İzmir Dr. Behçet Uz Çocuk Hast. Dergisi 2013; 3(3):219-224
doi:10.5222/buchd.2013.219

Olgu Sunumu

Ventriculoperitoneal shunt malfunction: Presentation of 2 case reports and review of the literature

Ventriküloperitoneal şant disfonksiyonu: İki olgu sunumu ve literatür değerlendirilmesi

Volkan Sarper ERİKCİ[1], Ozan GANİÜSMEN[2], Münevver HOŞGÖR[1]

[1]Dr. Behçet Uz Çocuk Hastanesi, Çocuk Cerrahisi Kliniği, İzmir
[2]Tepecik Eğitim ve Araştırma Hastanesi, Nöroşirürji Kliniği, İzmir

ABSTRACT

Objective: This study was carried out to focus on two unusual complications due to ventriculoperitoneal shunts (VPSs) performed in hydrocephalic children. Management of these patients with a special emphasis on the foregoing literature concerning the migration of shunt catheter into the scrotum is reviewed and discussed.
Methods: A retrospective clinical study performed in patients with complications of VPS causing acute abdomino-scrotal conditions in two different centers between 2002-2012 is presented in the current study.
Results: There are two pediatric cases with diagnosis of hydrocephaly and complications of VPS during the study period. Age, mode of presentation, results of treatment were studied. Apart from physical examination and radiological investigations, diagnosis of VPS complication was confirmed during surgical procedures in our patients.
Conclusion: Complications of intestinal obstruction and protrusion of the VPS catheter into the scrotum are rarely seen in hydrocephalic children with VPS. Early identification and management of these complications is recommended for that they may cause life- threatening acute abdomino-scrotal conditions.

Key words: Ventriculoperitoneal shunt, complication, migration of shunt catheter, scrotum

ÖZET

Amaç: Bu çalışmada hidrosefalik çocuklarda ventrikülöperitoneal şant (VPŞ) uygulamasına ait alışık olunmayan iki komplikasyon sunulmuştur. Bu çocukların yönetimi özellikle şant kateterinin skrotal migrasyonuna ilişkin literatürler ışığında değerlendirilip tartışılmıştır.
Yöntemler: Bu retrospektif kesitsel çalışmada iki ayrı merkezde 2002 ile 2012 yılları arasında akut abdomen ve akut skrotal şişme tablosu oluşturan VPŞ komplikasyonlu olgular sunularak tartışılmıştır.
Bulgular: Çalışma dönemi içerisinde hidrosefali tanısı almış ve VPŞ komplikasyonu gelişmiş iki olgu bulunmaktadır. Yaş, klinik yansıma şekli, tedavi sonuçları çalışılmıştır. Fizik muayene ve radyolojik görüntüleme yöntemleri dışında VPŞ komplikasyon tanısı cerrahi tedavi sırasında doğrulanmıştır.
Sonuç: Hidrosefalik VPŞ kateterli olgularda intestinal obstrüksiyon ve şant kateterinin skrotuma protrüzyonu nadiren görülür. Yaşamı tehdit edebilen akut abdominoskrotal durumlar oluşturabileceğinden bu komplikasyonların erken tanı ve tedavisi önerilmektedir.

Anahtar kelimeler: Mekanik ventilatör, komplikasyon, yenidoğan

Alındığı tarih: 28.05.2013
Kabul tarihi: 01.07.2013

Yazışma adresi: Uzm. Dr. Volkan Sarper Erikci, Dr Behçet Uz Çocuk Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Çocuk Cerrahisi Kliniği, 35040-İzmir
e-mail: verikci@yahoo.com

INTRODUCTION

Ventriculoperitoneal shunts (VPSs) are the most common operative procedures 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 approximately 25% of the cases [3]. It is reported that the occurence of a complication involving the intraperitoneal end of the catheter must be considered as an emergency as it may cause intracranial hypertension [1,4]. Two cases with unusual complications due to VPS are presented and discussed with special emphasis to relevant literature on the migration of the shunt catheter into scrotum.

