Acta Neurochir (2016) 158:2019–2021
DOI 10.1007/s00701-016-2905-2

CASE REPORT - PEDIATRICS

Pericardial effusion and cardiac tamponade after ventriculoperitoneal shunt placement: a case report

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Received: 25 June 2016 / Accepted: 21 July 2016 / Published online: 9 August 2016

Abstract Insertion of a ventriculoperitoneal shunt is a common neurosurgical procedure in both adult and paediatric patients. It is one of the most important treatments in cases of hydrocephalus; however, there is a wide range of complications: the most common complication being a shunt infection, and examples of rare complications are shunt migrations and cardiac tamponade. Several reports of distal ventriculoperitoneal shunt migration in different sites, including chest, right ventricle, pulmonary artery, bowel and scrotum were published. But pericardial effusion with cardiac tamponade and its relationship to distal ventriculoperitoneal shunt migration into the pericardial sac has never been reported.

Keywords Ventriculoperitoneal shunt · Shunt migration · Ventriculoperitoneal shunt complications · Cardiac tamponade · Pericardial effusion

Introduction

Insertion of a ventriculoperitoneal shunt is a common neurosurgical cerebrospinal fluid diversion procedure. It has been used for the relief of excessive cerebrospinal fluid in many congenital and acquired diseases of the central nervous system. The ventriculoperitoneal shunt was the technique preferred in treating neonates, infants and small children rather than the use of ventriculoatrial and ventriculopleural shunts, because the surgical techniques are less complex and also there are fewer serious complications. The mortality rate associated with ventriculoperitoneal shunts is very low but the overall complication rate is still high. Common complications are shunt infection and shunt malfunction. This report describes a very uncommon case of cardiac tamponade caused by shunt migration into the pericardial space.

Case report

A 2-month-old boy was referred from a secondary care hospital when he experienced a sudden onset of dyspnea. His underlying disease was bilateral schizencephaly with hydrocephalus. He had had a ventriculoperitoneal shunt inserted 2 weeks previously at a tertiary care hospital. He was discharged on day 3 after surgery. The referral physician performed a physical examination and took a chest film. He was found to have continued respiratory failure and cardiomegaly. Acute myocarditis was suspected. After intubation, the patient was referred to Chiang Mai University Hospital. When the patient was admitted, the physical examination described a tachypnea infant with endotracheal tube, distant heart sounds with a non-palpable pulse. Pericardial effusion with cardiac tamponade was suspected. The echocardiogram confirmed the diagnosis (Fig. 1).

Emergency pericardiocentesis and intrapericardial catheter insertion were carried out using a 20-gauge single lumen polytetrafluoroethylene arterial catheter with the modified Seldinger technique (Arterial Catheter Mini Kit; Argon Medical Devices, Plano TX, USA). Lucid yellow-brown

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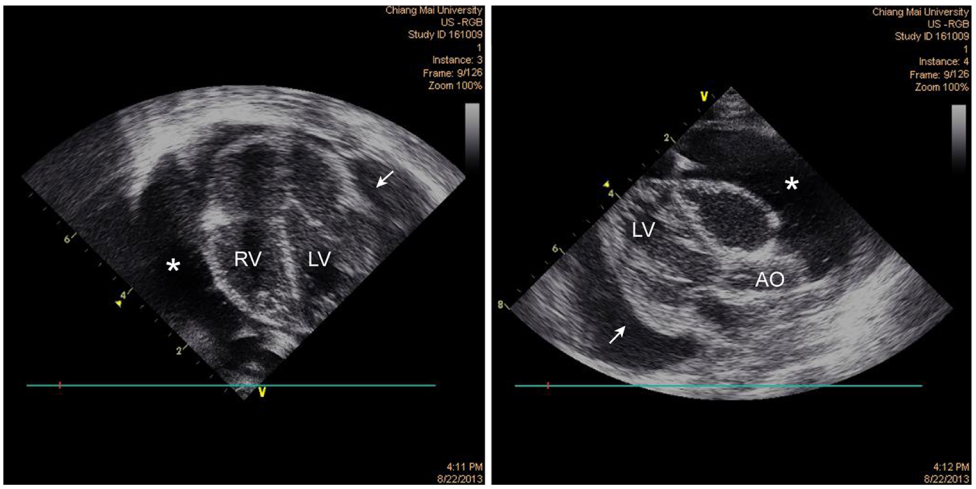

Fig. 1 *Left and right:* Echocardiograms of the apical four-chamber and parasternal long-axis view with the pericardial effusion on the RV (*asterisk*) and LV free wall (*arrow*) respectively

pericardial effusion (250 ml) was drawn. The pulse of the patient became fully palpable and his blood pressure returned to normal. He was admitted to the intensive care unit after the procedure. His clinical condition improved markedly. Extubation was carried out the following day.

A detailed physical examination showed the abdominal skin incision of this patient was on the xiphiod process. A history of cardiac tamponade occurring after the placing of the ventriculoperitoneal shunt and chest film from the referral hospital raised the suspicions of the possible malpositioning of the ventriculoperitoneal catheter. The antero-posterior and lateral chest film was requested and the neurosurgeon was consulted requesting an evaluation of the ventriculoperitoneal shunt position.

An antero-posterior film accompanied by a lateral chest film revealed that the distal part of ventriculoperitoneal catheter could be in the pericardial cavity (Fig. 2). Serial pericardial fluid removal using an indwelling catheter was carried out on a daily basis. The pericardial fluid volume on the second day via pericardial catheter was 100 ml.

