



Case Report

Multiple Abdominal abscesses following ventriculoperitoneal shunt placement in an immunosuppressed patient: An illustrative case

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ABSTRACT

Background: Ventriculoperitoneal (VP) shunt placement is one of the most performed procedures in neurosurgery to treat various types of hydrocephalus (HC). Immediate or late postoperative complications may quite commonly occur, especially in immunosuppressed patients, who are predisposed to develop rare and difficult-to-treat conditions.

Case Description: Herein, we report the case of a 41-year-old female patient with a prior history of acute myeloid leukemia, followed by a tetra-ventricular acute HC due to a spontaneous non-aneurysmal subarachnoid hemorrhage. After an urgent external ventricular drainage placement, she underwent careful testing of "shunt dependency," which ended with a VP shunt placement. After 2 months, she presented at the emergency department with worsening abdominal pain and fever. She underwent a computed tomography scan with contrast administration, which has shown abscesses in the abdominal cavity. An urgent surgical revision of the VP shunt and antibiotics administration followed this. After inflammatory markers normalization, due to the high risk of post-infective peritoneal adherence and consequent impairment of cerebrospinal fluid absorption, a ventriculoatrial shunt was considered the most appropriate solution.

Conclusion: Abdominal abscesses are a rare but subtle complication after VP shunt placement. Their management depends on etiology, patient clinical characteristics, and manifestations. Prompt interventions have been shown to improve clinical outcomes and optimize quality of life in such delicate patients.

Keywords: Abdomen, Abscess, Complication, Shunt, Ventriculoperitoneal

INTRODUCTION

Hydrocephalus (HC) is generally defined as a dynamic disorder between the production and absorption of cerebrospinal fluid (CSF), resulting in abnormal expansion of cerebral ventricles and frequently associated with increased intracranial pressure.^[6] The etiology is various, and clinical manifestations may be different.

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The management of HC includes different approaches according to the obstructive/communicating dichotomy and characteristics of patients. Ventriculoperitoneal (VP) shunt placement is one of the most commonly performed procedures associated with various complications: infection, functional and/or mechanical impairment, or others.^[2] One rare complication is the development of an abdominal abscess, which may be the cause of shunt malfunction.^[4]

Herein, we present the case of an immunocompromised patient who has developed abdominal abscesses after VP shunt placement, followed by a revision of the literature.

CASE REPORT

We present the case of a 41-year-old woman affected by acute myeloid leukemia who, 1 month after chemotherapy, was admitted to the hematology unit to perform a routine medical check-up. There, she suddenly developed a tension-type headache, vomiting, and lethargy. An urgent brain computed tomography (CT) scan showed a non-aneurysmal subarachnoid hemorrhage [Figure 1a] associated with a tetraventricular non-communicating HC [Figure 1b]. Moreover, a brain angio-CT scan has excluded the presence of any aneurysmal or arteriovenous malformation.

Then, she urgently underwent an external ventricular drainage (EVD) placement. During the postoperative course, the patient improved with progressive neurological recovery, and a “shunt dependency” test was performed; after its failure, once CSF was clear and laboratory tests negative, the patient underwent VP shunt placement 1 month later and was transferred back to the Hematology Unit to continue proper therapy.

Two months later, she presented at the emergency department with a fever and severe abdominal pain. No increase in fluorosis indexes was detected at preliminary laboratory tests. A contrast-enhancement CT scan showed abscess collections and pseudocysts in the mesogastrium [Figure 2a] and in the pelvic cavity [Figure 2b] with diffuse peritoneal hyperattenuation. Ultrasound-guided aspiration of the intra-abdominal abscesses was rapidly performed, considering the advantage of a minimally invasive approach in an immunosuppressed patient.

No further complications were detected, and a post-procedural clinical improvement was first noticed without any sign of fever or abdominal pain. Nevertheless, after a few days, the patient developed nausea, drowsiness, headache, and progressive neurological impairment (Glasgow Coma Scale 11- E 2, V4, M 5). She underwent an urgent CT scan, which showed a tetraventricular HC. Laboratory test parameters showed a sudden increase of inflammatory markers (white blood cells [WBC] $9 \times 10^3/\mu\text{L}$, C-reactive protein [CRP] 276 mg/L, and monocyte distribution width

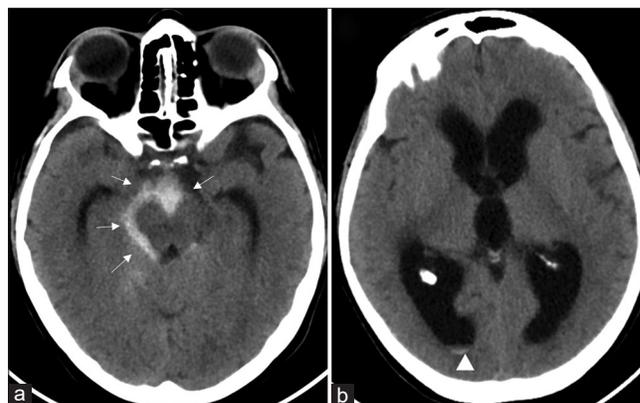


Figure 1: (a) Axial computed tomography (CT) image shows subarachnoid hemorrhage in the peri-mesencephalic and interpeduncular cisterns (arrows). (b) Axial CT image of the same patient shows significant dilatation of the ventricular system consistent with hydrocephalus. Minimal intraventricular hemorrhage (arrowhead) is also noted layering in the occipital horns of the right lateral ventricles, which are significantly dilated.

