Abdominal Cerebrospinal Fluid Pseudocyst Diagnosed by Point-of-Care Ultrasound

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Abstract: Abdominal cerebrospinal fluid pseudocyst is an uncommon complication of ventriculoperitoneal shunt and is seen more commonly in the pediatric population. The diagnosis of an abdominal cerebrospinal fluid pseudocyst is typically made by ultrasonography, which demonstrates a simple or loculated fluid collection in the abdomen. We present a case of abdominal pseudocyst diagnosed by point-of-care ultrasound.

Key Words: pseudocyst, point-of-care ultrasound, hydrocephalus

CASE

A 2-year-old boy with myelomeningocele and a ventriculoperitoneal (VP) shunt secondary to hydrocephalus presented to the emergency department with a 3-day history of progressive abdominal distension. The parents denied vomiting, diarrhea, constipation, or abdominal pain. The child was afebrile, his heart rate was 114 beats per minute, respiratory rate was 24 breaths per minute, and blood pressure was 84/46 mm Hg. In general, he was awake and alert, in no acute distress, and interactive. His examination was remarkable only for a distended abdomen (Fig. 1), which was soft and nontender.

On the basis of the presence of shunted hydrocephalus combined with abdominal distension, there was suspicion for an abdominal cerebrospinal fluid (CSF) pseudocyst, and the pediatric emergency medicine fellow performed a point-of-care abdominal ultrasound (US), which confirmed the diagnosis. A subsequent radiology US noted the same findings. Neurosurgery was consulted, and the patient was admitted to the hospital for a presumed shunt infection and drainage of the pseudocyst. He was treated with antibiotics and had externalization of his VP shunt as well as evacuation of the abdominal CSF pseudocyst. Culture results of the pathology fluid specimen revealed no organisms.

ULTRASOUND FINDINGS

The point-of-care US, performed using a phased array probe (5–1 MHz), demonstrated a large anechoic fluid collection in the left and right lower quadrants with echogenic debris within the collection (Fig. 2). Radiology US showed similar findings as well as the tip of the linear, hyperechoic shunt catheter in the lower central part of the fluid collection (Fig. 3).

TECHNIQUE

The peritoneal cavity is best visualized with a low-frequency probe that allows for adequate penetration of the abdomen. The peritoneal cavity and many of its organs such as the liver, spleen, bladder, and kidneys are well visualized with US. Fluid in the abdomen serves as an excellent medium for transmission of US waves and therefore can be used to improve the visualization of other organs (eg, the bladder is used as an acoustic window to evaluate the ovaries).

When scanning the abdominal cavity, it is recommended to use the same technique consistently and investigate each quadrant of the abdomen in a systematic manner.

The sonologist should scan each area/quadrant of the abdomen, and once pathology is noted, the area must be interrogated further and evaluated in 2 orthogonal planes. It is important to note that a small amount of peritoneal fluid is expected in any patient with normally functioning VP shunt; however, large amount of fluid should raise the suspicion for a pathological condition such as a CSF pseudocyst.

REVIEW OF LITERATURE

Abdominal CSF pseudocyst is a well-documented yet rare complication of VP shunts. Its incidence in the literature varies from less than 1% to 4.5% of patients with VP shunts and is more common in children. The clinical presentation of abdominal CSF pseudocyst varies greatly; however, the most common signs and symptoms include abdominal pain, distention, tenderness, and/or a palpable mass, with or without signs and symptoms of increased intracranial pressure. Some children may present solely with signs of shunt malfunction or infection such as headache and fever. There may or may not be radiographic changes to ventricular volume, depending on the case. Management involves treatment for potential infection and externalization of the VP shunt with or without additional drainage of the cyst.

The evaluation of an abdominal CSF pseudocyst is usually made by ultrasonography. Before the introduction of US, many cases of abdominal CSF pseudocyst were only diagnosed at the time of laparotomy. Several small case studies have demonstrated abdominal US to be an accurate and rapid method of diagnosis of abdominal CSF pseudocyst. In 1 case series of 5 patients, abdominal CSF pseudocyst was confirmed by US in all 5 patients including 2 patients who had very small, nonpalpable cysts measuring only 30 and 60 cc in volume.

As mentioned previously, it is important for sonologists to...
note that many patients with VP shunts will have abdominal fluid noted sonographically, by virtue of the normal CSF drainage from the distal catheter tip. A study by Egelhoff et al\(^4\) evaluated the sonographic features of 10 abdominal CSF pseudocysts and compared them with 10 control patients with VP shunts undergoing sonographic evaluation for genitourinary complaints. Those with a normally functioning shunt had small to no peritoneal fluid present. By comparison, those with an abdominal pseudocyst had larger, localized, and either a simple or loculated fluid collection. Any fluid collection within the abdomen will appear as an anechoic or hypoechoic area. However, by comparison, ascitic fluid will be surrounded by the normal structures of the abdomen, such as the liver, spleen, bowel, and uterus, whereas an abdominal pseudocyst will be surrounded by a membrane of fibrous tissue and may be loculated.\(^6\) There are even specific sonographic characteristics that can help differentiate between noninfected and infected pseudocyst. A noninfected pseudocyst will often appear as a well-defined hyperechoic mass without septations, whereas an infected pseudocyst will demonstrate a mixture of an echoes or even an air fluid level.\(^7\) In addition, in the case of abdominal CSF pseudocyst, the tip of the VP shunt catheter is often visible within the collection. This will appear as a linear, hyperechoic structure within the fluid collection as shown in Figure 3.

**CONCLUSIONS**

Abdominal CSF pseudocyst is an uncommon yet serious complication of VP shunt malfunction. Abdominal US can assist in the diagnosis, which should be suspected in any patient with a VP shunt who presents with abdominal complaints or symptoms of a distal shunt malfunction. All children with suspected distal shunt failure should be evaluated for an abdominal pseudocyst. Point-of-care US may be used to facilitate the diagnosis in suspected patients.

**REFERENCES**