Colonic perforation as a complication of ventriculoperitoneal shunt: two case reports with a literature review

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This report presents two cases of colonic perforation by a ventriculoperitoneal (VP) shunt. In both cases, the displacement of the distal catheter in the colon was diagnosed by abdominal computed tomography (CT). The perforation caused a VP shunt-related cerebrospinal fluid infection, and intravenous antibiotic treatment was applied. The distal end of the shunt catheter was removed by colonoscopy and the perforated site was sealed using hemoclips. There were no intra-abdominal complications after endoscopic management. After the removal of the VP shunt, the aggravation of hydrocephalus was confirmed by brain CT. The patients later died due to complications including aggravation of hydrocephalus, ventriculitis, and pneumonia. Treatment must be individualized and depends upon the clinical presentation. Conservative management, endoscopy, and surgery have been performed. Colonoscopic removal of the shunt catheter is a good option for the treatment of colonic perforation due to VP shunt migration.

KEY WORDS: Ventriculoperitoneal shunt, Colon perforation, Colonoscopy

INTRODUCTION

A ventriculoperitoneal (VP) shunt is a commonly performed treatment modality for hydrocephalus. The VP shunt-related complications include infection (peritonitis, ventriculitis, and meningitis), obstruction, migration, and perforation of the intestine [1,2].

Shunt devices have a high incidence of malfunction mainly due to catheter obstruction or infection and are associated with various complications, 25% of which are abdominal complications [3]. Spontaneous bowel perforation is a rare complication with an incidence of 0.01% to 0.07% in VP shunt procedures, occurring at any time, including a few weeks to several years after the placement of the VP shunt device [4].

Treatment must be individualized and depends upon the clinical presentation. Conservative management, endoscopy, and surgery have been performed for the treatment of bowel-related complications from a VP shunt device [5,6]. We report cases of a 79-year-old female and a 49-year-old male with colonic perforations due to migrated VP shunts that were successfully treated by the colonoscopic removal of the migrated distal catheter and hemoclipping of the perforated colonic wall,
along with a reported relevant literature review.

**Ethical statements**

This study was approved by the Gwangju Christian Hospital Institutional Bioethics Committee (approval No: KCHIRB-AE-2202-004). Written informed consent was omitted.

**CASE REPORT**

**Case 1**

A 79-year-old female visited the outpatient clinic with symptoms of headache, vomiting, and fever that started 2 days earlier. The patient had a surgical history of trephination and VP shunt placement due to a traumatic subarachnoid and intracerebral hemorrhage 10 years ago. In cerebrospinal fluid (CSF) studies of samples from the VP shunt valve, CSF infection was confirmed (red blood cell [RBC], 0/mm³; white blood cell [WBC], 300/mm³; protein, 145 mg/dL; glucose, 72 mg/dL). *Pseudomonas* and *Enterococcus* species were identified in the CSF culture. There was no additional abnormal finding observed in the blood test.

Even after maintaining antibiotic treatment, clinical symptoms and CSF study results showed no improvement. Contrast enhanced abdominopelvic computed tomography (CT) was done to search for other abdominal complications, and transverse colon perforation by the distal catheter of the VP shunt was observed (Fig. 1A, B).

In cooperation with the gastrointestinal department, a colonoscopy was done and the colonic portion of the VP shunt catheter

![Fig. 1.](https://example.com/fig1.png) (A, B) Contrast-enhanced abdominopelvic computed tomography showing a peritoneal catheter penetrating the transverse colon. (C) The peritoneal catheter penetrating the colon was confirmed and removed by colonoscopy. (D) The perforated site was sealed with hemoclips.
was removed (Fig. 1C, D) and hemoclipping of the perforated colonic wall was conducted. Subsequently, extra-ventricular and lumbar CSF drainage was done until confirming the conversion to sterile CSF culture results. The follow-up CSF exam was done just before second VP shunt operation (RBC, 0/mm³; WBC, 10/mm³; protein, 135 mg/dL; glucose, 41 mg/dL).

The patient was able to walk at the time of admission, but was bedridden due to mental disturbance and poor general condition during hospitalization. The hydrocephalus was aggravated after second VP shunt operation. The patient expired 6 months after the procedure with recurrence and aggravation of ventriculitis, encephalitis with pneumonia.

Case 2

A 49-year-old male had symptoms of persistent vague right lower quadrant discomfort 8 months after VP shunt operation. The patient had undergone dural repair surgery several times due to consistent CSF leakage, and a VP shunt procedure due to unreolved hydrocephalus.

