Complications of ventriculoperitoneal shunt in hydrocephalic children: a case report and a review of the literature

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This case study was carried out to focus on three unusual cases of complications in hydrocephalic children with ventriculoperitoneal shunts (VPSs) – namely, intestinal obstruction and protrusions of the shunt catheters into the right hemiscrotum. These children were treated at the Department of Pediatric Surgery, Dr. Behçet Uz Children's Hospital, and at the Department of Neurosurgery, Tepecik Training Hospital. Management of these patients with special emphasis on the literature pertaining to the migration of shunt catheters into the scrotum is reviewed and discussed. Complications of intestinal obstruction and protrusion of the VPS catheters into the scrotum are rarely seen in hydrocephalic children with VPSs. Early identification of these complications is recommended as they may cause life-threatening acute abdominoscrotal conditions, and prompt surgical intervention is necessary not only for immediate treatment of the child but also to ensure good quality of the patient's life in the long term. *Ann Pediatr Surg* 10:50–53 © 2014 Annals of Pediatric Surgery.

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Introduction

A ventriculoperitoneal shunt (VPS) is the most common operative technique used to treat hydrocephalic children for the relief of increased intracranial pressure. High rates of various complications have been reported, ranging from 5 to 47% [1,2]. Among these, abdominal complications account for ~25% [3]. It is reported that the occurrence of a complication involving the intraperitoneal end of the catheter must be considered an emergency as it may cause intracranial hypertension [1,4]. Three cases with unusual complications due to VPSs are presented and discussed with special emphasis on relevant literature on the migration of shunt catheter into the scrotum.

Case 1

An 8-month-old boy was admitted to our department because of refusal to eat and bilious vomiting. At the age of 2 months, apart from meningocele repair, he was operated upon for insertion of a VPS catheter because of the presence of hydrocephalus. Concomitant right inguinal hernia repair was also performed. He was doing well until 3 days before admission when his parents noticed abdominal distention, inability to defecate, and bilious vomiting. On examination, abdominal distention with no signs of peritoneal irritation, scoliosis, and incisional scars related to previous surgical interventions on the right inguinal and lumber regions were found. His laboratory tests were unremarkable. Plain radiographic films and abdominal ultrasound (US) showed distended bowel loops with air–fluid levels and left renal agenesis. The peritoneal portion of the shunt catheter was found to be coiled around the proximal ileal intestinal loops causing complete intestinal obstruction (Fig. 1). On laparotomy, a VPS catheter was found to be twisted around the intestinal loops causing obstruction, with dense adhesions between the intestinal segments. Adhesiolysis, repositioning the shunt catheter in the abdomen with incidental appendectomy, was performed. His postoperative course was uneventful and he was discharged in good health.

Case 2

A 4-year-old boy was admitted with an enlarged left scrotal sac of 5 days' duration. At the age of 2 months he was operated upon for insertion of a VPS catheter because of the presence of hydrocephalus. His physical examination was unremarkable except for a left scrotal enlargement. The catheter was palpated throughout its course in the inguinoscrotal region. Plain abdominopelvic radiograph showed the distal tip of the catheter to be located in the scrotum (Fig. 2). Under general anesthesia through an incision in the groin the catheter was exposed and repositioned into the abdomen, and inguinal herniorrhaphy was performed. Eight years after the initial operation, the distal part of the VPS catheter was lengthened by the neurosurgeon because of growth of the patient. He is doing well 10 years after the initial operation with his shunt catheter working well.

Case 3

A 2-month-old boy was admitted with right scrotal enlargement of 5 days' duration. At the age of 6 days he was operated upon for myelodysplasia and a VPS catheter was inserted. His weight and height were below the third percentile. The catheter was easily palpated in the inguinoscrotal region and scrotal US imaging showed the catheter to be located in the right hemiscrotum. During inguinal exploration the catheter was exposed and repositioned into the abdomen and standard hernia repair was performed (Fig. 3).

