



Port-a-cath and ventriculoatrial shunt at the same atrium: technical note

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Abstract

Hydrocephalus is a rare complication of brain involving acute lymphoblastic leukemia (ALL). The standard treatment is ventriculoperitoneal (VP) shunting, while ventriculoatrial (VA) shunting is the second option in a case of VP shunt failure in young children. But the presence of port catheter at the right atrium restricts and makes a VA shunt difficult to place in the same atrium. We presented a 4-year-old boy who had the diagnoses of ALL and underwent chemotherapy through a port-a-cath. He also had hydrocephalus due to the brain invasion of the ALL. He firstly underwent VP shunting for the treatment of hydrocephalus, but it failed due to an intraabdominal cyst. Then, he underwent VA shunting through the left internal jugular vein. This is the first case in the literature showing both catheters in the right atrium.

Keywords Ventriculoatrial shunt · Port · Leukemia

Introduction

Hydrocephalus treatment in children and adults is still a matter of debate and discussion after the first attempt by Ferguson [1]. Multiple routes have been reported through the history in order to provide a failure-free cerebrospinal fluid (CSF) diversion. Ventriculoperitoneal (VP), ventriculopleural, and ventriculoatrial (VA) shunts are the most preferred diversion types, but other shunt systems have also been described [2]. Each of them has its own complications; most of them did not end up as expected.

VA shunts are the second option in young children after VP shunt failure due to obstruction or impaired peritoneal absorption and intraperitoneal infection cases [3]. We are going to describe a new technique and an extraordinary indication in using the left internal jugular vein (IJV) route for VA shunt insertion to the right atrium in a case with a failed VP shunt and a port-a-cath at the right atrium.

Surgical technique

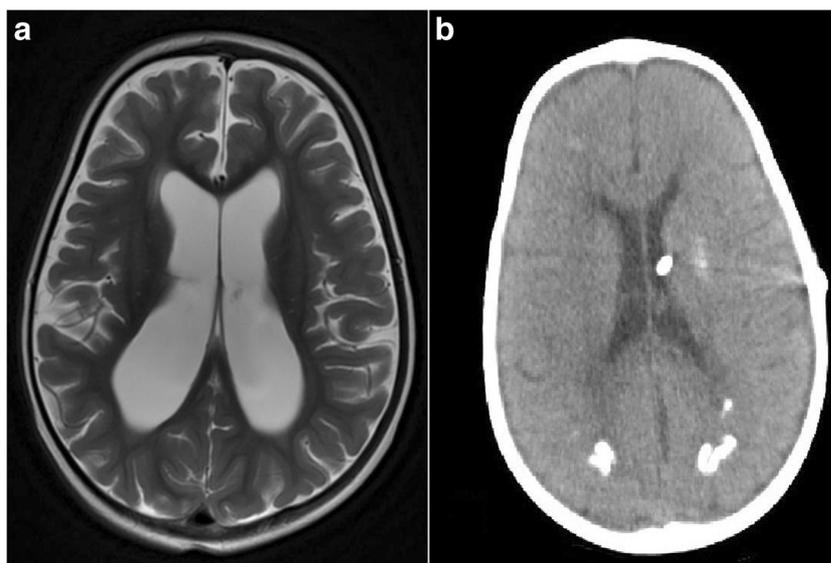
A one-year-old boy was admitted to the hospital with a persistent fever after having a mumps-measles-rubella vaccine. Acute lymphocytic leukemia (ALL) was the diagnosis. He received chemotherapy following the insertion of a port-a-cath at the right atrium through the right IJV. Routine radiological examinations showed central nervous system (CNS) involvement of ALL. Vomiting, sleepiness, irritability, and visual disturbances have occurred when he was 3 years old. Brain computed tomography (CT) and magnetic resonance imaging (MRI) revealed hydrocephalus (Fig. 1a). The VP shunt has been inserted through the left Kocher's point because of the presence of the right-sided port-a-cath. He was followed-up for 1 year without any complaint. Then, he was admitted to our hospital with abdominal distention. Abdominal CT scan showed a large intraperitoneal cyst with multiple septations around the shunt catheter (Fig. 2). Pediatric surgeons operated him and perforated the cyst walls but were unable to remove it totally due to its adhesions to intraabdominal organs. They also observed that the shunt was working. The cyst formation was still persisting at his 1 month after the abdominal surgery. Visual disturbances and headache also re-occurred. The CT scan showed hydrocephalus, and it was considered as a VP shunt failure. The ventriculopleural shunt was not preferred as the second choice because the pleural surface area capable of absorbing the CSF was much smaller in children than it is in adults. So, it was decided to

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Fig. 1 **a** Preoperative T2-weighted MRI of the patient shows enlargement of the lateral ventricles. **b** Postoperative CT scan confirmed small ventricles



insert a VA shunt. Due to the presence of a port-a-cath in the right atrium which was inserted through the right IJV, we preferred to use the left IJV route for shunt catheter.

