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Migration of ventriculoperitoneal shunt into the lung by passing through the liver and the diaphragm

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ABSTRACT
Thoracic complications are rare after shunt placement for drainage of cerebrospinal fluid to treat hydrocephalus. We report a case of a ventriculoperitoneal shunt catheter that migrated into the lung by passing through the liver and the diaphragm. To our knowledge, there is no previously published report of a ventriculoperitoneal shunt that has migrated into the lung by a transdiaphragmatic and transhepatic route.

Key words: • *ventriculoperitoneal shunt* • *migration* • *liver* • *lung*

Shunt infection and obstruction are the most common complications after shunt placement for drainage of cerebrospinal fluid (CSF) to treat hydrocephalus. Thoracic complications of ventriculoperitoneal shunts are rare. The peritoneal tip of the ventriculoperitoneal shunt may migrate into the chest by either a supradiaphragmatic or a transdiaphragmatic route, and generally causes pleural effusion (1). Pleural effusion may occur in some patients even if the shunt does not enter the chest cavity (2). There are a few reports of intrahepatic migration of the peritoneal tip of the shunt tube (3). We report a case of a ventriculoperitoneal shunt catheter that migrated into the lung by passing through the liver and the diaphragm. To our knowledge, there is no previously published report of a ventriculoperitoneal shunt that migrated into the lung by a transdiaphragmatic and transhepatic route.

Case report

A 45-year-old man was admitted to our hospital with high fever, cough, right lateral chest pain, and weakness. Cefazolin, a first generation cephalosporin, was administered for five days in the outpatient clinic before the patient was admitted to our hospital; however, his symptoms did not subside. Respiratory sounds were diminished, and rales were heard on auscultation of the right lower zone. Examination of other organ systems revealed no other pathologic findings. The patient gave a history of epilepsy that had started 20 years before, a left nephrectomy 10 years ago, and insertion of a ventriculoperitoneal shunt three years previously. Ceftazidime and clindamycin therapy were administered to the patient, who was hospitalized because of lack of response to first generations cephalosporins, and clinical suspicion of a parapneumonic pleural effusion. Thoracentesis was performed to establish the nature of the fluid, but aspiration was not successful.

Computed tomography (CT) of the chest showed pleural fluid in the right hemithorax, consolidation in the laterobasal segment of the right lower lobe, and thickening of the right pleura. In addition, a hyperdense linear structure was observed entering the consolidated area from the liver on CT (Fig. 1a). Abdominal CT was performed to evaluate the possibility that the hyperdense linear structure was related to the ventriculoperitoneal shunt catheter. This CT scan showed that the intra-abdominal tip of the ventriculoperitoneal shunt catheter entered in the right lobe of the liver and migrated into the lung by passing through the liver and the diaphragm (Fig. 1b). The patient's left kidney was not present, status post nephrectomy. Abdominal ultrasound detected the linear hyperechoic material that had penetrated the right lobe of the liver to the level of the diaphragm (Fig. 2). The linear radioopacity extending into the right hemithorax from the abdomen was

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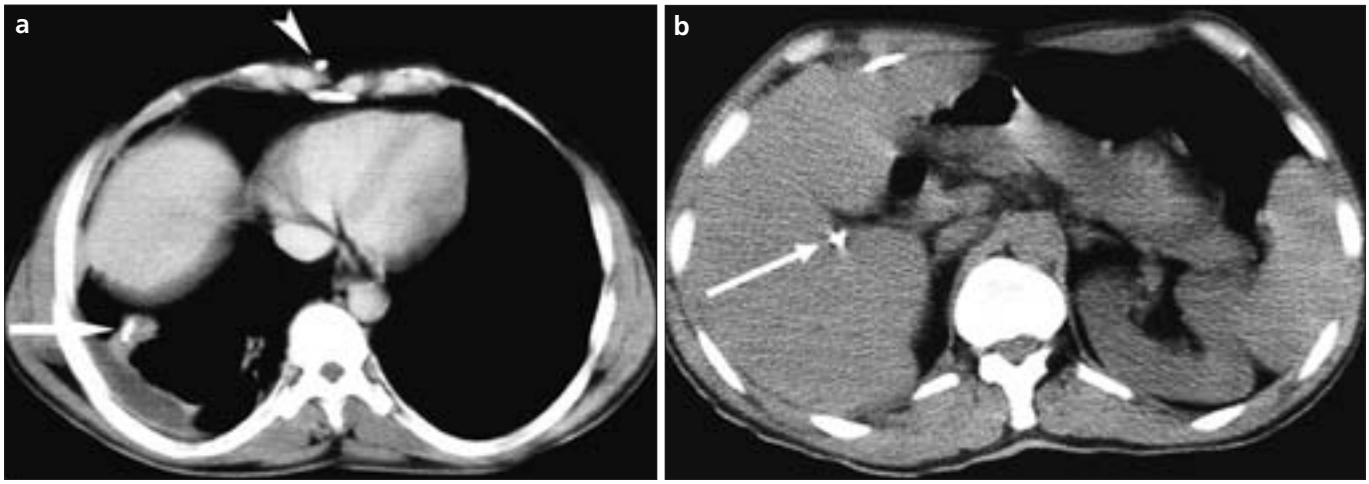

