Complete intracranial migration of ventriculoperitoneal shunt-a rare complication

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ABSTRACT

Background: Ventriculoperitoneal shunt (VPS) is one of the most common procedures for the treatment of hydrocephalus. However, there are a number of complications associated with it.

Case Presentation: We aim to present a rare complication of complete intraventricular migration of the VPS system. Our patient was a 12-month-old child who presented 8 months following placement of a right VPS for congenital hydrocephalus. He complained of progressive enlargement of head and vomiting. Examination did not reveal any palpable shunt under the skin on head, neck, or torso. An X-ray showed the presence of the complete shunt coiled within the ventricles. The shunt was removed endoscopically and third ventriculostomy was performed.

Conclusion: Complete intracranial migration of VPS is a rare complication and can be avoided by making a small burr hole and careful anchoring of shunt. Trans-cranial endoscope is a useful tool for retrieval in such case and avoid more invasive procedure.

Keywords: Ventriculoperitoneal shunt, intracranial migration, endoscopy, shunt reservoir.

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Background

Placement of Ventriculoperitoneal shunt (VPS) is one of the commonest procedures in neurosurgery and is performed in all age groups for the treatment of hydrocephalus. A number of complications are associated with this procedure including shunt blockage, improper placement, fracture of shunt, and infection [1]. Less common complications are peritoneal collection (pseudocyst), migration into gut or extrusion through rectum or anus [2].

We would like to present a rare complication of VPS, in which the whole shunt tubing along with the reservoir migrated into the lateral ventricle.

Case Report

A 12-month-old female child presented with increased head circumference, irritability, and vomiting. She was operated 8 months ago for myelomeningocele repair and placement of a right VPS through Keen's point for congenital hydrocephalus. Examination revealed increased head circumference with a tense and bulging anterior fontanelle. VPS reservoir or tubing was not palpable throughout its tract from head to abdomen. Initially X-rays of chest and abdomen was performed. The shunt tube was not identified on these X-rays. The skull X-ray showed complete shunt including the ventricular and peritoneal catheters within the lateral ventricles (Figure 1). These findings were later confirmed on the computed tomography (CT) scan head (Figure 2).

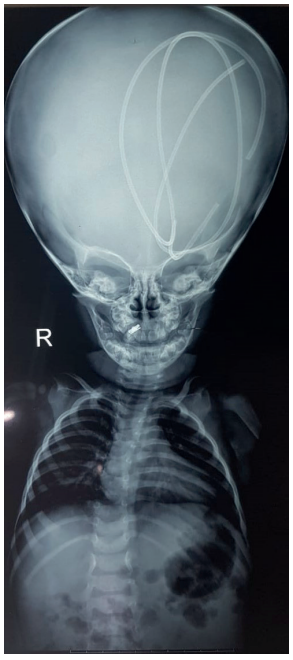

Figure 1. *X-ray skull shunt showing complete intracranial migration with no shunt tubing in neck, chest or abdomen.*

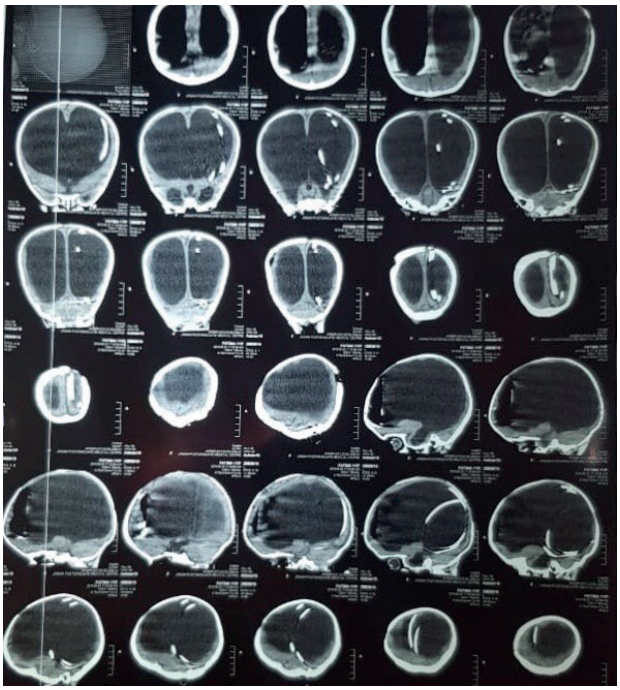

Figure 2. *CT scan brain showing complete intracranial migration of VP shunt coiled into multiple loops.*

