CASE REPORT – OPEN ACCESS

International Journal of Surgery Case Reports 6 (2015) 198–202

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Rare complication of ventriculoperitoneal shunt. Early onset of distal catheter migration into scrotum in an adult male: Case report and literature review

Bryan S. Lee [a], Sumeet Vadera [b], Jorge A. Gonzalez-Martinez [a,*]

[a] Cleveland Clinic Foundation, Department of Neurological Surgery, United States
[b] Assistant professor of neurosurgery, University of California, Irvine, 101 The City Drive, Bldg 200, Suite 210 Orange, CA 92868, United States

ARTICLE INFO

Article history:
Received 4 July 2014
Accepted 24 September 2014
Available online 11 December 2014

Keywords:
Ventriculoperitoneal shunt
Post-operative shunt complications
Scrotal migration
Hydrocele

ABSTRACT

INTRODUCTION: The role of shunt placement is to divert cerebrospinal fluid from within the ventricles to an alternative location in the setting of hydrocephalus. One of the rare shunt complications is distal catheter migration, and various body sites have been reported, including the scrotum. Although cases of scrotal migration of distal catheter have been reported in pediatric patients, cases in adult patients are rare due to obliterated processus vaginalis. Furthermore, there has not been a case reported for scrotal migration in an adult at an early onset.

PRESENTATION OF CASE: 65-year-old male underwent shunt placement for normal-pressure hydrocephalus-like symptoms. On post-operative day seven patient developed right testicular edema, for which ultrasound was performed, revealing hydrocele along with the presence of distal catheter in the scrotum. On post-operative day nine patient underwent distal catheter trimming via laparoscopic approach with general surgery, with post-operative imaging showing satisfactory location of distal catheter in the peritoneal cavity.

DISCUSSION/CONCLUSION: Early onset of distal catheter migration into scrotum in an adult male is a unique case, as most cases are reported in pediatric patients, and it is the first case reported in the English literature to have occurrence at an early onset during the peri-operative period. As our case demonstrates, early occurrence and detection of scrotal migration of the distal catheter prevent shunt malfunction. Prompt surgical management of catheter repositioning is therefore recommended to avoid the risk of further complications.

1. Background and importance

The role of shunt placement is to divert cerebrospinal fluid (CSF) from within the ventricles, from subarachnoid space in lumbar spine, or from a pre-existing cyst to an alternative location in the setting of hydrocephalus.[5] The most common location for CSF diversion is from the ventricle to the peritoneum, and this placement is known as the ventriculoperitoneal shunt (VPS). Other commonly used sites include the heart (ventriculo-atrial shunt), pleura (ventriculo-pleural shunts), and from lumbar space to periotoneum (lumbo-peritoneal shunt). VPS is associated with many complications, including overdrainage, valve failure, breakage of catheter, catheter obstruction, coiling of catheter, spontaneous knot formation, infection, and migration of distal catheter into another body part, ultimately leading to obstructive hydrocephalus. One of the rare sites of distal catheter migration is the scrotum.[32,46] Other reported sites of migration include the ventricle,[34] scalp/subgaleal space,[10] neck,[11] mouth,[30] breast,[31] breast implant,[52] thoracic cavity,[17] pulmonary artery,[35] intracardiac,[60] lungs/pleural space/transdiaphragmatic,[7,25,50] anterior chest wall,[6] intra-abdominal wall,[39] abdominal subcutaneous fat tissue,[33] umbilicus,[23] stomach,[3] large intestine,[15] liver,[57] gall bladder,[41] bladder/urethra,[9] inguinal sac,[62] buttocks,[48] canal of Nuck, which is the female counterpart of the spermatic cord,[63] vulva/vagina,[55] rectum/anus,[54] and knee.[36] Although cases of scrotal migration of distal catheter have been reported in pediatric patients, cases in adult patients are rare due to obliterated processus vaginalis.[46] Furthermore, there has not been a case reported for scrotal migration in an adult at an early onset. By reporting this rare case and reviewing English literature of similar rare complications of VPS, the authors strongly feel that the results of this manuscript can be useful to the journal readership given the rarity of such complications and providing readers with information about how different complications were managed.

