Migration of the distal catheter of the ventriculoperitoneal shunt in hydrocephalus patients

Mohammed Z. Allouh, DDS, PhD, Mohammed M. Al Barbarawi, MD, CHSM, Mohammed H. Hiasat, MBBS, CHSM, Bashar A. Abuzayed, MD.

ABSTRACT

Ventriculoperitoneal shunt (VPS) installation is a widely used method in hydrocephalus treatment. However, it is associated with a number of complications relating to the proximal and distal ends of the shunt, with complications at the distal end occurring more frequently. Distal abdominal complications may include obstruction, disconnection, pseudocyst formation, peritonitis, hydroceles, and catheter migration. Kanojia et al. reported that the incidence of distal VPS migration accounts for approximately 10% of all VPS complications. Distal VPS migration can have different presentations. The catheter may penetrate through hollow viscera (e.g., the heart, intestine, stomach, and urinary bladder). It may also penetrate through an intact or a potential weakness (e.g., the inguinal canal or umbilicus) in the abdominal wall, or through the gastrointestinal tract to exit either transorally or transanally. In general, distal VPS migration usually remains asymptomatic for a prolonged period. However, it may be exacerbated by the presence of co-infections that can be life threatening. The most common complications associated with distal VPS migration are meningitis and ventriculitis.

Herein, we present a case of spontaneous extrusion of the distal VPS catheter through the intact abdominal wall at an area unrelated to the surgical incision. Both clinical and radiological findings along with

Disclosure. The authors declare no conflicting interests, support or funding from any drug company.
the treatment regimens are discussed. In addition, we reviewed similar cases in the literature in order to improve the understanding and management of this complication.

**Case Report. History and presentation.** A 5-year-old boy, with a previous VPS insertion and Apert syndrome, presented with spontaneous complete extrusion of the distal end of a VPS catheter through the intact abdominal wall (Figure 1). At 1-month of age, the patient underwent a VPS installation for congenital hydrocephalus. His medical record showed no previous shunt revisions were conducted until presentation. On admission, he was conscious and had no neurological deficits. Physical examination revealed an old scar in the right subcostal region due to the previous VPS insertion. The distal peritoneal catheter protruded from the left paraumbilical region of the abdominal wall.

**Laboratory findings and treatment intervention.** Laboratory findings were essentially within normal limits. The cerebrospinal fluid (CSF) culture was negative and an abdominal computed tomography (CT) scan did not reveal any intra-abdominal pathology. A prophylactic antibiotic regimen that consisted of ceftriaxone (50 mg/kg twice daily) and vancomycin (15 mg/kg twice daily) was commenced 24 hours prior to surgical replacement of the shunt. The entire shunt system was replaced with a Strata® VPS. The distal peritoneal catheter was found to be adherent to the greater omentum and a small laparotomy was necessary by the pediatric surgeon to detach it (Figure 2).

**Postoperative course.** He had an uneventful postoperative course. Prophylactic antibiotic treatment was continued for the duration of the hospital stay. Serial postoperative CSF cultures were negative and a postoperative CT scan demonstrated a reduction in ventricular size. He was discharged after 8 days with scheduled follow-up appointments. At 6-months follow-up, he was doing well.

**Discussion.** Despite being a serious condition, the exact cause of distal VPS migration is usually not determined. However, several hypotheses have been proposed. Akyüz et al reported that when the distal end of the catheter adheres to a nearby viscera or body wall, it will initiate an inflammatory response that weakens the viscera or body wall, and the distal end of the catheter will gradually protrude through it. Sridhar et al suggested that distal VPS migration may occur due to the firmness of the type of catheter used. This hypothesis is supported by the observation that there is reduced occurrence of distal VPS migration when using softer, more flexible catheters. In addition, other authors have speculated that distal VPS extrusion through the body wall may occur due to focal wound dehiscence, poor host immunity, inappropriate surgical technique, or ischemic necrosis of the dermis. Additional contributing factors for distal VPS migration may include the patients’ age, as well as the length of the distal catheter inside the peritoneal cavity. For example, we noticed that most cases of distal VPS migration described in the literature have occurred...

---

**Figure 1** - Extrusion of the distal end of a ventriculoperitoneal shunt catheter (arrow tip) through the intact abdominal wall in a 5-year-old male with Apert syndrome.