A skin incision was made at the left side of the neck. First, the VP shunt catheter was found and cut. Then, the distal peritoneal catheter was removed, and CSF

accumulation was observed at the tip of the catheter. So, the ventricular side was not re-opened. After securing the ventricular catheter, a cardiovascular surgeon performed a neck dissection at the left side using a parallel longitudinal incision to the sternocleidomastoid (SCM) muscle. The left IJV was found just behind the SCM muscle. The left IJV, left brachiocephalic vein, and superior caval vein continuity was confirmed preoperatively. A small venotomy was performed on the IJV, and the distal catheter was placed in the right atrium through the left IJV under fluoroscopy guidance. The presence of the distal shunt catheter and port-a-cath in the right atrium was confirmed by chest X-rays (Fig. 3). The patient was discharged without complication. The length of follow-up was 1 year. Postoperative CT scans and echocardiography confirmed the lack of thrombus at the atrium and the treatment of hydrocephalus (Fig. 1b). The patient is still free of symptom and thrombus.

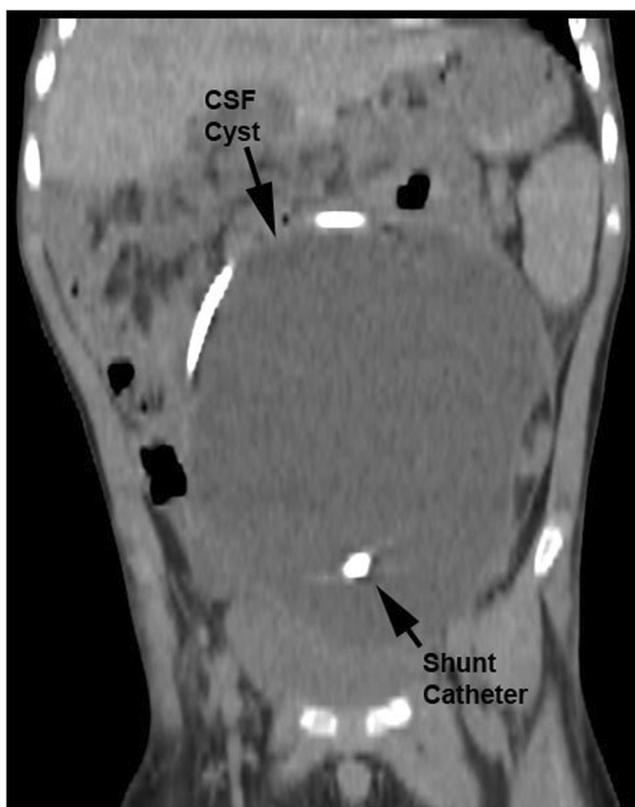


Fig. 2 Abdominal CT scan of the patient shows an intraabdominal cyst. (CSF, cerebrospinal fluid)

Discussion

Leukemia is the most common form of childhood cancer, making up 25% of childhood cancer cases [4]. Seventy-eight percent of cases are ALL [5]. Leptomeningeal infiltration is the most common finding, with leukemic cells first being seen in the superficial arachnoid veins and invading the surrounding stroma. Hydrocephalus may seldom present as a consequence of leptomeningeal infiltration of ALL [6].

The treatment of hydrocephalus after CNS relapse in ALL is important for a satisfactory clinical outcome. VP shunt is the first choice of treatment, but VA shunt is the second option, especially in young children.

