Case Report

Retrograde Partial Migration of Ventriculoperitoneal Shunt with Chamber: Review of Causative Factors and Its Prevention

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Distal migration of shunt is a very common occurrence. Proximal migration of shunt is rare and possible pathophysiological mechanisms to explain this unusual complication is rarely attempted. A 5-month-old child shunted for posttraumatic hydrocephalus presented 1.5 years later with raised intracranial pressure and seizures. Imaging showed subdural hygroma, partial intracranial migration of shunt/chamber. On endoscopy, choroid plexus was adherent to shunt tip and some pericranial tissue was found in the anchoring suture (intraventricularly displaced). Shunt was retrieved endoscopically and diversion established by endoscopic third ventriculostomy with symptoms free follow-up. Host-related and surgical factors have been postulated. Tug-of-war effect on the anchoring suture and collapsing cortex are the possible mechanisms that explain proximal migration in our case. Three-point fixation of the chamber to pericranium, small burr hole with a smaller durotomy, can prevent shunt migration. Proximal shunt migrations should be dealt with endoscopy so as to avoid complications.

Keywords: Hypothesis of shunt migration, neuroendoscopy, shunt chamber migration

Abstract

Distal migration of ventriculoperitoneal (VP) shunt following detachment from the chamber is a common complication, but complete proximal migration of VP shunt into the ventricle is exceptionally rare with a few anecdotal case reports. Proximal migration of VP shunt may present with shunt malfunction as well as additional features such as seizures and subgaleal coiling. Any breach in the continuity of the shunt also adds upon to risk of developing meningitis. We are presenting an endoscopically managed case of ventricular migration of an intact medium pressure VP shunt.

Case Report

A 5-month-old male child involved in a road traffic accident presented to casualty in E4V5M6 status. Noncontrast computed tomography (NCCT) of head showed minimal 3rd ventricular intraventricular hemorrhage (IVH) with normal ventricles. Repeat NCCT on day 3 showed ventriculomegaly with complete resolution of IVH with features of raised intracranial pressure (ICP). Hence, a medium pressure VP shunt was placed through the right Keen’s point with resolution of symptoms. Six months later, the patient developed features of shunt malfunction, for which the entire shunt assembly including the ventricular end was replaced. One year later, the patient developed an intermittent headache and three episodes of seizures despite on antiepileptic drug (valproate). On examination, the patient had no visual deficits. Head circumference was normal for the age. Shunt chamber was not palpable at its normal position in the region of mastoid.

NCCT head showed right-sided subdural hygroma, ventriculomegaly, with an abnormally large loop of ventricular catheter. Chamber was localized in the right occipital horn [Figure 1a and b]. Three-dimensional

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Noncontrast computed tomography (NCCT) reconstruction with minimal bone Subtraction (obtained by neurosurgery residents using our portable CT – CERE TOM™) showed chamber and almost 10 cm of shunt migration intracranially [Figure 1c]. Intracranial location of the chamber with the continuity of the entire system was evident even on skiagram [Figure 1d]. Cerebrospinal fluid (CSF) analysis was normal. The presence of subdural hygroma was suggestive of a still functioning shunt, but clinical features of raised ICP lead to a consensus decision of endoscopic exploration. A possibility of complete migration of the unsterile abdominal end into the ventricle was also kept in mind.

Through left Kocher’s point, neuroendoscope was inserted and showed moderate pressure. Shunt end slits were filled with choroid plexus which was released by saline irrigation and gentle manipulation. It was noted that the suture material used for anchoring had taken a small bit of pericranial tissue along with intraventricularly [Figure 2a]. The shunt was first cut at the parietal incision site (from externally). Endoscopically, the shunt tip was grasped end on and was delivered out under endoscopic guidance along endoscopic tract [Figure 2b]. Entire chamber with the shunt was delivered out. Endoscopic third ventriculostomy (ETV) was performed successfully. Through a small abdominal incision, the distal end of the catheter was removed. Patient recovered well after ETV and was discharged on postoperative day 7. NCCT showed B/L minimal subdural hygroma. Follow-up at 6 months and 2 years showed arrested ventriculomegaly with minimal subdural hygroma and asymptomatic course.

