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CASE REPORT

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Intestinal obstruction and necrosis as a complication of a ventriculoperitoneal shunt in a child undergoing surgery for ileus

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Abstract

A 3, 5-years-old girl was being followed for prenatal intraventricular hemorrhage and hydrocephalus. A ventriculoperitoneal shunt had been placed to treat progressive hydrocephalus 1 year after cesarean delivery. The shunt was revised 2 years later due to shunt dysfunction. Six months later, wound revision was performed at our hospital due to the presence of discharge from the cranial tip wound. The patient wasplaced on antibiotic therapy. One week later she was admitted with intermittent vomiting. Physicalexamination revealed right lower quadrant tenderness. Standing abdominal x-ray and abdominal ultrasound showed free fluid in the abdomen and intestinal wall thickening. Preliminary diagnosis was ileus and the patient underwent emergency surgery by a pediatric surgeon. During surgery, the catheter was observed to revolve around the jejunal segment like a cuff, disrupting intestinal nutrition and causing necrosis. The necrotic intestine was resected and end-to-end anastomosis was performed. Recovery was uneventful and she began oral feeding 5 days postoperatively. Abdominal complications of a ventriculoperitoneal shunt should be considered in the differential diagnosis in a child with a VPS who presents to the hospital with abdominal pathology.

Keywords: Abdominal complication, hydrocephalus, pediatrics, ventriculoperitoneal shunt.

Introduction

Ventriculoperitoneal Shunt (VPS) placement is a common procedure performed worldwide, and is the gold standard treatment for hydrocephalus [1]. Although VPS implantation is an effective, widely used technique, high complication rates are significant and affect follow-up and treatment. Cranial complications of VPS are more common than abdominal complications, with the latter incidence ranging from 5% to 47% [2, 3]. Abdominal complications may occur due to increased intraabdominal pressure, shunt inefficiency, or surgical error. Intestinal necrosis due to knotting of the abdominal end of the VPS is a very rare abdominal complication. Early diagnosis and treatment can significantly reduce morbidity and mortality, especially in such rare cases. Therefore, neurosurgeons and pediatric surgeons should consider VPS abdominal complications in cases of obstruction. We describe a case of intestinal obstruction in a child with a VPS.

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Case Report

A 3, 5-years-old girl with a right occipital VPS was evaluated in the emergency room due to the presence of wound inflammation compatible with the shunt cranial tip. At neurological examination, the patient was stable and awake, and pupils were isochoric. She had no fever or neck stiffness. İnfection markers were negative. The patient had undergone two VPS placements at an outside facility. In the first, the VPS was placed to prevent progressive hydrocephalus secondary to prenatal hemorrhage when the patient was 1 year old. The VPS was revised at the second procedure 6 months ago due to shunt dysfunction. The patient had had a rash and inflammation at the wound site for 6 months. She presented to the emergency room with wound dehiscence and underwent wound revision. Antibiotic therapy was started. There was no problem postoperatively. One week postoperatively, the wound was clean, her shunt was working, and her neurologic examination was stable.

At two weeks postoperatively, the patient presented with complaints of abdominal swelling, occasional bilious vomiting, and constipation. Preliminary diagnosis was ileus and she was

hospitalized in the pediatric intensive care unit. The patient was awake, pupils were isochoric, and her extremities were in motion. The VPS dome was working. There was no neck stiffness and no rebound distension on abdominal examination. However, she could not take oral feeds and her lips appeared dry and dehydrated. Standing direct abdominal x-ray revealed an ileus-like air-fluid level [Figure 1A]. Ultrasound showed free fluid in the abdomen [Figure 1B]. Pediatric Surgery was consulted and abdominal examination also revealed a swollen abdomen with a palpable sign of peritonitis.

The patient had a preliminary diagnosis of ileus and underwent emergency surgery. With the patient under general anesthesia, the abdomen was incised over the right paramedian incision scar. Liquid was aspirated after sampling the serous and hemorrhagic free fluid. The abdominal end of the shunt was noted to be wrapped around the intestinal jejunal segment like a cuff, thus disrupting feeding [Figure 2A]. There was a 60 cm necrotic segment of jejunal intestine approximately 80 cm distal from the ligament of Treitz [Figure 2B]. The intestines were released thefrom shunt. The abdominal adhesions were opened, the necrotic intestine was excised, and end-to-end anastomosis was performed with 4-0 Vicryl. After the anastomosis was strengthened, the anastomosis line was placed in the abdomen. A drain was placed in the surgical cavity. The abdominal VPS tip was removed from the abdomen. Layers were closed according to the anatomy. The abdominal and cranial ends of the VPS catheter were removed by Neurosurgery and an external ventricular drain was inserted from the right Frazier point.

Convalescence was uneventful and the patient started oral feeding 5 days postoperatively. The patient was in stable condition, with improved clinical status postoperatively.