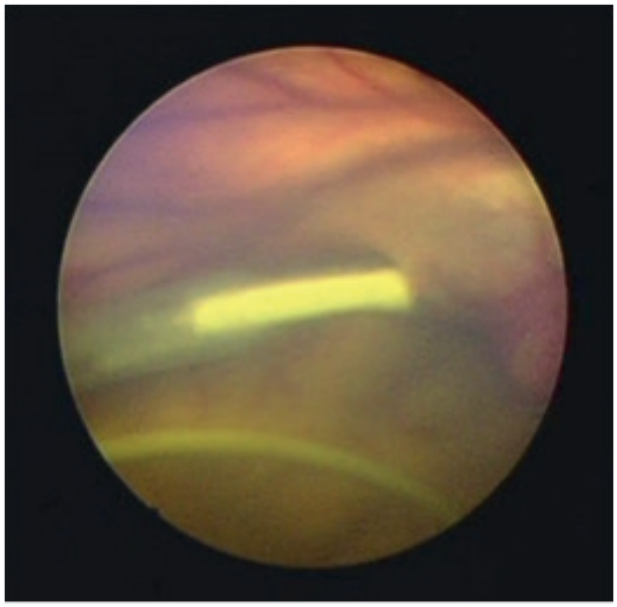

Figure 3. *Endoscopic view showing the coiled shunt along with the reservoir.*

Surgical intervention was planned to remove the shunt and divert the cerebrospinal fluid (CSF) flow. We opted for endoscopic procedure through the Kocher's point on the right side to remove the migrated VPS. The VPS was found to be coiled within the lateral ventricle (Figure 3). There were few adhesions on the shunt tube which were dissected carefully and the whole shunt was removed along with the endoscope (Figure 4). We also performed the endoscopic third ventriculostomy in the same setting. The child was discharged without any complication and

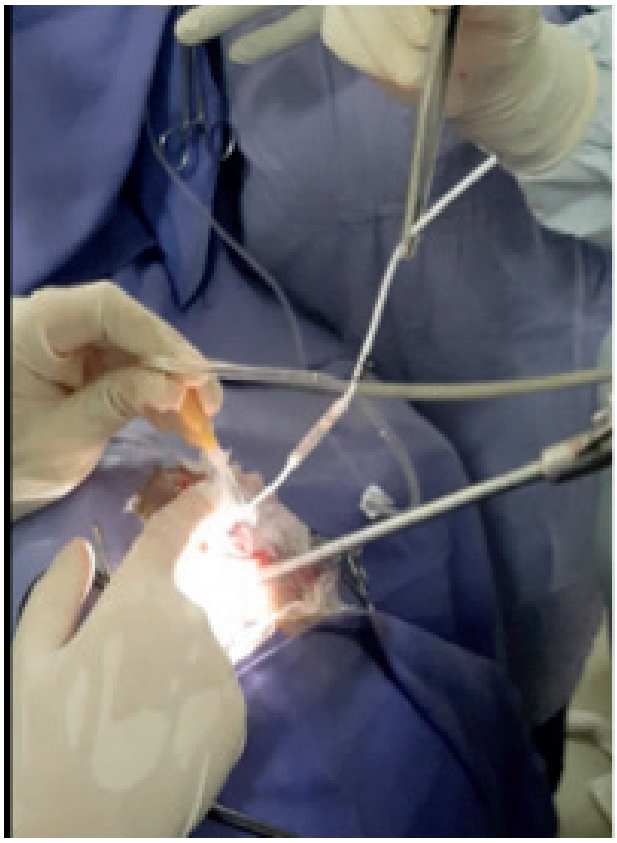

Figure 4. *Intra-operative picture showing retrieval of shunt following the endoscope.*

followed up at 12 weeks and then 6 months. No further complication was identified.