* Corresponding author at: Cleveland Clinic Foundation, Department of Neurological Surgery, Epilepsy Center, 9500 Euclid Avenue S60, Cleveland, OH 44195, United States. Tel.: +1 216 636 5860; fax: +1 216 444 0343.
E-mail address: gonzalj1@ccf.org (J.A. Gonzalez-Martinez).

http://dx.doi.org/10.1016/j.ijscr.2014.09.032

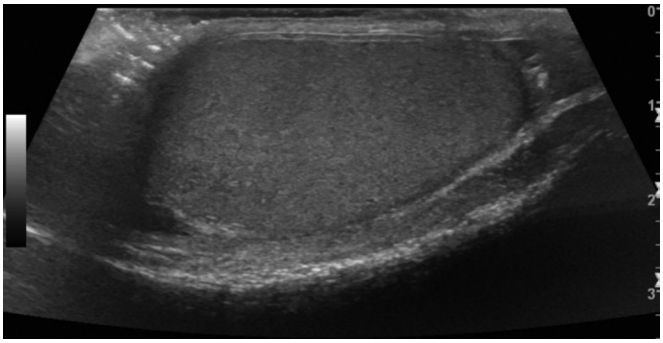

Fig. 1. Testicular US showing hydrocele and presence of catheter in scrotum.

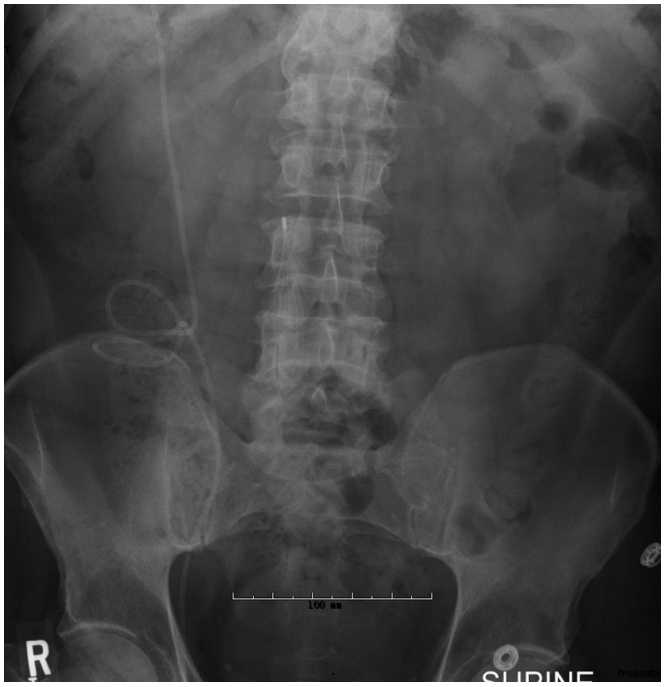

Fig. 2. Abdominal X-ray confirming distal catheter migration.

2. Clinical presentation

A 65-year-old male with past medical history of epilepsy status post left temporal lobectomy, and syncope and asystole status post pacemaker placement, presented with symptoms of imbalance, memory loss with episodic confusion, and urinary incontinence present for months. Initial computed tomography (CT) of brain revealed ventriculomegaly. After seizures were ruled out with bedside electroencephalography (EEG) monitoring, patient underwent VPS placement two days after admission, with valve pre-set at 100 mm H_20 (Codman-Medos Hakim® programmable valve). Post-operative imaging with CT brain and shunt series X-ray were satisfactory and confirmed the proper locations of catheters and valve setting. On post-operative day seven, patient developed right testicular edema, for which testicular ultrasound (US) was performed, revealing hydrocele along with the presence of distal catheter in the scrotum (Fig. 1). Abdominal X-ray was performed, confirming the migration of distal catheter through the inguinal canal (Fig. 2). On post-operative day nine, patient received another operation for distal catheter trimming via laparoscopic approach with general surgery, and post-operative imaging was satisfactory for the location of distal catheter in the peritoneal cavity (Fig. 3). Patient was then discharged home in a stable condition.