Figure 1. a, b. Axial chest CT image **(a)** shows minimal right pleural effusion with mild pleural thickening, and consolidation in the lateral basal segment of the right lower lobe, surrounding a linear hyperdensity representing the catheter tip *(arrow)*. Also note the subcutaneous course of the catheter in the anterior chest wall *(arrowhead)*. Axial abdominal CT image **(b)** shows the intraabdominal segment of the catheter entering the hepatic parenchyma posterior to the portal fissure *(arrow)*.

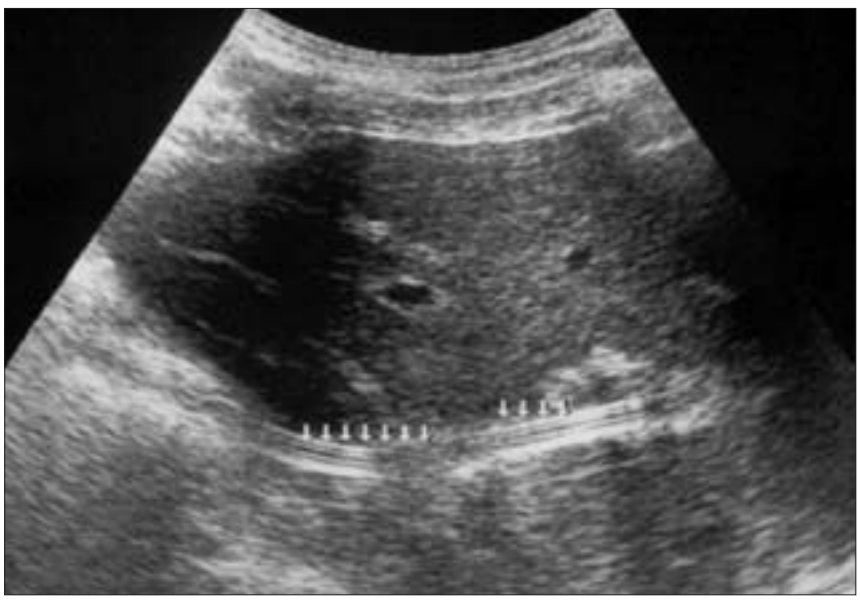

Figure 2. Sagittal sonogram shows a linear hyperechoic tubular structure representing the shunt catheter *(arrows)* that traverses the right lobe of liver and reaches the diaphragm.

also observed on a chest radiograph during follow-up, when pleural fluid was diminished (Fig. 3). The part of the ventriculoperitoneal shunt catheter that was superimposed on liver opacity was minimally visible.

The ventriculoperitoneal shunt was removed in the department of neurosurgery of our hospital and was not replaced. No complications occurred after shunt removal.

The patient was discharged five days after the procedure, when his symptoms had subsided. Chest radiograph prior to discharge showed that the pleural fluid volume had decreased.

Discussion

Migration of the peritoneal end of a ventriculoperitoneal shunt into the chest accounts for the majority of thoracic complications of these devices. The migration may be either supradiaphragmatic or transdiaphragmatic. In supradiaphragmatic migration, radiographs demonstrate the distal portion of the shunt coiled within the chest without any part of the shunt lying below the diaphragm. It is clear that the tip of the shunt could not have migrated through an opening in the diaphragm in such cases. In transdiaphragmatic migration, the tip of the shunt either erodes the diaphragm, or traverses a diaphragmatic hiatus (1).

A ventriculoperitoneal shunt that migrates into the chest by either a supradiaphragmatic or a transdiaphragmatic route generally causes a pleural effusion, presumably because the flow of CSF into the chest exceeds the resorptive capacity of the pleura (1).

