Clinical Case Report

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Aseptic Ascites: A Rare and Challenging Complication of Ventriculoperitoneal Shunting

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Introduction: Ventriculoperitoneal (VP) shunts are widely used to manage hydrocephalus providing significant relief from cerebrospinal fluid (CSF) accumulation. However, abdominal complications, such as aseptic ascites, can occur, albeit rarely. This condition is characterized by the diffuse accumulation of CSF in the peritoneal cavity without evidence of infection, often requiring specific interventions.

Case presentation: We present the case of a 3-year-old child with abdominal distension for the past 15 days, without other abnormalities. The child was in the late postoperative period for optic pathway pilocytic astrocytoma, with surgeries performed at 1 year and 7 months of age and VP shunt (VPS) placement at 1 year and 10 months of age. Abdominal ultrasound, computed tomography, and magnetic resonance imaging revealed large-volume ascites without additional findings. Diagnostic paracentesis showed a serum-ascites albumin gradient (SAAG) of 3.1. Biochemical and microbiological analyses showed no signs of infection, and liver, cardiac, and renal function markers were within normal ranges. Cytological analysis revealed no neoplastic cells. A ventriculoatrial shunt was placed, resolving the ascites.

Conclusions: Aseptic ascites is a rare dysfunction of VPS, with limited cases reported. Most cases of peritoneal fluid accumulation are associated with shunt infections resulting in peritonitis. In aseptic ascites, however, microbiological analysis of ascitic fluid was negative. Intracranial hypertension symptoms are not usual - typically, the main symptom is abdominal distension without signs of peritonitis. Owing to the high protein accumulation and CSF production in certain conditions, ventriculoatrial shunting is commonly chosen as an alternative.

Keywords: Aseptic ascites, Ventriculoperitoneal shunt, Pediatric neurosurgery

INTRODUCTION

Aseptic ascites is a rare and under-reported complication in patients undergoing ventriculoperitoneal (VP) shunting. While abdominal pseudocysts are the most common abdominal complication related to VP shunts (VPS), with an incidence ranging from 0.33% to 68%[1], aseptic ascites is a distinct manifestation characterized by the diffuse accumulation of cerebrospinal fluid (CSF) in the peritoneal cavity. Unlike pseudocysts, which are encapsulated and often associated with infections, ascites involves the free distribution of CSF throughout the abdominal cavity[1,2].

Most pseudocysts present with positive cultures, indicating infection by organisms such as Staphylococcus epidermidis and Streptococcus fecalis [1]. However, up to 50% of pseudocysts may also be aseptic, identified as encapsulated CSF collections without obvious infection[2,3]. In such cases, the fibrous wall surrounding the fluid leads to localized dysfunction, which can result in substantial abdominal proportions. While pseudocysts are more commonly linked to shunt malfunction, ascites typically manifests as diffuse abdominal symptoms, such as distension and discomfort, without clear signs of shunt failure [1,4].

Here, we report the case of a pediatric patient who presented with ascites associated with VPS placement, without any evidence of infection.

CASE REPORT

A 3-year-old boy presented with progressive abdominal swelling over 15 days (Figure 1). His neurosurgical history began at 1 year and 7 months of age with a partial resection of an optic pathway pilocytic astrocytoma. Hydrocephalus developed two months later, managed with a medium-pressure ventriculoperitoneal shunt (VPS). A second tumor resection occurred at 2 years of age. The current abdominal symptoms emerged approximately 13 months after the initial VPS placement. Upon admission, the patient had no symptoms of intracranial hypertension. Shunt reservoir pumping demonstrated prompt refilling, and plain radiographs (shunt series) confirmed the continuity of the distal catheter without kinks or fractures. There was no clinical suspicion of peritoneal fibrosis or multiple adhesions

