ISSN 1220-8841 (Print)
ISSN 2344-4959 (Online)

ROMANIAN
NEUROSURGERY

Vol. XXXVII | No. 2 June 2023

Total intracranial migration of ventriculoperitoneal shunt. A case report with literature review

Ahtesham Khizar,
Syed Aamir Shah,
Soha Zahid,
Jayant Kumar Yadav

DOI: 10.33962/roneuro-2023-040

Romanian Neurosurgery (2020) XXXIV (1): pp. 224-228
DOI: 10.33962/roneuro-2020-040
www.journals.lapub.co.uk/index.php/roneurosurgery

Total intracranial migration of ventriculoperitoneal shunt. A case report with literature review

Ahtesham Khizar[1], Syed Aamir Shah[1], Soha Zahid[2], Jayant Kumar Yadav[3]

[1] Pakistan Institute of Medical Sciences, Islamabad, PAKISTAN
[2] Jinnah Medical and Dental College, Karachi, PAKISTAN
[3] Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, NEPAL

ABSTRACT

Background. The ventriculoperitoneal shunt is a common treatment for hydrocephalus. There are several complications associated with it. Shunt failure is one of the most frequent complications, but total intracranial shunt migration is quite uncommon. The exact cause of shunt migration is unknown, but several factors are thought to play a role.

Case presentation. A 10-month-old boy was diagnosed with total intracranial migration of a ventriculoperitoneal shunt (Chhabra type). We used neuroendoscopy to remove this intracranially migrated shunt and implanted a new ventriculoperitoneal shunt (Medtronic type) on the opposite side. He had a favourable clinical outcome.

Conclusion. Total intracranial shunt migration is an uncommon complication which is most likely caused by increased intraperitoneal pressure, strong head movements, and insufficient shunt fixation. Better patient handling combined with appropriate operative technique would be the best way to prevent shunt migration.

Keywords
ventriculoperitoneal shunt, intracranial migration, shunt complications

Corresponding author:
Ahtesham Khizar

Pakistan Institute of Medical Sciences,
Islamabad, Pakistan

arwain.6n2@gmail.com

ISSN online 2344-4959
© Romanian Society of Neurosurgery

First published
June 2023 by
London Academic Publishing
www.lapub.co.uk

INTRODUCTION

The ventriculoperitoneal (VP) shunt is one of the most commonly performed procedures in neurosurgery. It is frequently used to treat various types of hydrocephalus, namely obstructive, non-obstructive and normal pressure hydrocephalus. Kausch performed the first VP shunt surgery for the treatment of hydrocephalus in 1908.[1] Shunt failure is the most common complication in 40-70% of cases. Shunt blockage, infection, overdrainage, underdrainage, and visual field defects are all possible complications associated with the VP shunt. Shunt migration is another complication and it can migrate to various parts of the body such as the thorax, stomach, liver, gallbladder, umbilicus, colon, and urinary bladder but complete intracranial migration of the VP shunt has rarely been reported.[2]

anterior cerebral artery (DACA) represents all segments of the anterior cerebral artery (ACA) distal , saccular aneurysms of the A4-A5 segments have only been reported once in the literature (4). Giant partially thrombosed aneurysms usually have been proposed to result from accumulative intramural bleeding, enlargement, and thrombosis (11). Therefore, endovascular treatment can often be ineffective, as it only eliminates the intraluminal portion of the aneurysm, leaving the mural portion liable to more bleeding, enlargement, and even rupture (2). This makes microsurgical management of giant partially thrombosed A4-A5 aneurysms more appealing, and raises several surgical challenges owing to their location posteriorly within the anterior interhemispheric fissure, the configuration of their domes, involvement of proximal and distal vessels within their base, and the mass effect which can significantly alter the anatomy of this region (11-13).

All of the aforementioned highlights the importance of this paper, in which we report the second case of an idiopathic, giant, saccular, partially thrombosed A4-A5 DACA aneurysm, discussing the treatment nuances of such extremely rare lesions.

