the right inferior subsegmental artery. This loop was gradually undone so that the extremity of the shunt was set free in the inferior vena cava. The pigtail catheter was removed, and a 6F EN snare® lasso retrieval device (Merit Medical Inc., South

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Jordan, Utah 84095 USA) was used to catch and remove the migrated shunt [Figures 2 and 3].

Two weeks after admission, the patient underwent revision surgery with removal of the remaining proximal shunt, and implantation of a contralateral frontal VPS shunt with an adjustable pressure valve. The patient's neurological status improved remarkably within days following the surgery. His post-operative course was unremarkable. He was discharged three weeks after admission.



Figure 1: A 40-year-old man presented 3 years after ventriculoatrial shunt surgery for recurrence of Hakim–Adams syndrome. (a) Head CT without contrast shows enlarged ventricles with transependymal edema. (b) CT scan of the head and chest without contrast in coronal MIP slices shows the proximal ventricular shunt (arrow) connected to the valve (star), and the distal catheter (arrowhead) which is disconnected from the valve and has migrated in the left pulmonary artery and the right posterobasal artery. (c) 3D reconstruction of the CT scan of the head and chest without contrast shows the proximal ventricular shunt (arrow) connected to the valve (star) and the migrated distal catheter (arrowhead).

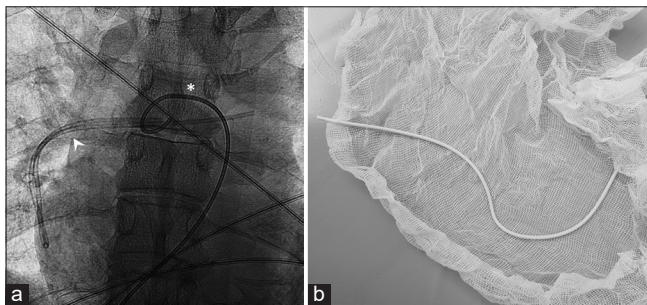


Figure 2: A 40-year-old man presented 3 years after ventriculoatrial shunt surgery for recurrence of Hakim–Adams syndrome, revealing disconnection and migration of the distal catheter in the pulmonary arteries. The migrated distal catheter was extracted with an endovascular procedure. (a) Intraoperative biplane imaging of the chest shows the pigtail catheter (star) used to navigate the pulmonary arteries and to undo the loop of the migrated distal catheter (arrowhead). (b) Ventriculoatrial shunt distal silicone catheter after successful extraction.

DISCUSSION

SAH is the second most common etiology of chronic hydrocephalus (17.4%). VPS is the treatment of choice for chronic hydrocephalus; however, this procedure has one of the highest rates of complications in neurosurgery (11–47%), including excessive CSF drainage, shunt obstruction, infection, and abdominal complications.^[1] VAS can be performed as a revision surgery or as a first-line treatment for chronic hydrocephalus, depending on the surgeon's experience or in the case of prior abdominal surgery. VAS is also associated with a 43–50% rate of post-operative complications, including excessive drainage, infection, autoimmune glomerulonephritis, and pulmonary embolism; however, less shunt obstructions are reported compared to VPS.^[2]

VAS is a medical device inserted in the superior vena cava through the internal jugular vein, using the Seldinger technique. Thrombus formation at its distal extremity is a rare complication. Migration of the distal catheter in the right chambers of the heart or into the pulmonary arteries is an even rarer complication;^[3] it may be life-threatening and has been reported essentially in children, but also in adults, in case of broken distal catheter.^[4–6]

Our case report discusses the migration of an intact distal catheter, disconnected from the valve 3 years after its implantation. Unless there are cardiac or pulmonary injuries due to the migration of the catheter, the latter should be urgently extracted by the endovascular procedure, and surgery should be avoided.^[4–6] Minimally invasive endovascular retrieval of lost foreign material was a fantasy 50 years ago, but it has rapidly become a preferred solution with the technical improvement of endovascular catheters and biplane imaging.^[7,8]

Concerning the VAS, we would recommend revision surgery of the whole system. What is more, to avoid disconnection and migration of the distal catheter, we also recommend implanting shunts with a monobloc valve-distal shunt system or securing the junction between the valve and the catheter with a tight suture. Ideally, the ventricular catheter is placed in the frontal horn of the lateral ventricle so that the valve lies directly on the convexity of the skull and not behind the ear, where repeated neck movements may lead to shunt disconnection. This concept applies to both VAS and VPS.

CONCLUSION

Neurosurgeons and interventional radiologists are used to working together, for example, in patients with aneurysm rupture. This collaboration is beneficial for an interdisciplinary approach in case of unexpected

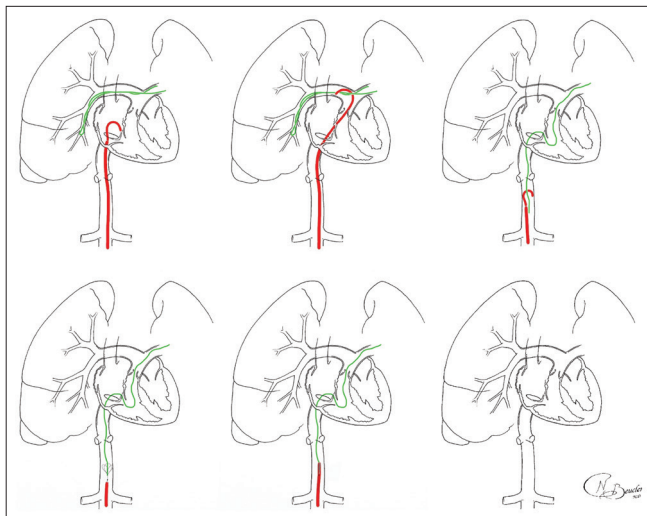


Figure 3: A 40-year-old man presented 3 years after ventriculoatrial shunt surgery for recurrence of Hakim-Adams syndrome, revealing disconnection and migration of the distal catheter in the pulmonary arteries. Here is an artistic view of the endovascular procedure that was used to remove the migrated shunt. A pigtail catheter was used to navigate the right heart and the pulmonary arteries. Then it was used to undo the loop of the migrated silicone shunt, so that its extremity was set free in the inferior vena cava. Finally, a lasso snare retrieval device was used to catch the shunt and remove it.

complications, such as endovascular VAS catheter migration. Indeed, minimally invasive techniques should always be preferred for the extraction of migrated endovascular material in modern medicine.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Conflicts of interest

There are no conflicts of interest.

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