

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Case report of migration of 2 ventriculoperitoneal shunt catheters to the scrotum: Use of an inguinal incision for retrieval, diagnostic laparoscopy and hernia repair

Caesar Ricci^a, Bratislav M. Velimirovic^b, Tamara N. Fitzgerald^{a,*}^a Department of Surgery, Paul L Foster School of Medicine, Texas Tech University, El Paso, TX, USA^b Neurosurgical Specialists of El Paso, El Paso, TX, USA

ARTICLE INFO

Article history:

Received 21 September 2016

Received in revised form 31 October 2016

Accepted 1 November 2016

Available online 5 November 2016

Keywords:

Ventriculoperitoneal shunt

Scrotal migration

Post-operative shunt complication

Laparoscopic-assisted ventriculoperitoneal

shunt placement

Case report

ABSTRACT

BACKGROUND: Ventriculoperitoneal shunts are commonly used in the treatment of hydrocephalus, and catheter migration to various body sites has been reported. Pediatric and general surgeons are asked on occasion to assist with intraabdominal access for these shunts, particularly when there may be extensive adhesions or other complicating factors.

METHODS: We describe a case in which an old shunt catheter was never removed from the abdomen, and it migrated through an inguinal hernia into the scrotum. The catheter became entangled and fibrosed to the testicle. A second and more recent shunt catheter was also in the scrotum. A single incision in the inguinal region was used to remove both shunt catheters, repair the inguinal hernia and perform diagnostic laparoscopy to assist in placing a new ventriculoperitoneal shunt.

RESULTS: Prompt surgical removal is recommended for catheters remaining in the abdomen after ventriculoperitoneal shunt malfunction. These catheters may cause injury to the testicle, or possibly other intraabdominal organs. General or pediatric surgical consultation should be obtained for lost catheters or inguinal hernias.

CONCLUSION: In the case of an inguinal hernia containing a fractured shunt catheter, the hernia sac can be used to remove the catheter, repair the hernia and gain laparoscopic access to the abdomen to assist with shunt placement.

© 2016 The Author(s). Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Background

Ventriculoperitoneal (VP) shunt placement is the most common treatment for hydrocephalus. Traditionally, the distal catheter is placed into the abdominal cavity through an open incision or via a laparoscopic assisted technique. The catheter allows drainage of excess cerebrospinal fluid (CSF) into the peritoneal cavity, where it can be absorbed, thus relieving the intraventricular pressure. For laparoscopic assistance or for hostile abdominal conditions, often a general or pediatric surgeon is called upon to assist the neurosurgeon with abdominal access. Laparoscopic assistance has been shown to be associated with a lower rate of malposition, distal obstruction and distal shunt failure. [1]

Shunt migration is a rare complication, but due to the frequent incidence of shunt placement, there are many case reports of shunt migration. A handful of case reports have reported migration to the scrotum. [2–14] Other complications of shunt migration have

included: colonic perforation [15], shunt abandoned in the pelvis [16], fistulization to the umbilicus [17], intracardiac migration and knotting [18], peroral extrusion [19], gastric perforation [20], bladder perforation [21], CSF leakage in the neck [22], pulmonary vasculature migration [23], breast migration with CSF galactorrhea [24], intestinal perforation [25], pneumonia caused by transdiaphragmatic erosion [26] and liver perforation [27].

Although scrotal migration has previously been reported, we report a case in which 2 catheters were found in the scrotum, and 1 catheter was extremely fibrosed and tangled around the testicle. We also report a novel technique of using 1 small inguinal incision to remove the catheters, gain laparoscopic access to the abdomen and repair the inguinal hernia.

2. Presentation of case

Informed consent was obtained, and this report was written within the guidelines of the SCARE criteria [28]. A 10-year-old male with a history of hydrocephalus and 3 prior VP shunt placements, presented to El Paso Children's Hospital emergency room (an academic, tertiary care hospital) with several days of wors-

* Corresponding author at: Paul L Foster School of Medicine Texas Tech UHSC 4800 Alberta Avenue El Paso, TX 79905, USA.

E-mail address: tnftz@hotmail.com (T.N. Fitzgerald).



Fig. 1. Left inguinal hernia containing the fractured VP shunt catheter.

