CASE REPORT

Supradiaphragmatic and transdiaphragmatic intrathoracic migration of a ventriculoperitoneal shunt catheter

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A hydrothorax following ventriculoperitoneal shunt catheter insertion is very rare and usually reported in children. Only about 25 cases have been described in the literature and very few have been adults. We report a 51-year-old woman with a massive hydrothorax and respiratory distress following both supradiaphragmatic and transdiaphragmatic migration of a ventriculoperitoneal shunt catheter into the pleural space. To our knowledge this is the first report of the simultaneous occurrence of two types of such migration in one patient.

Introduction

The intrathoracic migration of a ventriculoperitoneal shunt catheter (VPSC) is classified into two types: supradiaphragmatic and transdiaphragmatic migration. These have been reported sporadically in association with pleural effusion after a VPSC insertion.[1-7] All reports describe the occurrence of only one type of migration in a single patient. We report a case where both supradiaphragmatic and transdiaphragmatic intrathoracic migration of the VPSC occurred in an adult 4 months after insertion. Possible mechanisms of catheter migration and ways of preventing it are described.

Case report

In January 2006, a 51-year-old female came to our clinic in Urmia, Iran because of right pleuritic chest pain and dyspnoea. On physical examination, there was dullness on percussion with diminished breath sounds over the lower two thirds of the right chest. She had a history of five craniotomies for a recurrent arachnoid cyst. In 2001, during the fourth craniotomy, a VPSC was inserted but later removed when it became obstructed. On 6 September 2005 another craniotomy was performed and a VPSC was placed in the arachnoid cyst with a subcutaneous tunnelling catheter inserted into the abdomen. The peritoneal part of the catheter was inserted into the peritoneal cavity via a right upper quadrant abdominal incision about 1 cm above the level of the umbilicus, near the previous incision. This operation was her fifth craniotomy and second VPSC insertion. She had experienced mild right-sided pleuritic chest pain 5 days after surgery and noted that while she could always palpate the previous catheter on her chest she could not palpate this one. On examination, we could not palpate the catheter either. A review of a chest X-ray taken on 30 October 2005 showed the VPSC coiling in the chest, entering the abdomen then coiling again in the abdomen and returning to the chest (Fig 1). On 12 January 2006, an ultrasonographic examination of the abdomen and right pleural space revealed a pleural effusion with free movement of the VPSC in the effusion, and no ascites. On 17 January 2006, a computed tomographic (CT) scan of the chest confirmed that the shunt had been unwittingly passed into the pleural cavity in the supraclavicular fossa (Fig 2). Lower CT scan cuts demonstrated the incorrect location of the catheter under the ribs, and the shunt-tip within the pleural effusion, and part of the shunt returning from the abdomen in the posterior mediastinal pleura (Fig 2). She refused hospitalisation because she wanted to return to the hospital where the operation had been done. After 10 days she returned to our hospital in respiratory distress. An emergency chest drain was inserted which relieved her symptoms. In her sixth craniotomy, performed on 19 April 2006, the catheter was removed and a new VPSC was replaced in the peritoneal cavity. At the most recent follow-up, on 17 September 2006, she was found to be well, with no signs of pleural effusion. The new catheter was palpable on the chest wall and the scars of the three incisions were seen on the abdomen.

Discussion

Most VPSC complications involve infection and obstruction. Thoracic VPSC complications

Key words
Arachnoid cysts; Diaphragm; Hydrothorax; Pleural effusion; Ventriculoperitoneal shunt

Hong Kong Med J 2007;13:147-9

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腦室腹膜腔分流管在胸腔內上橫膈膜和穿橫膈膜移位

植入腦室腹膜腔分流管後發生胸腔積液的情況非常罕有，而且病例多為兒童。醫學文獻至今只刊載25宗病例，而成人病例則極少。本文報告一名51歲女病人胸腔位置的腦室腹膜腔分流管在上橫膈膜和穿橫膈膜移位後，繼而出現胸腔大量積液和呼吸困難。據了解，這是病人同時發生上述兩種移位的首宗病例報告。