Taub and Lavyne (1) reported a case of a shunt catheter traversing the diaphragm with its tip lying in the right hemithorax. After they injected contrast material into the Rickham reservoir, a radiograph of the chest revealed a bronchogram, thus confirming the diagnosis of drainage of CSF into the tracheobronchial tree (1). We did not inject contrast material into the shunt because we had established by CT that the tip of the shunt catheter was in the lung.

CSF hydrothorax may occur even if a peritoneal catheter remains in the proper (intraperitoneal) position (2). In this circumstance, migration of CSF from the peritoneal to the pleural cavity depends on two factors: insufficient absorption of CSF in the peritoneal cavity, and the presence of an open communication between the peritoneal and pleural cavities to enable intraperitoneal CSF to pass into the pleural cavity (2).

There are a few reports of ventriculoperitoneal shunt penetration into the liver (3–5). Thipphavong et al. reported a case of an abandoned distal tip of a ventriculoperitoneal shunt that penetrated the liver and perforated the colon in a 12-year-old girl (4). Chitkara

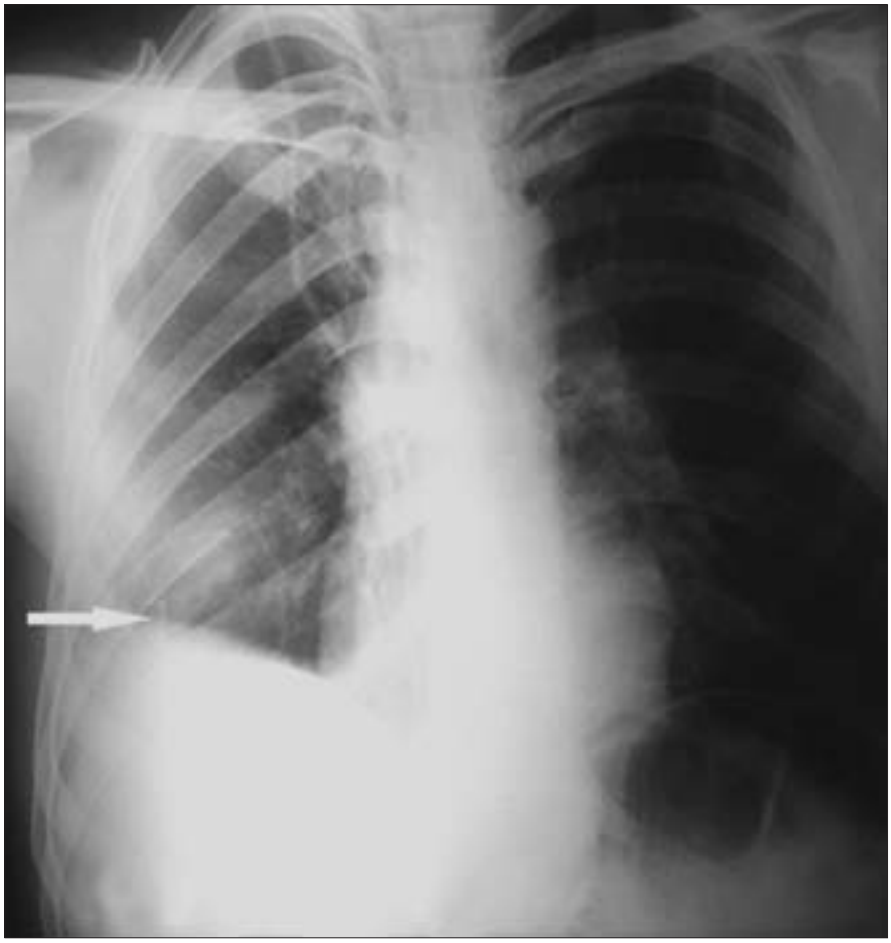

Figure 3. PA chest X-ray shows the tip of the catheter *(arrow)* in the basal right lung, and pleural effusion in the right hemithorax.

et al. reported a shunt tube embedded in liver parenchyma, with a cystic cavity around its tip (5).

Although there are published complications of ventriculoperitoneal shunts such as migration into the chest through the diaphragm, or penetration into the liver, there is no previous report of the distal tip of a catheter migrating into the lung after traversing the liver and the diaphragm. If a patient with a ventriculoperitoneal shunt has persistent chest complaints, malposition of the tip in the chest should be ruled out.

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