**Figure 2** - Laparotomy procedure for the detachment of a migrated distal ventriculoperitoneal shunt catheter (arrow tip) from the greater omentum in a 5-year-old male with Apert syndrome.
in early childhood. This may be attributed to the weak musculature at this period of life that may ease penetration of the catheter through the viscera or body wall. In addition, we speculate that a longer catheter may have a higher tendency to migrate than a shorter one. However, further studies are required to confirm these hypotheses.

When spontaneous extrusion of the distal catheter of a VPS through the abdominal wall is detected, a course of prophylactic antibiotics should be administered immediately and the shunt system must be replaced completely.\(^5,7\) During removal of the extruded shunt system, it is important to avoid pulling the distal end proximally in order to prevent the spread of infection from the extrusion site. If there is no peritoneal or skin infection then the VPS catheter can be removed without laparotomy. Laparotomy is indispensable in the presence of peritonitis and in cases where the catheter has adhered to components of the peritoneum. After complete removal of the existing shunt system, reinsertion of a new shunt system may be performed in the same session, provided that the CSF culture was negative. However, if an infection is suspected then an external ventricular drainage system is placed and an intravenous course of antibiotics is administered.\(^8,9\) Serial CSF sampling is subsequently carried out until 2 consecutive, negative

---

**Table 1 - Literature review of cases of complete extrusion of the distal end of a ventriculoperitoneal shunt catheter in the last 20 years.**

| References                  | Cases (n) | Extrusion type | Extrusion site               | Age at presentation (yrs) | Post-insertion duration (yrs) |
|-----------------------------|-----------|----------------|------------------------------|--------------------------|-----------------------------|
| Nourisamie et al,\(^10\) 2001 | 1         | Intact         | Left thigh                   | <1 (10 mo)               | <1 (2 mo)                   |
| Pandey et al,\(^11\) 2003  | 1         | Intact         | Left posterior auricular region | 10.5                     | <1 (6 mo)                   |
| Schulz and Labram,\(^12\) 2006 | 1         | Intact         | Epigastric region            | 26                       | 14                          |
| Schulz and Labram,\(^12\) 2006 | 1         | Intact         | Right lumbar region          |                          |                             |
| Kanojia et al,\(^1\) 2008  | 4         | Intact         | Cervical region              | <1 (3-6 mo)              | <1 (1-3 mo)                 |
| Kanojia et al,\(^1\) 2008  | 1         | Intact         | Right anterior chest wall     | 14                       | 3                           |
| Vural et al,\(^13\) 2008   | 1         | Intact         | Sacroccocygeal region        | <1 (7 mo)                | <1 (7 mo)                   |
| Birbils et al,\(^14\) 2009 | 1         | Intact         | Left paraxial region         | 33                       | 1                           |
| Silva Neto et al,\(^15\) 2011 | 1         | Intact         | Right posterior abdominal wall | 5                       | 5                           |
| Dağtekin et al,\(^16\) 2011 | 1         | Intact         | Umbilical region             | 2                        | 1.7                         |
| Panigrahi et al,\(^17\) 2012 | 2         | Intact         | Epigastrium                  | <1 (7 mo)                | <1 (3 mo)                   |
| Okray et al,\(^18\) 2015   | 1         | Intact         | Right lumbar region          | 1                        | 1                           |
| Rehm et al,\(^19\) 1997    | 1         | Weakness       | Scrotum                      | 46                       | 4                           |
| Esposito et al,\(^20\) 1998 | 1         | Weakness       | Umbilicus                    | 14                       | N/A                         |
| Wani et al,\(^21\) 2002    | 1         | Weakness       | Umbilicus                    | 1.5                      | <1 (6 mo)                   |
| Silav et al,\(^22\) 2002   | 1         | Weakness       | Umbilicus                    | N/A                      | N/A                         |
| Chan et al,\(^23\) 2003    | 1         | Weakness       | Left lumbar wound scar       | 70                      | 6                           |
| de Aquino et al,\(^24\) 2006 | 1         | Weakness       | Umbilicus                    | 1.6                      | N/A                         |
| Eser et al,\(^25\) 2006    | 1         | Weakness       | Umbilicus                    | <1 (3 mo)                | <1 (3 mo)                   |
| Kella et al,\(^26\) 2008   | 1         | Weakness       | Umbilicus                    | 1.5                      | 1.4                         |
| Kumar et al,\(^27\) 2010   | 1         | Weakness       | Umbilicus                    | <1 (3 mo)                | <1 (3 mo)                   |
| De Jong et al,\(^28\) 2011  | 1         | Weakness       | Umbilicus                    | 38                      | 38                          |
| De Jong et al,\(^28\) 2011  | 1         | Weakness       | Neck wound scar              | 1.4                      |                             |
| Ghritlaharey et al,\(^29\) 2012 | 4         | Weakness       | Anterior chest wall wound scar | <12                     | <1 (2 mo)                   |
| Aras et al,\(^30\) 2013    | 1         | Weakness       | Upper right abdomen wound scar | <1 (2 mo)              |                             |
| Fleissig et al,\(^31\) 2013 | 1         | Weakness       | Umbilicus                    | 1.8                      | <1 (8 mo)                   |
| Aras et al,\(^31\) 2013    | 1         | Weakness       | Posterior abdominal wall wound scar | 82                     | 2.3                         |

