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A rare complication of the ventriculoperitoneal shunt in infant, distal catheter anal migration: Case report

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Abstract
4-month-old presented with trans analprotrusion of distal end of ventriculo-peritoneal shunt catheter.She had undergone VP shunting for congenital Hydrocephalous after one month of birth,two weeks later had undergone revision of the VP shunt. She presented to our pediatric emergency with complaints of distal end of VP shunt protrusion from anal canal with lethargies and severely depressed anterior fontanel. After basic stabilization in the ED, the patient was taken to OR and the shunt system was removed immediately and EVD was continued for2 weeks until shunt replacement and was discharged without neurological sequelae.

Keywords: complication, ventriculoperitoneal shunt, catheter, migration

Introduction

Hydrocephalus is an abnormally increased volume ofcerebrospinal fluid (CSF) in the brain's ventricular system,due to either abnormal flow or impaired absorption [1]. In 1908, Kausch attempted, for thefirst time, to divert the flow of CSF into the peritonealcavity through a shunt installation [2]. Ventriculoperitoneal (VP) shunt is an establishedmethod of diverting CSF for the management of hydrocephalus.However, the procedure is associated with various complications. Shunt infection, malfunction, peritoneal complications,pseudocyst and extrusion are some of the commoncomplications. Thereported incidence of abdominal complications is 10–30% [3]. Migration of the lower end of the shunt catheteris an infrequent problem, which occurs without any recognizablecause.The reported incidence of distal shunt migration is 10% [4]. There are three dentified anatomical patterns of migration based on catheterextension and organs involved: [1] internal, when the catheter invades any viscus inside the thoracic, abdominal, or pelvic cavity; [2] external, when thecatheter penetrates through the body wall either incompletely (subcutaneously)or completely (outside the body); and [3] compound, when the catheterpenetrates a hollow viscus and protrudes through a pre-existing anatomicalorifice. External migration occurred mostly in infants. In contrast,internal migration occurred mostly in adults. A body wall weakness was not arisk factor for catheter protrusion. Shunt duration was a critical factor in themigration pattern, as most newly replaced shunts tended to migrate externally.

Internal Migration (Type I)

The internal migration type included cases in which the VPS distal catheter migrated into one of the threemain body cavities (thoracic, abdominal and pelvic). According to the extension of the catheter, this type wasthen further sub-classified into thoracic, abdominal,and pelvicmigration.In cases of thoracic migration, thecatheter could reach the thoracic cavity through one oftwo entry routes, either supra-diaphragmatic (SD) ortrans-diaphragmatic (TD) (Taub and Lavyne, 1994). The two entry routes can be differentiated radiographically,since the X-ray images will show the entirecatheter above the diaphragm in SD cases, whereas part of it will still be detectable below the diaphragm inTD cases [5].

External Migration (Type II)

The external migration type encompassed cases inwhich the catheter was extruded completely throughthe body wall to the outside or passed incompletely (either penetration or retraction) into the subcutaneoustissue without protruding further.

The catheter can pierce the intact body wall or passing through aweakened region of it. Potential weaknesses in the bodywall include the umbilicus, a previous wound scar, anaugmented breast, and the external genitalia (scrotumand labia majora) via the inguinal canal.

Compound Migration (Type III)

Interno-external or compound migration comprisedcases in which the VPS distal catheter initially perforatedthe wall of a hollow viscus, subsequently passed throughthe viscus lumen, and was ultimately extruded throughan anatomical body orifice. This type was sub-classifiedinto four categories according to the system involved (gastrointestinal or genitourinary) and the orificethrough which the catheter was extruded. The first twocategories included cases in which the catheter penetrateda segment of gastrointestinal tract, then migratedcranially and eventually protruded through the mouth (trans-oral), or caudally to protrude through the anus (trans-anal). In the third category, the catheter penetratedthe urinary bladder and protruded throughthe urethra (trans-urethral). In the last category, thecatheter penetrated a part of the female genital tract andprotruded from the vaginal orifice (trans-vaginal).