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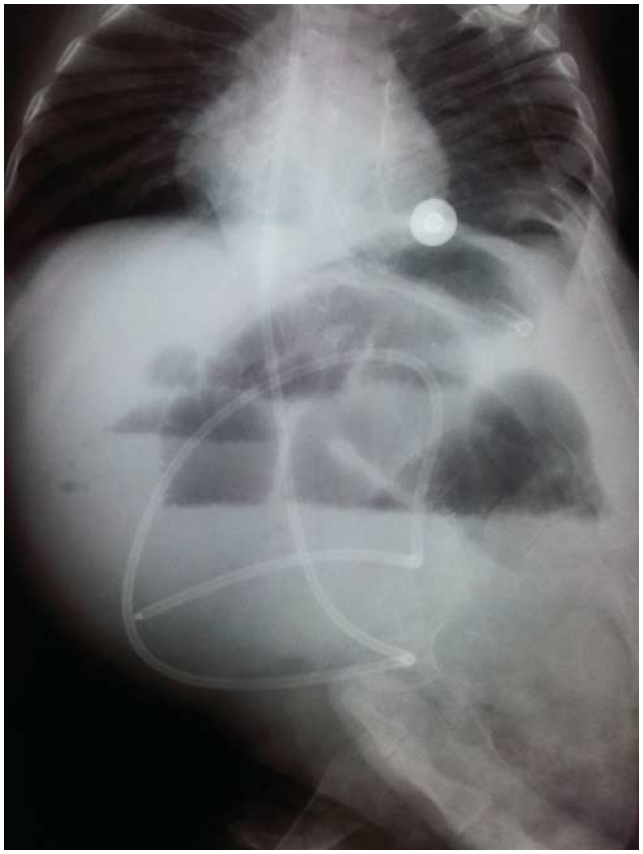
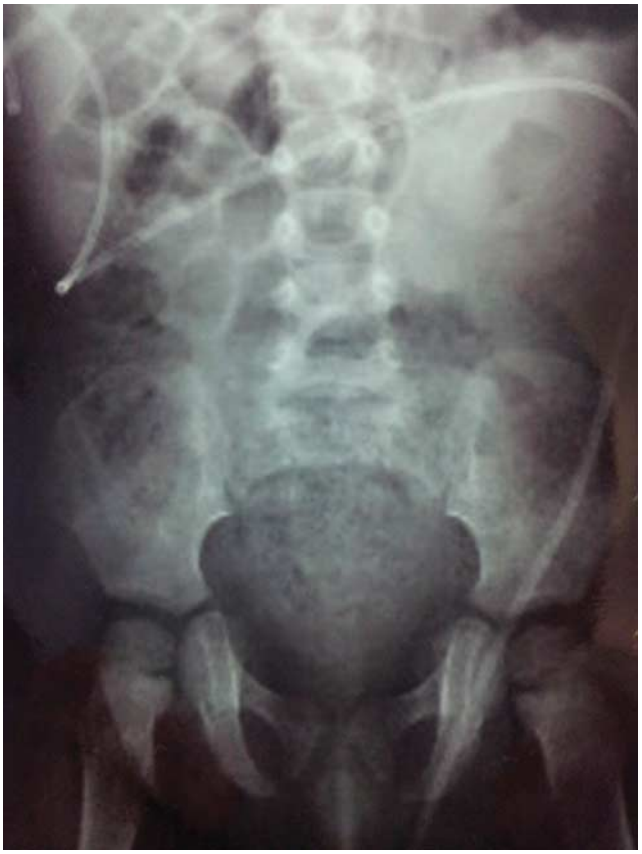
Fig. 1



Radiograph of the abdomen showing distended bowel loops with air–fluid levels and a coiled shunt catheter.

Fig. 2

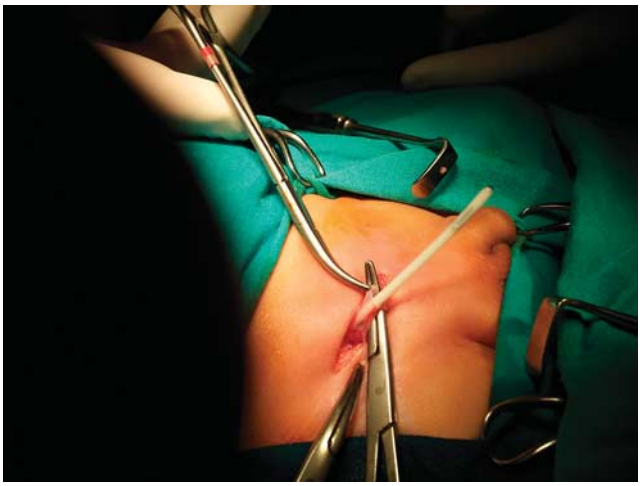


Plain abdominopelvic radiograph showing the distal tip of the catheter to be located in the scrotum.

Discussion

The diversion of cerebrospinal fluid using VPS is commonly employed in the management of hydrocephalus. It is often followed by various complications with a reported incidence of up to 47% [1,2], although it is suggested that shunt failure rates of only about 5% or less per year be considered reasonable [5]. The patient's medical history has an important role in the diagnosis of catheter malfunction. A child with a VPS who develops signs or symptoms of increased intracranial pressure must be carefully examined. After clinical evaluation, a computed tomography of the brain to assess change in ventricular size and a shunt survey to exclude extracranial VPS complications are usually included in the radiographic workup. Although computed tomography of the brain showed no change in the ventricular sizes of our patients, the plain radiographic film and abdominal US showed distended bowel loops with the shunt catheter coiled around intestinal loops; the scrotal US revealed the catheter to be located in the right hemiscrotum. The shunt survey consists of anteroposterior and lateral views of the head and neck plus an anteroposterior view of the chest and abdomen. Additional views may be necessary to view the segments of the shunt that are not clearly seen on the standard views.