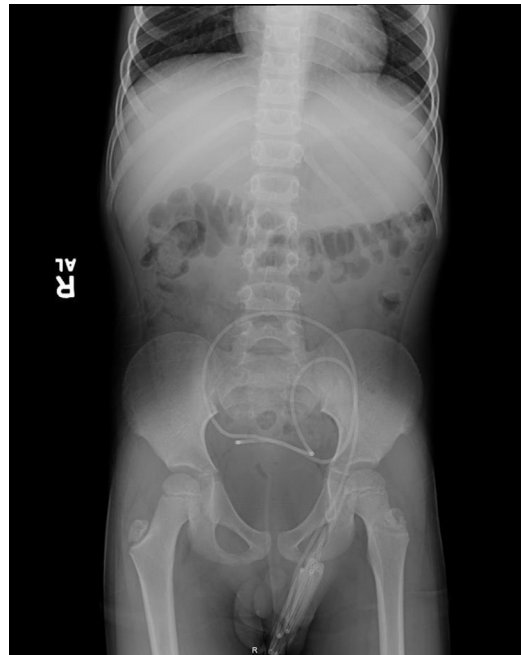


Fig. 2. Abdominal radiograph showing the fractured shunt catheter herniating into the left scrotum.

ening headache, fatigue, nausea and vomiting. Hydrocephalus had been diagnosed in the neonatal period and his initial VP shunt was placed at two years of age. At four years of age the shunt malfunctioned and was removed and replaced. He subsequently underwent a third shunt revision. He was living in Mexico and intermittently travelling to the United States. He had last seen a neurosurgeon in the United States two years ago. Two years prior to presentation the mother had noticed a left scrotal bulge, but as it was asymptomatic, she did not seek further medical attention. While in Mexico he became ill with several days of worsening headache, fatigue, nausea, and vomiting and was treated by a pediatrician in Mexico. After failure to improve, he was brought to our children's hospital in El Paso, on the Texas-Mexico border.

On presentation he was lethargic but oriented with reactive pupils. The VP shunt catheter was palpable under the skin of his neck. His abdomen was soft, non-tender, and he had a palpable bulge in the left hemi-scrotum that was felt to contain a loop of catheter (Fig. 1). His vital signs and initial labs studies including complete blood count and metabolic panel were normal. A CT scan of the head demonstrated a fractured VP shunt at the level of the

upper neck with resultant hydrocephalus. A shunt series showed fracture of the VP shunt with the catheter coiled and extending into the left inguinal-scrotal region (Fig. 2).

He was seen in the emergency room and emergently taken to the operating room for shunt externalization. 3 days later he was returned to the operating room for VP shunt replacement with laparoscopic assistance, removal of the scrotal catheter and left inguinal hernia repair. A small left inguinal incision as was made and a Mitchell-Banks hernia repair was performed. The hernia sac was dissected away from the spermatic cord. Upon opening the hernia sac, the fractured VP shunt catheter was found and easily removed (Fig. 3A). At this point a 3 mm laparoscopic port was placed through the hernia sac and the abdomen was insufflated with carbon dioxide. Using the laparoscope, the peritoneal cavity was visualized. The right upper quadrant was free of intestinal adhesions, and this area was chosen for peritoneal placement of the new VP shunt catheter. After removal of the camera, abdominal desufflation and removal of the port, high ligation of the hernia sac

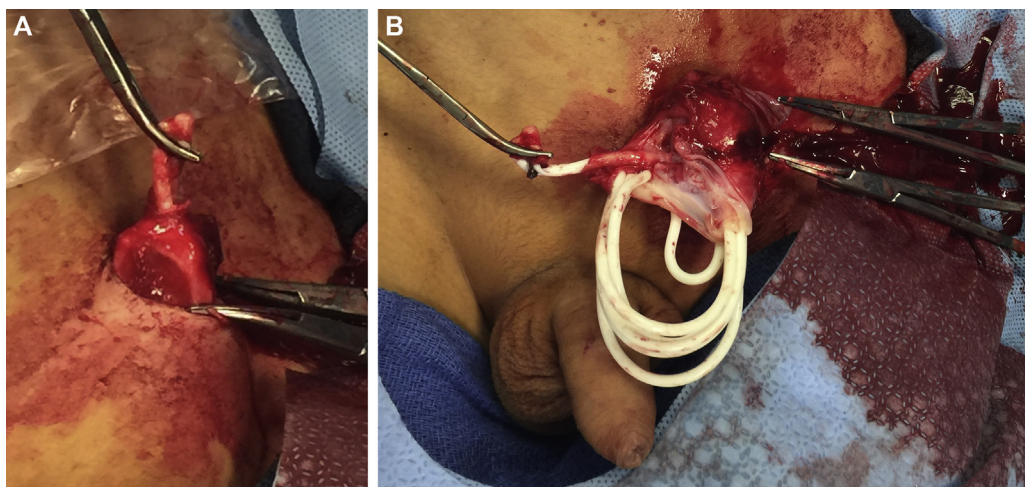


Fig. 3. A) The first fractured VP shunt catheter was removed easily from the hernia sac. B) The second shunt catheter was adherent to the left testicle.