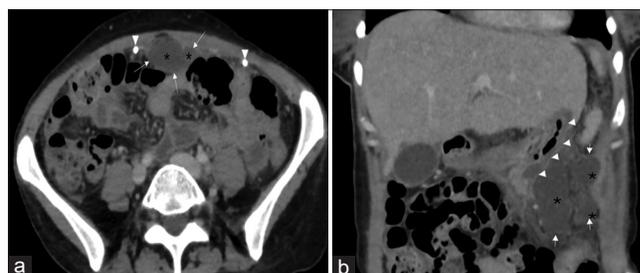


Figure 2: (a) Axial contrast-enhanced computed tomography (CT) image shows homogeneous collections (asterisks) with thin contrast-enhancing walls (arrows) in the anterior peritoneal cavity. The ventriculoperitoneal shunt distal catheter is also visible (arrowheads). (b) Reformatted coronal contrast-enhanced CT image shows homogeneous collections (asterisks) with contrast-enhancing walls (arrows) adjacent to the gastric wall (arrowheads).

[MDW] 25.9). Then, she underwent urgent surgery for removal of the VP system, followed by Bactiseal® EVD placement.

Subsequently, blood culture investigations isolated *Candida albicans* and *Enterococcus faecium*. No bacterial growth was shown at the CSF investigation, despite the catheter showing a bacterial colonization (i.e., *E. faecium*) as well. An intravenous administration of linezolid 600 mg/2 times a day, rifampicin 600 mg/day, and itraconazole 100 mg/day was started and lasted for 4 weeks. Due to the failure to improve inflammatory markers, meropenem/vaborbactam 2 g/2 g 4 times a day was added, with a progressive clinical and neurological improvement. Antibiotic therapy lasted for 6 weeks, and EVD was replaced twice.

After symptoms recovery, a decrease of WBC, CRP, and procalcitonin due to “shunt dependency,” a new surgical

procedure was mandatory. Due to the high risk of post-infective peritoneal adherence and consequent impairment of CSF absorption, a ventriculoatrial (VA) shunt was considered the best option. VA shunt was finally performed after a careful risk-benefit assessment.

The postoperative course was uneventful, without any complications or new onset of neurological deficit. Then, she was transferred to the hematologic unit to continue proper therapy. A 6-month follow-up has assessed a good recovery, with a significant improvement in the patient's quality of life.

DISCUSSION

The use of the peritoneal cavity for CSF absorption in VP shunting is a procedure first introduced in 1908 by Kausch^[6], and nowadays, it is widely used in neurosurgery. Although VP shunting represents a safe and common procedure, it is not free from complications.

The most common VP-shunt complications include peritoneal pseudocyst (both infect and sterile), shunt infections, bowel perforation, catheter disconnection, and ascites.^[4] Among all complications, abdominal abscesses are rare, with few reported cases in the literature.

Indeed, according to our literature review, just nine cases of intra-abdominal abscess after VP-shunt placement are reported, as shown in Table 1.

In three cases,^[3,5,9] VP-shunt was introduced due to a normal-pressure HC, and in one case^[8] after astrocytoma resection. Clinical onset, course, and management of the intra-abdominal abscess were heterogeneous. In two cases,^[5,9] percutaneous aspiration and antibiotics administration were the main treatment.

Liu *et al.*^[9] described the case of a 76-year-old man case who developed abdominal pain and fever 6 months after VP-shunt placement; he underwent fluid collection drainage,

Table 1: A literature review of reported cases.

