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Ventriculovesical Shunting As An Alternative Approach For Treating Hydrocephalus With A Technical Note And Case Series

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Method Article

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Abstract

Background

Ventriculoperitoneal (VP) shunting remains the standard treatment for hydrocephalus; however the management of hydrocephalus often poses significant challenges, particularly due to the complications associated with abdominal shunt failures, which create substantial difficulties for neurosurgeons. When the abdominal cavity or heart is unsuitable for cerebrospinal fluid (CSF) drainage, the urinary system may be considered as an alternative site for shunt placement and may represent a viable option in select cases.

Objective

Between 2018 and 2025, three patients underwent ventriculovesical (VV) shunt placement as an alternative to ventriculoperitoneal (VP) shunting. Two of them had spinal meningomyelocele associated with hydrocephalus.

In the first patient, VP shunt malfunction occurred due to the development of a pseudocyst following intra-abdominal infection and adhesions. The second patient had chronic renal failure and was undergoing peritoneal dialysis three times per week. The third patient had congenital anal atresia and had previously undergone colostomy.

Methods

For all patients, the distal catheter was placed into the urinary bladder via a suprapubic approach.

A review of the literature was conducted to identify the characteristics of ventriculovesical shunts and to evaluate the clinical indications and circumstances in which this technique represents a viable alternative to conventional VP shunting.

Results

VV shunting was successfully performed in all patients without immediate surgical complications. The procedure provided an effective alternative for cerebrospinal fluid diversion in cases where the peritoneal cavity was unsuitable.

Conclusion

VV shunting may be considered as an alternative for selected patients with peritoneal failure and contraindications to VA diversion, particularly in the presence of dialysis dependence, peritoneal thickening, or absent urinary output. Proper distal catheter fixation is essential to prevent migration and extrusion. Further studies are needed to evaluate long-term outcomes.

Introduction

Hydrocephalus is a common pathology in the clinical practice of neurosurgery, with the ventriculoperitoneal (VP) shunt being the most commonly used approach for its treatment. Various shunting techniques have been developed to drainage of excess cerebrospinal fluid (CSF) from the ventricular system for any types of hydrocephalus. The VP [1], ventriculoatrial (VA) [2, 3] and ventriculopleural (VPl) [4] shunts are recognized as the most prevalent modern solutions for the management of this condition.

The long-term neurosurgical treatment of hydrocephalus is often complicated by issues such as shunt failure, infections [5], and complications related to the abdomen [6], cranium, or cardiopulmonary system [7, 8]. However, when VP and VA shunts are no longer regarded as viable options, the ventriculovesical (VV) shunt procedure can be an alternative to divert CSF from the ventricular system into the urinary system.

Methods

This study was designed as a retrospective case series accompanied by a technical description of the VV shunting procedure.

All surgical procedures and clinical methods were performed in accordance with the ethical standards of the Harran University Clinical Research Ethics Committee (Approval No. HRU/26.02.85) and with the World Medical Association (WMA) Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Participants.

We present three illustrative cases in which VV shunting was selected due to peritoneal failure and contraindications to atrial diversion, and we discuss technical strategies. A summary of the case series is provided in table 1.

Case Description

Case 1

The first case is a 3-year-old girl with congenital hydrocephalus underwent multiple VP and VA shunt placements. Repeated abdominal interventions complicated by infection and obstruction. Imaging revealed peritoneal thickening, absorption failure and pseudoabdominal cyst formation (Fig.1A). Consequently, it was decided to place the distal end of the catheter into the bladder as an alternative drainage site (Fig.1B)**.** The patient was discharged without any complications.

Case 2

The second case is a 15-year-old female patient diagnosed with congenital meningomyelocele and hydrocephalus, presenting with paraplegia in the lower extremities. The patient had a VP shunt for several years, but since the patient received peritoneal dialysis 3 times a week due to chronic renal failure, the VP shunt was an obstacle to this procedure. For this reason, the patient's VPS was taken out

and an endoscopic third ventriculostomy (EVT) was performed, however, following the EVT due to increased CSF and high intracranial pressure after 3 months a shunt surgery became necessary. The patient had no urine output due to severe renal failure. Before the shunt surgery, the patient had an external ventricular drainage (EVD) placed, with approximately 1500 mL of CSF drained over a 24-hour period. A VA shunt was considered unsuitable for this patient with renal failure, as it would directly release nearly triples the daily CSF excretion into the circulatory system, thereby increasing the need for dialysis. The indications deemed most suitable for VV shunting in this patient included peritoneal dialysis, thickening of the peritoneum, inadequate absorption, and the complete lack of urine output. On the day following the operation, the patient underwent haemodialysis, with a daily CSF volume of approximately 1500 mL drained via the urinary catheter (Fig.2).

Case 3

The third patient was a 6-month-old boy diagnosed with a congenital anal atresia with a hydrocephalus. He had a colostomy surgery. He underwent three separate insertions of VP and VA shunts, yet each procedure was concluded by complications such as infection or obstruction. Following numerous revisions and peritoneal thicknesses and malabsorption VV shunt was inserted. One week after surgery the patient was discharged without any complications (Fig. 3 A, B).