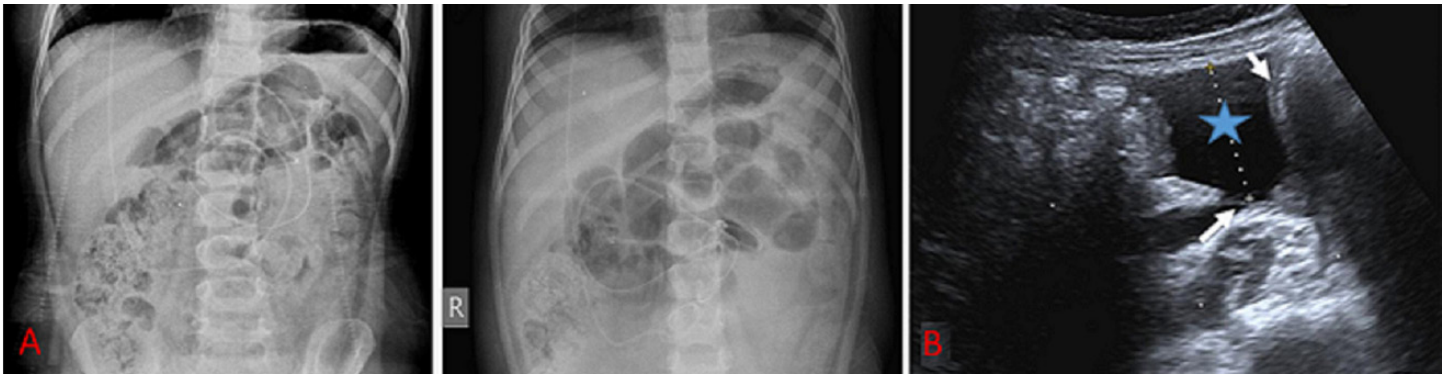

Figure 1. Standing direct abdominal x-ray shows dilatation of the bowel loops and intestinal obstruction compatible with air-fluid levels, with the VPS catheter bending around the bowel loops more prominently in the left upper quadrant.1B. Abdominal ultrasonography shows thickening (arrow), free fluid (star), and edemathickening (arrowheads) on the peritoneal wall due to peritonitis.

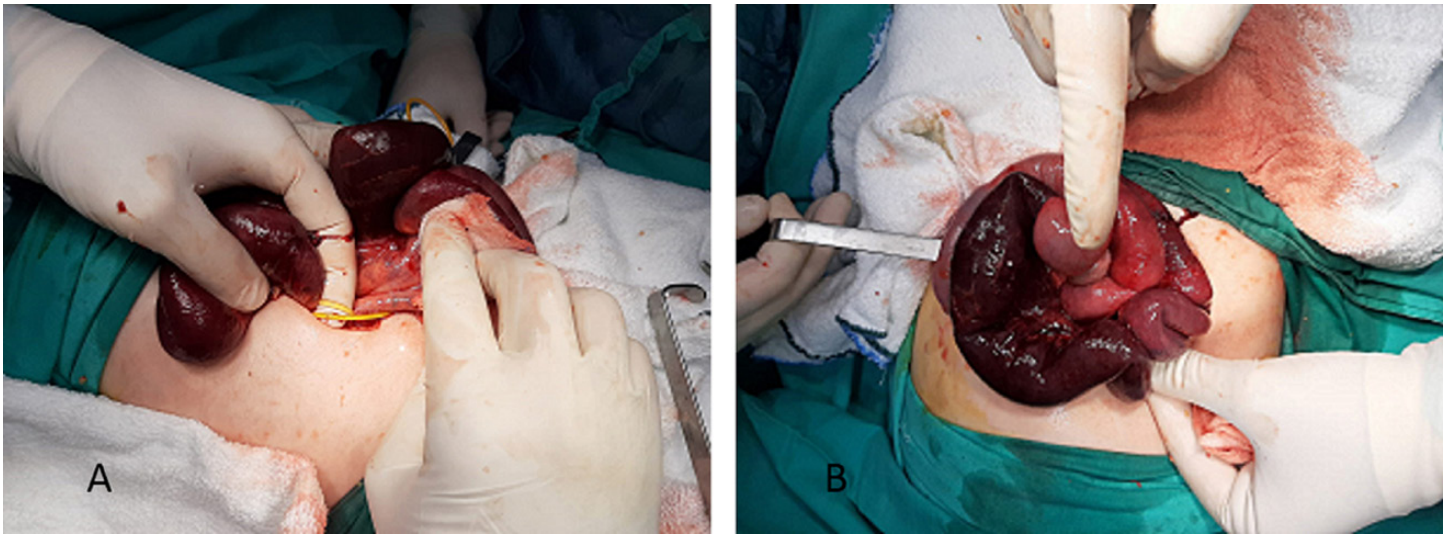

Figure 2. A-Image shows that the intraoperative VPS abdominal tip is knotted around the intestine. B-Intestinal necrosis detected as an intraoperative VPS abdominal complication.