N/A - not available, yrs - years, mo - months
culture results are obtained.\textsuperscript{2} Finally, reinsertion of a new shunt system can be performed. A review of the literature for cases of complete catheter extrusion in the last 20 years identified 24 studies reported on 31 cases of external distal VPS migration. Detailed information regarding these cases is provided in Table 1. Of these 31 cases, 14 (~45\%) had the distal catheter extruded through the intact body wall, while the remaining 17 cases (~55\%) had the catheter extruded through a potential weakness in the body wall. A summary for the frequencies of different extrusion types is provided in Table 2. No significant difference in the incidence of distal VPS catheter extrusion was observed between cases through an intact body wall and cases through potential weakness in the body wall (\(p=0.59\), chi-square goodness of fit test). This may indicate that the presence of a potential weakness in the body wall is not a predisposing factor for external migration of the distal VPS catheter.

In conclusion, migration of the distal VPS catheter is a rare but serious complication that is associated with a high morbidity and mortality rate. Proper management of distal VPS migration should include a course of prophylactic antibiotics and complete replacement of the shunt system, with laparotomy, if required (peritonitis or adhesion). In addition, strict follow-up should be performed for serial CSF cultures and in order to ensure correct functioning of the new shunt system. This study suggests that the presence of a potential weakness in the body wall may not be a predisposing factor for VPS catheter extrusion.

\textbf{Acknowledgments.} The authors would like to thank Dr. Sihair M. Qudsieh and Dr. Waleed F. Dabbas for their valuable comments on an earlier draft of this manuscript.

\textbf{References}

1. Allouh MZ, Al Barbarawi MM, Asfour HA, Said RS. Migration of the Distal Catheter of the Ventriculoperitoneal Shunt in Hydrocephalus: A Comprehensive Analytical Review from an Anatomical Perspective. \textit{Clin Anat} 2017; 30: 821-830.

2. Kanojia R, Sinha SK, Rawat J, Wakhlu A, Kureel S, Tandon R. Unusual ventriculoperitoneal shunt extrusion: experience with 5 cases and review of the literature. \textit{Pediatr Neurosurg} 2008; 44: 49-51.

3. Akyüz M, Uçar T, Göksu E. A thoracic complication of ventriculoperitoneal shunt: symptomatic hydrothorax from intrathoracic migration of a ventriculoperitoneal shunt catheter. \textit{Br J Neurosurg} 2004; 18: 171-173.

4. Sridhar K, Sharma BS, Kak VK. Spontaneous extrusion of peritoneal catheter through intact abdominal wall. \textit{Clin Neurol Neurosurg} 1988; 90: 373-375.

5. Borkar SA, Sayarthde GD, Khan RN, Sharma BS, Mahapatra AK. Spontaneous extrusion of migrated ventriculoperitoneal shunt catheter through chest wall: a case report. \textit{Turk Neurosurg} 2008; 18: 95-98.

6. Kumar B, Sharma SB, Singh DK. Extrusion of ventriculoperitoneal shunt catheter. \textit{Indian J Pediatr} 2010; 77: 336.

7. De Jong L, Van Der Aa F, De Ridder D, Van Calenbergh F. Extrusion of a ventriculoperitoneal shunt catheter through an appendicovesicostomy. \textit{Br J Neurosurg} 2011; 25: 115-116.

8. Birbilis T, Theodoropoulou E, Matsis G. Spontaneous externalization of peritoneal catheter through the abdominal wall in a patient with hydrocephalus: a case report. \textit{Cases J} 2009; 2: 6898.

9. Silva Neto AR, Bezerra MJ, Farias MG, Câmara RL. Unusual extrusion of ventriculoperitoneal shunt. \textit{Acta Neurochir (Wien)} 2011; 153: 203-204.