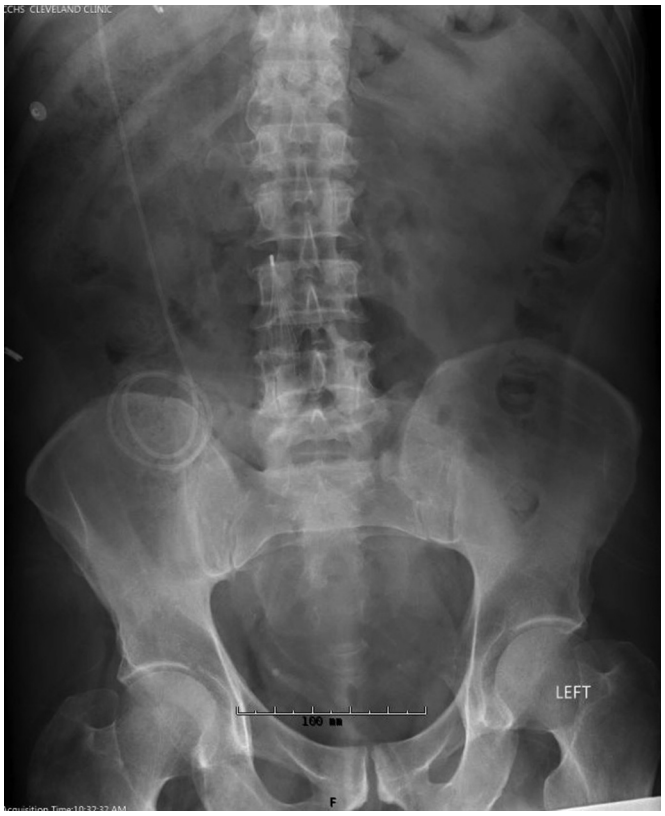

Fig. 3. Post-operative abdominal X-ray after distal catheter trimming.

3. Discussion

The distal catheter of VPS can migrate into various body parts. Migration into the scrotum is a rare complication and has been reported only in 30 case reports in the English literature (Table 1). As demonstrated most cases occurred in pediatric patients, mostly during infancy and in the first six months after VPS shunt placement.[32] A higher incidence of unobliterated processus vaginalis in pediatric patients than in adult patients leads to a higher likelihood of VPS distal catheter migration into the scrotum.[28] Anatomically the distal catheter enters the scrotum from the patent processus vaginalis, which becomes the scrotal tunica vaginalis as it separates from the peritoneum.[26] In the majority of the population the processus vaginalis becomes obliterated. It remains patent in 90% of population at birth, 50–60% at one year of age, 40% between ages two and 16, and 15–30% in older adults at necropsy.[19,49] The presence of patent processus vaginalis creates the conduit through which the distal catheter in the abdominal cavity can travel to reach the scrotum. In pediatric patients the patency of processus vaginalis can be theoretically prolonged by the increased abdominal pressure from VPS placement creating constant in-flow of fluid.[19,22] Moreover, as the residual peritoneal cavity volume is linearly correlated with the body surface area, younger pediatric patients have a higher tendency to have VPS distal catheter migrate into the scrotum due to patent processus vaginalis and smaller peritoneal cavity. This explains the dominance of distal catheter migration into scrotum in pediatric patients. Only two cases of distal catheter migration into scrotum occurred in adolescent patients,[20,53] and only one other case occurred in an adult male.[46] However, in the case reported by Rehm et al., post-operative period was uneventful, and the scrotal edema secondary to distal catheter migration did not occur until four years after the VPS placement. Distal catheter into scrotum has also been reported in LPS adult patients, but the migration did not occur until

Table 1
Summary of previous cases of scrotal migration of VPS.