Discussion

Complications related to VPS have been extensively reported in the literature. Intra-abdominal migration of the shunt and protrusion through the rectum have been reported more frequently than the intracranial migration [2,3]. There are reports on migration of the shunt within the small intestine and protrusion through the mouth [4]. Few cases have been reported with proximal migration of shunt tube coiled under the scalp [5,6,7,8]. Complete intra-cranial migration of VPS has rarely been reported.

The earliest case report on intraventricular migration of shunt that can be traced was by Mori et al. [9]. There were few other case reports in the same decade by Garijo et al. [10] and Villarejo et al. [11]. They also gave their theories for this upward migration of the shunt. Mori suggested the size of bur hole and large dural opening as the causative factors. Case reported by Garijo et al. [10] was an adult patient and he had an opinion that increased intra-abdominal pressure secondary to inadequate absorption of CSF and cyst formation can be a factor for this migration. Similar findings were also observed in other studies [5].

Another theory presented by few surgeons is the short distance between the scalp and abdominal incisions and excessive neck movement [12]. The short distance is

Table 1. *Supplementary table: summary of reported cases.*

Author	Year	No. of cases	Age/Sex	Type of shunt	Interval	Action/ Remarks	Reference link
Huliyappa HA	2017	1	17 months/Male	-	1 year	Endoscopic removal of shunt and ETV	https://pubmed.ncbi.nlm.nih.gov/28553395/
Malhotra A	2015	1	9 months/Male	-	2 months	Contralateral VP shunt placed. Shunt removed via craniotomy in a different sitting.	https://www.ijsurgery.com/index.php/isj/article/view/800
Sharma RK	2015	1	9 months/Female	Chhabra shunt	3 months	Endoscopic retrieval was attempted but resulted in intraventricular hemorrhage and therefore EVD was placed.	https://pubmed.ncbi.nlm.nih.gov/25751481/
Naik V	2013	1	3 years/Male	Chhabra shunt	1 year	Endoscopic removal of shunt and Insertion of new shunt	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3579071/
Shahsavaran S	2012	2	6 months/Female	-	1 month	Endoscopic removal of whole shunt and repositioning the VP shunt	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3519067/
Aggarwaal A	2011	1	10 months/Male	-	4 months	Shunt revision	https://pubmed.ncbi.nlm.nih.gov/21977102/
Ali MN	2008	1	4 months/Male	Chhabra shunt system	3 weeks	Migrated shunt left *in situ*. Shunt inserted on opposite side	https://pubmed.ncbi.nlm.nih.gov/18760054/
Nadkarni TD	2007	1	5 months/Male	Chhabra	6 weeks	Shunt left *in situ*. New shunt inserted on opposite side	https://pubmed.ncbi.nlm.nih.gov/16935511/
Oluwole KE	2007	1	5 years/Male	-	1 year	At 1 year the ventricular catheter was detached and migrated. A new ventricular catheter was replaced on the same system. Subsequently presented with complete intracranial shunt migration after 4 weeks. Parietal craniotomy and retrieval of shunt was performed and EVD was placed.	https://ajns.paans.org/complete-intraventricular-migration-of-a-ventriculo-peritoneal-shunt-a-case-report-and-brief-literature-review/
Pereira C	2004	1	5 months/Male	-	Few days	Surgical removal and insertion of new shunt on contralateral side	http://ispub.com/IJPN/4/2/4996
Acharya R	2002	1	11 months/	Chhabra “slit n spring” shunt	1 month	Shunt retrieved endoscopically and a new VP shunt placed on the opposite side	https://pubmed.ncbi.nlm.nih.gov/12235495/
Shimzu	2002	1	60 years/Male	Pudenz medium-pressure valve	10 years	He was no more shunt dependent therefore shunt was left *in situ* on patient’s choice.	https://pubmed.ncbi.nlm.nih.gov/12382134/
Gupta PK	1999	1	1.5 months/	Codman unishunt system	20 days	Endoscopic removal of the tube. New tube with a reservoir implanted.	https://pubmed.ncbi.nlm.nih.gov/10492690/
Eljamel MS	1995	1	32 years/Female	Raimondi unishunt	3 months	Shunt tubing retrieved and had a new unitized shunt system with a reservoir inserted.	https://pubmed.ncbi.nlm.nih.gov/8748857/
Abou el Nasr HT	1988	1	5.5 months/Female	Raimondi unishunt	1.5 months	Extraction of the valve through craniotomy was performed and the shunt reinserted.	https://pubmed.ncbi.nlm.nih.gov/3042135/
Young HA	1983	2	3 months/Female 12 weeks/Female	Holter ventricular catheter and pudenz peritoneal catheter	10 days 5 weeks	Surgical removal and insertion of VA shunt Shunt retained. Low pressure VP shunt inserted on the opposite side	https://pubmed.ncbi.nlm.nih.gov/6343910/
Garijo JA	1979	1	Adult/Male	-	-	-	https://pubmed.ncbi.nlm.nih.gov/375451/
Villarejo F	1979	1	6 months/Male	Raimondi unishunt	3 months	Surgical removal of shunt and insertion of a new VP shunt	https://pubmed.ncbi.nlm.nih.gov/388246/
Mori K	1975	1	3 months/Male	-	-	-	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3579071/

