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# Intestinal perforation due to a ventriculoperitoneal shunting catheter. Case report and review

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## ABSTRACT

**Introduction:** The ventriculoperitoneal (VP) shunt allows the drainage of excess cerebrospinal fluid; among its gastrointestinal complications are intestinal volvulus, pseudocyst, and perforation, the last of which is rare but potentially serious, with a frequency between 0.1% and 0.7% and a mortality rate around 15%. We present the case of a male child who required VP shunt colocation and suffered GI tract perforation with transanal protrusion.

**Case report:** A three-year-old male with a long clinical history of pilocytic astrocytoma in the posterior fossa that was partially resected in February 2022 and with VP shunt placement since March 2022. He was diagnosed with an intestinal perforation and anal externalization due to a VP shunt. He required surgery and management with combined antimicrobials.

**Discussion:** Although the aetiology of GI tract perforation due to a VP shunt is not fully established, some risk factors have been described, including the use of abdominal trocars, rigid distal catheters, silicone allergies, and children's thin intestine walls. Treatment must be individualized, with some principles including external drainage of the proximal part until the CSF fluid reaches a biochemically near-normal state and becomes sterile on culture; secondly, the administration of intravenous antibiotics; and finally, the removal of the perforating section of the catheter.

**Conclusions:** Bowel perforation due to a VP shunt is an extremely rare entity whose aetiology is not fully established, primarily affects children and may be mostly related to chronic-irritative gastrointestinal distress. Individualizing treatment is the cornerstone of the therapeutic approach that includes VP shunt replacement, antimicrobial therapy, and management of life-threatening complications.

## INTRODUCTION

The ventriculoperitoneal (VP) shunt allows drainage of excess cerebrospinal fluid (CSF) under circumstances where there is an obstruction in the normal outflow or where there is an absorptive abnormality of CSF (1). Considering the technique of the procedure, some complications may occur, including abdominal complications, which include intestinal volvulus, pseudocyst, and perforation of

## Keywords

ventriculoperitoneal shunt,  
gastrointestinal tract,  
children,  
neurosurgery



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different anatomical sites like the scrotum, umbilicus, vagina, or gastrointestinal (GI) tract (2,3). Perforation of the GI tract is a rare but potentially serious complication that has a frequency between 0.01% and 0.07% (4-8). Considering the main target population for VP, most VP shunt protrusions manifest in individuals who are younger than 10 years old (9) with up to 70% of the reported patients being children (10).

Since the first case report about GI tract perforation for a VP shunt in 1966 (11) about a hundred cases have been described (10, 12), and half of them were asymptomatic (10). The mortality rate of intestinal perforation by a VP catheter is around 15% (7). The reduction in mortality and morbidity is substantial when early diagnosis and treatment are implemented, particularly in cases of asymptomatic intestinal perforations (10).

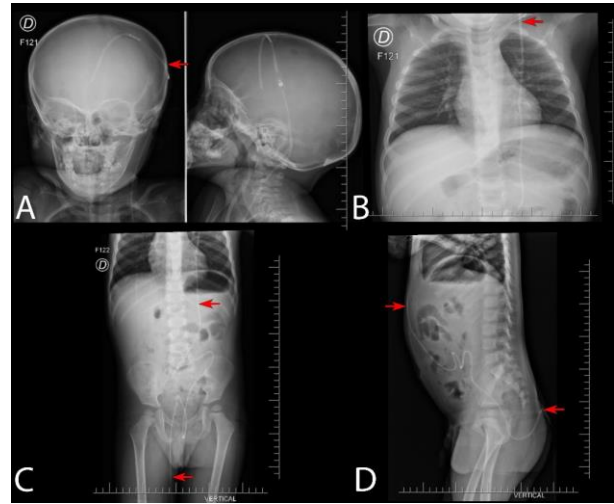
Anal extrusion of the VP shunt is a shocking and even more rare condition associated with perforation of the GI tract. Some cases have been described in children (2,4,5,9,12-15) and others in adults (6, 16-18). We present the case of a male child who required VP shunt colocation and suffered GI tract perforation with transanal protrusion.

### CASE REPORT

A three-year-old male with a long clinical history of pilocytic astrocytoma in the posterior fossa that was partially resected in February 2022 and with VP shunt placement since March 2022 with the requirement of resection of a cyst at the tip of the VP shunt catheter in January 2023 and with recent Magnetic resonance imaging (MRI) findings of spinal metastasis was brought by his mother to the emergency room after finding a foreign body in the anal region. The mother decided to pull the catheter, suspecting other causes, without achieving extraction.

