Original Research Paper

Volume - 16 | Issue - 05 | May - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Paediatrics

RARE VENTRICULOPERITONEAL SHUNT-RELATED COMPLICATIONS IN PEDIATRIC HYDROCEPHALUS.

Saurabh Gade — Senior Resident, Department of Pediatrics, Topiwala National Medical College and B.Y.L. Nair Charitable Hospital, Mumbai.

Sonu Antony* — MD, DCH, DNB, MRCPCH, Assistant Professor, Department of Pediatrics, Topiwala National Medical College and B.Y.L. Nair Charitable Hospital, Mumbai. *Corresponding Author

Sushma Save — MD, DCH, IBCLC, FAIMER, Professor, Department of Pediatrics, Topiwala National Medical College and B.Y.L. Nair Charitable Hospital, Mumbai.

ABSTRACT Introduction: Hydrocephalus is a common pediatric neurological condition with a global pooled prevalence of 84 per 100,000, and a higher incidence in India (0.2-0.5 per 1,000 live births). Ventriculoperitoneal (VP) shunting is the primary treatment, but complications lead to high revision rates (30-54% globally; 23-34% in India. This report presents two cases highlighting severe VP shunt related complications. Case: Case 1 involved a 7-month-old girl with congenital hydrocephalus who underwent initial right VP shunt at 2.5 months, followed by two revisions for blockage. She presented with a multiloculated peritoneal pseudocyst with Acinetobacter infection. Initial antibiotics failed, necessitating shunt externalization, tigecycline therapy, and eventual left VP shunt placement after resolution. Case 2 described a 2-year-9-month-old boy with hydrocephalus, initial right VP shunt at 5 months, and left revision at 1 year 9 months. Subsequent presentations included vomiting and raised intracranial pressure due to adhesions and hematoma, preventing complete ventricular catheter removal. The catheter was clipped in situ, peritoneal end removed, and a new right shunt inserted, with postoperative improvement and retained hardware on X-ray. Conclusion: These cases underscore the challenges in managing shunt infections emphasizing early detection via imaging and multidisciplinary intervention. Endoscopic third ventriculostomy may reduce complications in select patients. Limited Indian data necessitate multicenter studies for risk prediction and improved outcomes.

KEYWORDS :

INTRODUCTION

Hydrocephalus is a common pediatric neurological disorder characterized by abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles [1]. The estimated, pooled global prevalence of pediatric hydrocephalus is around 84 per 100,000 [1]. Existing studies show a higher burden in India compared to developed countries, with the incidence of congenital hydrocephalus reported as being 0.2-0.5 per 1000 live births [2]. A ventriculoperitoneal (VP) shunt remains the most widely used treatment for pediatric hydrocephalus. However, shunt related complications are frequent resulting in a high rate of shunt revision surgeries, especially in the first post-operative year. [3] Overall shunt failure rates in pediatric patients range from approximately 30% to 54% across various studies [4,5]. Literature from Indian studies, although relatively sparse, report similar rates (23 to 34%) of shunt-related complications [6,7] Here, we present two pediatric cases with differing, but serious VP shunt complications, emphasizing the need for early diagnosis and comprehensive care.

Case 1: An 8-month-old girl presented with abdominal distension, irritability, and vomiting for 2 days. She had an uneventful perinatal history but was diagnosed with hydrocephalus secondary to aqueductal stenosis at 2.5 months of age, for which she underwent right-sided ventriculoperitoneal (VP) shunt placement. She subsequently required two shunt revision surgeries at 4 and 6 months of age due to mechanical blockage. On admission, clinical examination revealed a bulging anterior fontanelle, distended scalp veins, and localized tenderness over the shunt tract; neurological examination was otherwise normal. Computed tomography (CT) of the head and abdomen demonstrated a 5 cc multiloculated pseudocyst at the tip of the peritoneal catheter. Initial empirical treatment with intravenous ceftriaxone (100 mg/kg/day in two divided doses) and vancomycin (20 mg/kg/day in two divided doses) was initiated. However, there was poor clinical response, necessitating shunt externalization. Cerebrospinal fluid (CSF) culture subsequently grew Acinetobacter baumannii, resistant to cephalosporins and carbapenems. Targeted therapy with intravenous tigecycline (1.2 mg/kg/day in two divided doses) was administered for 4 weeks in accordance with antimicrobial susceptibility testing. Following resolution of the infection, a left-sided VP shunt was inserted. Child continues to be asymptomatic on follow-up and was referred for neurorehabiltation.