The patient's age is considered one of the maincontributors to VPS complications [6, 7] Children experience a high rate ofshunt complications, probably because of their rapidgrowth and the higher risk of shunt infections (Wu *et al*., 2007). It noticed that more than half of thedistal VPS migration cases described in the literatureoccurred in children under 12 years of age (63.5%).In addition, analysis revealed a higher incidenceof external migration than internal and compoundmigrations in infants. This could be mainly attributableto the smaller body size during this period of life,which provides insufficient internal space for themigrated catheter. In addition, the weak body musculatureduring infancy could make it easier for the catheterto penetrate through the body wall. Perforation of a hollow viscus and extrusion throughan anatomical orifice is a well-known complication ofdistal VPS catheter migration (compound migration).

Analysis revealed that children are more susceptibleto this kind of migration, perhaps because theirgastrointestinal wall is weaker and peristalsis strongerthan in elderly patients [8] Perforation of the colon by a VPS distal cathetercan be lethal as it can cause intracranial infections,peritonitis, intraperitoneal abscess, fecal fistulae, and/or sepsis [9] However, patientswith trans-anal shunt extrusion do not necessarilypresent with significant abdominal symptoms ordevelop infections [10] This lackof symptoms could be due to fibrous tract formationat the perforation site, which can seal the perforationand prevent spillage of fecalmatter into the peritoneum [11], This can result in a delayed diagnosis,by which time retrograde Gram negative meningitis,encephalitis or ventriculitis has become fully established,leading to significant morbidity and mortality [10], During the management of this unusual complication,features of ascending gram-negative bacterial meningitis,sepsis, peritonitis, or intraperitoneal abscessformation should be considered individually. The decisionfor optimum treatment of such a patient should Betaken accordingly. In a patient with intestinal perforationbut no other complications, a formal exploratory laparotomyis not required. The treatment for acute (withinfew days) cases with peritonitis may need an emergencyexploratory laparotomy with shunt removal, thoroughperitoneal lavage and primary repair of the intestinalwall. But in chronic cases (after weeks/months) onlydetachment of shunt catheter at the abdominal wall andremoval of the distal end through the anus (rarely colonoscopy/sigmoidoscopy guided) is only needed. The cutdistal end is not pulled back to avoid contamination ofthe tract. External ventriculostomy (using proximal partof the shunt system) may be maintained at least forsome weeks after putting the patient on broad-spectrumantibiotics. If repeated bacteriological culture of CSFcomes negative, then VP shunt placement on the oppositeside could be performed.

Case summary

4-month-old female, a product of elective Cesarean Section, known case of Atrial Septal Defect andobstructive hydrocephalus for which EVD was done at birth, followed by VP shunt insertion at 1 month followed by a revision after 2 weeks. Patient presented to our pediatric emergency as the mothernoticing distal catheter of the VP shunt projecting from the anus (Figure 1) today while changing her diapers the with clear CSF coming from it, followed by decreased activity and repetitive vomiting. Her fontanelle then became sunken (Figure 2). Neurologically, she was depressed but combative. Blood pressure andheart rate were within normal limits for age. Her abdomenwas soft, abdominal X-ray did not reveal any shunt fracture or free abdominal air (Figure3), Computed tomography (CT) of the head revealed hydrocephalus.

Fig 1: Showing the distal end of vp shunt protruding through the anus.

Fig 2: showing the depressed fontanelle of the same patient.

