



## Case report

## Duodenal perforation as a postoperative complication after ventriculoperitoneal shunt: A case report

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## ABSTRACT

**Introduction and importance:** Ventriculoperitoneal shunt (VP shunt) is the one of the most common and important tools for the treatment of hydrocephalus. It requires simple technique and demonstrates effectiveness in treating hydrocephalus. However, many complications have been reported such as infection, valve obstruction, valve dysfunction and abdominal complications. Complications of intestinal perforation and catheter penetrating the intestine are very rare, accounting for 0.01–0.07% of abdominal complications. In the literature, 94 cases of intestinal perforation and catheter penetration and only 2 cases of duodenal perforation have been reported.

**Case presentation:** In this study, we report a successful surgical treatment of a duodenal perforation complication after 5 months of VP shunt. Gastroscopy showed the distal tip penetrating into the D2 segment of the duodenum. Surgery was performed to relocate the abdominal tip and to repair the perforation. Meningitis was treated with antibiotics. The patient was stable and discharged after 3 weeks.

**Clinical discussion:** The epidemiology, presentation and diagnosis and strategy of treatments as well as their outcomes were discussed.

**Conclusion:** Intestinal perforation with VP shunt catheter is rare. Diagnosis is simple if the catheter comes out of the anus, mouth, vagina, penis, scrotum, navel. In case when the catheter is inside the lumen of the gastrointestinal tract, diagnosis often requires imaging such as abdominal computed tomography, and gastrointestinal endoscopy. Surgery treatment was to replace the drainage valve and to close the perforation the digestive tract.

## 1. Introduction and importance

Ventriculoperitoneal shunt (VP shunt) is the most important tool for the treatment of hydrocephalus. This is a safe and effective treatment for most types of hydrocephalus: communication and non-communication. However, many complications have been reported in the medical literature such as infection, obstruction, mechanical complications (valve disconnection, broken tip ...) and abdominal complications. Complications rate of VP shunt ranged from 24 to 47% depending on the study, time, the cause, postoperative follow, and the age of the patient [1]. Complications in the abdomen account for 10–30% of the total number of complications [1]. Gastrointestinal tract perforation with the catheter entering the tract is very rare, about 0.01–0.07% [2,12,18]. The locations commonly encountered are stomach, small intestine, colon and

sigma, while duodenal perforation with the catheter entering the duodenum is very uncommon. In the literature, only 2 cases have been described. In this study, we report a clinical case of duodenal perforation (segment D2) 5 months following the VP shunt.

## 2. Case presentation

We report a case of a 29-year-old male patient. Past medical history revealed no drug use. No family history was observed. He presented with severe headache and vomiting and was admitted to the province hospital. On examination, his GCS was 15 points, no paralysis was observed. CT scan showed that ruptured AVM (arteriovenous malformation) caused hemorrhages in the cerebellum, IV ventricle, III ventricle, lateral ventricle and subarachnoid hemorrhage in the posterior fossa. The

**Abbreviations:** AICA, anterior inferior cerebellar artery; AVM, arteriovenous malformation; CT, computer topography; D2 segment, second part (descending part) of the duodenum; GCS, Glasgow Coma Scale; VP shunt, ventriculoperitoneal shunt; WBC, white blood cell.

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feeder was the AICA artery. He was treated with embolization of the AVM with onyx, and surgical resection followed. After one week, the patient had increased headache and vomiting. Computer tomography confirmed hydrocephalus post ventricular hemorrhages. VP shunt was performed with medium pressure valve. The peritoneal catheter was inserted using a trocar. One month after, the patient was stable and discharge from hospital.

At three months follow-up, the patient had headache, vomiting and fever. On examination, he had clear signs and symptoms of infection with stiff neck. Cranial tomography shows that the ventricles were not dilated, the catheter located inside the ventricles (Fig. 1). X-ray of the abdomen, chest shows that the tube is located in the normal position. Cerebrospinal fluid is cloudy, elevated pressure, WBC counted 1200/mm<sup>3</sup>, protein increased. Cerebrospinal fluid culture result was *Klebsiella pneumoniae*, sensitive to third-generation cephalosporine. Bacterial meningitis was diagnosed, the patient was administered antibiotic treatment with third-generation cephalosporine with the dose of 4 g/day. After 15 days, no fever was observed, cerebrospinal fluid tests were normal, the patient was discharged.