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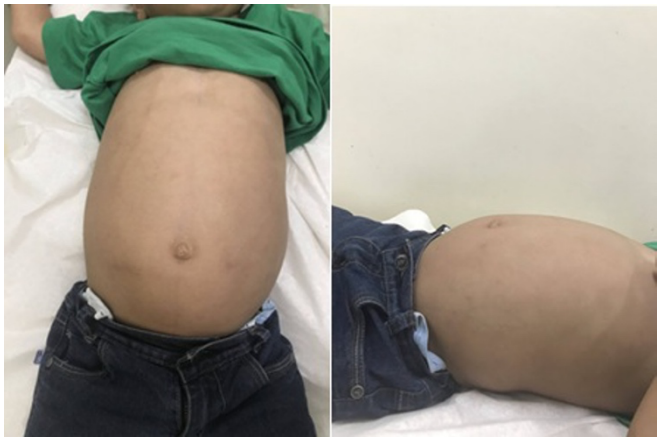

Figure 1: Clinical presentation showing the patient with significant diffuse abdominal distension (ascites) prior to intervention.

given the history of only one previous abdominal catheter insertion.

Physical examination revealed significant abdominal distension, positive-shifting dullness, fluid thrill, a previously undetected umbilical hernia, and an abdominal circumference of 65 cm. Neurological examination revealed no new deficits beyond pre-existing right hemiparesis and developmental speech delay, which were attributed to the residual glioma.

A total abdominal ultrasonography revealed large-volume ascites without evidence of loculated fluid or other abnormalities. Doppler ultrasonography of the portal vein was unremarkable, ruling out portal hypertension. Computed tomography confirmed the presence of ascites with no additional anomalies (Figure 2). Paracentesis and subsequent ascitic fluid analysis revealed a high serum-ascites albumin gradient (SAAG) of 3.1, normal biochemical and microbiological markers, and the absence of neoplastic cells.

Figure 2: Axial Computed Tomography scan of the abdomen without contrast. The asterisks (*) indicate the distal catheter of the VPS floating freely. The arrows point to the homogeneous low-density fluid filling the peritoneal cavity, confirming massive ascites without loculation.

Treatment and Outcome

Given the recurrence of ascites 15 days after large-volume paracentesis (900 mL) and the exclusion of mechanical shunt failure or infection, the decision was made to convert the distal catheter. A peritoneovenous shunt was not considered due to the small caliber of the patient's vessels and the high risk of occlusion. Laparoscopy was deemed unnecessary as imaging did not suggest adhesions or pseudocysts (which would favor the possibility of changing the catheter place). Differently from a pseudocyst, all abdominal cavity contained fluid. Therefore, VPS was converted into a ventriculoatrial shunt (VAS). Intraoperative CSF analysis confirmed a high protein level (447 mg/dL) with no pleocytosis. Follow-up: At the 24-month follow-up, the abdominal distension had completely resolved with no recurrence of ascites. The patient remained neurologically stable, with no signs of shunt dysfunction, endocarditis, or glomerulonephritis associated with the atrial catheter.

DISCUSSION

Pathophysiology and clinical presentation

Aseptic ascites is a rare complication in patients with VPS[5–7]and is characterized by the diffuse accumulation of CSF within the peritoneal cavity without signs of infection. In aseptic ascites, the fluid is freely distributed throughout the abdominal cavity. This condition is typically associated with high protein levels in the CSF or altered peritoneal absorption of CSF, likely secondary to multiple surgeries, immune responses, or changes in the peritoneal environment[4]. Patients with aseptic ascites often present with vague symptoms such as abdominal distension without significant pain or signs of peritonitis. There are usually no systemic signs of infection, and laboratory results such as normal white blood cell counts, absence of fever, and negative microbial cultures support a non-infectious process. Biochemical analysis typically reveals a high SAAG[6], as observed in the present case, with a SAAG of 3.1.

The exact cause remains unclear, although various theories suggest immune responses to the shunt material, peritoneal fibrosis, elevated CSF protein levels, and increased CSF production as potential factors[5,6,9,10]. In patients with pilocytic astrocytoma, additional mechanisms, such as overproduction of CSF induced by the tumor and nonspecific inflammatory responses linked to the tumor tissue and shunt material, may be involved. These alterations may increase oncotic pressure and impair the peritoneal absorption of CSF [11]. Although a high SAAG typically suggests portal hypertension, in this context, it was attributed to the equilibration of high-protein CSF into the peritoneal cavity, as liver function and image tests were normal.