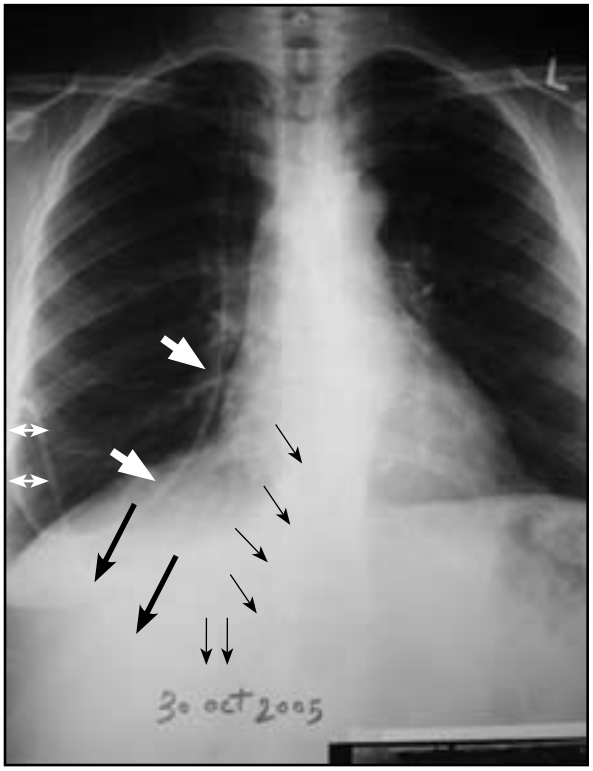

FIG 1. Chest X-ray showing the shunt tube (white single head arrows) within the right thoracic cavity coiling in the chest (double head arrows); its subdiaphragmatic part (black thick arrows) coiling and returning into the chest (narrow black arrows) with mild blunting of the right costophrenic angle

include pleural effusion, bronchial perforation, pneumothorax, and pneumonia. Taub and Lavyne[8] proposed classifying such complications into three types: intrathoracic trauma during placement of a shunt, migration of the peritoneal catheter into the chest, and pleural effusion accompanying cerebrospinal fluid (CSF) ascites. The latter mechanism depends on two factors: malabsorption of fluid in the peritoneal cavity and the presence of an open communication between the peritoneal and pleural cavities enabling intraperitoneal fluid to pass into the pleural cavity. Muramatsu and Koike[9] presented two adult patients who experienced pleural effusions during hospitalisation for stroke rehabilitation therapy after VPSC placement for normal pressure hydrocephalus associated with aneurysmal subarachnoid haemorrhages.