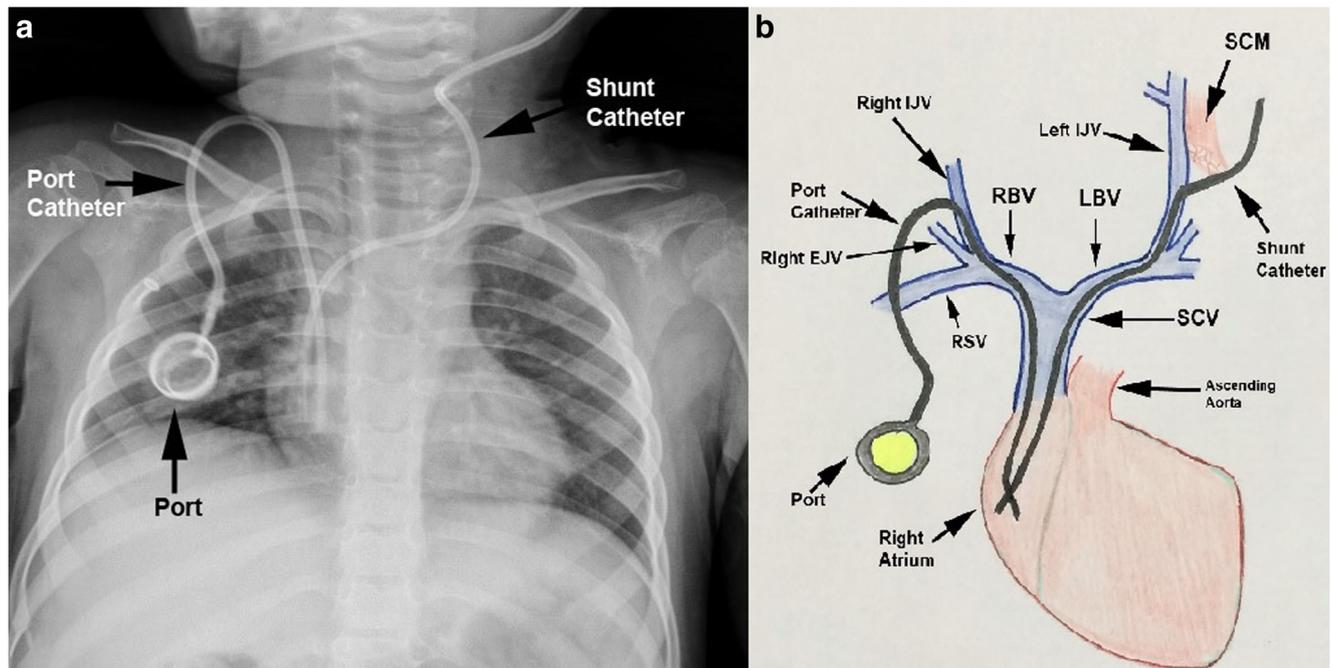


Fig. 3 **a** Postoperative chest X-rays of the patient shows both catheters in the right atrium. **b** Line drawing shows the catheters' routes to reach the right atrium. (IJV, internal jugular vein; RSV, right subclavian vein; SCV,

superior caval vein; LBV, left brachiocephalic vein; RBV, right brachiocephalic vein; SCM, sternocleidomastoid muscle; EJV, external jugular vein)

A port-a-cath (port) is a device which implanted in the subcutaneous tissue of the chest and connected to the right atrium of the patient via a catheter for the easy delivery of the chemotherapeutic agents to the children with leukemia. It is usually implanted through the IJV at the right side of the neck. In our case, the port-a-cath was previously inserted through the right IJV. Therefore, we could not use this way for VA shunt and we preferred left IJV. This technique combined both catheter tips at the same atrium. The use of the right atrium is possible for delivering chemotherapeutic agents and CSF diversion if the port-a-cath should be used only as a temporary measure.

Some technical notes were previously published for VA shunts such as electrocardiographic-guided technique [7], fluoroscopy-guided technique [8], and endovascular repositioning methods [9], but none of them was related with the use of left IJV to reach the right atrium.

White et al. evaluated 49 patients with VA shunt for the risk of bloodstream infections from central lines, and they did not find an increased risk of shunt infection, malfunction, or bacteremia in patients with a concomitant central venous line and VA shunt [10]. Nowoslawska et al. described a new hybrid technique for VA shunt implantation in case of completely occluded right IJV. They used left IJV for VA shunting under fluoroscopy guidance [11].

As a conclusion, hydrocephalus secondary to CNS relapse of ALL is very rare and VP shunting is the first choice for treatment. In a case of VP shunt failure and the presence of port-a-cath, right atrial catheter placement through the left IJV

can be preferred in young children. Close follow-up is needed to avoid the complications of VA shunt.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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