10. Nourisamie K, Vyas P, Swanson KF. Two unusual complications of ventriculoperitoneal shunts in the same infant. \textit{Pediatr Radiol} 2001; 31: 814-816.

11. Pandey P, Suri A, Singh AK, Mahapatra AK. Brain abscess--an unusual complication of ventriculoperitoneal shunt. \textit{Indian J Pediatr} 2003; 70: 833-834.

12. Schulz UG, Labram EK. A healthy lifestyle leading to a rare ventriculo-peritoneal shunt complication. \textit{Br J Neurosurg} 2006; 20: 173-174.

13. Vural M, Cosan TE, Ilhan H. Ventriculoperitoneal shunt catheter spontaneously protruding through the skin at the sacrococcygeal region. \textit{Pediatr Neurosurg} 2008; 44: 261-262.

14. Dağtekin A, Karabağ H, Avci E, Nayci A, Bağdatoğlu C. A rare complication with ventriculoperitoneal shunt in pediatric cases. \textit{Ege J Med} 2011; 50: 65-68.

15. Panigrahi S, Mishra SS, Das S, Tripathy L, Pattajoshi AS. Spontaneous extrusion of peritoneal catheter of ventriculoperitoneal shunt through the intact abdominal wall: report of two cases. \textit{J Pediatr Neurosci} 2012; 7: 228-230.

16. Öktay K, Erkoc YS, Ethemoglu KB, Olguner SK, Sarac ME. Spontaneous extrusion of ventriculoperitoneal shunt catheter through the right lumbar region: a case report and review of the literature. \textit{Pediatr Neurosurg} 2015; 50: 336-338.

17. Rehm A, Bannister CM, Victoratos G. Scrotal perforation by a ventriculoperitoneal shunt. \textit{Br J Neurosurg} 1997; 11: 443-444.

18. Esposito C, Porreca A, Gangemi M, Garipoli V, De Pasquale M. The use of laparoscopy in the diagnosis and treatment of abdominal complications of ventriculo-peritoneal shunts in children. \textit{Pediatr Surg Int} 1998; 13: 352-354.

19. Wani AA, Ramzan A, Wani MA. Protrusion of a peritoneal catheter through the umbilicus: an unusual complication of a ventriculoperitoneal shunt. \textit{Pediatr Surg Int} 2002; 18: 171-172.

20. Silav G, Tun K, Dolgun H, Unlu A, Selcuki M. The spontaneous umbilical perforation of the distal end of ventriculoperitoneal shunt. \textit{Neurochirurgie} 2002; 48: 128-130.
21. Chan Y, Datta NN, Chan KY, Rehman SU, Poon CY, Kwok JC. Extrusion of the peritoneal catheter of a VP shunt system through a gastrostomy wound. Surg Neurol 2003; 60: 68-69.

22. de Aquino HB, Carelli EF, Borges Neto AG, Pereira CU. Nonfunctional abdominal complications of the distal catheter on the treatment of hydrocephalus: an inflammatory hypothesis? Experience with six cases. Childs Nerv Syst 2006; 22: 1225-1230.

23. Eser O, Dogru O, Aslan A, Kundak AA. Umbilical perforation: an unusual complication of a ventriculoperitoneal shunt. Childs Nerv Syst 2006; 22: 1509-1510.

24. Kella N, Rathi PK, Qureshi MA. Umbilical perforation: a rare complication of ventriculoperitoneal shunt. J Coll Physicians Surg Pak 2008; 18: 644-645.

25. Ghritlaharey RK, Budhwani KS, Shrivastava DK, Srivastava J. Ventriculoperitoneal shunt complications needing shunt revision in children: a review of 5 years of experience with 48 revisions. Afr J Paediatr Surg 2012; 9: 32-39.

26. Aras M, Ataş M, Seraslan Y, Akçora B, Yılmaz A. Protrusion of a peritoneal catheter via abdominal wall and operated myelomeningocele area: a rare complication of ventriculoperitoneal shunt. Childs Nerv Syst 2013; 29:1199-1202.

27. Fleissig K, Hattingen J, Willems L, Förster C, Gaab MR, Burger R. Spontaneous umbilical cerebrospinal fluid fistula due to transdermal dislocation of the ventriculoperitoneal distal shunt ending—a case report. J Neurol Surg A Cent Eur Neurosurg 2013; 74: 64-67.