CASE 1

An 8-month-old boy was admitted to our department due to abdominal pain, refusal to eat and bilious vomiting. At the age of 2 months, apart from meningocele repair, he was operated on for the insertion of VPS catheter with the indication of hydrocephalus. Concomitant right inguinal hernia repair was also performed. He was doing well until 3 days prior to admission when his parents noticed abdominal distention, constipation, and bilious vomiting in the patient. On examination abdominal distention with no signs of peritoneal irritation, scoliosis and incisional scars related to previous surgical interventions on the right inguinal and lomber regions were found. His laboratory tests were unremarkable. Plain x-ray films and abdominal ultrasound showed distended bowel loops with air-fluid levels and left renal agenesis. Peritoneal portion of the shunt catheter was found to be coiled around the intestinal loops causing complete intestinal obstruction (Figure 1). At laparotomy 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 were performed. Postoperative course was uneventful and he was discharged in good health.

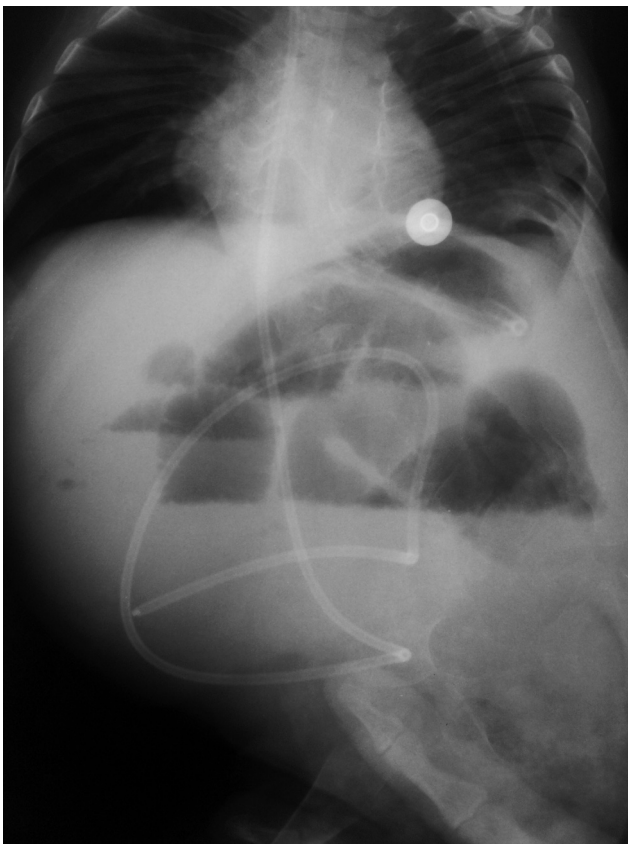

Figure 1. Plain x-ray of abdomen showing distended bowel loops with air-fluid levels and a coiled shunt catheter.

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 on for insertion of VPS catheter due to hydrocephalus. Physical examination was unremarkable except a left scrotal enlargement. The catheter was palpated throughout its course in the inguinoscrotal region. Plain abdomino-pelvic x-ray showed the distal tip of the catheter to be located in the scrotum (Figure 2). Under general anesthesia through an incision in the groin the catheter was exposed, and repositioned into the abdomen and inguinal herniorraphy was performed (Figure 3). Eight years after the initial operation, since the pati-

ent became taller, the distal part of the VPS catheter was extended by the neurosurgeon. He is doing well 10 years after the initial operation with his shunt catheter working well.

