Migration of Ventriculoperitoneal Shunt into the Heart

—Case Report—

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Abstract

A 76-year-old man underwent ventriculoperitoneal shunting for hydrocephalus after subarachnoid hemorrhage. Eighteen days after the shunt operation, fluoroscopy revealed the peritoneal catheter in the heart. Three-dimensional computed tomography demonstrated penetration of the catheter into the internal jugular vein. Under local anesthesia, part of the peritoneal catheter was pulled out through the cervical incision and cut off. The ends of the peritoneal catheter were connected so that the distal end was settled in the right atrium of the heart under fluoroscopic visualization. The migration of the peritoneal catheter into the heart presumably occurred because the subcutaneous wire guide of the shunt catheter perforated the internal jugular vein and the catheter was drawn into the heart through the internal jugular vein by the negative pressure of the vein and thoracic cavity.

Key words: heart, hydrocephalus, migration, ventriculoperitoneal shunt

Introduction

Ventriculoperitoneal (VP) shunting is an effective and established treatment for hydrocephalus, which is preferable to ventriculoatrial shunting.¹¹⁾ Several complications besides obstruction and infection have been reported such as intraabdominal pseudocyst,^{7,16)} volvulus,¹⁷⁾ bowel obstruction,⁷⁾ extrusion of the peritoneal catheter through the vagina,¹³⁾ umbilicus,²⁾ surgical wound,⁴⁾ and lumbar region,⁹⁾ and migration of the catheter into various sites including the bowel,^{1,7,18)} scrotum,⁷⁾ urinary bladder,⁷⁾ and ventricle.^{12,14)} Intraabdominal complications occurred in 24% of hydrocephalic infants and children after VP shunting.⁷⁾ Intrathoracic migration of the catheter is a rare complication in which the peritoneal catheter penetrates into the pleural cavity.^{3,5,6,19)} Intracardiac migration of the catheter is extremely rare, with only one reported case in which the peritoneal catheter migrated via the external jugular vein.¹⁰⁾ We report a case in which the peritoneal catheter of the VP shunt migrated to the heart via the internal jugular vein.

Case Report

A 76-year-old man visited the outpatient department

of Keiwakai Ebetsu Hospital complaining of transient loss of consciousness. Neurological examination revealed no definite deficit including nuchal rigidity. Computed tomography (CT) showed subarachnoid hemorrhage in the interhemispheric fissure and bilateral sylvian fissures. He was admitted to our hospital and emergent cerebral angiography confirmed an aneurysm on the anterior communicating artery.

On the day of admission, the patient underwent neck clipping of the aneurysm by the interhemispheric approach. Cerebrospinal fluid drainage was placed in the right lateral ventricle for 7 days. CT showed the subarachnoid clot soon disappeared. However, the patient suffered disorientation and deterioration of memory, and CT showed progressive enlargement of the ventricles. Twenty-eight days after the craniotomy, a VP shunt operation was performed for hydrocephalus using a programmable valve system (Codmann, HAKIM™ Programmable Valve System; Johnson & Johnson, Raynham, Mass., U.S.A.). A subcutaneous tunnel was formed by the wire guide. There was no difficulty in passing over the clavicle. The intraperitoneal catheter was introduced to a distance of 20 cm under direct vision, and fixed to the peritoneum with a purse string suture. Abdominal radiography on the

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Fig. 1 Abdominal radiograph after ventriculo-peritoneal shunting showing the tip of the peritoneal catheter in the peritoneal cavity.

next day demonstrated that the distal end of catheter was located in the left lower quadrant of the abdomen (Fig. 1). His consciousness and mentality were normal after the VP shunt procedure.

On the 46th day after admission, postoperative cerebral angiography demonstrated complete disappearance of the aneurysm. However, fluoroscopy showed the peritoneal catheter of the VP shunt was located in the heart (Fig. 2). Cerebral CT showed the ventricles were normal, suggesting the shunt remained effective, but chest CT revealed that the catheter was coiled in the right atrium and ventricle of the heart. The tip of the catheter was supposed to be positioned in the left pulmonary artery. Three-dimensional CT of the neck demonstrated the shunt catheter penetrating into the right internal jugular vein (Fig. 3). On the day after postoperative angiography, part of the coiled shunt catheter was

Fig. 3 Three-dimensional computed tomography scan showing the shunt tube (arrows) penetrating into the internal jugular vein (arrowheads).

pulled out through the cervical incision and was cut off under local anesthesia. Then the proximal and distal parts of the catheter were connected to each other so that the distal end was settled in the right atrium of the heart under fluoroscopic visualization. The point of perforation of the vein was not confirmed during the procedure. The course after reconstruction surgery was uneventful and the patient was discharged without neurological deficit.

Discussion

The mechanism of perforation of the peritoneal catheter into various structures is unknown. Previously reported migrations or extrusions occurred several months to years after shunt operation,³⁾ and may have been caused by chronic mechanical damage to the shunt catheter because of its stiffness.⁸⁾ Ulceration of the viscera by adhesion of catheter may lead to perforation.¹⁾ Excessive length of the peritoneal catheter could also cause penetration of the viscera.^{3,13)}

Fig. 2 A: Chest radiograph after postoperative angiography showing the peritoneal catheter in the heart. B: Schematic drawing of A.

Catheter migration manifested as various symptoms of shunt malfunction or infection, or recognition of the extruded catheter. The peritoneal catheter had migrated into the inferior vena cava at autopsy in one case.⁸⁾ The same mechanism was probably the cause in that case, although there would have been no signs of migration.

The mechanism of migration was thought to be different in the present case. Two mechanisms for migration into the heart were proposed because shunt malfunction was recognized 2 months after VP shunting in the previous case.¹⁰⁾ However, migration was recognized 18 days after the shunt operation in the present case. As there was no symptom of malfunction at that time, the migration was probably happened earlier after the operation. Continuous grinding by the catheter would have taken time to erode the internal jugular vein. Although there was no sign of direct injury to the internal jugular vein such as cervical subcutaneous hemorrhage or edema in the present case, the subcutaneous wire guide for the catheter probably perforated the vein at the operation. Negative pressure in the vein and thoracic cavity⁶⁾ probably then drew the peritoneal catheter gradually into the heart through the perforated internal jugular vein. Pneumothorax caused by the wire guide and gallbladder perforation caused by the trocar occurred during placement of VP shunts, but were recognized soon after or during operation because of subcutaneous crepitus and gush of bile.¹⁵⁾ Some cases of intrathoracic migration of peritoneal catheter were probably caused by the shunt tube passing into the pleural cavity with the subcutaneous wire guide.^{5,19)} Head movement can also cause upward dislocation to be completed in short period, by acting as a windlass in a case of intraventricular migration of peritoneal catheter.¹²⁾

Direct injury to the internal or external jugular vein is rare, but the subcutaneous wire guide should be passed carefully, especially in the supraclavicular fossa.

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