Two days after admission, the patient received the elective ventriculoperitoneal shunt revision. The distal part of the ventriculoperitoneal shunt was identified as being in the pericardial space. The revision of the distal part of the ventriculoperitoneal shunt from the pericardial space to the abdominal cavity was successfully completed by making a small incision on the epigastrium, then careful extraction of the from the pericardial cavity and its subsequent repositioning in to the peritoneal cavity. A day after the ventriculoperitoneal shunt revision, the pericardial catheter was removed. Three days after the pericardial catheter was removed, an echocardiogram showed no pericardial effusion. The patient was doing well immediate after surgery. His chest X-ray, included film of the abdomen, revealed the correct positioning of the distal ventriculoperitoneal shunt. He was discharged on day 13 after admission. At a 2-month check postoperatively, he was well.

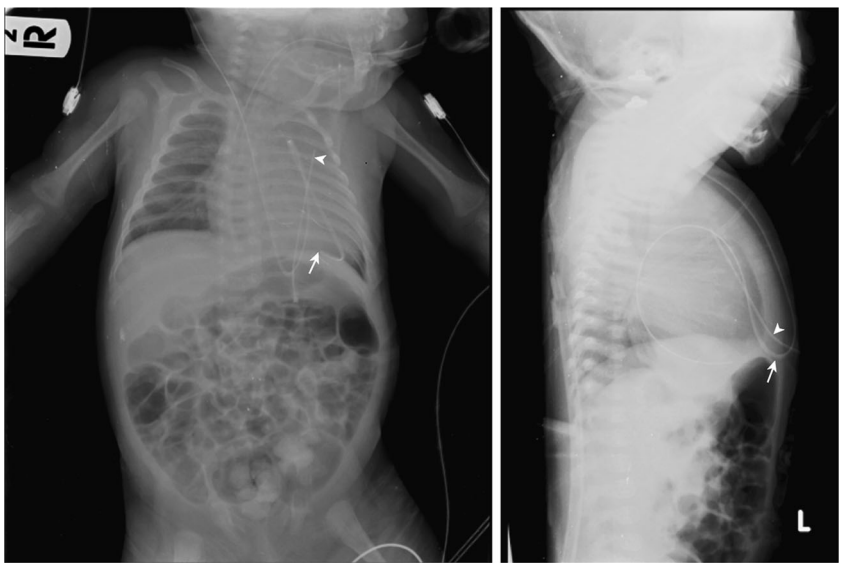

Fig. 2 *Left and right:* Chest X-ray antero-posterior and lateral view reveal drainage catheter was on cardiac silhouette (*arrowhead*) and ventriculoperitoneal catheter was in pericardial space (*arrow*)

Discussion

Various cerebrospinal fluid diversions, such as the ventriculoatrial, ventriculopleural and ventriculoperitoneal shunts, have been well established. These procedures are frequently used for the treatment of hydrocephalus. At present, the ventriculoperitoneal shunt is used more frequently in neonates, infants and small children, or even in adult patients due to the greater level of technical difficulty and higher level of complication in the insertion of both ventriculoatrial and ventriculopleural shunts [8].

Pericardial effusion is a rare complication even in cases of ventriculoatrial shunt insertion. Few reports had evidence of the migration of the distal part of the ventriculoatrial shunt into the right heart chamber which also causes perforation of the pericardial cavity, causing cardiac tamponade [1, 5, 8]. Surprisingly there was cerebrospinal fluid rather than blood in the pericardial cavity indicating a slow erosive process [1, 5]. Timing for ventriculoatrial insertion to migration varies from the earliest at 6 months to the latest, 17 years after surgery [1, 5]. Ventriculopleural shunt migration into the pericardial sac causing cardiac tamponade also has been reported [8]. To date there are no reported cases of ventriculoperitoneal shunt migration into the pericardial sac. Few intracardiac ventriculoperitoneal shunt migrations have been reported [3, 4, 6, 7].

The proposed mechanism causing cardiac tamponade in this case is distal shunt migration from the peritoneal cavity into the pericardial space, although there was no immediate postoperative ventriculoperitoneal shunt X-ray to confirm the position of the distal shunt. In general, cerebrospinal fluid production rate is 500 ml/day in both paediatric and adult patients. Unfortunately there are no data about maximum fluid absorption rate of the pericardium. But the pericardial space is relatively small and less compliant, and at this cerebrospinal fluid production rate the pericardial space could not tolerate the acute accumulation of fluid for as long as 2 weeks without any sign and symptom of cardiac tamponade. Therefore, intraoperative direct misplacement of distal shunt into the pericardial cavity was a less likely cause of pericardial effusion in this case. Moreover, most ventriculoperitoneal shunt migrations occur soon after surgery, usually as early as 18 days after placement [4].

To prevent this complication, the distal part of the shunt should be long enough to permit growth of the children without frequent revision; however, excessive length should be avoided to decrease risk of distal catheter migration [2]. The abdominal skin incision should not be too close to the thorax and all ventriculoperitoneal shunt catheter positioning should be verified by abdominal roentgenogram.

Acknowledgments The authors would like to thank Tanat Vaniyapong, MD for his helpful opinions and Pannee Visrutaratna, MD for the review of the X-ray films.

Compliance with ethical standards

Conflict of interest All authors certify that they have no affiliations with or involvement in any organisation or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Patient consent The patient/next of kin/guardian has consented to the submission of the case report for submission to the journal.

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