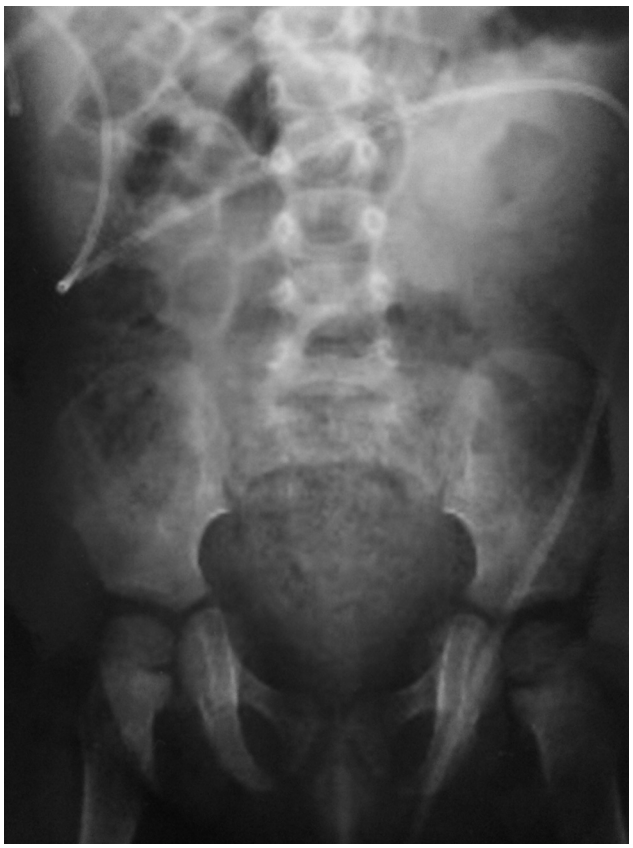

Figure 2. Plain abdomino-pelvic x-ray showing the distal tip of the catheter to be located in the scrotum.

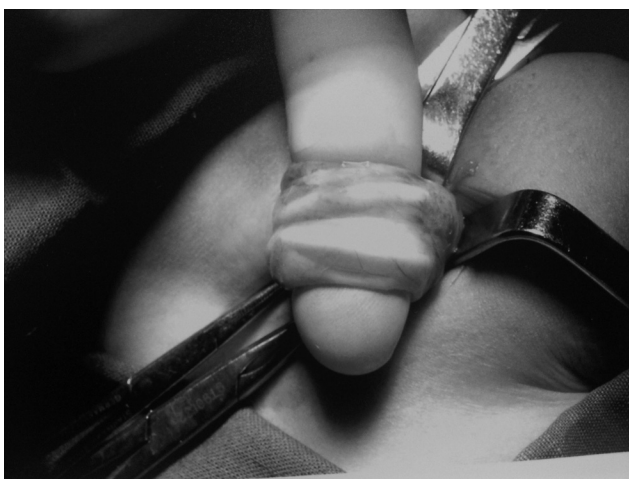

Figure 3. Operative view of case 2 with VPS catheter inside the hernia sac.

DISCUSSION

The diversion of cerebrospinal fluid with the use of VPS is commonly employed in the management of hydrocephalus. It is often followed by various complications with reported incidence of up to 47% [1,2]. However it is suggested that shunt failure rates of about or less than 5% per year should be considered as a reasonable goal [5].

Patients' medical history has an important place 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 (CT) 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. The shunt survey consists of AP and lateral views of the head and neck plus an AP view of the chest and the abdomen. Additional views may be necessary to see the segments of the shunt that are not clearly seen on the standard views.

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 on the end of the catheter tip [6-9]. Intestinal obstruction is one of the less common abdominal complications [10]. Proposed mechanism of intestinal obstruction may include the hypermobility of the peritoneal end of the shunt catheter inside the abdomen as well the anatomical characteristics of the abdominal cavity itself [11]. Whatever the exact mechanism, once diagnosed it is important that prompt surgical intervention to overcome the obstruction is mandatory as in our case who presented with the symptoms of mechanical intestinal obstruction and was treated surgically by adhesiolysis with repositioning of the catheter.

Laparotomy remains the standard approach in the treatment of intestinal obstruction. Recent trends in surgical management of these complications also include laparoscopic intervention. Laparoscopic tre-

Table 1. Chronological review of the literature on the migration of VPS catheters into inguinoscrotal region.