Two weeks after discharge, the patient returned to the hospital, with signs and symptoms of increased intracranial pressure and infection.

Cerebrospinal exam showed meningitis, and he was treated with third-generation cephalosporine. After 4 days of treatment, the patient had mild to moderate abdominal pain in the epigastric region. On examination, his abdomen was soft with no tenderness. Abdominal X-ray and ultrasound were normal. Gastroscopy revealed the present of a VP shunt tube in the D2 segment of the duodenum (Fig. 2). He was treated surgically with neurosurgery and gastrointestinal teams, with affirmation from the patient and his family members. During the operation, we saw the end of the drainage tube entering into the D2 segment of duodenum (Fig. 3). We removed the VP shunt tube, closed the duodenum, and replaced with new VP shunt system. The patient was treated with cephalosporine antibiotic treatment 4 g/day for 3 weeks. The patient was stable and discharged from the hospital. The procedure was performed by Dr. H.V.D. and his team.

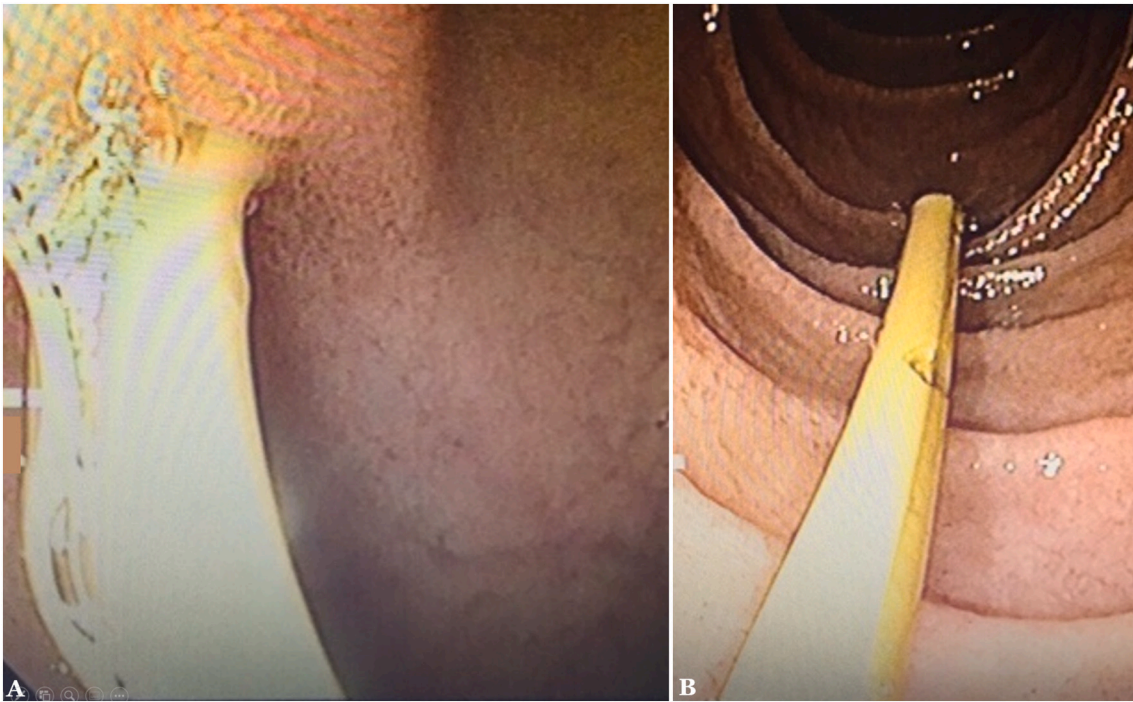
At one year and two years postoperative follow-up, the patient was alert with GCS of 15 points. No fever, no abdominal pain was observed.