After admission, CSF infection was confirmed (RBC, 50/mm³; WBC, 108/mm³; polymorphonuclear cell:lymphocyte, 30:70; protein, 47 mg/dL; glucose, 49 mg/dL) and antibiotics treatment was done. In the CSF examination, Enterobacter species were cultured. There was no specific abnormality in the blood test. Ascending colonic perforation was found in the contrast enhanced abdominal CT (Fig. 2A, B). There was no evidence of intraperitoneal complications, and colonoscopic removal of the distal tip of

Fig. 2. (A, B) Contrast-enhanced abdominopelvic computed tomography showing a peritoneal catheter penetrating the ascending colon. (C) The peritoneal catheter penetrating the colon was confirmed and removed by colonoscopy. (D) The perforated site was sealed with hemoclips.
the VP shunt device (Fig. 2C) and hemoclipping were performed (Fig. 2D).

The patient was non-ambulatory due to general weakness because of longstanding hospitalization by previous diseases. Hydrocephaeus was not aggravated after the VP shunt removal as not same as Case 1. There was no change of neurologic state including mental change during observation period. Then we did permanent VP shunt operation 5 months later after colonoscopic removal of distal shunt catheter. The CSF infection was completely treated at the time of discharge. The patient was transferred to a local hospital and expired several months later from unrecoverable pneumonia.

**DISCUSSION**

Common complications of VP shunts are well-documented and include shunt malfunction, infection, disconnection, migration, and perforation. Many possible mechanisms for the migration of VP shunts have been suggested, including an inadequate catheter length, failure to fix the shunt firmly to adjacent tissue, foreign body reaction, silicone allergy, the formation of a fibrous sheath and local pressure, the use of spring-loaded shunts, the use of both hard and soft-tipped silicone shunts, inoculation of the shunt with bacteria during insertion, and use of the trocar technique [1].

Spontaneous bowel perforation is a rare complication with an incidence of 0.01% to 0.07% in VP shunt procedures, occurring at any time including a few weeks to several years after the placement of the VP shunt device [4]. More than half of the bowel perforations as a complication of VP shunts occur in children under 10 years of age and are known as more common in non-ambulatory patients, such as in our cases series [7].

The overall mortality rate of bowel perforation after VP shunt placement is relatively high, approaching 15% to 18%, and it is further increased when a related infection is present. In the case of a central nervous system infection, the mortality rate is increased up to 22%, which can result in meningitis, encephalitis, or brain abscesses, and 33% with intra-abdominal infection [8]. Bowel perforation from a VP shunt procedure can progress to peritonitis and ventriculitis. Therefore, when there is a suspicion of bowel-related complications from a VP shunt procedure, prompt diagnosis by an imaging study and the appropriate treatment modality should be timely applied.

Because bowel perforation can progress to peritonitis and ventriculitis, early diagnosis and treatment are essential. Among the complications of bowel perforation, the colon is the most frequent site of perforation and the clinical manifestations can range from asymptomatic to life-threatening conditions [5]. However, colon perforation by a VP shunt catheter can be diagnosed at a late stage because of the late manifestation of related clinical symptoms and the delayed suspicion of bowel perforation involving the colon due to the rarity of the condition. The exact mechanism of bowel perforation has been debated and suggested that inadequate catheter length, failure to fix the shunt to adjacent tissue, adherence of the tip of the VP catheter to the bowel wall and subsequent chronic local inflammation, silicone allergy leading to a foreign body reaction can induce bowel perforation [9]. The management of colon perforation must be tailored to the individual circumstances based on the clinical state of the patient. In severe cases of significant abdominal infectious pathology, such as an abscess or life-threatening peritonitis, the fistulous opening may not close spontaneously and laparotomy should be considered [4,10].

The initial clinical presentations were totally different in the present two case series. While the patient in the first case had prominent symptoms of fever, vomiting, and signs of ileus, the patient in the second case did not show any prominent symptoms such as fever or signs of ileus but had local abdominal discomfort as well as an elevated C-reactive protein level and WBC count. Limited local bowel inflammation was only seen in the abdominopelvic CT scan. An abdominal CT scan can be a useful diagnostic modality for patients with a VP shunt catheter showing consistent vague abdominal symptoms. Furthermore, endoscopy would be useful to show the exact location of catheter penetration through the colonic wall.

We gave special attention to preventing the spread of infection before the procedure. We performed a direct needle puncture of the reservoir to collect CSF for culture studies and then, externalized the shunt catheter to prevent retrograde spread. After that, we did colonoscopic removal of infected distal shunt catheter. After confirming the conversion to sterile CSF results, we conducted permanent VP shunt operation subsequently in our cases.

**CONCLUSION**

In the two patients in this report, the migrated distal catheter of a VP shunt in the colon was removed by colonoscopy and the colon perforation site was successfully sealed using hemoclips. There were no postoperative intra-abdominal complications in either case. The colonoscopic removal of the VP shunt distal catheter would be a good option for treating colonic perforation due to a VP shunt, especially in cases of no intra-abdominal complications.

**CONFLICTS OF INTEREST**

No potential conflict of interest relevant to this article was re-
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REFERENCES