Author	Year	n	Clinical finding	Type of surgical repair
Murtagh F, et al. [10]	1967	1	Scrotal swelling	Surgical repair of hernia
Ramani PS [18]	1974	1	Scrotal swelling	Surgical repair of hernia
Levy SH, et al. [19]	1977	1	Simulated testicular torsion	Surgical repair of hernia
Redman JF, et al. [20]	1977		Scrotal swelling	Surgical repair of hernia
Bristow DL, et al. [21]	1978	1	Simulated testicular torsion	Extraperitoneal catheter shortening
Di Rocco C, et al. [16]	1982	1	İnguinoscrotal swelling	Hernia repair with repositioning the catheter
Crofford MJ, et al. [22]	1983	4	İnguinal hernia	Herniorraphy with repositioning the catheter
Fuwa I, et al. [23]	1984	1	Scrotal swelling	Hernia repair with replacement of the catheter with a new one
Kobayashi H, et al. [24]	1987	2	Scrotal swelling	Hernia repair with repositioning the catheter
Ram Z, et al. [25]	1987	1	İnguinal hernia	Abdominal repositioning the catheter followed by herniorraphy with repositioning the catheter
Albala DM, et al. [26]	1989	2	Scrotal swelling	Surgical repair of hernia
Kwok CK, et al. [27]	1989	1	Scrotal swelling (Bilateral)	Bilateral hernia repair with repositioning the catheter
Göçer A, et al. [28]	1990	1	Scrotal swelling	Withdrawal and shortening the catheter
Selçuklu A, et al. [29]	1991	1	Scrotal swelling	Hernia repair with repositioning the catheter
Oktem IS, et al. [30]	1998	4	Scrotal swelling	Hernia repair with repositioning the catheter
Ozveren MF, et al. [31]	1999	1	Scrotal swelling	Hernia repair with repositioning the catheter
Silver RI, et al. [32]	2000	1	Paratesticular swelling resembling paratesticular tumor	Hernia repair with removal of the nonfunctioning catheter
Henriques JG, et al. [33]	2003	1	İnguinal hernia	Hernia repair with repositioning the catheter
Agarwal T, et al. [34]	2009	1	Scrotal swelling	Hernia repair with repositioning the catheter
Kita D, et al. [35]	2010	1	Scrotal swelling	Hernia repair with repositioning the catheter
Gupta M, et al. [36]	2012	1	İnguinal hernia	Hernia repair with repositioning the catheter

atment is a safe option with lower complication rates and a reduced economic burden. It allows the inspection of whole abdominal cavity and associated pathology. In a meta-analysis, laparoscopic adhesiolysis has been found advantageous in most of the analyzed outcomes [12]. The sole restrictive characteristic of laparoscopic treatment is that it requires experienced laparoscopic surgeons. Nevertheless there is an increase in utilization of laparoscopy in the treatment of these complications [13].

Incidental appendectomy has been widely practiced by different surgical specialties during the course of abdominal surgery for patients who are prone to a future acute appendicitis. The main objective of doing the procedure is to prevent potential development of appendicitis, so as to reduce the mortality, morbidity and cost of this very common acute surgical emergency [14]. On the other hand the use of an isolated appendiceal segment as an intermittent catheterization route to empty a continent urinary reservoir has been recommended for future treatment in patients with myelodysplasia [15]. Short vascular supply together with retrocecal and subhepatic location of the appendix which might preclude to perform future Mitrofanoff procedure infeasible in our patient prompted us to perform incidental appendectomy to prevent the occurrence of appendicitis in the future and its related complications.

Inguinal hernia and/or hydrocele may follow the insertion of VPS with a frequency ranging from 3.8% to 16.8% occurring at a variable length of time after the operation [16,17]. Extrusion of the abdominal catheter into the inguinoscrotal region via a patent processus vaginalis was rarely reported and data of a chronological review of the published literature on the migration of the VPS catheter into inguinoscrotal region is depicted in Table 1 [10,18-36]. As can be seen, standard hernia repair with repositioning of the VPS catheter into abdominal cavity seems to be an effective therapeutical choice in the majority of patients with migration of VPS catheter into scrotum through a patent processus vaginalis. Inadequate or loose fixation of the catheters, an unobliterated processus vaginalis, repeated traction of the peritoneal catheter and an increased abdominal pressure are the main factors for shunt migration inside the scrotum [10,22]. It

is suggested that the migration of the peritoneal catheter into the scrotum in our patient was probably due to a patent processus vaginalis 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 VPS catheter in children may be an incidental finding requiring elective hernia repair as in our case. However once combined with the signs of increased intracranial pressure, after other reasons for increased intracranial pressure are ruled out, and considering the risk of incarceration in infancy, an emergency surgical repair of hernia with release of the entrapped catheter into the abdominal cavity becomes a matter of necessity rather than of choice [21,24].