### 3. Clinical discussion

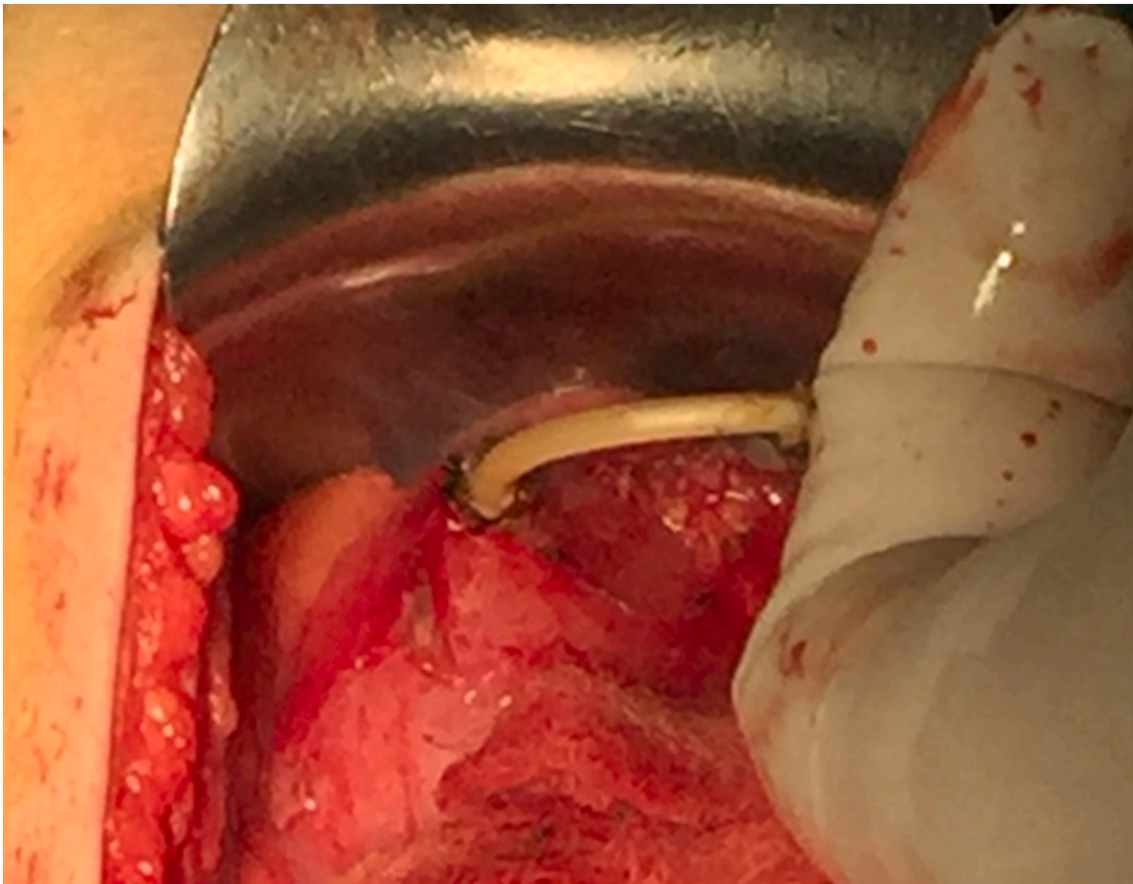
Complications following VP shunt include valve obstruction, infection, valve failure, abdominal complications. Abdominal complications



Fig. 1. Cranial CT scan after VP shunt. The catheter was inside the ventricles. The ventricles were not dilated.



**Fig. 2.** The gastroscopy images. A: The location where the catheter entered the duodenum. Noted the fibrosis around the location. B: The distal catheter inside the duodenum was shown.