Fig. 4. Two separate shunt catheters were removed from the scrotum and sent to pathology. The catheters are made of different colored plastics.

was performed with absorbable suture. Upon attempting to pull the testicle back down into the scrotum it was noted that there was a foreign body still present near the testicle. The testicle was brought up into the wound, and it became apparent that there was a second catheter present. It was very fibrotic and adherent to the testicle, tangled around the testicle in multiple locations (Fig. 3B). Removing the second shunt was a difficult dissection, as both the testicle and spermatic cord were at great risk for injury. The shunts were of 2 different colors, and were obviously from 2 different VP shunt placements (Fig. 4).

Postoperatively the patient had an uncomplicated course. At follow up, the testicle appeared healthy with no hernia recurrence. Pathology showed a left inguinal hernia sac with reactive fibrosis and focal chronic inflammation. Two separate catheters were noted (94 cm and 89 cm) with reactive fibrocollagenous connective tissue and focal chronic inflammation.

3. Discussion

Catheter migration is a known complication of VP shunt placement, and migration to the scrotum has previously been described. [2–14] In children, the persistence of a patent processus vaginalis (PPV) may lead to the formation of an inguinal hernia. [29] Even if a hernia is not yet present, the PPV provides a migration pathway for a fractured shunt catheter.

The processus vaginalis forms in both sexes during embryologic development, as an evagination of the peritoneum occurs at the inguinal canal. In males, at 28 weeks gestation, the testes have migrated from the posterior abdomen to the internal inguinal ring, and by 32 weeks the testes enter the scrotum. In females, the round ligament of the uterus passes through the inguinal canal and terminates in the labia majorus. When the communication between the abdomen and the scrotum or labia fails to close, a PPV exists. [30]

Standard treatment for pediatric hernia repair is high suture ligation of the hernia sac. In unilateral inguinal hernia, it was historically common to perform a bilateral groin exploration to evaluate for a PPV on the contralateral side. [31] It has now become standard practice to evaluate for a PPV on the contralateral side via laparoscopy, thus avoiding exploration. When the hernia sac is isolated, it is opened and a laparoscopic port inserted, thus gaining access to the peritoneal cavity. Pneumoperitoneum is achieved, and an angled laparoscopic telescope is used to visualize the contralateral side. When a PPV is present, it presents as an opening in the peritoneum at the internal ring. Occasionally the hernia sac is too narrow or fragile, and this may prevent laparoscopic access. [32]

Laparoscopy has also been introduced to assist with abdominal access during VP shunt placement. It has been shown to reduce shunt failure and abdominal malposition as compared to laparotomy. There are no differences in rates of infection, length of hospital stay, complication rate or shunt failure. [1]

In the case presented, a PPV or hernia allowed for migration of 2 shunt catheters into the scrotum. Obviously this child had a previous fractured shunt catheter, and the distal catheter was never properly removed, allowing for its prolonged entanglement with the testicle. This could have compromised the testicle before or during surgery. This illustrates the importance of removing fractured shunt material from the abdomen at the time of shunt revision.

This complication could have been prevented by searching for a PPV at the time of the first VP shunt placement. Laparoscopy can easily be used to visualize an appropriate window for the VP shunt insertion and to search for a PPV. If a PPV or occult hernia is found, then a hernia repair should be performed proactively at the same operation.

4. Conclusion

Prompt surgical removal is recommended for catheters remaining in the abdomen after ventriculoperitoneal shunt malfunction. These catheters may cause injury to the testicle, or possibly other intraabdominal organs. General or pediatric surgical consultation should be obtained for lost catheters or inguinal hernias. In the case of an inguinal hernia, the hernia sac can be used to gain laparoscopic access to the abdomen to assist with shunt placement and foreign body retrieval. Any hernias found at the time of VP shunt placement should be proactively repaired.

Conflicts of interest

The authors have no financial relationships to disclose that would influence this work.

Author contribution

Caesar Ricci – data collection, interpretation, writing the paper.
Bratislav Velimirovic – Neurosurgeon involved in the care of the patient and the operation. Data collection and study concept.
Tamara Fitzgerald – study concept, data collection, analysis, writing the paper.

Funding

This case report had no funding.