There are conflicting reports as regards to 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 [37]. The value of contralateral groin exploration in premature neonates has been found to be doubtful [38]. There are also reports that routine contralateral groin exploration is not indicated in any situation [39]. The finding of a patent processus vaginalis (PPV) in the literature is usually present in over 35% of the cases, while the occurrence of a contralateral hernia is usually seen in less than 15% of the cases [40]. Therefore, routine contralateral inguinal exploration does not seem justified.

Incidence of inguinal hernia development after insertion of VPS has been reported to be 14% and 20% of the children who had developed an incarceration. It is recommended that after VPS insertion these infants should be closely watched for the development of a clinical inguinal hernia [4,41]. After diagnosis of a hernia prompt surgical intervention including contralateral side exploration has been also recommended [4,41]. 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 [17]. Although contralateral inguinal exploration has been recommended contralateral side exploration was not performed in our case since the patient was in the follow-up of both the neurosurgery and pediatric surgery team and the patient's parents had been highly concerned about the future 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 by way of VPS. Early identification and management of these uncommon complications are important not only to preserve the well-being of the child but also to assure the quality of the patients' long term outcome.

REFERENCES

1. Lortat-Jacob S, Pierre-Kahn A, Renier D, et al. Complications abdominales des shunts ventriculo-péritoneaux chez l'enfant. *Chir Pediatr* 1984;25:17-21. PMid:6375883
2. Rodgers BM, Vries JK, Talbert JL. Laparoscopy in the diagnosis and treatment of malfunctioning ventriculo-peritoneal shunts in children. *J Pediatr Surg* 1978;13:243-247. http://dx.doi.org/10.1016/S0022-3468(78)80395-9
3. Guillen A, Costa JM, Castello I, et al. Neurocirugia (Astur) 2002;13(5):401-404.
4. Grosfeld JL, Cooney DR, Smith J, et al. Intra-abdominal complications following ventriculo-peritoneal shunt procedures. *Pediatrics* 1974;54:791-796. PMid:4431676
5. Drake JM, Kestle JR, Tuli S. CSF shunts: 50 years on past, present and future. *Child's Nerv Syst* 2000;16(10-11):800-804. http://dx.doi.org/10.1007/s003810000351 PMid:11151733
6. Davidson RI. Peritoneal bypass in the treatment of hydrocephalus: historical review and abdominal complications. *J Neurol Neurosurg Psychiatry* 1976;39:640-646. http://dx.doi.org/10.1136/jnnp.39.7.640 PMid:136498 PMCid:PMC492393
7. Grosfeld JL, Cooney DR. Inguinal hernia after ventriculoperitoneal shunt for hydrocephalus. *J Pediatr Surg* 1974;9:311-315. http://dx.doi.org/10.1016/S0022-3468(74)80286-1
8. Harmon WM, Colonel MC. Evaluation and use of the ventriculoperitoneal shunt in hydrocephalus. *J Neurosurg* 1971;34:792-795. http://dx.doi.org/10.3171/jns.1971.34.6.0792 PMid:5561024
9. Jackson IJ, Snodgrass SR. Peritoneal shunts in the treatment of hydrocephalus and increased intracranial pressure: a four-year survey of 62 patients. *J Neurosurg* 1955;12:216-222. http://dx.doi.org/10.3171/jns.1955.12.3.0216 PMid:14381928
10. Murtagh F, Lehman R. Peritoneal shunts in the management of hydrocephalus. *JAMA* 1967;202:1010-1014. http://dx.doi.org/10.1001/jama.1967.03130240052008
11. Dominguez CJ, Tyagi A, Hall G, et al. Sub-gleal coiling of