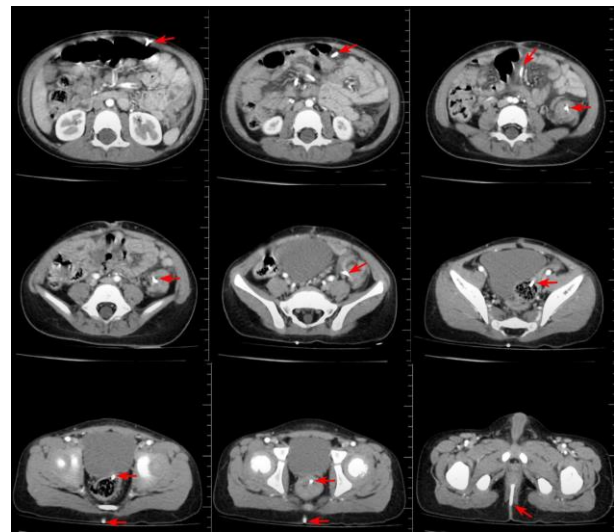
Initial clinical examination showed a heart rate of 114 beats per minute, a breath rate of 22 breaths per minute, a temperature of 36 °C, oxygen saturation of 97%, and a VP shunt catheter protruding through the anus. Initial labs showed slightly microcytic and hypochromic anemia (hemoglobin (Hb): 11.9 g/dL, hematocrit (Hto): 34.5%, mean corpuscular volume (MCV): 72.2  $\mu\text{m}^3$ , mean corpuscular hemoglobin (MCH): 24.8 pg.), and positive C-reactive protein (CRP) (48 mg/L). Initial skull, chest, and abdomen radiography showed a VP catheter with a wide travel

in the body, making multiple turns to exit through the anus (Figure 1).



**Figure 1.**

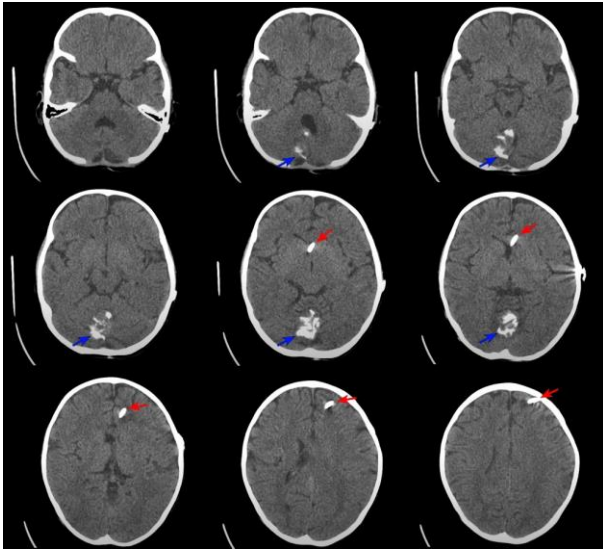
Abdominal Computerized Tomography (CT) showed colonic perforation migration through the bowel of the distal VP shunt to the anal level (Figure 2) A head CT reported a fossa posterior tumor previously known and a VP shunt in an adequate position (Figure 3).



**Figure 2.**

Initial surgical management was externalization of the VP shunt via clavicular and partial removal of the distal catheter via anal; days later, he underwent surgery for a change of VP. He was also given antibiotics through a central venous catheter (CVC) in the left subclavian area before and after surgery.

These included metronidazole (140 mg IV every 8 hours) for ten days, cefepime (700 mg IV every 8 hours) for thirteen days, and vancomycin (210 mg IV every six hours) for sixteen days.



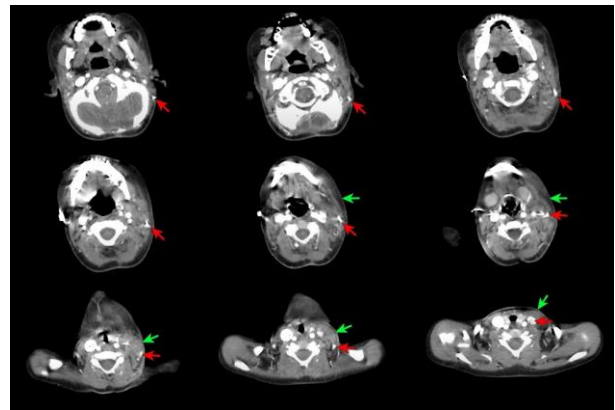
**Figure 3.**

During postoperative VP shunt replacement, the patient presented with fever (38.4 °C), tachycardia (162 bpm), tachypnea (31 bpm), neck edema, and abdominal pain. Laboratory control reported a deteriorating microcytic and hypochromic anemia (Hb: 8.7 g/dL, Hto: 26.4%, MCV: 74.2  $\mu\text{m}^3$ , MCH: 24.4 pg.), CRP positive (48 mg/L), SARS-COV-2 antigen negative, neck ultrasonography showed soft tissue edema in the left neck and reactive lymph nodes, and abdominal ultrasonography showed slightly free fluid in the pelvis. Blood cultures and CSF cultures were reported as negative.

The medical staff made an antibiotic switch from cefepime to meropenem (560 mg IV every 8 hours) and a change of CVC to the right internal jugular. Imaging studies reported neck CT with contrast showing edema in soft tissues and reactive adenopathy (**Figure 4**), and thorax CT with contrast showing both lower lobe consolidation, bilateral lower lobe subsegmental atelectasis, and right pleural effusion.