Ethical approval

This was not a research study and does not require IRB approval.

Consent

Written consent was obtained from the patient's mother and is available in the patient's medical record.

Guarantor

Tamara Fitzgerald.

References

- [1] S. Phan, et al., Laparotomy vs minimally invasive laparoscopic ventriculoperitoneal shunt placement for hydrocephalus: a systematic review and meta-analysis, *Clin. Neurol. Neurosurg.* 140 (2016) 26–32, <http://dx.doi.org/10.1016/j.clineuro.2015.10.025>.
- [2] T. Agarwal, et al., Unusual complication of ventriculoperitoneal shunt surgery, *J. Pediatr. Neurosci.* 4 (2009) 122–123, <http://dx.doi.org/10.4103/1817-1745.57340>.
- [3] D.L. Bristow, W.L. Buntain, H.L. James, Ventriculoperitoneal (VP) shunt migration causing an acute scrotum: a case report of Doppler evaluation, *J. Pediatr. Surg.* 13 (1978) 538–539.
- [4] D. Kita, Y. Hayashi, M. Kinoshita, K. Ohama, J. Hamada, Scrotal migration of the peritoneal catheter of a ventriculoperitoneal shunt in a 5-year-old male: case report, *Neurol. Med. Chir. (Tokyo)* 50 (2010) 112–1125.
- [5] S. Korfiatis, G.A. Alexiou, E. Vlachakis, D.E. Sakas, Scrotal swelling due to migration of the abdominal catheter of a cyst-peritoneal shunt, *Clin. Neurol. Neurosurg.* 115 (2013) 1918–1919, <http://dx.doi.org/10.1016/j.clineuro.2013.03.012>.
- [6] B.S. Lee, S. Vadera, J.A. Gonzalez-Martinez, Rare complication of ventriculoperitoneal shunt. Early onset of distal catheter migration into scrotum in an adult male: case report and literature review, *Int. J. Surg. Case Rep.* 6c (2015) 198–202, <http://dx.doi.org/10.1016/j.ijscr.2014.09.032>.
- [7] A. Mohammadi, A. Hedayatiasl, M. Ghasemi-Rad, Scrotal migration of a ventriculoperitoneal shunt: a case report and review of literature, *Med. Ultrasonogr.* 14 (2012) 158–160.
- [8] S.S. Panda, A. Singh, M. Bajpai, N. Sharma, Shunt in scrotum: unusual complication in operated cases of hydrocephalus, *BMJ Case Rep.* 2013 (2013), <http://dx.doi.org/10.1136/bcr-2013-201854>.
- [9] A. Rehm, C.M. Bannister, G. Victoratos, Scrotal perforation by a ventriculoperitoneal shunt, *Br. J. Neurosurg.* 11 (1997) 443–444.
- [10] A.M. Shahizon, M. Hanafiah, E.Y. Hing, M.R. Julian, Migration of a fractured ventriculoperitoneal shunt into the scrotum: a rare complication, *BMJ Case Rep.* 2013 (2013), <http://dx.doi.org/10.1136/bcr-2013-200609>.
- [11] B. Shankar, R. Narayanan, S.M. Paruthikunnan, C.D. Kulkarni, Scrotal migration of ventriculoperitoneal shunt, *BMJ Case Rep.* 2014 (2014), <http://dx.doi.org/10.1136/bcr-2014-204404>.
- [12] R.I. Silver, S.G. Docimo, A ventriculoperitoneal shunt masquerading as a paratesticular tumor, *J. Pediatr. Surg.* 35 (2000) 1407–1408.
- [13] A.R. Walsh, D. Kombogiorgas, Coiled ventricular-peritoneal shunt within the scrotum, *Pediatr. Neurosurg.* 40 (2004) 257–258, <http://dx.doi.org/10.1159/000082304>.
- [14] J.F. Ward, R.R. Moquin, S.T. Maurer, Expanding the differential diagnosis of the acute scrotum: ventriculoperitoneal shunt herniation, *Urology* 58 (2001) 281.
- [15] L.L. Chiang, M.F. Kuo, P.C. Fan, W.M. Hsu, Transanal repair of colonic perforation due to ventriculoperitoneal shunt? case report and review of the literature, *J. Formos. Med. Assoc. = Taiwan yi zhi* 109 (2010) 472–475, [http://dx.doi.org/10.1016/s0929-6646\(10\)60079-4](http://dx.doi.org/10.1016/s0929-6646(10)60079-4).