the proximal and distal components of a ventriculo-peritoneal shunt: an unusual complication and proposed mechanism. *Child's Nerv Syst* 2000;16:493-495. http://dx.doi.org/10.1007/PL00007294
12. Li MZ, Lian L, Xiao LB, et al. Laparoscopic versus open adhesiolysis in patients with adhesive small bowel obstruction: a systematic review and meta-analysis. *Am J Surg* 2012;204(5):779-786. http://dx.doi.org/10.1016/j.amjsurg.2012.03.005 PMid:22794708
13. O'Connor DB, Winter DC. The role of laparoscopy in the management of acute small-bowel obstruction: a review of over 2,000 cases. *Surg Endosc* 2012;26(1):12-17. http://dx.doi.org/10.1007/s00464-011-1885-9 PMid:21898013
14. Bijnen CL, van den Broek Wt, Bijnen AB, et al. Implications of removing a normal appendix. *Dig Surg* 2003;20(2):115-121. http://dx.doi.org/10.1159/000069386 PMid:12686778
15. Farrugia MK, Malone PS. Educational article: The Mitrofanoff procedure. *J Pediatr Urol* 2010;6(4):330-337. http://dx.doi.org/10.1016/j.jpurol.2010.01.015 PMid:20188633
16. Di Rocco C, Iannelli A, Puca A, et al. Hydrocele and inguinal hernia after ventriculo-peritoneal shunt in childhood. *Pediatr Med Chir* 1982;4(6):661-664. PMid:6927418
17. Clarnette TD, Lam Sk, Hutson JM. Ventriculo-peritoneal shunts in children reveal the natural history of closure of the processus vaginalis. *J Pediatr Surg* 1998;33(3):413-416. http://dx.doi.org/10.1016/S0022-3468(98)90080-X
18. Ramani PS. Extrusion of abdominal catheter of ventriculoperitoneal shunt into the scrotum. *J Neurosurg* 1974;40:772-773. http://dx.doi.org/10.3171/jns.1974.40.6.0772 PMid:4826603
19. Levy SH, Cooper P, Schiffman D. Simulated testicular torsion in a neonate. Complication of ventriculoperitoneal shunt. *Urology* 1977;9(2):174-176. http://dx.doi.org/10.1016/0090-4295(77)90190-X
20. Redman JF, Seibert JJ. Abdominal and genitourinary complications following ventriculoperitoneal shunts. *J Urol* 1977;119:295-297.
21. Bristow DL, Buntain WL, James HL. Ventriculoperitoneal (VP) shunt migration causing an acute scrotum: a case report of Doppler evaluation. *J Pediatr Surg* 1978;13(6):538-539. http://dx.doi.org/10.1016/S0022-3468(78)80326-1
22. Crofford MJ, Balsam D. Scrotal migration of ventriculoperitoneal shunts. *Am J Roentgenol* 1983;141:369-371. http://dx.doi.org/10.2214/ajr.141.2.369 PMid:6603136
23. Fuwa I, Matsukado Y, Itoyama Y, et al. Migration of a dissected peritoneal shunt catheter into the scrotum. *Brain Dev* 1984;6(3):336-338. http://dx.doi.org/10.1016/S0387-7604(84)80049-2
24. Kobayashi H, Hayashi M, Kawano Y, et al. Migration of abdominal catheter of ventriculoperitoneal shunt into the scrotum. *Zentralbl Neurochir* 1987;48(3):232-234. PMid:3324576
25. Ram Z, Findler G, Guttman I, et al. Ventriculoperitoneal shunt malfunction due to migration of the abdominal catheter into the scrotum. *J Pediatr Surg* 1987;22:1045-1046. http://dx.doi.org/10.1016/S0022-3468(87)80516-X
26. Albala DM, Danaher JW, Huntsman WT. Ventriculoperitoneal shunt migration into the scrotum. *Am Surg* 1989;55:685-688 PMid:2683914