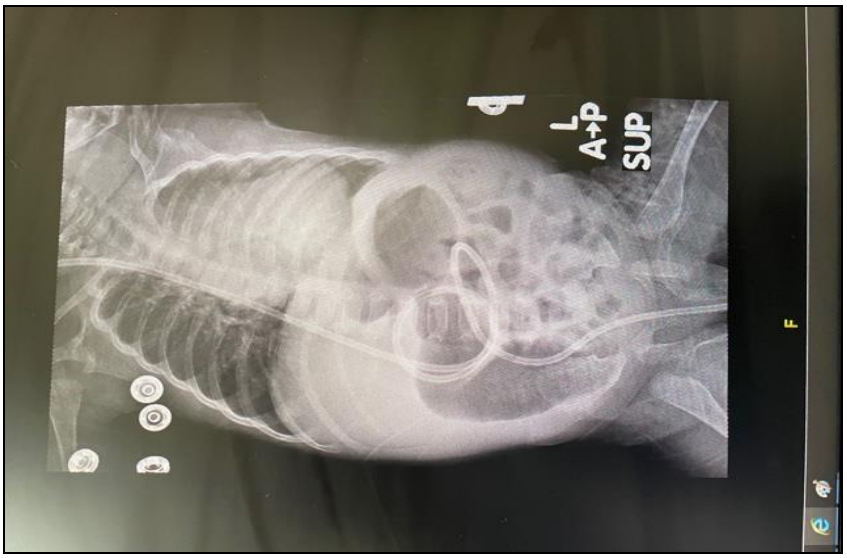

Fig 3: Showing the shunt series showing the distal end protrusion through the anus.

The patient was admitted through Emergency Department. Basic laboratory was sent and patient was started on fluid hydration and kept on maintenance fluid.Pediatric surgery were involved initially, prior to surgery antibiotics were started and Infectious Disease were consulted .Patient was immediately taken to Operating Room on the same day and operated as right occipitoparietal ventricular peritoneal shunt removal and right EVD insertion . The patient tolerated the procedure well, shifted to Pediatric Intensive Care Unit for observation, followed closely by pediatric neurosurgery andpediatric surgeryteam. CSF cell count, glucose, and proteins were normal, and broad spectrum antibiotics (ceftriaxone, vancomycin, and metronidazole) were started. Culture of CSF: Light Growth Staphylococcus epidermidis, following CSF samples were negative. The child made a rapid, uneventful recovery without fever and transferred to the floor on day 7.Feeding was gradually introduced until fully tolerable,after infectious disease clearance the patient was taken to OR for vp shunt insertion on day ?: right ventriculoperitoneal shunt insertion and EVD removal was done. Tolerated the procedure well, went back to the floor,Fast T2 MRI and shunt series xrays were done and reveal unremarkable finding prior to discharge.

Discussion

The incidence ofdistal catheter migration is less than 10% [3]. Such a complication can be fatal due to ascending bacterialmeningitis. The commonesttypeof the abnormal migration of the lower end reported is the migration within the peritoneum. The favored sites are within the bowel lumen [12] (perforation), rectum [13] and out through the umbilicus [14]. Isolated reports are available of shunt catheter comingout through the mouth [15]. Migration into the scrotumthrough an inguinal hernia is also reported [16]. Theother common extraperitoneal sites are the thoraxthrough the diaphragm resulting in CSF hydrothorax [17] .None of the authors in the literature have been able toidentify a specific cause of these complications. Akyuz etal. [18] hypothesized that the catheter tip adheres

to thevisceral wall, a local inflammatory process weakens thebowel wall and the tip then erodes into the lumen over aperiod of time. A constant pressure abutting the tip of thecatheter with the viscera, or the extruding surface usuallyco-occurs ad this favors the tip migrationthrough the abnormal site.

The basic principles in the management of these patientsare [19] immediate shunt removal, covering with broad spectrum intravenous antibioticsand an adequate recovery gap so that CSF cultureis sterile on two separate tests. This is followed byshunt replacement on the other side. During the intervalwhich can be around 3–4 weeks, the patient can be kept oncerebral dehydrants to limit the increasing hydrocephalus.

Summary

Catheter tip migrations should be taken as serious issue particularly when catheter penetrates the large bowel, sincethey are associated with a high incidence of retrogradeintracranial infections. Moreover, the viscusinvolved in compound migration seems to determinethe route of extrusion. For example, the viscusinvolved in all trans-anal extrusion cases was thebowel, while in trans-oral cases the stomach was theprimary organ involved.

Lastly, shunt revision had nosignificant influence on the incidence of VPS distalcatheter migration. Nevertheless Shunt behavior is unpredictable. The complication occurs even after all precautions with the technique of placement have been taken; however, in view of the potential for meningitis prompt and aggressive management is essential to avoid complication related morbidity and mortality.

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