Author	Sex/age	Comorbidities	Onset of abscess after VPS	Pathogens	Characteristics of abscess	Therapy	Outcome
Bremer and Darouiche, 1996 ^[1]	F/58	Rheumatoid arthritis	4 days	<i>Serratia marcescens</i>	Intra-abdominal abscess	Ciprofloxacin	Clinical improvement
Chung <i>et al.</i> , 2008 ^[4]	M/N/A	Arteriovenous malformation	N/A	<i>Staphylococcus aureus</i>	Omental-mesentery abscess	Not specified antibiotics	N/A
Chung <i>et al.</i> , 2008 ^[4]	M/14	Arnold-Chiari malformation	N/A	<i>Pseudomonas aeruginosa</i>	Intra-peritoneal abscess	Not specified antibiotics	N/A
Popa <i>et al.</i> , 2009 ^[11]	N/A	N/A	Early onset	<i>Staphylococci</i>	Lesser Omentum and peripancreatic abscesses	Not specified antibiotics	N/A
Lin <i>et al.</i> , 2000 ^[8]	F/19	N/A	11 years	<i>Neisseria gonorrhoeae</i>	Intra-abdominal abscess	Ceftriaxone	Blurred vision
Liu <i>et al.</i> , 2007 ^[9]	M/76	N/A	6 months	<i>Staphylococcus aureus</i> , <i>Proteus mirabilis</i> , <i>Staphylococcus epidermidis</i>	Lobulated fluid collection in the left abdomen	Not specified antibiotics	N/A
Kashyap <i>et al.</i> , 2017 ^[5]	F/43	Diabetes mellitus	N/A	<i>Streptococcus</i> Group D.	Abdominal pseudocyst infectious	Not specified antibiotics	N/A
Chambers, 2020 ^[3]	M/70	Biliary disease, Meningitis	N/A	N/A	Intra-abdominal abscess with acute appendicitis	Not specified antibiotics	N/A
Morinaga <i>et al.</i> , 2023 ^[10]	F/49	N/A	1 year	<i>Enterobacter cloacae</i>	Small bowel abscess	Meropenem, Vancomycin	Clinical improvement
Gulino <i>et al.</i> , 2024 ^[1] (Current Study)	F/41	Acute myeloid leukemia	2 months	<i>Candida albicans</i> , <i>Enterococcus faecium</i>	Intra-abdominal abscesses	Meropenem/Vaborbactam, Itraconazole	Clinical improvement after abscess drainage and VA shunt

VA: Ventriculoatrial, VPS: Ventriculoperitoneal shunt, N/A: Not available

antibiotics administration, and shunt removal. Kashyap *et al.*^[5] presented a 43-year-old female with abdominal pain, headache, and nausea. In this case, the worsening of the HC was secondary to an abdominal pseudocyst, which cultural examination post-drainage has revealed *Streptococcus* Group D. Patient's symptoms initially resolved, but 6 years later, she was readmitted for sepsis due to cellulitis. Subsequently, the distal portion of the VP shunt was externalized. Once the infectious disease was resolved, the shunt was repositioned on the left side of the abdomen without any complication.

Indeed, Lin *et al.*^[8] described a temporary externalization of the VP shunt due to an isolated *Neisseria gonorrhoeae* infection. Intravenous antibiotics successfully resolved the infection, and both the VP shunt and abdominal drainage were removed without any bacterial growth.

In another case described by Chambers,^[3] a patient underwent laparoscopic appendectomy and repositioning of the VP shunt. Post-operative meningitis led to the removal of the VP shunt, subsequently followed by EVD placement.

To the best of our knowledge, this is the first reported case describing abdominal complications caused by a yeast infection (i.e., *C. albicans*) in an immunosuppressed patient with a VP shunt.

Abdominal complications, such as abscesses or infections, can occur after VP shunt placement. VP shunt infection stands as a common cause of shunt failure, affecting approximately 8.1% of patients.^[2] The signs of VP shunt malfunction are the same as the clinical manifestations of increased intracranial pressure (i.e., headache, nausea, vomiting, lethargy, and irritability). Patients presenting with abdominal complications often refer to lower abdominal pain, fever, or mild nausea. This category, indeed, might present any abdominal pathology unrelated to the shunt, so it is of utmost importance a differential diagnosis is essential to achieve a skilled diagnostic workup and clinical judgment. Moreover, especially in the case of immunocompromised patients, as in the present case, symptoms might be subtle and difficult to place, leading to delays in diagnosis.

Since the inherent difficulties related to their management, Kashyap *et al.*^[5] have proposed a valuable algorithm that should be taken into account every time such complication is faced. A thorough evaluation of symptoms, inflammatory markers, CSF infection, and recurrence of pseudocyst should be evaluated to guide the surgeon to assess the most suitable treatment.

The accurate diagnosis of an abscess is typically achieved through an abdominal contrast CT scan,^[7] although some authors^[13] recommend ultrasound due to its lack of radiation exposure, especially in the pediatric and pregnant population.

Treatment strategies heavily rely on the etiology, patient presentation, and clinical manifestations. At present, various treatment methods have been described, including CT-guided fluid aspiration (to reduce mass effect and identify pathogens), paracentesis, and laparotomy.^[12]

CONCLUSION

Multiple abdominal abscesses with pseudocysts represent a rare but important complication of VP shunt. Clinicians other than neurosurgeons should be aware of this complication and keep it on the differential diagnosis for those who have a history of VP shunt placement presenting with acute abdomen symptoms. Neurological and clinical monitoring is crucial, especially for immunocompromised patients. Early and timely intervention has been shown to improve clinical and neurological outcomes and optimize the quality of life for such complicated patients.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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