**Fig. 3.** Intra-operative image. The distal tip entering the duodenum was shown.

account for 10–30% including various types such as occlusive/mechanical (15%), infections (5%), cyst formation (1–2%), and visceral perforation (0.2–0.3%) [1,2]. The catheter can migrate into the intestine, stomach, bladder, vagina, scrotum, penis, navel [3,4,5–10,12–14]. Intestinal perforations are very rare: 0.01–0.07% of abdominal complications [2,12,18], and mortality due to these complications can be up to 15% (mostly due to infection) [2,3]. The first intestinal perforation was described by Wilson and Bertan in 1966 [4]. Most studies were case reports. Intestinal perforation usually occurs in the colon, rarely occurs in the stomach, small intestine and very rarely occurs in the duodenum. Most of the patients with these complications had no clinical signs (42%), transanal protrusion of the tip (44%), fever (27%), abdominal symptoms like diarrhea, vomiting (29%), shunt dysfunction (16%), meningitis (13%) [2]. The complication of intestinal perforation, catheter entering into the intestine occurs in all ages. However, some authors believe that this complication is often observed in young children due to a thin, easily punctured intestinal wall [6]. Most cases of a catheter that entering into the intestine are diagnosed when the tube was found outside of the anus [1–9,13,15–19] or the mouth [14,15], or comes out of the penis and navel [15,17]. In cases where the tube does not come out (anus, mouth, penis, vagina, etc.), imaging exams are required for definitive diagnoses such as computed tomography or endoscopy. Cheng-Hung Lee et al. summarized many studies that showed the average time from insertion of VP-Shunt to diagnosis of intestinal perforation was 16.3 months (2.5 months–3 years) [1]. Abdominal pain is an alarm sign of intra-abdominal complication. Carrying out abdominal investigations such as conventional X-rays, ultrasound, computed tomography will diagnose complications. Conventional X-ray does not help diagnose without contrast or the tube does not extend through the anus. Ultrasound is difficult to determine the tube in the lumen of the intestine. Computer tomography can diagnose the catheter in the lumen, but depending on the cut [3,4,5]. A gastrointestinal endoscopy as in our case makes a definitive diagnosis. Lee's patient [1] was a 3-year-old boy, before the catheter came out of the anus, many episodes of abdominal pain, epigastric pain, especially when pressing the epigastric region. Early diagnosis of complications helps reduce mortality [3].

In this case, the 29-year-old male patient presented with meningitis and abdominal pain. Gastroscopy determined that the catheter was located in the duodenum. The perforation occurred 4 months after VP shunt. When the catheter gets into the intestine, stomach, duodenum..., the fibrous organization develops around the catheter (Figs. 2A and 3), so fluid in the digestive tract cannot enter into the peritoneum, the patient does not have peritonitis [1–9,13,15–19]. Treatment is done by removing the catheter, then sealing the hole in the intestinal wall with open surgery [1–6,8,11,13,16,18,19] or laparoscopic surgery [1,17], or removing the catheter without need repairing the intestine [7,9,10]. Our patients are treated by removing the valve, catheter, opening the abdomen and stitching the hole in the duodenum, replacing the VP shunt system. Patients with meningitis caused by bacteria *Klebsiella pneumoniae* and treated with antibiotics.

This paper has been reported in line with the SCARE 2020 criteria [20].

#### 4. Conclusion

Intestinal perforation with VP shunt catheter is rare. Diagnosis is simple if the catheter comes out of the anus, mouth, vagina, penis, scrotum, navel. In case when the catheter is inside the lumen of the gastrointestinal tract, diagnosis often requires imaging such as abdominal computed tomography, and gastrointestinal endoscopy. Surgery treatment was to replace the drainage valve and to close the perforation the digestive tract.

#### Consent

Written informed consent was obtained from the patient and his

family members for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Availability of data and material

Data is available upon reasonable request and with permission of Viet Duc Hospital. No patient or author details are included in the figures.

#### Provenance and peer review

Not commissioned, externally peer-reviewed.

#### Ethical approval

The study was approved by the Research Ethics Committee of Hanoi Medical University. The procedures used in this study adhere to the tenets of the Declarations of Helsinki.

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#### Guarantor

Hung Thanh Chu, MD.

#### Research registration number

Not applied. This was not a first time a new surgical technique or new equipment/technology was used.

#### CRediT authorship contribution statement

He Van Dong: Conceptualization, Resources, Supervision.

Hanh Duc Van: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Visualization.

Hieu Tri Vu: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Visualization.

Hung Thanh Chu: Investigation, Visualization, Writing - review & editing.

All authors contributed to the interpretation of the results, discussed the results. All authors read and approved the final manuscript to submit.

#### Declaration of competing interest

The authors declared no conflict of interest.

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