Case description

A 10-month-old boy came in with a history of progressive head enlargement, multiple episodes of vomiting, and decreased oral intake for the last three days. He had congenital hydrocephalus and received a medium pressure VP shunt (Chhabra type) surgery at another hospital when he was one month old. He recovered well from his VP Shunt surgery. On clinical examination, he had an enlarged head, as well as a tense and bulging anterior fontanelle. Engorged scalp veins were prominent and there was a sunset sign present. The shunt chamber could not be felt. Routine investigations became the norm. An X-ray shunt series revealed abnormal cranially migrated VP shunt assembly (Figure. 1, A&B). Computed Tomography (CT) brain plain revealed grossly dilated ventricles, subdural hygroma, and the assembly of VP shunt within the ventricles (Figure. 2 A&B). The previous burrhole site was explored during surgery. The burrhole was approximately 1x1 cm in size. Through the burrhole, a rigid paediatric neuro endoscope was inserted, and the entire shunt was seen coiled up within the lateral ventricle. An endoscopic grasper was used to remove it. On the opposite side, a new VP shunt (Medtronic type) was implanted. He recovered well postoperatively, improved clinically, and was discharged in the next three days.

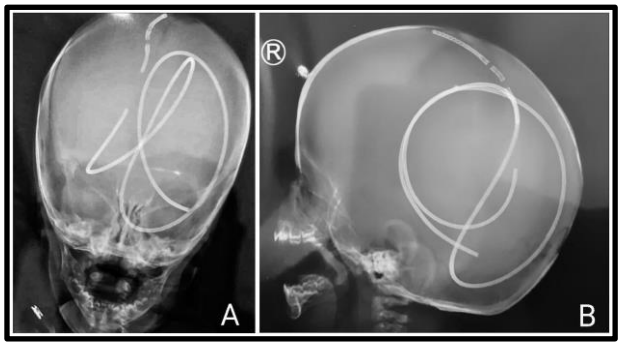

Figure 1. A&B: X-rays skull AP and lateral views showing total intracranial migration of ventriculoperitoneal shunt.

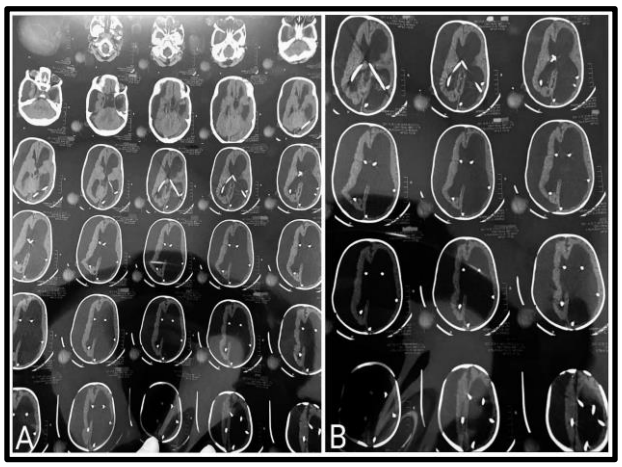

Figure 2. A&B: CT scan brain plain axial views showing gross hydrocephalus, subdural hygroma and intracranial migration of ventriculoperitoneal shunt.

Discussion

VP shunts may be simple to perform but they are associated with intracranial and intra-abdominal complications. Meningitis, ventriculitis, sepsis, and subcutaneous infection are intracranial complications, whereas pseudocyst formation, intestinal volvulus, and spontaneous bowel perforation are intra-abdominal complications. One of the complications of VP shunt is the migration of the shunt. This migration typically occurs distally, into the thorax, diaphragm, heart, pleural cavity, breast, stomach, gallbladder, liver, umbilicus, inguinal canal, hernia sac, scrotum, urinary bladder, urethra, vagina, colon, and rectum, among other places.[3] On the other hand, proximally total

intracranial migration of the VP shunt is a very uncommon complication.