Table 1. Summary of the case series.

Case	Age/Sex	Primary Diagnosis	Previous Shunt History	Complications
1	3-year-old female	Congenital hydrocephalus	Multiple VP and VA shunt placements	Recurrent infections, obstruction, peritoneal thickening, abdominal pseudocyst, absorption failure
2	15-year-old female	Meningomyelocele, hydrocephalus, chronic renal failure	Long-term VP shunt, followed by ETV	Peritoneal dialysis dependency, peritoneal thickening, absorption failure, anuria, elevated CSF output
3	6-month-old male	Congenital anal atresia and hydrocephalus	Multiple VP and VA shunt insertions	Recurrent infections, shunt obstruction, peritoneal thickening, impaired CSF absorption

Indications for VV shunting for case 1 were: failure of VP and VA shunts; peritoneal thickening; inadequate peritoneal absorption. Indications for case 2: peritoneal thickening; pseudocyst formation; impaired absorption; repeated shunt failure. And case 3: contraindication to VP shunt (peritoneal dialysis); contraindication to VA shunt (risk of volume overload); absent urine output; peritoneal failure. All indications for each case were summarised in table 2.

Table 2. Summary of indications for ventriculovesical shunt for each case.

Indication	Case 1	Case 2	Case 3
Failed VP/VA shunts	☒	☒	☒
Peritoneal malabsorption or thickening	☒	☒	☒
Peritoneal dialysis	☒	☒	☒
Neurogenic bladder / incontinence	☒	☒	☒
Anuria / absence of urinary output	☒	☒	☒
Unsuitability for VA shunting	☒	☒	☒

A technical note

Surgical procedure was performed in collaboration with an urologist.

1. **Patient Positioning:** The patient is placed supine under general anaesthesia.
2. **Ventricular Catheter Placement:** The neurosurgeon inserts the proximal shunt catheter into the lateral ventricle as a standard VP shunt procedure.
3. **Shunt Valve Connection:** The ventricular catheter is connected to a pressure-regulated valve system.
4. **Distal Catheter Routing:** The distal catheter is tunneled subcutaneously towards the lower abdomen, reaching the suprapubic region.
5. **Urological Procedure:** A Foley catheter is inserted into the bladder. A volume of isotonic saline, calculated as (age in years + 2) × 30 mL based on estimated bladder reservoir capacity, is instilled to facilitate bladder identification and handling.
6. **Bladder Access:** A small horizontal Pfannenstiel incision in the suprapubic region is made to expose the bladder dome. The skin and subcutaneous tissue are elevated off the rectus fascia. The abdominal muscles were separated using blunt dissection, the peritoneum was lifted, and the anterior wall of the bladder was exposed (Fig. 4 a, b).
7. **Catheter Insertion:** Under direct vision, about 0.5 cm incision is made in the anterolateral bladder wall, approximately 3 cm above the bladder neck, near the midline and isotonic solution flowed from the bladder. The detrusor muscle was incised in a manner that preserved the mucosa. The distal end of the shunt catheter is inserted into the bladder.
8. **Securing and Closure:** A serosal tunnel of approximately 2 cm is created around the catheter to help stabilize it and prevent infection. İncisions are closed in layers (Fig. 4 c).

Because two of our cases were paediatric patients, it was necessary to account the additional length of the distal end when placing the VV shunt. In this way, as the child grows and the abdomen and trunk lengthen, this coiled segment is gradually released without the need for surgical intervention, preventing

tension on the catheter (Fig. 5). Therefore, in addition to the technical considerations described above, we incorporated the following steps.

1. The excess portion is coiled loosely within the subcutaneous tissue of the abdominal wall, near the suprapubic region where the bladder is accessed.
2. To reduce the risk of extrusion and increase mechanical stability, the catheter secured with one or two sutures to the abdominal muscles.

Such fixation is critical in preventing proximal migration (retraction from the bladder lumen) as well as distal extrusion through the bladder wall.

Results

Case 1: Unfortunately, the patient had the shunt removed at an external center two months later after the surgery and did not return for further follow-up.

Case 2: The patient was discharged on postoperative day four without any complications and continued regular dialysis sessions with no immediate shunt-related complications. It was recommended that the urethral catheter be replaced every 20 days.

Case 3: Follow-up 5 months after surgery he did not have any VPS dysfunction or other complications.

Follow-up recommendations for patients were as follows:

1. Adequate fluid intake was encouraged.
2. Regular surveillance for urinary tract infections was advised, including urinalysis and urine culture every 3 months and antibacterial therapy was recommended to prevent catheter-associated infection.

