Extrusion of Ventricular-Peritoneal Shunt through the Urethra: Pediatric Case Report and Literature Review

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Abstract

Ventricular-peritoneal shunts are commonly used to treat hydrocephalus, but carry the risk of complications including perforation of abdominal viscera. Bladder perforation by the distal shunt may present with urinary symptoms uncommonly seen in children, raising the clinical suspicion of this rare phenomenon. Even less commonly, this complication can result in extrusion of the distal catheter through the urethra, which has only previously been reported four times in males. In this paper, we discuss the existing literature and present the youngest male case (2 years old) of ventricular-peritoneal shunt bladder perforation with urethral extrusion. Following, we review the existing literature using a systematic search of PUBMED and MEDLINE.

Keywords: Ventricular-peritoneal shunt (V-P); Cerebral spinal fluid (CSF) shunt; Shunt migration; Foreign body migration; Shunt complications

Introduction

The surgical insertion of a ventricular-peritoneal (V-P) shunt is the most common method of treatment for hydrocephalus [1]. V-P shunts allow cerebrospinal fluid to drain via a catheter into the peritoneal cavity. The most commonly reported complications of V-P shunts include shunt obstruction and infections such as intra-abdominal abscess or bacterial meningitis [2]. The percentage of abdominal complications associated with V-P shunts has been reported to range from 5% to 47%, and include formation of peritoneal pseudocysts, formation of incisional hernias, and subcutaneous collection of cerebrospinal fluid (CSF) [1]. Migration of the distal catheter infrequently results in perforation of both solid and hollow viscera. Extrusion of catheters through the mouth, anus, umbilicus, scrotum, and vagina has been reported in the literature [3-8]. However, migration of the distal V-P shunt and perforation of the bladder, in particular, is uncommon. Anatomically, the bladder poses a difficult target for the distal shunt, as the catheter would have to either pass through the peritoneum and into the extra-peritoneal space before reaching the wall of the bladder, or penetrate the peritoneal lining directly adjacent to the bladder dome thus entering the bladder lumen [9]. The case presented in this paper is the youngest male case of bladder perforation presenting with urethral extrusion. This represents an uncomplicated case occurring in a patient with a normal bladder.

Case Presentation

We report a two-year-old boy with a history of surgical resection of a posterior fossa medulloblastoma and left V-P shunt placement in 2008. Eight months after placement of the V-P shunt, the boy presented to the IWK Hospital in Halifax, Nova Scotia, after his mother discovered a tube extruding from his urethra, concerned that the infant had inserted the tube himself. Closer examination at the hospital revealed it was, in fact, the peritoneal portion of his V-P shunt extruding through his urethra (Figure 1).

The patient’s vital signs were stable. Physical examination revealed no other findings. Urinalysis was normal. A radiographic shunt study including X-ray of the skull, chest, and abdomen revealed the V-P shunt to be continuous and followed the route of the left pelvic ureter (Figure 2). Perforation of the bladder was noted. No evidence of bowel obstruction, free air, or fluid was found. Renal ultrasound revealed no evidence of perforation of the kidneys by the V-P shunt. No evidence of hydronephrosis, hydrourетer, urinary ascites, perirenal, or perivesicle fluid collection was observed. However, ultrasonography of the bladder revealed the presence of a tubular structure within its lumen (Figure 3). At the time of presentation, the V-P shunt was believed to be non-functional and was surgically removed without complication on the same day. A Foley catheter was inserted at the
time of shunt removal to prevent bladder distension and to allow healing at the site of bladder wall perforation. The Foley catheter was removed on post-operative day five after which the patient was able to void normally on his own. The patient was discharged from hospital in stable condition on post-operative day six.

Methods

A literature search was performed using MEDLINE and PubMed using the keywords “ventricular-peritoneal shunt”, “ventriculoperitoneal shunt”, “cerebrospinal fluid shunt”, “bladder perforation”, and “migration”. A second manual search through references from selected articles provided additional sources, completing the search.