Total upward intracranial migration of VP is estimated to be between 0.1 and 0.5 percent.[4] We discovered twenty-eight cases of total intracranial VP shunt migration to date after conducting a thorough literature review (Table.1). Although the precise cause of this unusual complication is unknown, a number of factors are thought to play a role in proximal shunt migration. Paediatric patients are particularly vulnerable to shunt migration due to the shorter distance between the peritoneum and the cranium. This short distance, combined with violent, uncontrolled head movements, could result in mechanical shunt displacement.[5] Another possibility for proximal shunt migration is insufficient distal shunt fixation or detachment due to rapid growth in the early stages of life.[6,7] Furthermore, the thin cortical mantle, large ventricles, and wide fontanelles produce intracranial pressure close to atmospheric pressure, whereas abdominal pressure remains positive in comparison to atmospheric pressure. This produces a pressure gradient, which can cause the shunt to suction towards the cranium. This drastic complication can be avoided by tightly securing connector sites of the shunt to the periosteum and by avoiding large dural openings and burrholes.[5] It is interesting to note that numerous additional case reports list comparable patient-related characteristics, such as malnutrition, younger age, a thin cortical layer, and severe hydrocephalus, all of which may be connected to upward shunt migration.[4,5,6,7] In most VP shunt insertions, a burrhole is made in the occiput to provide a straight path up from the peritoneum because it is the simplest mode of insertion, but as the path is straightforward, it may contribute to cranial shunt migration.[8]

Due to their affordability, Chhabra shunt systems are commonly used in our area. This type of shunt system contains a valve and a reservoir, but the valve is cylinder-shaped and it has a diameter that is just a little bit larger than the shunt tube. It appears that this type of shunt system is more vulnerable to migration. In our case, we used a neuro endoscope to remove the shunt assembly through a burrhole to avoid craniotomy-related morbidity. The safe removal of the shunt tube and prevention of unintentional pulling, which could result in choroid plexus bleeding, are additional benefits of using a neuro endoscope. In the future, as an alternative to shunting techniques, the use of endoscopic third ventriculostomy and choroid plexus cauterization should be acknowledged and encouraged in suitable patients.

Table 1. Twenty-eight previously reported cases of intracranial migration of ventriculoperitoneal shunt in literature.

S. no.	Authors' Name	Year reported	No. of cases reported
1	Mori K et al.[6]	1975	1
2	Gariejo JA[9]	1979	1
3	Villarejo F et al.[10]	1979	1
4	Drigo P et al.[11]	1983	2
5	Young HA et al.[7]	1983	2
6	Eljamel MS et al.[12]	1995	1
7	Ammar A and Nasser M[8]	1995	1
8	Abou el Nasr HT[13]	1998	1
9	Gupta PK et al.[14]	1999	1
10	Dominguez CJ et al.[15]	2000	1
11	Acharya R et al.[16]	2002	1
12	Shimzu et al.[17]	2002	1
13	Umberto Pereira C et al.[18]	2004	1
14	Nadkarni TD et al.[5]	2007	1
15	Oluwole KE and Abiodun AA[19]	2007	1
16	Ali MN et al.[20]	2008	1
17	Agarwal A and Kakani A[21]	2011	1
18	Shahsavaran S et al.[2]	2012	2
19	Naik V et al.[22]	2013	1
20	Malhotra A and Malhotra M[23]	2015	1
21	Sharma R et al.[4]	2015	1

22	Gundogdu EB et al.[24]	2017	1
23	Shrestha R et al.[3]	2018	1
24	Mehtab H et al.[25]	2021	1
25	Deo RC et al.[26]	2022	1

Conclusions

Total intracranial migration of the VP shunt in individuals with severe hydrocephalus is an uncommon but significant event. The optimum strategy for limiting shunt migration would involve better shunt attachment to the pericranium and peritoneum, a frontal burrhole instead of an occipital burrhole, and a smaller burrhole opening. Additionally, parents should be informed about warning signs and shunt related issues and should receive continuous follow-up. A nationwide analysis of the prevalence as well as incidence of risk variables for VP shunt migration is advised to direct future therapeutic practises.