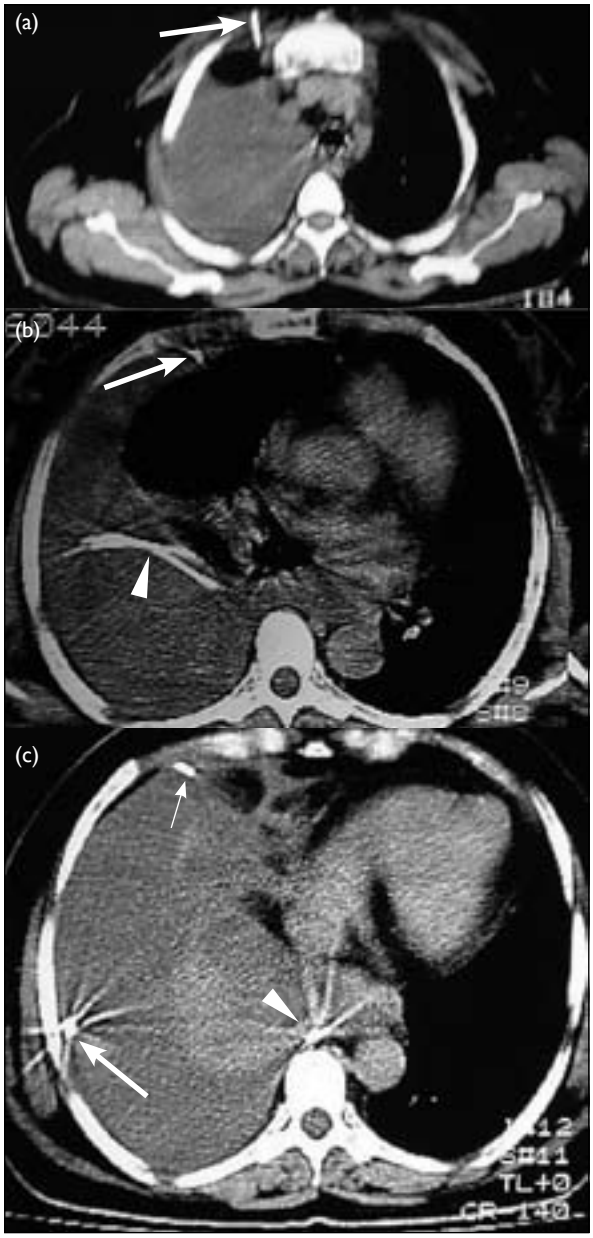

FIG 2. Chest computed tomographic scan showing (a) a pleural effusion and the precise entry of the catheter into the thoracic cavity (arrow); (b) incorrect location (incorrect tunnelling) of the shunt tube beneath ribs anteriorly (arrow), and the shunt tip free within the effusion (arrowhead); and (c) catheter after transdiaphragmatic migration (arrowhead), and incorrect tunnelling (short arrow), and coiled part in chest (long arrow)

The pleural effusions developed without migration of the catheters into the thoracic cavities.

Our patient developed right-sided pleuritic pain 5 days after catheter insertion. Her chest CT scans confirmed a right pleural effusion with migration of the VPSC. Intrathoracic migrations of VPSCs are classified into two types: supradiaphragmatic and transdiaphragmatic migration. In supradiaphragmatic migration, the site of entry to the chest is an incorrect subcutaneous passage formed during distal tunnelling. There have been reports

of the shunt being unwittingly passed into and out of the pleural cavity, probably in the supraclavicular fossa, during the distal tunnelling procedure.[6]

It has been indicated that in cases of transdiaphragmatic intrathoracic migration of a peritoneal catheter, the presence of congenital diaphragmatic hiatuses, in the anterior part close to the sternum (foramen of Morgagni) and/or in a posterior location close to the lumbar spine (foramen of Bochdalek), might allow a prolapse of the peritoneal catheter into the pleural cavity to take place.[1,10] Even when closed, these two locations are the weak points of the diaphragm. Other authors suggest that the catheter could migrate from the peritoneal to thoracic cavity through other small congenital defects in the diaphragm, or as a result of an inflammatory process facilitating erosion and perforation of the diaphragm and prolapse of the catheter into the pleural cavity.[6]

In the present case, a chest X-ray showed a return of the catheter to the chest from the abdomen, and a CT scan confirmed both supradiaphragmatic and transdiaphragmatic migration of the catheter to the pleural space. As in other reported cases, formation of an incorrect subcutaneous passage during distal tunnelling was the cause of the supradiaphragmatic migration. Neither the patient nor we could palpate the catheter on the chest wall. However the transdiaphragmatic migration was probably due to placement of the catheter near the previous incision. The anchoring effect of peritoneal fibrosis secondary to the previous catheter may have resulted in repeated pressure by the catheter tip at a fixed point on the diaphragmatic surface, eventually leading to perforation as suggested by Rubin et al.[11]

Although the complication described is rare, this patient and other reported cases presented in serious respiratory distress.[2,6,8,10,12] In infants and children younger than 5 years, respiratory failure is more severe because the pleura cannot absorb sufficient CSF.[6] In this case involving an adult, the initial presentation of mild chest pain and the development of a slowly increasing pleural effusion culminating in respiratory distress over about 120 days may be explained by the progressive diminution in the absorptive capacity of the pleura. The migration of the catheter to the chest before the development of a massive effusion was unnoticed on the chest X-ray taken on 30 October 2005, despite the presence of chest symptoms.

To prevent these complications, unnecessarily long peritoneal catheters should be avoided. Lourie and Bajwa[4] emphasised that the use of a more flexible catheter might decrease the incidence of diaphragmatic perforation. Dickman et al[2] emphasised early recognition of an unintentional intrathoracic shunt passage. In addition, we suggest that (1) placement of the catheter near previous incisions should be avoided; (2) the catheter should be palpated subcutaneously during and after insertion and if it is not palpable the surgeon should think about incorrect tunnelling; (3) as stated by Dickman et al,[2] an early response to patient complaints after VPSC insertion should be emphasised.

Pleural effusion is an unusual complication following VPSC placement. It is clinically important because of its potential respiratory involvement. To our knowledge, this is the first case of a VPSC complicated by both supradiaphragmatic and transdiaphragmatic intrathoracic migration associated with a hydrothorax.

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