Case Report

Gastric perforation from a migrating ventriculoperitoneal shunt: A case report and review of literature

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A B S T R A C T

Ventriculoperitoneal (VP) shunts represent a surgical option for patients affected by increased intracranial hypertension when medical management fails or is contraindicated. Complications following implantation include shunt obstruction, infection, over and under drainage, migration or disconnection of the tube, formation of a pseudocyst, and allergy to the silicone tube. We report the case of a 31-year-old woman who presented to the emergency room with nausea and generalized malaise, found to have the distal segment of the VP catheter perforating her gastric wall into the stomach lumen which required surgical intervention. In this report, we describe a rare complication associated with the implantation of ventriculoperitoneal shunt (VPS) catheters and the subsequent management plan.

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Introduction

Shunting is one of the surgical strategies implemented in the management of idiopathic intracranial hypertension (IIH) when it is causing significant visual loss, visual deterioration, and continuous intractable headaches despite nonoperative management [1]. Other surgical options include serial lumbar punctures, lumbar drainage, subtemporal bony decompressions, optic nerve sheath fenestrations/decompressions, lumbo-peritoneal shunting and, most recently, venous sinus stenting.

Complications following ventriculoperitoneal shunt (VPS) implantation occur in approximately one-fifth to four-fifths of all implanted cases [2]. According to their pathological outcome, they can be classified as mechanical complications, which can include distal and proximal catheter failures due to obstruction, disconnection or migration, and nonmechanical complications, including cerebrospinal fluid (CSF) leak, pseudocyst formation, and shunt tract infections, rarely followed by meningitis, peritonitis or CSF infection. Abdominal complications contribute to 25%-30% of VPS-related issues. Among these, gastrointestinal (GI) perforations following a VPS migration are very rare and account for only

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Complications deriving from the insertion and subsequent migration of VP shunt are very rare and generally more common in children than adults. Such complications can lead to fatal consequences, such as peritonitis and meningitis, resulting in high mortality rates, estimated as high as 18% of cases. These events have a time-dependent gap related to the pathophysiology of the bowel perforation itself that allows gram-negative bacterial replication and upward migration. Intracranial infections such as meningitis caused by enteric organisms like Escherichia coli in patients with VPS should be promptly investigated for possible shunt migration and organ perforation [4].

To our knowledge, very few cases were reported as having gastric perforation from an orphaned peritoneal catheter and, actually, presenting to the emergency room with only mild generalized symptoms. Although the migration of a peritoneal catheter can involve any intraabdominal organ, gastric perforation by VP shunt is rarely described; only approximately 20 cases have been reported so far. In these cases, a high degree of clinical suspicion is warranted for diagnosis as only approximately 25% of the patients present with clear signs of perforitis [4].

The usual presentation for abdominal catheter migration and gastric perforation could range from generalized intestinal symptoms, such as mild nausea, abdominal discomfort, and/or diarrhea, to fever, abdominal pain, and bleeding.
Some authors support the idea that bowel perforation has a slow course and occurs as a direct consequence of a chronic process: the tip of the misplaced catheter rubs against the external wall of the bowel, gradually adhering to it, leading to the formation of a fibrous tract surrounding and enveloping the catheter. With further friction the catheter perforates through the wall, entering the hollow viscus [3,5].

For this reason, the mild generalized symptoms are a direct consequence of the slow nature of the process itself: with the development of a well-formed fibrotic tract, no spillage of bowel content occurs; this validates also the rare incidence of infective complications.

The type of material used to make the shunt catheters—silicone—is thought to cause an allergic reaction similar to a foreign body inflammatory response which can cause local inflammation, leading to the above-mentioned pathophysiological mechanism [3,6].

Moreover, the central nervous system (CNS) and gastrointestinal (GI) physiology could have a role in the pathological induction: both CSF pulsations—with their continuous water hammering effect—and peristaltic waves in the bowel can aid in the perforation process by adding more friction between the tip of the migrated catheter and the bowel wall [6].

Additional relevant risk factors which could contribute to visceral penetration mainly regard the personal medical history of the patient. Allouh et al. reported in their review that previous surgeries in the affected organ, increased intra-abdominal pressure and history of shunt revisions are significant factors predisposing to viscus perforation [7].

Furthermore, having an orphaned peritoneal catheter left after removal of a prior VPS implantation, as in the case of our patient, has been validated as a risk factor for bowel perforation. In the entire shunt migration review performed by Harischandra et al., 50% of the abandoned catheters resulted in migration and bowel perforation [3].

It is therefore fundamental to underline that any abdominal complaint in a patient with an orphaned catheter would need to raise suspicion of catheter migration and bowel perforation, so that prompt evaluation and intervention can follow.

Currently, there are no guidelines to support physicians in the diagnostic process and yet no management plan has been regulated; however, based upon the analysis of the few cases presenting with gastric perforation, it is notable to mention the consensus among the authors.

In the first instance, CT scan seems to represent the ideal technique for investigation, as it allows the clear identification of complications and the assessment of possible sequelae. This imaging technique can study the catheter path in its continuity and the potential presence of gas and/or fluid collection, mucosal thickening, and associated inflammation, all indicators of supra-infection, abscess or ascites [2].

Upper GI endoscopic evaluation seems to be helpful in confirming the shunt catheter penetration through the stomach wall, with the associated characterization of the lesion as irregular, friable, or ulcerated [8], and in identifying the site of entry; in some cases, it has been reported also the possibility of removal of the perforating part during the endoscopic examination, when the conditions allowed it with no following complications, showing for this procedure potentiality in the surgical management.

Most patients complained of abdominal discomfort prior to the intragastric perforation. However, CT and gastroscopic examination often reveal no abnormality at this stage. Therefore, the examination should be repeated in patients with VP shunt complaining of abdominal pain [8].

Most of the cases often do not require surgical intervention because of the chronic characterization of the complication: the perforation site seals with fibrous tissue as a result of the long-standing process. In general, follow-up endoscopy to
assure healing does not appear to be necessary unless symptoms recur. Surgical intervention is reserved for cases in which there is significant intra-abdominal infection [8] or complication of the physiological function.

Among the surgical alternatives, the authors recognize relative advantages in the choice of laparoscopic techniques.

These procedures, which are at first often employed in the placement of the peritoneal catheter during the VPS insertion, also guarantee multiple benefits during the management of abdominal complications: the reduced invasiveness, a consequence of the reduced peritoneal exposure to the outside, entails low rates of postoperative infections and adhesiogenesis, also providing a better vision for adhesiolysis when required [2].

In some specific cases, when the gastric perforation is not complete and/or not clearly visualized at imaging, due to the anatomy of the patient, the diagnosis can be reached by means of laparoscopic exploration, with the option of simultaneous therapeutic intervention.

Hence, after confirmation by imaging and endoscopic procedures and the extrusion of the VPS catheter with minimal exploration, a CSF sample can be obtained to study and observe the patient for possible arising complications. Based on the treatment outcome and patient requirements, an appropriate management plan would take into consideration different possibilities, including fluoroscopy-guided lumbar punctures with therapeutic purpose, temporary external ventricular drain and, ultimately, revaluation for delayed re-VPS implantation [2].

**Conclusion**

Any patient who underwent a shunt procedure and presents with generalized or specific organ-related signs and symptoms should be evaluated for presumptive shunt migration and associated complications, such as gastric perforation.

A standardized guideline for their management is currently not available, but authors have referred to similar modalities, suggesting abdominal CT and endoscopic procedures for a first-line evaluation and laparoscopy as the best technique in terms of outcome/effectiveness.

**Patient consent**

The written informed consent was obtained from the patient.

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