Abbreviations

VP: Ventriculoperitoneal
CT: Computed Tomography

References

1. Surchev J, Georgiev K, Enchev Y, Avramov R. Extremely rare complications in cerebrospinal fluid shunt operations. J Neurosurg Sci. 2002;46(2):100-103.
2. 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(2):114-116.
3. Shrestha R, Pradhan R, Pradhan MM. Intracranial migration of proximal and distal components of ventriculoperitoneal shunt in the child. World J Surg Surgical Res. 2018; 1. 2018;1038.
4. Sharma RK, Bansal M, Agrawal M, Gupta A, Sinha VD. Complete intracranial migration of a ventriculoperitoneal shunt: rare complication of a common procedure. Neurol India. 2015;63(1):106-107.
5. Nadkarni TD, Menon RK, Dange NN, Desai KI, Goel A. Cranial migration of complete ventriculo-peritoneal shunt assembly. J Clin Neurosci. 2007;14(1):92-94.
6. Mori K, Yamashita J, Handa H. "Missing tube" of peritoneal shunt: migration of the whole system into ventricle. Surg Neurol. 1975;4(1):57-59.
7. Young HA, Robb PJ, Hardy DG. Complete migration of ventriculoperitoneal shunt into the ventricle: report of two cases. Neurosurgery. 1983;12(4):469-471.
8. Ammar A, Nasser M. Intraventricular migration of VP shunt. Neurosurg Rev. 1995;18(4):293-295.
9. Garijo JA, Pecourt JC, de la Resurrección M. Migration of ventriculo-peritoneal shunt into lateral ventricle of an adult. Surg Neurol. 1979;11(5):399-400.
10. Villarejo F, Alvarez-Sastre C, Gimenez D, Gonzalez C. Migration of an entire one-piece shunt into the ventricle. Neurochirurgia (Stuttg). 1979;22(5):196-198.
11. Drigo P, Casara GL, Laverda AM, et al. Una rara complicanza dell'intervento di shunt ventricolo-peritoneale: la migrazione intracranica del sistema derivativo [A rare complication of ventriculo-peritoneal shunt: intracranial migration of the derivative system]. Pediatr Med Chir. 1983;5(6):623-624.
12. Eljamel MS, Sharif S, Pidgeon CN. Total intraventricular migration of unisystem ventriculo-peritoneal shunt. Acta Neurochir (Wien). 1995;136(3-4):217-218.
13. Abou el Nasr HT. Modified method for prophylaxis against unishunt system complications with presentation of total intraventricular migration of unisystem ventriculoperitoneal shunt. Childs Nerv Syst. 1988;4(2):116-118.
14. Gupta PK, Dev EJ, Lad SD. Total migration of a ventriculo-peritoneal shunt into the ventricles. Br J Neurosurg. 1999;13(1):73-74.
15. Dominguez CJ, Tyagi A, Hall G, Timothy J, Chumas PD. Sub-galeal coiling of the proximal and distal components of a ventriculo-peritoneal shunt. An unusual complication and proposed mechanism. Childs Nerv Syst. 2000;16(8):493-495.
16. Acharya R, Bhutani A, Saxena H, Madan VS. Complete migration of ventriculoperitoneal shunt into the ventricle. Neurol Sci. 2002;23(2):75-77.
17. Shimizu S, Mochizuki T, Nakayama K, Fujii K. Visual field defects due to a shunt valve migrating into the cranium. Acta Neurochir (Wien). 2002;144(10):1055-1056.
18. Umberto Pereira C, Silva Santos EA, Silva Monteiro JT, Araújo Dias LA. Migration of ventriculoperitoneal shunt catheter into the cranium-case report. Rev. chil. neurocir. 2004:46-7.
19. Oluwole KE, Abiodun AA. Complete intraventricular migration of a ventriculo-peritoneal shunt-a case report and brief literature review. Afr J Neurol Sci. 2007;26:69-74.
20. Ali MN, Atif SM, Khan S. Intracranial migration of a ventriculoperitoneal shunt. J Coll Physicians Surg Pak. 2008 Jun 1;18(6):382-3.
21. Agarwal A, Kakani A. Total migration of a ventriculo-peritoneal shunt catheter into the ventricles. J Pediatr Neurosci. 2011;6(1):88-89.
22. Naik V, Phalak M, Chandra PS. Total intracranial shunt migration. J Neurosci Rural Pract. 2013;4(1):95-96.
23. Malhotra A, Malhotra M. Ventricular migration of shunt: Chhabra shunt complication. International Surgery Journal. 2016 Dec 14;2(4):706-9.
24. Gundogdu EB, Ozsoy U, Tuzun Y. Complete intraventricular migration of the ventriculoperitoneal shunt. The European Research Journal. 2017;3(1):87-9.

25. Mehtab, H., Khizar, A., Zahid, S. et al. Complete intracranial migration of ventriculoperitoneal shunt: a common procedure with a rare complication. Egypt J Neurosurg 36, 34 (2021).
26. Deo RC, Acharya A, Senapati SB, Panigrahi S, Mohapatra AK. Complete intraventricular migration of ventriculo-peritoneal shunt: A rare case report. Int J Surg Case Rep. 2022;101:107772.