- [16] A. Despot, A.T. Luetic, Letter to the editor: ultrasound detection of the disconnected distal catheter of a ventriculoperitoneal shunt in the pelvic region, *Ultraschall in der Medizin (Stuttgart, Germany)* 36 (2015) 393, <http://dx.doi.org/10.1055/s-0034-1399720>.
- [17] I. Dolas, et al., Cerebrospinal fluid leakage from the umbilicus: case report and literature review, *Int. J. Surg. Case Rep.* 20 (2016) 60–62, <http://dx.doi.org/10.1016/j.ijscr.2015.12.052>.
- [18] G. Frahm-Jensen, P.R. Newton, K.J. Drummond, T.P. Wagner, B.M. Mees, Intracardiac migration and knotting of a ventriculoperitoneal shunt, *J. Clin. Neurosci.* 22 (2015) 771–773, <http://dx.doi.org/10.1016/j.jocn.2014.10.020>.
- [19] P. Mandhan, M. Wong, U. Samarakkody, Laparoscopic removal of peroral extrusion of a ventriculoperitoneal shunt, *Asian J. Endosc. Surg.* 8 (2015) 95–97, <http://dx.doi.org/10.1111/ases.12157>.
- [20] M. Alonso-Vanegas, et al., Gastric perforation due to ventriculo-peritoneal shunt, *Pediatr. Neurosurg.* 21 (1994) 192–194.
- [21] D.G. Burnette Jr., Bladder perforation and urethral catheter extrusion: an unusual complication of cerebrospinal fluid-peritoneal shunting, *J. Urol.* 127 (1982) 543–544.
- [22] S. Chopra, D.K. Singh, B. Kumar, A. Gupta, V. Gupta, CSF hygroma in the neck: rare complication of ventriculoperitoneal shunt, *Pediatr. Neurosurg.* 45 (2009) 78–80, <http://dx.doi.org/10.1159/000204909>.
- [23] K. Lyon, et al., Migration of a ventriculoperitoneal shunt into the pulmonary vasculature: case report, review of the literature, and surgical pearls, *World Neurosurg.* (2016), <http://dx.doi.org/10.1016/j.wneu.2016.05.024>.
- [24] A. Maknoja, J.L. Caron, Proximal subcutaneous migration of the distal end of a ventriculoperitoneal shunt presenting with recurrent cerebrospinal fluid galactorrhoea, *J. Neurosurg.* 120 (2014) 164–166, <http://dx.doi.org/10.3171/2013.6.jns121768>.
- [25] E.K. Rinker, D.A. Osborn, T.R. Williams, D.L. Spizarny, Asymptomatic bowel perforation by abandoned ventriculoperitoneal shunt, *J. Radiol. Case Rep.* 7 (2013) 1–8, <http://dx.doi.org/10.3941/jrcr.v7i9.1243>.
- [26] S. Sahin, A.F. Shaaban, B.J. Iskandar, Recurrent pneumonia caused by transdiaphragmatic erosion of a ventriculoperitoneal shunt into the lung. Case report, *J. Neurosurg.* 107 (2007) 156–158, <http://dx.doi.org/10.3171/ped-07/08/156>.
- [27] H. Touho, M. Nakauchi, T. Tasawa, J. Nakagawa, J. Karasawa, Intrahepatic migration of a peritoneal shunt catheter: case report, *Neurosurgery* 21 (1987) 258–259.
- [28] R.A. Agha, et al., A protocol for the development of reporting criteria for surgical case reports: the SCARE statement, *Int. J. Surg. (London, England)* 27 (2016) 187–189, <http://dx.doi.org/10.1016/j.ijssu.2016.01.094>.
- [29] N. Centeno-Wolf, et al., Long-term outcome of children with patent processus vaginalis incidentally diagnosed by laparoscopy, *J. Pediatr. Surg.* 50 (2015) 1898–1902, <http://dx.doi.org/10.1016/j.jpedsurg.2015.07.001>.
- [30] L. Keith, T.P. Moore, *The Developing Human: Clinically Oriented Embryology*, W.B. Saunders, 1993, pp. 290–294.
- [31] R.E. Rothenberg, T. Barnett, Bilateral herniotomy in infants and children, *Surgery* 37 (1955) 947–950.
- [32] M.L. Wulkan, E.S. Wiener, N. VanBalen, P. Vescio, Laparoscopy through the open ipsilateral sac to evaluate presence of contralateral hernia, *J. Pediatr. Surg.* 31 (1996) 1174–1176, discussion 1176–1177.

Open Access

This article is published Open Access at [sciencedirect.com](http://www.sciencedirect.com). It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.