Case Report

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Retrograde Partial Migration of Ventriculo-Peritoneal Shunt With its Chamber: Review of Causative Factors and Its Prevention

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Abstract

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 (ICP) 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). Endoscopic retrieval of migrated shunt along with CSF diversion was established by endoscopic third ventriculostomy (ETV) with symptoms free follow-up. Host-related and surgical factors have been postulated. Tug-of – tie 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: Shunt Chamber Migration; Neuroendoscopy; V-P Shunt; ETV.

Introduction

Distal migration of ventriculo-peritoneal shunt (V-P shunt) following detachment from the chamber is a common complication, but complete proximal migration of V-P shunt into the ventricle is exceptionally rare with few anecdotal case reports [1,2]. Proximal migration of V-P shunt may present with shunt malfunction as well as additional features such as seizures and sub-galeal coiling. The common tendency to deliver out the shunt may result in cortical/ venous injury. Any breach in the continuity of the shunt also adds upon to risk of developing meningitis. We are presenting a case of ventricular migration of an intact medium pressure Ventriculoperitoneal (Chhabra's) shunt without disconnection of the chamber with features of cortical irritation managed by endoscopic removal of shunt.

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Case Report

A 5-month-old male child involved in a road traffic accident presented to casualty in E4V5M6 status. Non contrast computed tomography (NCCT) head showed minimal 3rd ventricular intra-ventricular haemorrhage (IVH) with normal ventricles. Repeat NCCT on day 3 showed ventriculomegaly with complete resolution of IVH with features of raised ICP. Hence, a medium pressure ventriculo-peritoneal shunt was placed through the right Keen's point with resolution of symptoms. 6 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 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 & Figure 1b)**. 3D-NCCT reconstruction with minimal bone subtraction showed chamber and almost 10cms of shunt migration intracranially [Figure1c]. Intracranial location of the chamber with the continuity of the entire system was evident even on skiagram **(Figure 1d)**. CSF analysis was normal. 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 holes 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 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. ETV was performed successfully. Via a small abdominal incision, the distal end of the catheter was removed. The patient recovered well after ETV and was discharged on post-operative day 7. NCCT showed bilateral minimal subdural hygroma. Follow up at 6months and two years showed arrested ventriculomegaly with minimal subdural hygroma and asymptomatic course.

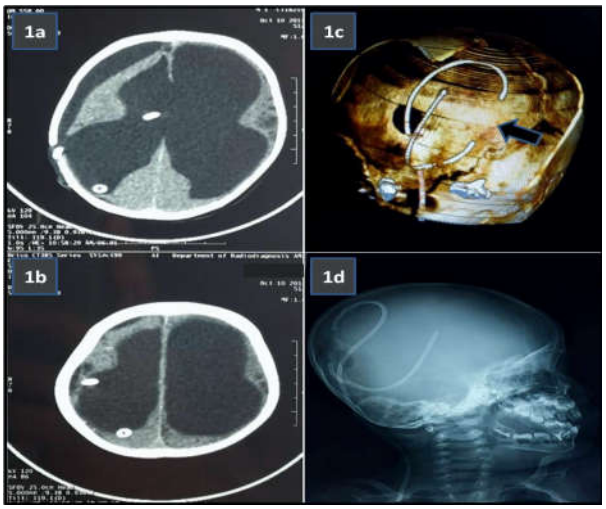

Fig. 1: (a & b) NCCT head showing proximally migrated V-P shunt Chamber in the right occipital horn of lateral ventricle, **(c)** 3D-NCCT head & **(d)** X-ray skullshowing Intracranial location of the chamber

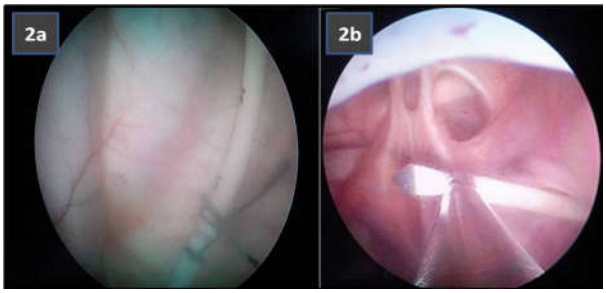

Fig. 2: (a) Endoscopic view of migrated ventricular end of V-P shunt along with suture tied junction of its chamber **(b)** Endoscopic retrieval of migrated chamber and ventricular end of V-P shunt

Discussion

Hydrocephalus of various etiology is common in the paediatric age group. V-P shunt surgery and ETV are universally accepted procedures with various success rates based on the disease [3]. Nevertheless, shunt surgery is associated with many complications such as shunt malfunction, shunt blockage, shunt infection, CSF loculation, and pseudocyst formation, CSFomas, cutaneous exposure, bowel perforation and its presentation through aboral [4-6], migration of the tube into pleural cavity [7], liver [8], heart [9], scrotum [10], abdominal wall [11], subcutaneous coiling of the peritoneal catheter [12] and oral cavities [13]. Dislodgement and migration of the distal portion of the shunt are commonly encountered at least once in 3- 5years 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 [14-22].

Many hypotheses 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 sub-galeal space or dilated ventricles with negative suctioning pressure or a positive intra-abdominal pressure, patient's habit of rubbing the chamber area have been considered in many studies [3,14,21,24]. Surgical factors such as inadvertently large burr hole [3], wide durotomy(larger than chamber) 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 sub-galeal pocket [23]. Rare anecdotal reports of trans-external jugular venous catheterization of distal end has resulted in respiration associated negative venous pressure assisted pulling of distal end from the peritoneal cavity [25]. Chhabra's shunt which has a cylindrical chamber has been implicated

[16-19]. Short distance between the ventricular and abdominal end in young patients and rapid decompression of larger hydrocephalus are additional events [14-16]. In our case, young child, in a rapid growth phase, cut through of the pericranial anchorage and a larger burr hole are evident.

We also propose two theories for possible mechanism. ***Tug-of-tie*****:** 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 can explain provided the shunt anchorage has been dislodged as might been in our case. We have been using this three point anchorage technique in all cases of shunt fixation and have come across just 2 cases of migration including this out off more than 2,000 shunts for congenital hydrocephalus. It is not evident from the literature 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 guide shunt removal thereby mitigating injury to the cortex, choroid plexus, and veins [18,21]. V. Naik etal described the first case of endoscopically managed total intracranial shunt migration without any complications [14]. It also allows procedures like 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 [14-22], but 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.

Conclusion

Proximal migration of shunt is rare and possible pathophysiological mechanisms to explain this unusual complication and is rarely attempted. Host-related and surgical factors have been postulated. Tug-of – tie effect on the anchoring suture and collapsing cortex are the possible mechanisms that explain proximal migration. Three-point anchorage of the chamber to pericranium, small burr hole and a smaller durotomy are the key factors in preventing shunt migration. Neuroendscopic assisted retrieval of proximal migrated shunt is safe.

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