Discussion

Hydrocephalus is a common central nervous system anomaly in children and its etiology may include blockage of cerebrospinal fluid (CSF) flow, excessive CSF production, or damaged absorption of CSF [3-5]. For treatment of hydrocephalus the cranial tip of the VPS is placed in the cerebral ventricle and the abdominal tip is located inside the peritoneum. Distal and proximal catheters are connected to each other with the shunt dome [6]. Although VPS complications are common, abdominal complications are rare and

the literature has described volvulus; peritonitis; acid; intestine, bladder, gallbladder, and vagina perforation; and distal catheter migration through peritoneal cysts and the intestinal tract, navel, scrotum, or vagina [6-8]. It has been stated in many articles that shunt complications usually occur within the first 6 months after the operation and are mostly related to mechanical occlusion and infection; Pradyumna Pan, in her analysis of 137 patients, gave this rate as 67.56% were mechanical, and 16.2% were infective complications [9, 10]. Intestinal ischemia and necrosis due to strangulation of the intestines by the VPS abdominal tip is quite rare, even among abdominal complications [9-11]. A complication with such a low incidence is a problem because its mechanism is not fully understood. When risk factors are evaluated in the literature, theses have been presented that a longer abdominal catheter, one with a smaller diameter or greater flexibility, a crowded abdominal cavity, and strong intestinal peristalsis may be potential risk factors for spontaneous formation of a node in the peritoneal catheter [1, 2]. Remarkably, almost all cases in the literature review related to intestinal obstruction following VPS were in children [12, 13]. In an interesting experiment, Raymer and Smith [14] placed a piece of string in a rotating cubic box and observed, by changing the properties of the string in the cube, that the probability of spontaneous knotting would increase with the increase in length and flexible structure of the string and the number of rotations while the rotation speed was decreased [14, 15]. Although it is a simple experiment, these data are important, as they illustrate a complication in which the mechanism is not fully understood. In fact, umbilical cord entanglement was explained using a similar mechanism and in retrospective studies, a long umbilical cord and multiparity (larger uterine volume) were considered high risk factors. Some studies have reported that especially in infants spontaneous knotting can be prevented by keeping the abdominal catheter tip shorter, even if this has not been proven [15].

In the pediatric hydrocephalus population, open minilaparotomy, trocar insertion and laparoscopic insertion routes are used for peritoneal end placement of the shunt. In our clinic, the placement of the shunt abdominal tip to the peritoneum is performed by neurosurgeons with open minilaporotomy. The role of the technique in placing the shunt andominal tip into the peritoneum was questioned. Although there have been experiments with peritoneal catheter placement, this issue remains unclear, but the authors emphasize that pediatric surgery colleagues should be consulted for laparoscopic shunt peritoneal catheter placement in patients at high risk of intraperitoneal adhesion [16].

The question of whether intestinal obstruction due to spontaneous knotting of the shunt can be especially secondary to VPS revisions and to abdominal adhesions has been raised frequently in the literature. While adhesions are expected to have greater roles in intestinal occlusion due to shunt knotting, it is interesting that only one case with this etiology appears in the literature to our knowledge [17].

Intestinal obstruction due to spontaneous knotting of the shunt may not always be symptomatic. It should be noted that the intestinal obstruction also may be partial. In such a case, the patient may be asymptomatic or may have nonspecific abdominal disorders. The most common cause of partial bowel obstruction is believed to be infection [18]. In such patients, follow-up with palliative treatment may be the first option. During laparoscopic abdominal examination, it was emphasized that a large percentage of patients would improve during follow-up with palliative treatment, since intestinal necrosis did not develop in such patients. Likewise, when VPS abdominal complications are suspected, laparoscopic examination may be considered as a step for treatment if the patient has no acute abdominal signs [2, 19]. In our case, laparoscopic examination was not required due to the peritonitis findings discovered during evaluation by our pediatric surgeons and radiologists. The rapid surgical treatment allowed for excision of the necrotic area without spreading it much more and for repair with anastomosis of the remaining intestines. In our case, we again emphasize that rapid treatment is important when intervening for shunt complications.

The literature has emphasized that delay in the diagnosis and treatment of abdominal end shunt dysfunctions is the main risk for development of intestinal necrosis. Therefore, even in the case of standard shunt dysfunctions, consideration of abdominal complications, especially knotting of the shunt, is very important [7, 20].

Conclusion

VPS complications are seen more frequently in children because children require this treatment more often. It is noteworthy that almost all cases in the literature are pediatric, especially where abdominal complications are concerned. İntestinal necrosis due to knotting of the abdominal tip is a rare abdominal complication of VPS. The main factor in the treatment of this complication is time, and the time from diagnosis to treatment is very important. More experience means more information, so it is inevitable that case reports related to rare complications such as ours will contribute to the literature.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
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Patient informed consent
Written informed consent was obtained from study participant

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