Authors	Age of migration	Interval time	Affected side	Management
Agarwal et al.[1]	36 weeks	3 weeks	Right (Rt)	Repositioning of distal catheter, inguinal hernia repair
Albala et al.[2]	14 months	7 months after revision	Rt	Repositioning of distal catheter, hernia sac reduction
Ammar et al.[4]	6 months	2 months	Left (Lt)	VPS removal and reinsertion
Bristow et al.[8]	10 months	1 day	Rt	Shortening of distal catheter
Clarnette et al.[12]	25 patients (age range from less than 8 weeks to 64 weeks, mean 48 weeks)	Not reported	Hydrocele reported: Bilateral 14, 4 Lt, 7 Rt (side of catheter migration not reported)	Not reported
Crofford et al.[14]	4 patients (38 weeks, 1 month, 3 months, 4 years)	5 months, 3 months, 1 month, 2 months, respectively	Rt, Rt, Rt, Lt, respectively	Repositioning of catheter and processus vaginalis closure
Fuwa et al.[16]	13 months	12 weeks	Rt	Catheter removal via inguinal incision and inguinal hernia repair
Goh et al.[18]	4 months	Near 4 months	Rt	Processus vaginalis closure
Ho et al.[20]	14 years	1 year after fractured catheter revision	Lt	Shunt removal via scrotal incision and repair of hernia sac
Jamjoom et al.[21]	14 months	2 months	Rt	Replacement of catheter and processus vaginalis closure
Karaosmanoglu et al.[22]	14 months	Not reported	Rt	Distal catheter removal
Kita et al.[26]	5 years	4 months	Lt	Processus vaginalis closure
Kobayashi et al.[27]	2 patients (23 days, 45 months)	3 days, 9 months, respectively	Rt	Catheter removal via groin incision, inguinal hernia repair, and subsequent processus vaginalis closure
Kowk et al.[28]	31 weeks	1 week after revision	Bilateral (old catheter in Rt and new catheter in Lt)	Removal of old catheter via groin incision, repositioning of new catheter, processus vaginalis closure
Lee et al. (present case)	65 years	7 days	Rt	Laparoscopic distal catheter trimming
Levey et al.[29]	29 days	6 days	Rt	Catheter repositioning via scrotal and inguinal incision
Mohammadi et al.[32]	7 months	5 months	Rt	Exploratoy laparotomy for distal catheter repositioning and processus vaginalis closure
Oktem et al.[37]	4 patients (10 months, 2.5 months, 9 days, 2.5 months)	6 months, 5 months, 4 months, 1 day, respectively	Rt, Rt, Rt, Lt, respectively	Repositioning of catheter and processus vaginalis closure
Ozveren et al.[38]	3 days	1 day	Rt	Replacement of catheter into peritoneum and inguinal hernia repair
Prabhu et al.[42]	Not reported	15 months	Lt	Removal of catheter and processus vaginalis closure
Rahman et al.[43]	4 years	1 month	Rt	Processus vaginalis closure
Ram et al.[44]	3 years	2.5 years	Rt	Shortening of distal catheter via open abdominal incision
Ramani et al.[45]	12 days	5 months	Rt	Repositioning of catheter via groin incision
Rehm et al.[46]	46 years	4 years	Rt	VPS revision with distal catheter truncation
Rivero-Garvia et al.[47]	6 years	5 years	Rt	Processus vaginalis closure
Scherzer et al.[51]	2 patients (3 months, 2 months)	13 days, 35 days respectively	Lt, Rt, respectively	Repositioning of catheter and inguinal hernia repair
Shahizon et al.[53]	3 years	Not reported	Rt	Removal of shunt catheter and inguinal hernia repair
Silver et al.[56]	14 years	7 months after revision	Lt	Removal of distal catheter and inguinal hernia repair
Walsh et al.[58]	17 months	6 months	Rt	Not reported
Ward et al.[59]	18 months	7 months	Rt	Repositioning of catheter and processus vaginalis closure
Wong et al.[61]	7 months	4 weeks	Rt	Repositioning of distal shunt

four weeks after the implantation.[24,40] The interval between the latest shunt implantation and the migration report date ranged from one day to five years in all pediatric and adult patients. The present case occurred in the oldest patient documented and reported to date. Furthermore, there has not been an adult case in which the migration occurred at an early onset within seven days during the peri-operative period. The involvement of the right-sided scrotum was dominant, and this can be explained by the fact that the right testicle descends later than the left testicle. The most common management encompassed repositioning of the distal catheter and processus vaginalis closure. The CSF flow into the patent processus vaginalis can create a trough effect, drawing the shunt tip into the trough center.[28] This would indicate the proper management would include not only the repositioning of the catheter but would also have to include catheter truncation, as simple repositioning can lead to recurrence of migration. In our case patient's distal catheter was truncated properly via laparoscopic approach to prevent recurrence.

4. Conclusion

In this case report an early onset of distal catheter migration into scrotum in an adult male is illustrated. It is a unique case as most cases are reported in pediatric patients, and there is only one other case reported in an adult patient with VPS migration into the scrotum. It is the first case reported in the English literature to have occurrence in an adult patient at an early onset during the peri-operative period. As our case demonstrates, early occurrence and detection of scrotal migration of the distal catheter prevent VPS malfunction. Prompt surgical management of catheter

repositioning and truncation is therefore recommended to avoid the risk of further complications.

Conflict of interest

None.

Funding

None.

Ethical approval

None.