Case 2: A 2.5-year-old boy presented with vomiting for 3 days. He had an uneventful perinatal history and was diagnosed with aqueductal stenosis causing hydrocephalus at 5 months of age, for which a right-sided VP shunt was placed. At 1 year 9 months, he underwent left-sided VP shunt placement due to malfunction of the original shunt. On admission, examination revealed a Glasgow Coma Scale score of E4V5M5, hypotonia, brisk deep tendon reflexes, and bilateral extensor plantar responses. CT imaging of the brain showed intact shunt systems with persistent hydrocephalus. CSF analysis demonstrated elevated protein (120 mg/dL). In view of suspected shunt blockage, revision of the left VP shunt was attempted; however, dense intraoperative adhesions precluded complete removal of the ventricular catheter. The ventricular end was clipped and left in situ, the peritoneal end was removed, and a new left-sided shunt was placed. He was readmitted at 3 years of age with projectile vomiting, altered sensorium, and clinical features suggestive of raised intracranial pressure. Neurosurgical intervention was undertaken for malfunction of the right VP shunt. Intraoperatively, attempts to remove the right ventricular catheter were unsuccessful due to localized hematoma formation; the ventricular end was therefore clipped and retained in situ, the peritoneal end was removed, and a new right-sided VP shunt was inserted through the same burr hole. Postoperatively, the patient exhibited resolution of signs of raised intracranial pressure and was discharged. A postoperative skull and chest X-ray (Figure 1) demonstrated four ventricular catheter tips in situ, two of which were clipped (one on the right and one on the left), along with two peritoneal ends belonging to the functioning bilateral VP shunts. Post the intervention, symptoms resolved and the child continues to be on regular follow-up

DISCUSSION

VP shunt placement remains the cornerstone treatment for pediatric hydrocephalus, yet it is associated with substantial complication rates globally and in India [1,2]. Common complications reported include mechanical obstruction (often the most frequent, accounting for 30-45% of failures), infection (5-15%), catheter disconnection or migration (3-10%), abdominal pseudocyst formation (0.25-10%), and over drainage or adhesions (2-5%) [3,4,5]. In low- and middle-income countries (LMIC), including India, complication rates are comparable or potentially higher due to factors like delayed presentation and resource limitations, with Indian studies reporting shunt-related complications in 23-34% of cases, often with most common complication being shunt obstruction (11-29%), followed by infections (4-16%) and migrations (5-10%) [2,6,7]. Early failures, particularly within the first year, predominate and are influenced by young age at insertion (<6 months), etiology (e.g., post-infectious or congenital), and multiple revisions [3,6].

Abdominal pseudocyst formation represents a notable relatively infrequent but important complication of VP shunts and is often secondary to low-grade infection, peritoneal inflammation, adhesions, or impaired CSF absorption [8,9] It typically presents in the first-year after shunt insertion with abdominal distension, pain, vomiting, and signs of shunt malfunction [9]. Management depends on cyst sterility and clinical severity: sterile pseudocysts may respond to catheter repositioning (laparoscopic or open) with or without cyst drainage, while infected cases necessitate urgent shunt externalization, culture-guided antibiotics, and delayed revision to minimize recurrence [8]. Broad-spectrum antibiotics are initiated empirically, with escalation to agents like higher antibiotics like tigecycline for resistant pathogens such as Acinetobacter, as demonstrated in case one. Shunt removal or conversion (e.g., to ventriculoatrial) is warranted in persistent infection or high-recurrence risk, with early ultrasound/CT imaging and serial CSF analysis critical for timely intervention [8,10]. Adhesions pose significant hurdles during VP shunt revisions in children, arising from prior infections, repeated surgeries, or peritoneal inflammation [11]. These fibrous adhesions can encase catheters and complicate extractions thereby increasing risks of intraoperative hematoma, further obstruction, or incomplete removal, as seen in Case 2. Standard approaches include meticulous adhesiolysis, catheter repositioning, or temporary external ventricular drainage (EVD) if extraction fails [10,11]. In challenging cases, leaving clipped segments in situ while placing a new shunt through an alternative trajectory is acceptable, as performed here. Preoperative neuroimaging-guided planning and use of antibiotic-impregnated catheters may help prevent adhesion-related issues, though pediatric evidence is limited [2,6]

These cases illustrate the complexity and pragmatic issues of managing VP shunt complications in pediatric hydrocephalus. Infections, pseudocysts, adhesions, and retained hardware often require emergent, multidisciplinary care to prevent neurological deterioration and morbidity. Pediatricians, neurologists and intensivists must remain vigilant for early warning signs such as irritability, vomiting, abdominal changes, or bulging fontanelle, enabling rapid imaging and intervention. Endoscopic third ventriculostomy (ETV) serves as a promising shunt-independent option in select cases (particularly obstructive hydrocephalus in older children), with lower infection rates and reduced long-term dependency, achieving success in 60-90% of appropriate candidates and potentially fewer revisions [13]. However, ETV failure rates are higher in infants (<1 year) and certain etiologies, limiting universal application compared to VP shunting [13] Nonetheless, data on VP shunt complications in India remain sparse and heterogeneous, highlighting the critical need for multicentre prospective registries to better delineate risks, facilitate early complication detection, and develop context-specific strategies to mitigate morbidity in this vulnerable population.

