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Case Report

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

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ABSTRACT

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.

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, lumboperitoneal 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.

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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 0.1%-0.7% of them. Migration has been defined as "translocation of part/whole of the shunt system (proximal/distal catheter/reservoir/valve) from the compartment where it was intended to be, to a new compartment which may be associated with/without shunt dysfunction" [3].

Diverse clinical presentations, ranging from asymptomatic to symptomatic, mainly related to the site of migration and/or shunt dysfunction have been reported in the literature [3].

Delayed diagnosis due to paucisymptomatic or aspecific clinical presentations in the case of gastric perforations associated with shunt migration could lead to fatal outcomes. These can be avoided with prompt diagnosis and well-planned management.

Case presentation

We report the case of a 31-year-old woman with a past medical history significant for IIH who underwent right frontal VPS in 2006, after the initial failure of both medical management and right optic nerve sheath decompressions. Despite an uneventful postoperative period, in 2018, she developed shunt malfunctioning, due to an underlying infection, which required her VPS to be removed. Since, the patient had been maintained with medical treatment, achieving headache control and no vision alteration.

She presented to our emergency room at the beginning of April 2022 with a 1-day history of nausea, malaise, weakness, shortness of breath, and headaches. Both physical examination and laboratory analysis were unremarkable. An abdominal X-ray was taken, where no abnormalities of the VPS tract could be visualized (Fig. 1). A few days before, in a routine office visit, she was noted to have a mildly tender 3-cm subcutaneous area of fluctuance behind her right ear. No redness, drainage, or fever were evident on examination. A contrasted computed (CT) tomography scan of the head, chest, and abdomen was ordered in the outpatient setting. This showed a 2.2×1.8 cm simple fluid collection without rim enhancement, posterior to the right ear, within the subcutaneous soft tissue, thought to represent a seroma at the tip of a remnant VP shunt. In the same evaluation, the body scan disclosed a partially visualized-abandoned VPS catheter with its distal segment perforating through the anterior gastric wall into the stomach lumen, with no associated perigastric fluid, localized collection, or pneumoperitoneum (Fig. 2A and B).

Subsequently, a gastroenterologist was consulted. An esophagogastroduodenoscopy confirmed the presence of the distal VPS catheter perforating the anterior wall of the body of the stomach.

The patient was taken to the operating room and underwent a laparoscopic gastrectomy, which allowed a complete takedown of the VP shunt fistula tract and the removal of the catheter, followed by washouts of cranial, neck and abdomen wounds. During the cranial wound washout, she was found to have a retained proximal VPS catheter noted to be scarred in the sternocleidomastoid muscle, which was successfully dissected and explanted.

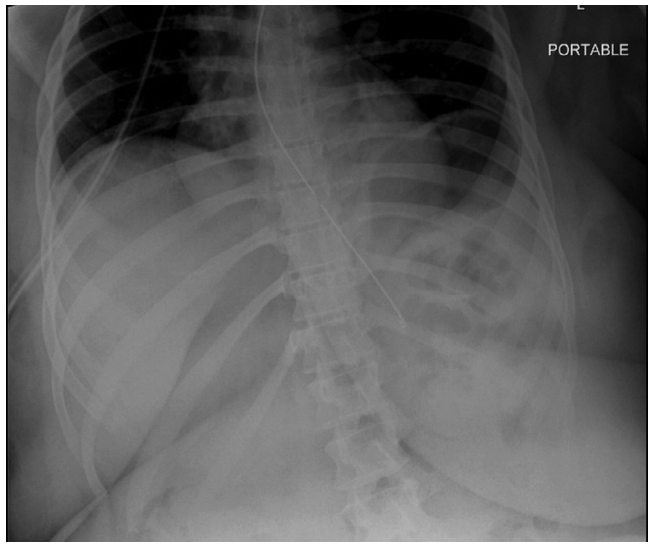

Fig. 1 – Abdominal X-ray showing correct ventriculoperitoneal shunt (VPS) position with no evident abnormalities.

In the last months, the patient started complaining of recurrences of symptoms consistent with IIH which required a series of fluoroscopy-guided lumbar punctures. Further ophthalmological and neurosurgical consults have been considered to control further worsening and uncontrolled symptoms.

Discussion

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 peritonism 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 peritonitis [4].

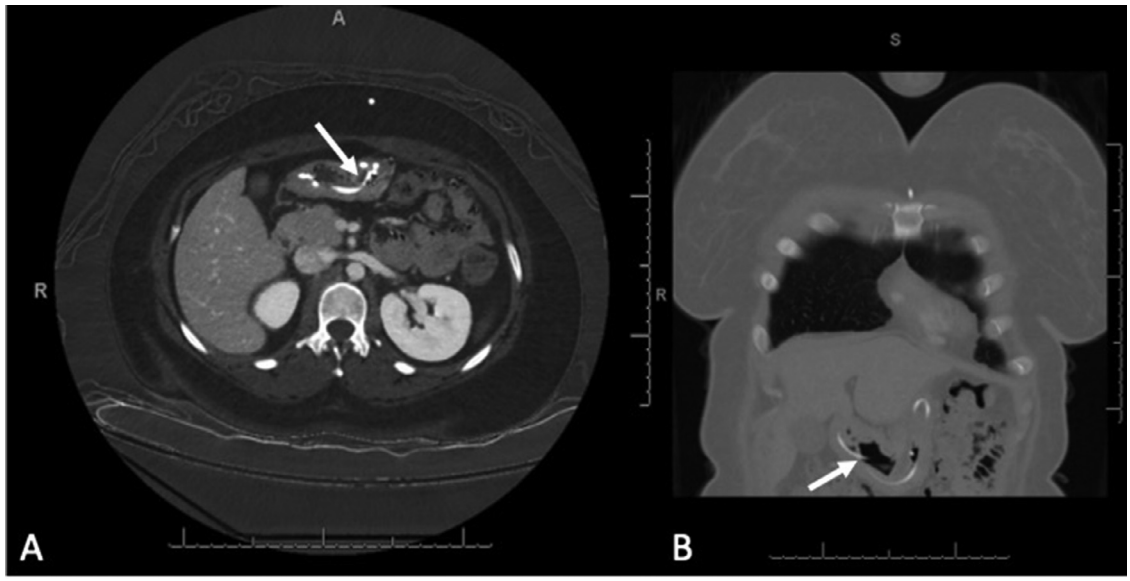

Fig. 2 – Computed tomography images of the abdomen showing the distal catheter migration into the stomach: axial view (A) and coronal view, (B); white arrow: perforation site.

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 compromission 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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