**DISCUSSION**

Hydrocephalus of various etiologies is common in the pediatric age group. VP shunt surgery and ETV are universally accepted procedures with various success rates based on the disease. Nevertheless, shunt surgery is associated with many complications such as shunt malfunction, shunt infection, pseudocyst formation/CSFomas, cutaneous exposure, bowel perforation, and its presentation through aboral, migration of the tube into pleural cavity, liver, heart, scrotum, abdominal wall, and oral cavities.[1-3] Dislodgement and migration of the distal portion of the shunt are commonly encountered at least once in 3–5 years of a neurosurgical career and pose no difficulty in their management. Proximal migration, with its rare incidence (0.1%–0.4%), has only anecdotal case-based management decisions.[4-5]

Many hypothesis and factors have been postulated for the migration of shunt. Host factors such as younger age, thin cortical mantle, malnutrition, excessive neck movements producing a windlass effect coupled with a large potential subgaleal space or dilated ventricles with negative suctioning pressure or a positive intraabdominal pressure, patient’s habit of rubbing the chamber area has been considered in many studies.[4,6,7] Surgical factors such as inadvertently large burr hole, wide durotomy, and inadequate anchorage to the pericranial tissues have been postulated. A large burr hole with a large dural rent may result in a subgaleal pocket with enough CSF acting like a sump sucking the ventricular catheter into the subgaleal pocket.[8] Chabra’s shunt which has a cylindrical chamber has been implicated.[9] Short distance between the ventricular and abdominal end in young patients and rapid decompression of larger hydrocephalus are additional events.[4,5,9] In our case, young child, in a

![Figure 1](image1.png)  
**Figure 1:** (a and b) Noncontrast computed tomography head showing right-sided subdural hygroma, ventriculomegaly, with an abnormally large loop of ventricular catheter. Shunt chamber was localized in the right occipital horn as a thick tube with a lumen. Furthermore, a long segment of shunt ~ 10 cm lied in the subdural fluid. (c) Three-dimensional noncontrast computed tomography reconstruction with minimal manual bone subtraction showed chamber (arrow) and almost 10 cm of shunt migration intracranially. (d) An intracranial location of the chamber with the continuity of the entire system was evident even on skiagram

![Figure 2](image2.png)  
**Figure 2:** (a) Endoscopic view showing the intraventricular location of connector anchorage suture with pericranial tissue. (b) Endoscopically, the shunt tip was grasped and was delivered out under endoscopic guidance after separating from the adjacent choroid
rapid growth phase, slackened pericranial anchorage, and a larger burr hole are evident. We also propose two theories for possible mechanism.

**Tug-of-war**

A constant pulsatile thrust exerted by the entrapped choroid plexus at the tip of the shunt and a constant dragging force from a larger distal system can have a tug-of-war effect at the fixed anchorage point near the burr hole. This repeated to and fro movement may snap the pericranial tissue along with the suture. Even though we follow a three-point anchorage to pericranium, in this case, only a single-point anchorage had been performed.

**Collapsing cortex**

Development of subdural hygroma with receding cortex may add on to more negative pull from the ventricular side. This hypothesis can explain the migration of shunt if the stay sutures have given away as might be in or case. However, it is not evident from literature search about an association between proximal migration and development of subdural hygroma.

Unguided pulling off a migrated shunt can lead to catastrophic consequences. In the era of endoscopic interventions, the added advantage of visualizing the pathology and guided shunt removal thereby mitigating injury to the cortex, choroid plexus, and veins. Naik et al. described the first case of endoscopically managed total intracranial shunt migration without any complication.[4] It also allows procedures such as adhesiolysis, septostomy, and ETV thus eliminating shunt complications. In literature, most of the cases of proximal shunt migrations are of whole assembly type which allows only endoscopic removal as an option or a craniotomy. However, a partial proximal migration has not been reported. In partial migration with dysfunction, after endoscopic insertion, percutaneous disconnection is to be done followed by removal under endoscopic visualization.

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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Jindal A, Kansal S, Mahapatra AK. Unusual complication – VP shunt coming out per rectum and brain abscess. Indian J Pediatr 1999;66:463-5.
2. Agarwal A, Kakani A. Shunt malfunction due to proximal migration and subcutaneous coiling of a peritoneal catheter. J Neurosci Rural Pract 2010;1:120-1.
3. Sridhar K, Karmarkar V. Peroral extrusion of ventriculoperitoneal shunt: Case report and review of literature. Neurol India 2009;57:334-6.
4. Naik V, Phalak M, Chandra PS. Total intracranial shunt migration. J Neurosci Rural Pract 2013;4:95-6.
5. Villarejo F, Alvarez-Sastre C, Gimenez D, Gonzalez C. Migration of an entire one-piece shunt into the ventricle. Neurochirurgia (Stuttg) 1979;22:196-8.
6. Agarwal A, Kakani A. Total migration of a ventriculo-peritoneal shunt catheter into the ventricles. J Pediatr Neurosci 2011;6:88-9.
7. Yee GT, Han SR, Choi CY. Migration and coiling of peritoneal catheter into the subgaleal space: A very rare complication of subgaleoperitoneal shunt. J Korean Neurosurg Soc 2013;54:525-7.
8. Shahsavaran S, Kermani HR, Keikhosravi E, Nejat F, El Khashab M. Ventriculoperitoneal shunt migration and coiling: A report of two cases. J Pediatr Neurosci 2012;7:114-6.
9. Young HA, Robb PJ, Hardy DG. Complete migration of ventriculoperitoneal shunt into the ventricle: Report of two cases. Neurosurgery 1983;12:469-71.