Author contribution

Bryan S Lee – study concept, data collection, writing the paper; Sumeet Vadera – editing; Jorge A Gonzalez-Martinez – editing.

References

1. Agarwal T, Pandev S, Niranian A, Jain V, Mishra S, Agarwal V. Unusual complication of ventriculoperitoneal shunt surgery. *Pediatr Neurosci* 2009;**4**(2):122–3.
2. Albala DM, Danaher JW, Huntsman WT. Ventriculoperitoneal shunt migration into the scrotum. *Am Surg* 1989;**55**(11):685–8.
3. Alonso-Vanegas M, Alvarez JL, Delgado L, Mendizabal R, Jimenez JL, Sanchez-Cabrera JM. Gastric perforation due to ventriculo-peritoneal shunt. *Pediatr Neurosurg* 1994;**21**:192–4.
4. Ammar A, Ibrahim AW, Nasser M, Rashid M. CSF hydrocele – unusual complication of V-P shunt. *Neurosurg Rev* 1991;**14**(2):141–3.
5. Blount JP. Ventricular shunting procedures. In: Wynn RH, editor. *Youman's Neurological Surgery*. Philadelphia, PA: Elsevier; 2011. p. 2009–20.
6. Borkar SA, Satyarthee GD, Khan RN, Sharma BS, Mahapatra AK. Spontaneous extrusion of migrated venticuloperitoneal shunt through chest wall: a case report. *Turk Neurosurg* 2008;**18**(1):95–8.
7. Born M, Reichling S, Schirrmeister J. Pleural effusion: beta-trace protein in diagnosing ventriculoperitoneal shunt complications. *J Child Neurol* 2008;**23**(7):810–2.
8. 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):538–9.
9. Burnette DJ. Bladder perforation and urethral catheter extrusion: an unusual complication of cerebrospinal fluid-peritoneal shunting. *J Urol* 1982;**127**:543–4.
10. Cho KR, Yeon JY, Shin HJ. Upward migration of a peritoneal catheter following ventriculoperitoneal shunt. *J Korean Neurosurg Soc* 2013;**53**(6):383–5.
11. Chopra S, Singh DK, Kumar B, Gupta A, Gupta V. CSF hygroma in the neck: rare complication of ventriculoperitoneal shunt. *Pediatr Neurosurg* 2009;**45**(1):78–80.
12. 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):413–6.
14. Crofford MJ, Balsam D. Scrotal migration of ventriculoperitoneal shunts. *AJR Am J Roentgenol* 1983;**141**:369–71.
15. Fischer G, Goebel H, Latta E. Penetration of the colon by a ventriculo-peritoneal drain resulting in an intra-cerebral abscess. *Zentralbl Neurochir* 1983;**44**:155–60.
16. Fuwa I, Matsukado Y, Itoyama Y, Yokota A. Migration of a dissected peritoneal shunt catheter into the scrotum. *Brain Dev* 1984;**6**:336–8.
17. Glatstein MM, Roth J, Scolnik D, Haham A, Rimon A, Koren L, et al. Late presentation of massive pleural effusion from intrathoracic migration of a ventriculoperitoneal shunt catheter: case report and review of the literature. *Pediatr Emerg Care* 2012;**28**(2):180–2.
18. Goh KY, Ng AC, Lee KH, Poon WS. From hydrocephalus to hydrocele. *Hong Kong Med J* 1997;**3**(1):105–6.
19. Grosfeld JL, Cooney DR. Inguinal hernia after ventriculoperitoneal shunt of hydrocephalus. *J Pediatr Surg* 1974;**9**:311–5.
20. Ho CC, Jamaludin WJ, Goh EH, Singam P, Zainuddin ZM. Scrotal mass: a rare complication of ventriculoperitoneal shunt. *Acta Med (Hradec Králové)* 2011;**54**(2):81–2.
21. Jamjoom A, Ur-Rahman N, Jamjoom ZA, Jawad A, Fadley F. Unique complications of cerebrospinal fluid shunts in children – a report of two cases. *Neurochir (Stuttg)* 1992;**35**(5):156–9.
22. Karaosmanoglu D, Metin Y, Akata D, Haliloglu M. An unusual cause of hydrocele: malpositioned ventriculoperitoneal shunt in the scrotum. *J Ultrasound Med* 2008;**27**:159–60.
23. Kella N, Rathi PK, Qureshi M. Umbilical perforation: a rare complication of entriculoperitoneal shunt. *J Coll Phys Surg Pak* 2008;**18**(10):644–5.
24. Kimura T, Tsutsumi K, Morita A. Scrotal migration of lumboperitoneal shunt catheter in an adult. *Neurol Med Chir (Tokyo)* 2011;**51**:861–2.
25. Kiran NA, Kasliwal MK, Suri A, Mahapatra AK. Intrathoracic migration of ventriculoperitoneal shunt. *Indian J Pediatr* 2010;**77**(3):335.
26. Kita D, Hayashi Y, Kinoshita M, Ohama K, Hamada J. Scrotal migration of the peritoneal catheter of a ventriculoperitoneal shunt in a 5-year-old male. Case report. *Neurol Med Chir (Tokyo)* 2010;**50**:1122–5.
27. Kobayashi H, Hayashi M, Kawano Y, Handa Y, Tsuji T, Ishii H. Migration of abdominal catheter of ventriculoperitoneal shunt into the scrotum. *Zentralbl Neurochir* 1987;**48**:232–4.
28. Kwok CK, Yue CP, Wen HL. Bilateral scrotal migration of abdominal catheters: a rare complication of ventriculoperitoneal shunt. *Surg Neurol* 1989;**31**:330–1.
29. Levey SH, Cooper P, Schiffman D. Simulated testicular torsion in a neonate: complication of ventriculoperitoneal shunt. *Urology* 1977;**9**(2):174–6.