CONCLUSION

In conclusion, these cases demonstrate the high morbidity associated with VP shunt complications in pediatric hydrocephalus, necessitating vigilant monitoring and prompt intervention to mitigate neurological risks. While VP shunting remains essential, exploring ETV in suitable candidates could lower dependency and infection rates. Ultimately, expanding Indian registries is crucial for evidence-based strategies to enhance care in resource-limited settings.

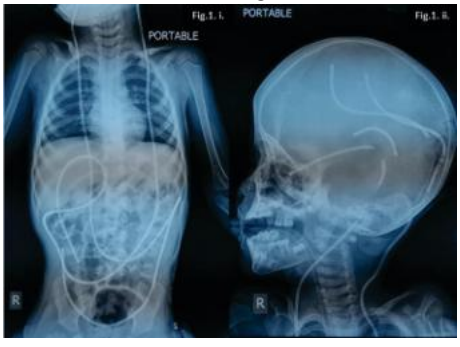

Figure 1: i. X-Ray of Chest Anteroposterior view and ii. Anteroposterior X-Ray Skull showing 4 retained ventricular ends of catheters and 2 peritoneal distal ends.

REFERENCES

1. Isaacs AM, Riva-Cambrin J, Yavin D, Hockley A, Pringsheim TM, Jette N, et al. Age-specific global epidemiology of hydrocephalus: systematic review, metanalysis and global birth surveillance. PLoS One. 2018;13(10):e0204926.
2. Venkataramana NK. Hydrocephalus Indian scenario - a review. J Pediatr Neurosci. 2011;6(Suppl 1):S11-S22.
3. Limwattananon P, Kitkhuandee A. Ventriculoperitoneal shunt failure in pediatric patients: an analysis of a national hospitalization database in Thailand. J Neurosurg Pediatr. 2021;28(2):128-138.
4. Välimaa J, Pääkkö E, Jääskeläinen JE, Serlo W, Sinikumpu JJ. Rate and risk factors for shunt revision in pediatric patients with hydrocephalus during a 17-year study period. Childs Nerv Syst. 2025;41(1):75-82.
5. Lazarus JS, Fourie L, Enslin JMN. Ventriculoperitoneal shunt failures at Red Cross War Memorial Children's Hospital. Childs Nerv Syst. 2024;40(8):2453-2460.
6. Pan P, Sable MN, Madan K, et al. Outcome Analysis of Ventriculoperitoneal Shunt Surgery in Pediatric Hydrocephalus. J Indian Assoc Pediatr Surg. 2018;23(3):143-147.
7. Kumar S, Prusty BS, Sahoo SK, Mohanty S. A Study of Surgical Outcomes and Complications in Children Undergoing Ventriculoperitoneal Shunt in a Tertiary Care Hospital of Eastern India. Ann Afr Med. 2025;24(4):858-863.
8. Erwood A, Rindler RS, Motiwala M, et al. Management of sterile abdominal pseudocysts related to ventriculoperitoneal shunts. J Neurosurg Pediatr. 2019;25(1):57-61.
9. Ghritlaharey RK. Management of Ventriculoperitoneal Shunt Complications in Children: A Review of 34 Cases. Turk J Pediatr. 2023;65(2):306-315.
10. Ghritlaharey RK. Management of ventriculoperitoneal shunt complications in children: A review of 34 cases. Afr J Paediatr Surg. 2023;20(2):89-95.
11. Ghritlaharey RK. Ventriculoperitoneal shunt complications needing shunt revision in children: a review of 5 years of experience with 48 revisions. Afr J Paediatr Surg. 2012;9(1):29-34.
12. Paff M, Alexandru-Abrams D, Muhlestein WE, Grant GA. Ventriculoperitoneal shunt complications: A review. Interdiscip Neurosurg. 2018;12:66-70.
13. Fagundes W, Dantas A, Santos A, et al. Endoscopic third ventriculostomy versus ventriculoperitoneal shunt for treating pediatric tuberculous meningitis hydrocephalus: a systematic review and meta-analysis. J Neurosurg Pediatr. 2025;36(3):296-304.