Differential Diagnosis

Diagnosis involves ruling out other causes, such as infections, liver disease, heart failure, and neoplastic processes, as demonstrated in this case. Pseudocysts are an important differential diagnosis. However, they differ significantly in terms of their clinical presentation, pathophysiology, and management. Differentiating these conditions is crucial for management. Pseudocysts are encapsulated fluid collections within the peritoneal cavity more frequently associated with shunt infections. They are often formed in response to bacterial contamination or an inflammatory process and are commonly linked to organisms such as Staphylococcus epidermidis or Streptococcus fecalis. Infected pseudocysts tend to present with signs of shunt malfunction, including fever, abdominal pain, and localized fluid collection, which can be detected on imaging as encapsulated cystic masses [1,4]. Although some pseudocysts may be sterile (aseptic pseudocysts), they differ from aseptic ascites because of the presence of an encapsulated fibrous wall, leading to localized dysfunction in the peritoneum[2]. Ultrasound is a widely available tool in clinical practice that can assist in differentiating between pseudocysts and ascites. In pseudocysts, ultrasound can visualize the capsule or loculated fluid, whereas in ascites, it is sensitive for detecting free fluid in the peritoneal cavity[2]. Table 1 summarizes the key differences.

Table 1. Comparison between Abdominal Pseudocyst and Aseptic Ascites in VP Shunts.

Feature	Abdominal pseudocyst	Aseptic ascites
Definition	Encapsulated CSF collection	Diffuse free intraperitoneal CSF
Infection	Common (often *S. epidermidis*)	Absent (Sterile)
Presentation	Palpable mass, abdominal pain, fever	Diffuse distension, painless, no fever
Ultrasound	Loculated fluid, membranes visible	Free fluid, shifting dullness
Pathophysiology	Inflammatory/Infectious walling-off	Malabsorption/High protein/Immune reaction

Management Strategies

Previous reports have provided insights into the various approaches to managing aseptic ascites related to VPS. Paracentesis is widely used as the initial diagnostic and symptomatic intervention. Dean and Keller (1972)[7] described repeated paracentesis to relieve respiratory distress caused by ascites prior to definitive conversion to a VAS. Similarly, Li et al. (2019) [6]performed paracentesis to remove large volumes of ascitic fluid; however, this alone did not resolve the condition, necessitating a peritoneovenous shunt (Denver shunt) as an alternative approach. In some cases, such as those reported by Gil et al. (2001) [9] and Mathew et al. (2022) [8], the diagnostic utility of paracentesis was insufficient, requiring laparotomy to confirm the diagnosis and assess underlying abdominal adhesions or inflammation, particularly when pseudocysts or other anatomical abnormalities were suspected.

Shunt externalization is a valuable interim strategy in patients with aseptic ascites. DiLuna et al. (2006)[3] reported externalizing the shunt to allow for drainage while stabilizing the patient, followed by conversion of the VPS to a VAS. Conversion to a VAS has been the definitive treatment in most reported cases [2,3,7]. These cases highlight the importance of individualized approaches depending on the patient's condition and the underlying etiology of the ascites.

In this case, the absence of infection, encapsulation, or other signs typical of pseudocysts, combined with high SAAG and imaging findings, led to the diagnosis of aseptic ascites. The patient's abdominal distension, without systemic signs of infection, and the normality of other biochemical parameters further supported this diagnosis. Successful resolution was achieved through VA shunt conversion, emphasizing the effectiveness of this approach when aseptic ascites is identified.

CONCLUSION

Aseptic ascites should be considered a diagnosis of exclusion in patients with VPS with abdominal distension. Conversion to a VAS is a safe and effective treatment option once other causes of ascites are ruled out. Continued research and reporting of such cases will enhance our understanding and management of this rare complication.

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DISCLOSURES

Ethical approval

This work is a retrospective analysis of a single clinical case and was conducted in accordance with the principles of the Declaration of Helsinki.

Consent to participate

The patients gave consent to use their information and images for research purposes.

Conflict of interest

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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Artificial intelligence

The authors affirm that no artificial intelligence tools were used in the writing, editing, or content generation of this manuscript. All work was conducted manually, based on thorough research and academic expertise.

CONTRIBUTIONS

Renato Colenci: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing.
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Marco Antônio Zanini: Project administration, Supervision, Validation, Visualization.
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