Migration of Distal Ventriculoperitoneal Shunt Catheter into the Pulmonary Artery

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A 50-year-old man presented with an abdominal bulge 2 years after receiving a ventriculoperitoneal (VP) shunt for hydrocephalus. Chest radiography revealed that the peritoneal end of the catheter had migrated into the right pulmonary artery. Exploration through a small neck incision revealed that the shunt catheter had entered the internal jugular vein. The catheter was extracted and positioned in the subcutaneous space in preparation for reimplantation. This type of shunt migration is quite unusual, but it could cause lethal pulmonary infarction or arrhythmia. Follow-up radiography should be scheduled to detect such complications.

Key words: ventriculoperitoneal shunt, hydrocephalus, migration

INTRODUCTION

The ventriculoperitoneal (VP) shunting is an established method that is preferable to ventriculoatrial shunting for treating hydrocephalus. However, it can be complicated by migration of the peritoneal end of the shunt catheter to sites outside the peritoneal cavity, including the gastrointestinal tract, the urinary bladder, the vagina, and the scrotum. Intracardiac migration of the catheter is extremely rare, as only six cases have been reported. We describe migration of the peritoneal catheter of a VP shunt to the heart via the internal jugular vein.

CASE

A 50-year-old man with a subarachnoid hemorrhage had undergone clipping of a cerebral arterial aneurysm and a VP shunt operation for hydrocephalus at another hospital during March 2006. The shunt catheter was easily placed subcutaneously by tunneling with an ordinary shunt passer. The abdominal catheter was introduced into the peritoneum via an incision over the right rectus muscle. Postoperative abdominal radiography confirmed that the catheter was correctly positioned (Fig. 1A).

Two years after VP shunting, the patient presented with a bulge at the site of the abdominal incision, and a hernia was diagnosed. The patient provided written informed consent to undergo repair of the incisional hernia and he was thus examined in more detail preoperatively. Chest radiography revealed that the peritoneal end of the catheter had migrated into the right pulmonary artery (Fig. 1B). A CT examination from the neck to the thorax showed the tube passing through the superior vena cava, right atrium and right ventricle, into the main pulmonary artery, and then into the right pulmonary artery (Fig. 2A and B). After consultation with his original physician regarding removal of the catheter, the patient was transferred to our hospital on November 4, 2008, where he provided written informed consent to the procedure, which was performed on November 7, 2008.

Operation: The patient was placed in the supine position and a temporary filter catheter (Toray Medical, Tokyo, Japan) was positioned under general anesthesia from the right femoral vein to the main pulmonary artery using the previous transluminal guide to prevent distal em-
bolism of the pulmonary artery. A skin incision along the lateral edge of the sternocleidomastoid muscle revealed that the VP shunt catheter had entered the internal jugular vein (Fig. 2C). The catheter was easily extracted under transluminal guidance, and it was functional with good cerebrospinal fluid outflow from the peritoneal end. During its extraction, a temporary filter catheter was opened to prevent pulmonary embolism. The filter catheter was finally removed, and we confirmed the absence of emboli. According to the patient’s request, the catheter was temporarily positioned at the subcutaneous space in the infraclavicular area and he was returned to the previous hospital two days later for repositioning of the distal catheter into the peritoneum.

**DISCUSSION**

Six case reports have been published that involve the migration of a distal shunt catheter into the heart and pulmonary artery. The intervals between the VP shunt operation and a diagnosis of migration ranged from 18 days to 4 years. The shunt catheter had penetrated the right internal jugular vein in two patients, the right external jugular vein in two, and the remaining two were not described. The most probable mechanism of catheter migration into the heart suggested by Imamura et al. and supported by Kubo et al. is that the subcutaneous catheter guide perforates the internal/external jugular vein during the VP shunt procedure and negative pressure in the vein draws the catheter into the heart. The same mechanism probably occurred in our patient. The external jugular vein is located near the surface of the neck beneath the platysma muscle, whereas the internal jugular vein runs deep in the carotid triangle. Though the likelihood of perforation might be lower in the internal, than in the external jugular vein, it is more likely if the catheter guide runs posterior to the sternocleidomastoid muscle.

Whether catheter removal requires the involvement of a cardiologist, interventional radiologist or cardiovascular surgeon is controversial. The review by Fewel et al. indicates that percutaneous removal of the distal catheter can be achieved as safely as withdrawal of a standard ventriculoatrial shunt or central venous line. In contrast, Morell et al. emphasized that percutaneous removal can be problematic if the interval between initial shunt insertion and diagnosis of the migration is long because of adhesion of the shunt catheter to the pulmonary artery or intracardiac structures. Moreover, the possibility of embolic formation along with the catheter might be higher in such patients. Considering these issues and previous placement of a temporary filter catheter, a standby cardi-
ologist/cardiovascular surgeon should be available to re-
move the shunt catheter in case of cardiogenic shock 
caused by a distal embolism of the pulmonary artery or 
cardiac injury.

According to the original attending physician, subcu-
taneous hematomas and signs of vessel injury were not 
evident during the original VP shunt procedure. Perfora-
tion of the internal jugular vein by the shunt guide is dif-
ficult to detect during surgery. This type of migration 
can cause lethal pulmonary emboli, arrhythmia, sepsis or 
cardiac insufficiency, so periodic follow-up radiography 
should always be scheduled after VP shunt placement.

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