Fig. 3



Operative view of case 3. Note the hernial sac opened with the shunt catheter inside.

The most common complications of VPS are the abdominal complications that involve blockage of the system at the peritoneal end by the omentum or development of a fibrous scar over the end of the catheter tip [6–9]. Intestinal obstruction is one of the less common abdominal complications, and the proposed mechanism of intestinal obstruction may be the high mobility of the peritoneal end of the shunt catheter

inside the abdomen as well as the anatomical characteristics of the abdominal cavity itself [10]. Whatever the exact mechanism, once diagnosed, prompt surgical intervention to overcome the obstruction is necessary.

Laparotomy remains the standard approach in the treatment of intestinal obstruction. Recent trends in surgical management of these complications include laparoscopic intervention, which is a safe option. It allows the inspection of the whole abdominal cavity and associated pathology. In a meta-analysis, laparoscopic adhesiolysis has been found to be advantageous in most of the analyzed outcomes [11]. The sole restrictive characteristic of laparoscopic treatment is that it requires experienced laparoscopic surgeons. Nevertheless, there is an increase in the utilization of laparoscopy in the treatment of these complications [12].

Incidental appendectomy has been widely practiced by different surgical specialties during the course of abdominal surgery in patients who are prone to acute appendicitis in the future. The main objective of the procedure is to prevent future appendicitis, thus reducing the mortality, morbidity, and cost of this very common acute surgical emergency [13]. In contrast, the use of an isolated appendix as an intermittent catheterization route to empty a continent urinary reservoir has been recommended for future treatment in patients with myelodysplasia [14]. Although incidental appendectomy on a VPS might be a risk to the patient, short vascular supply together with retrocecal and subhepatic location of the appendix, which might render a future Mitrofanoff procedure infeasible in our patient, prompted us to perform incidental appendectomy to prevent the occurrence of future appendicitis and related complications.

Inguinal hernia and/or hydrocele may follow the insertion of a VPS, with a frequency ranging from 3.8 to 16.8% and occurring at various time periods after the operation [15]. Extrusion of the abdominal catheter into the inguinoscrotal region through a patent processus vaginalis (PPV) has been rarely reported in the English literature [16–24]. Standard hernia repair with repositioning of the shunt catheter into the abdominal cavity seems to be the most effective therapeutic modality and the preferred choice in the majority of patients with migration of the VPS catheter into the scrotum through a patent PPV. Inadequate or loose fixation of the catheters, an unobliterated PPV, repeated traction of the peritoneal catheter, and increased abdominal pressure are the main factors in patients with shunt migration inside the scrotum [10,22]. It is suggested that the migration of the peritoneal catheters into the scrotum in our patients was probably due to a patent PPV combined with the additive effect of increased abdominal pressure, and classical hernia repair with repositioning of the catheter into the abdominal cavity resolved the problem. Scrotal location of the VPS catheter in children may be an incidental finding requiring elective hernia repair, as in our case. However, once combined with signs of increased intracranial pressure, after other reasons for increased intracranial pressure have been ruled out and as there is increased risk for incarceration in infancy, an emergency surgical repair of the hernia with release of the entrapped catheter into the abdominal cavity becomes a matter of necessity rather than of choice.

There are conflicting reports as regards routine contralateral groin exploration in the complications of inguinal hernia. Earlier reports have recommended that the contralateral side be explored in case of a clinical unilateral hernia [25]. The value of contralateral groin exploration in premature neonates has been found to be doubtful [26]. There are also reports that routine contralateral groin exploration is not indicated in any situation [27]. A patent PPV is usually present in over 35% of cases seen in the literature, whereas the occurrence of a contralateral hernia is usually seen in less than 15% of cases [28]. Therefore, routine contralateral inguinal exploration does not seem justified.

Incidence of inguinal hernia development after insertion of a VPS has been reported in 14 and 20% of children who developed an incarceration; it is recommended that after VPS insertion these infants be closely watched for the development of a clinical inguinal hernia [4,29]. After diagnosis of a hernia, prompt surgical intervention including contralateral side exploration has also been recommended [4,29]. In another report, the incidence of subsequent inguinal hernia development closely paralleled the age at which the shunt was performed, falling sharply to 10% at age 1 year [15]. Although contralateral inguinal exploration has been recommended, contralateral side exploration was not performed in our case as the patient was being followed up in both the neurosurgery and pediatric surgery team and the patient's parents had high active collaboration with the medical team regarding the future probable development of an inguinal hernia.

Complications of intestinal obstruction and protrusion of the VPS catheter into the scrotum are rarely seen in children with hydrocephalus treated with cerebrospinal fluid diversion using VPSs. Early identification and management of these uncommon complications is recommended as they may cause life-threatening acute abdominoscrotal complications. In the case of occurrence, prompt surgical intervention is also recommended, not only to treat the child but also to ensure good quality of the patient's life in the long term.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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