attributed to the fact that most cases of hydrocephalus and shunt placement are of pediatric age.

Few other authors have suggested that huge hydrocephalus and thin cortical mantle can be the factors for retrograde migration of the shunt into the ventricles. Excessive soft tissue dissection at scalp and neck and inadequate anchoring of the shunt can be the possible causes of the shunt migration [13]. It is noted that this complication is more frequently observed in the pediatric patients than adults, especially in their early childhood [14]. Shunt type especially its reservoir can be one theorized factor for shunt migration [2]. Small tubular chambers are more likely to migrate than the round or large chambers. In our patient, it was a tubular shunt reservoir. Shunts are packed in a coiled manner and they are thought to retain this memory after placement of VPS, and this can be another reason for migration of the shunt [15]. Moreover, shunts after migrating to the scalp or the ventricles are found in coils solidifying this theory.

In our patient, ventricles were large with thin cortical mantle but there was no abdominal collection of CSF or pseudocyst formation. The whole shunt was completely intraventricular, and he had presented 8 months after the VPS placement. Large ventricles, very thin cortical mantle, cylindrical shunt chamber, and less developed scalp soft tissues are thought to be the reasons for complete migration of the VPS in our patient.

Conclusion

Placement of VPS is a frequently performed neurosurgical procedure but not uncommonly complicated. Though large ventricles and thin cortex covering the ventricles are unavoidable factors, the risk of intraventricular migration can be reduced, with the use of small but adequate burr holes and good anchoring sutures to secure the shunt.

What is new?

Complication of VP shunt with surgical management consisting of endoscopic removal of the shunt and third ventriculostomy.

Conflicts of interests

None.

Funding

None.

Consent for publication

Written consent was obtained from the patient for publication.

Ethical approval

Ethical approval was granted by Institutional Review Board via letter number 51250 dated: 22nd December 2020.

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Summary of the case

1	**Patient (gender, age)**	12 month old female child
2	**Final diagnosis**	Hydrocephalus with shunt malfunction
3	**Symptoms**	Increased head circumference, irritability and vomiting
4	**Medications**	---
5	**Clinical procedure**	Endoscopic retrieval of the shunt tube and third ventriculostomy
6	**Specialty**	Pediatric Neurosurgery