30. Low SW, Sein L, Yeo TT, Chou N. Migration of the abdominal catheter of a ventriculoperitoneal shunt into the mouth: a rare presentation. *Malays J Med Sci* 2010;**17**(3):64–7.
31. Maknojia A, Caron JL. Proximal subcutaneous migration of the distal end of a ventriculoperitoneal shunt presenting with recurrent cerebrospinal fluid galactorrhea. *J Neurosurg* 2013 [Epub ahead of print].
32. Mohammadi A, Hedayatiasl A, Ghasemi-rad M. Scrotal migration of a ventriculoperitoneal shunt: a case report and review of literature. *Med Ultrason* 2012;**14**(2):158–60.
33. Nagasaka T, Inao S, Ikeda H, Tsugeno M, Okamoto T. Subcutaneous migration of distal ventriculoperitoneal shunt catheter caused by abdominal fat pad shift – three case reports. *Neurol Med Chir* 2010;**50**(1):80–2.
34. Naik V, Phalak M, Chandra PS. Total intracranial shunt migration. *J Neurosci Rural Pract* 2013;**4**(1):95–6.
35. Nguyen HS, Turner M, Butty SD, Cohen-Gadol AA. Migration of a distal catheter into the heart and pulmonary artery: report of a case and review of the literature. *Childs Nerv Syst* 2010;**26**(8):1113–6.
36. Nourisamie K, Vyas P, Swanson KF. Two unusual complications of ventriculoperitoneal shunts in the same infant. *Pediatr Radiol* 2001;**31**(11):814–6.
37. Oktem IS, Akdemir H, Koç K, Menku A, Tucer B, Selcuklu A, Turan C, et al. Migration of abdominal catheter of ventriculoperitoneal shunt into the scrotum. *Acta Neurochir (Wien)* 1998;**140**:167–70.
38. Ozveren MF, Kazez A, Cetin H, Ziyal IM. Migration of the abdominal catheter of a ventriculoperitoneal shunt into the scrotum-case report. *Neurol Med Chir (Tokyo)* 1999;**39**:313–5.
39. 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. *J Pediatr Neurosci* 2012;**7**(3):228–30.
40. Pollak TA, Marcus HJ, James G, Dorward N, Thorne L. Adult hydrocele complicating a lumboperitoneal shunt. *Br J Neurosurg* 2011;**25**(5):647–8.
41. Portnoy HD, Croissant PD. Two unusual complications of a ventriculoperionteal shunt. Case report. *J Neurosurg* 1973;**39**:775–6.
42. Prabhu S, Cochran W, Azmy AF. Wandering distal ends of ventriculo-peritoneal shunts. *Z Kinderchir* 1985;**40**:80–1.
43. Rahman N, Lakhoo K. Patent processus vaginalis: a window to the abdomen. *Afr J Paediatr Surg* 2009;**6**:116–7.
44. Ram Z, Findler G, Guttman I, Cherniak R, Knoller N, Shacked I. Ventriculoperitoneal shunt malfunction due to migration of the abdominal catheter into the scrotum. *J Pediatr Surg* 1987;**22**:1045–6.
45. Ramani PS. Extrusion of abdominal catheter of ventriculoperitoneal shunt into the scrotum. Case report. *J Neurosurg* 1974;**40**(6):772–3.
46. Rehm A, Bannister CM, Victoratos G. Scrotal perforation by a ventriculoperitoneal shunt. *Br J Neursurg* 1997;**11**(5):443–4.
47. Rivero-Garvia M, Barbeito Gaido JL, Morcillo J, Marquez Rivas J. Shunt dysfunction secondary to peritoneal catheter migration to the scrotum. *Arch Argent Pediatr* 2013;**111**(1):e14–6.
48. Rosenthal A, Norman MA, Harris O, Feliciano DV. Unusual migration of a ventriculoperitoneal shunt segment. *J Trauma* 2009;**66**(6):1743.
49. Rowe MI, Copelson LW, Clatworthy HW. The patent processus vaginalis and the inguinal hernia. *J Pediatr Surg* 1969;**4**:102–7.
50. Sahin S, Shaaban AF, Iskandar BJ. Recurrent pneumonia caused by transdiaphragmatic erosion of a ventriculoperitoneal shunt into the lung. Case report. *J Neurosurg* 2007;**107**(2 Suppl):156–8.
51. Scherzer AL. Letter: Hydrocele following placement of a ventriculoperitoneal shunt. *J Pediatr* 1975;**86**(5):811.
52. Schrot RJ, Ramos-Boudreau C, Boggan JE. Breast-related CSF shunt complications: literature review with illustrative case. *Breast J* 2012;**18**(5):479–83.
53. Shahizon AM, Hanafiah M, Hing EY, Julian MR. Migration of a fractured ventriculoperitoneal shunt into the scrotum: a rare complication. *BMJ Case Rep* 2013, http://dx.doi.org/10.1136/bcr-2013-200609.
54. Sharifian A, Abdollahi A, Maddah G, Anaraki F, Alvandipour M, Abbasi SM, et al. Spontaneous transanal protrusion of ventriculoperitoneal cathether: a case report. *Acta Med Iran* 2013;**51**(2):135–8.
55. Sharma M, Velho V, Mally R, Hrushikesh K. Vulvar migration of the peritoneal end through the inguinal canal in a female infant: an unusual complication of the ventriculo-peritoneal shunt: a case report and review of literature. *J Pediatr Neurosci* 2013;**8**(1):67–9.
56. Silver RI, Docimo SG. A ventriculoperitoneal shunt masquerading as a paratesticular tumor. *J Pediatr Surg* 2000;**35**(9):1407–8.
57. Touho H, Nakauchi M, Tasawa T, Nakagawa J, Karasawa J. Intrahepatic migration of a peritoneal shunt catheter: case report. *Neurosurgery* 1987;**21**:258–9.