27. Kwok CK, Yue CP, Wen HL. Bilateral scrotal migration of abdominal catheters: a rare complication of ventriculoperitoneal shunt. *Surg Neurol* 1989;31:330-331. http://dx.doi.org/10.1016/0090-3019(89)90061-X
28. Göçer A, Bağdatoğlu H, Çetinalp E, et al. An unusual complication of the ventriculoperitoneal shunt: Migration of the distal end into the scrotum through the inguinal canal. *Turk Neurosurg* 1990;1:176-177.
29. Selçuklu A, Pasçaoğlu A, Akdemir H, et al. Migration of the peritoneal catheter of a ventriculoperitoneal shunt into the scrotum. *Turk Neurosurg* 1991;57:52-53.
30. Oktem IS, Akdemir H, Koc K, et al. Migration of abdominal catheter of vetriculoperitoenal shunt into the scrotum. *Acta Neurochir (Wien)* 1998;140:167-170. http://dx.doi.org/10.1007/s007010050078
31. Özveren MF, Kazez A, Çetin H, et al. Migration of the abdominal catheter of a ventriculoperitoneal shunt into the scrotum. *Neurol Med Chir (Tokyo)* 1999;39:313-315. http://dx.doi.org/10.2176/nmc.39.313
32. Silver RI, Docimo SG. A ventriculoperitoneal shunt masquerading as a paratesticular tumor. *J Pediatr Surg* 2000;35:1407-1408. http://dx.doi.org/10.1053/jpsu.2000.9352
33. Henriques JG, Pinho AS, Pianetti G. Complication of ventriculoperitoneal shunting: inguinal hernia with scrotal migration of catheter. Case report. *Arq Neuropsiquiatr* 2003;61(2B):486-489. http://dx.doi.org/10.1590/S0004-282X2003000300031 PMid:12894291
34. Agarwal T, Pandey S, Niranjan A, et al. Unusual complication of ventriculoperitoneal shunt surgery. *J Pediatr Neurosci* 2009;4(2):122-123. http://dx.doi.org/10.4103/1817-1745.57340 PMid:21887195 PMCid:PMC3162779
35. Kita D, Hayashi Y, Kinoshita M, et al. Scrotal migration of the peritoneal catheter of a ventriculoperitoneal shunt in a 5-year-old male. Case report. *Neurol Med Chir (Tokyo)* 2010;50(12):1122-1125. http://dx.doi.org/10.2176/nmc.50.1122
36. Gupta M, Digra NC, Sharma N, et al. Migration of the peritoneal catheter of a ventriculoperitoneal shunt into the scrotum. *S Afr J CH* 2012;6(3):93-94. http://dx.doi.org/10.7196/sajch.386
37. Grosfeld JL, Cooney DR, Smith J, Campbell JR. Intraabdominal complications following ventriculoperitoneal shunt procedures. *Pediatrics* 1974;54:791-796. PMid:4431676
38. Steven M, Greene O, Nelson A, Brindley N. Contralateral inguinal exploration in premature neonates: is it necessary? *Pediatr Surg Int* 2010;26(7):703-706. http://dx.doi.org/10.1007/s00383-010-2614-5 PMid:20454795
39. Ein SH, Njere I, Ein A. Six thousand three hundred sixty-one pediatric inguinal hernias: a 35-year review. *J Pediatr Surg* 2006;41(5):980-986. http://dx.doi.org/10.1016/j.jpedsurg.2006.01.020 PMid:16677897
40. Nassiri SJ. Contralateral exploration is not mandatory in unilateral inguinal hernia in children: a prospective 6-year study. *Pediatr Surg Int* 2002;18(5-6):470-471. http://dx.doi.org/10.1007/s00383-002-0711-9 PMid:12415383
41. Philip L. Glick and Scott C. Boulanger: Inguinal Hernias and Hydroceles (Ventriculoperitoneal shunts/peritoneal dialysis). İn Arnold G. Coran (ed in chief) Pediatric Surgery 7th ed, 76 chapter, p 999, 2012.