Despite antibiotic management, the patient continued to have a fever associated with emesis and diarrhea. Laboratory control reported leukocytosis ( $20.66 \times 10^3/\text{mm}^3$ ), neutrophilia

(69.2%), microcytic and hypochromic mild anemia (Hb: 9.4 g/dL, Hto: 28%, VCM: 72.9  $\mu\text{m}^3$ , HCM: 24.6 pg.), a rise in CRP (96 mg/L), a respiratory viral panel positive to enterovirus and syncytial virus, and a new blood culture isolated *Staphylococcus epidermidis*. The antimicrobial management was modified by adding clindamycin (140 mg IV every 6 hours) and restarting vancomycin (210 mg IV every 6 hours); however, the pediatric infectologist suspended meropenem and clindamycin while continuing vancomycin. Due to the requirement of a major complexity level considering the need for a new evaluation by oncology due to a relapse evidenced in an MRI, the patient was transferred to the oncology unit.



**Figure 4.**

## DISCUSSION

The etiology of GI tract perforation due to a VP shunt is not fully established; however, some risk factors have been described, including the use of abdominal trocars, rigid distal catheters, silicone allergies, and children's thin intestine walls (4, 19). Gmeiner et al. (2020) studied how GI perforation happens and divided it into two types: an acute and traumatic type that happens when the first distal catheter is placed, and a chronic type that is caused by irritative gastrointestinal distress. This latter type is the main cause of late cases of GI tract perforation (19). In addition, patient motion, peristalsis, and CSF pulsation may contribute to bowel wall perforation (19). In this case, our patient presented some of the risk factors described above: first, his age, a thinner intestinal wall, and patient motion. In addition, the relevant background of the resection of a cyst at the tip of the VP shunt catheter in combination with the above-mentioned risk factors may indicate the

presence of an event of chronic-irritative gastrointestinal distress as the main cause of GI tract perforation.

The need for surgical treatment must be individualized. According to Alves et al. (2017), three principles are crucial to individualized surgical management: firstly, the implementation of external drainage of the proximal part until the CSF fluid reaches a biochemically near-normal state and becomes sterile on culture; secondly, the administration of intravenous antibiotics; and finally, the removal of the perforating section of the catheter (20). In cases where peritonitis or abdominal abscesses are absent, the removal of the abdominal end of the catheter can be accomplished using percutaneous or endoscopic methods without surgery. Surgical intervention is indicated when intra-abdominal infection occurs or when the fistulous tract fails to shut spontaneously following percutaneous or endoscopic removal (20). Laparotomy, laparoscopic, and transanal repair have been reported as methods for managing the colonic perforation (20). In the presence of severe peritonitis or with a relevant background of severe abdominal problems such as abdominal adhesions (10), laparotomy is mandatory (6). Our patient required surgical procedures. First, our patient was taken for VP shunt externalization and removal of the catheter that was perforating and was externalized via anal, and subsequently, he had a second surgical event, the placement of a new VP shunt.

Abdominal or systemic infections related to GI tract perforation can produce life-threatening conditions. Even though peritonitis was supposed to be the most common infectious outcome, less than 25% of patients present with peritonitis (12). However, other foci of infection can be found; for this reason, the majority of cases explain and address infection prevention and management (4, 9, 10, 13-16, 18, 19, 20, 21-23), some of them found a positive CSF culture and directed a specific antibiotic therapy (15, 16, 21, 22), and notice that in nearly 50% of GI tract perforations due to VP shunt CSF cultures are positive (16) and the most common bacteria isolated in any type of culture is *Escherichia coli* (12, 15, 16). According to Birbilis et al. (2009), mortality can reach up to 22% if a central nervous system (CNS) infection is confirmed due to meningitis, encephalitis, or brain abscesses (16); other authors have also reported these statistics (22, 24). In our case, fortunately, no

peritonitis or other abdominal complications from the GI tract perforation were reported; however, despite initial negative blood and CSF cultures, the patient presented clinical symptoms and other laboratory tests suggestive of an infectious event, which made it necessary to switch the antimicrobial management several times, completing long treatment schedules. Finally, the last blood culture isolated *Staphylococcus epidermidis*, allowing the pediatric infectologist to direct specific treatment.

## CONCLUSIONS

The bowel perforation due to a VP shunt is an extremely rare entity whose etiology is not fully established; however, it is known that it primarily affects children and may be mostly related to chronic-irritative gastrointestinal distress. The treatment required must be individualized, including management of the VP shunt, antimicrobial therapy to prevent or treat concomitant infectious diseases, and control of another wide range of life-threatening complications.

## List of Abbreviations

VP: Ventriculoperitoneal  
 CSF: Cerebrospinal fluid  
 GI: Gastrointestinal  
 MRI: Magnetic resonance imaging  
 Hb: Hemoglobin  
 Hto: Hematocrit  
 MCV: Mean corpuscular volume.  
 MCH: Mean corpuscular hemoglobin.  
 CRP: C-Reactive protein  
 CT: Computerized tomography  
 CVC: Central venous catheter  
 CNS: Central nervous system

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