58. Walsh AR, Kombogiorgas D. Coiled ventricular-peritoneal shunt within the scrotum. *Pediatr Neurosurg* 2004;**40**:257–8.
59. Ward JF, Moquin RR, Maurer ST. Expanding the differential diagnosis of the acute scrotum: ventriculoperitoneal shunt herniation. *Urology* 2001;**58**: 281.
60. Wei Q, Qi S, Peng Y, Fan J, Lu Y. Unusual complications and mechanism: migration of the distal catheter into the heart – report of two cases and review of the literature. *Childs Nerv Syst* 2012;**28**:1959–64.
61. Wong CW. Scrotal migration of a ventriculo-peritoneal shunt: report of a case. *J Formos Med Assoc* 1994;**93**:640–1.
62. Yoo IH, Yum SK, Oh SJ, Kim KM, Jeong DC. Melanotic neuroectodermal tumor of infancy disseminated by a ventriculoperitoneal shunt and diagnosed from the inguinal sac. *J Pediatr Hematol Oncol* 2013 [Epub ahead of print].
63. Yuksel KZ, Senoglu M, Yuksel M, Ozkan KU. Hydrocele of the canal of Nuck as a result of a rare ventriculoperitoneal shunt complication. *Pediatr Neurosurg* 2006;**42**(3):193–6.