Discussion

We found a total of 25 cases of V-P shunt with bladder perforation reported in 21 different articles in the literature [9-25]. Of the 25 cases, 22 reported the age of the patient, which ranged from 8 days [26] to 82 years [22], with the majority (19/22) occurring in children aged 16 or younger. This may be primarily due to the fact that V-P shunts are more prevalent in this age group as hydrocephalus commonly occurs with congenital spinal and neural tube defects [27]. Furthermore, these defects are often associated with neurogenic bladder, requiring augmentation. Bladder perforation by V-P shunt can occur in both augmented bladders and normal bladders.

Through our literature search, we found only twelve cases described to present with urethral extrusion of the distal catheter [9,12,13,16-19,21-23,26,27]. From these cases, urethral extrusion appears to preferentially effect females, presenting at a male to female ratio of 1:2. It is possible that this is due to the anatomical differences between sexes, predisposing females with shorter, straighter urethras to extrusion.

Cases without extrusion presented clinically with urinary symptoms including at least one of dysuria, urgency, retention, and lower abdominal pain. Acute bladder perforation is likely to present with a degree of hematuria, but interestingly, the present case demonstrated normal urinalysis. It is possible that the perforation of the bladder occurred sometime before extrusion, allowing adequate healing to occur before presentation to the emergency department upon extrusion of the distal catheter.

The present case represents an occurrence of a bladder perforation by distal V-P shunt with no additional pathology. However, bladder perforation can present concurrently with local complications such as bladder calculi [2,11,20], or even meningitis as a result of bacterial ascent to the proximal V-P shunt [26]. Rarely, it has been documented to occur with knotting of the distal shunt, requiring a more complicated procedure of removal due to the inability to remove the shunt atraumatically from the urethra [9,16]. Knotting of the catheter has been hypothesized to be due to retained memory by the shunt material of the packaged shape [28].

Migration of the distal V-P shunt is not well understood, but has been suggested to be the result of inflammatory reactions within the peritoneal cavity due to interactions between the shunt apparatus, the CSF contents, and the peritoneal membrane as a foreign body response is initiated [29]. In addition, bowel peristalsis, increased intra-abdominal pressure from inspiration, expiration, and vasaalva effects, and CSF pulsations may also factor into friction effects that lead to visceral involvement [16,23]. The resultant inflammatory reactions can then lead to fixation of the distal V-P shunt, progressing to erosion of the visceral or abdominal wall, finally resulting in complications such as perforation, local abscess formation, and shunt obstruction [26]. Prasad et al. described the first reported case of urethral extrusion following bladder perforation of the distal V-P shunt, postulating a mechanism for this complication. They propose four events to occur: fixation (as described earlier to involve inflammatory reactions), penetration, perforation, entry into the urethra, and finally extrusion [19]. It is unclear how long this process takes in vivo. There has been a variable amount of time reported from the initial placement of the shunt to the presentation of bladder involvement ranging from three months to twelve years, with the exception of one case that presented after one day [26]. However, the latter case is more likely to have been caused iatrogenically at surgical insertion with a trocar. It is likely that perforation of the bladder can
occur and remain asymptomatic for some time before presenting to clinic.

In terms of prevention, it has been recommended that the length of the V-P shunt be taken into consideration and controlled to reduce the degree of unnecessary rubbing that may be contributing to migration complications [2,12]. In addition, the material of the shunt should be considered, as the previously mentioned memory-retaining properties of the shunt may increase the risk of coiling, knotting, and friction in general within the peritoneal cavity. Finally, careful surgical placement of the shunt if a trocar is used is imperative to avoid direct perforation of any visceral organs leading to acute complications. Having patients empty their bladder prior to the procedure, particularly toddlers with smaller intra-abdominal compartments, is recommended. Fortunately, the present case had a positive outcome with no further complaints related to the bladder perforation and extrusion of the shunt. This is in agreement with the general outcome reported in the literature. However, due to the fact that this complication requires surgical management and can progress to serious additional shunt-related morbidity, it is important for physicians treating patients with V-P shunts to be aware of this rare complication and monitor for urinary symptoms that may represent early indicators of urogenital involvement.

References