Discussion

Hydrocephalus occurs due to a disruption in the balance between the secretion and absorption of CSF with clinical manifestations resulting from ventricular dilation and high intracranial pressure. Cases of hydrocephalus were described by Hippocrates and Galen, with early operative procedures in antiquity involving the evacuation of intracranial fluid through ventricular puncture [9]. With the invention of artificial valves and silicone catheters, VP became the most common treatments for hydrocephalus worldwide. Alternative distal sites include the right atrium (VA), pleural space (VP), and less commonly, the urinary bladder (VV). In the early 20th century, the invention of the endoscope led to ETV becoming a significant method for treating particularly non-communicating obstructive hydrocephalus [10, 11]. Approximately 18% of patients who underwent ETV subsequently required the placement of VPS [12].

The literature demonstrates that the ventriculorenal (VR) [13], ventriculoureteral (VU) [14-19] and VV shunts are rare [20]**.** The evidence is limited, heterogeneous, and largely based on case reports or small

series, with inconsistent follow-up and reporting. Morosanu et al. [21] reviewed 28 studies on alternative CSF shunting techniques, classifying them as ventriculopyeloureteral (VPU), VU, and VV [21]. These approaches are advantageous because they do not rely on peritoneal absorption. Lou et al. presented one of the largest reported series of VV shunts in the literature, including 25 cases with relatively low complication rates [22]. Their findings suggest that VV shunts are a feasible alternative for hydrocephalus when VP shunting is contraindicated, although complications such as catheter occlusion and urogenital discomfort may still occur. However, VV and VU shunts are also associated with complications, including ascending infections, bladder pressure imbalance, distal migration, metabolic disturbances such as hyponatremia, and stone formation [23, 24]. Rare but serious adverse events—including death in an early case—also emphasize the potential risks [25].

When VP shunts are contraindicated in patients with peritoneal adhesions, infections, or prior multiple abdominal surgeries, the urinary bladder offers a physiologic reservoir capable of accommodating diverted CSF. This technical note outlines the VV shunt procedure and presents illustrative cases in which VV shunting was inserted successfully. In Case 1, extensive peritoneal scarring, pseudoabdominal cyst formation due to fibrosis and malabsorption blocked VP shunting, in case 2 peritoneal dialysis and complete anuria made both VP and VA shunts unsuitable due to risks of infection and circulatory overload, respectively. In Case 3, the presence of a colostomy along with recurrent shunt infections contraindicated VP shunting. In all cases, VV shunting provided a solution tailored to the patient's specific needs.

VV shunting can be an alternative CSF diversion strategy in hydrocephalus patients with:

- Peritoneal fibrosis or absorptive failure
- Dependence on peritoneal dialysis
- Contraindications to atrial diversion
- Absent urinary output or controlled renal failure

Careful surgical technique, secure distal catheter fixation, patient selections are crucial to minimize complications. According to our cases we classified indications and contraindications for VV shunting and presented in table 3.

Table 3. Indications and contraindications for VV shunt.

Category	Condition
Primary Indications	Non-functional peritoneum (fibrosis, infection, adhesions), VP shunt failure, peritoneal dialysis, contraindication to VA shunt
Relative Indications	End-stage renal failure (hemodialysis), failed ETV without peritoneal option
Absolute Contraindications	Active UTI, high bladder pressure (neurogenic bladder), vesicoureteral reflux, bladder outlet obstruction
Relative Contraindications	Normal renal function with high urine output, poor bladder compliance

We also compared advantages and disadvantages between all shunts types and summarised in the table 4.

Table 4. Comparison of the VV to other shunting methods.

Shunt Type	Advantages	Disadvantages	Main Indications
VP	Most common, effective	Abdominal infection, adhesions, pseudocyst	First-line treatment
VA	Avoids abdomen	Cardiac and thromboembolic risks	Non-usable peritoneum
VPL	Alternative CSF route	Pleural effusion, pneumothorax	VP/VA not suitable
VV	Avoids abdomen, urinary reservoir	UTI, hematuria, bladder issues	Peritoneal scarring or infection

Conclusion

The VV shunt diverts CSF into the bladder, which is a physiologic reservoir capable to accommodate diverted CSF. This method avoids the peritoneal cavity, reducing risks related to abdominal infections or adhesions. VV shunting offers advantages in select patients, particularly when urinary output is absent or clinically controlled. Attention to distal catheter fixation and growth accommodation is essential to reduce mechanical complications.

However, appropriate patient selection is essential. Long-term data remain limited, these cases suggest that VV shunting may represent a viable salvage option in highly selected patients.

Abbreviations

CSF: cerebrospinal fluid

EVD: external ventricular drainage

VA: ventriculoatrial

VP: ventriculoperitoneal

VPl: ventriculopleural

VPU: ventriculopyeloureteral

VR: ventriculorenal

VU: ventriculoureteral

VV: ventriculovesical WMA: World Medical Association

Declarations

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Conflicts of interest: The authors declare that they have no competing interests.

Ethics approval: This study was approved by the Harran University Clinical Research Ethics Committee (Approval No. HRU/26.02.85; Date: 23 February 2026; Session: 02). All methods were performed in accordance with the ethical standards of the institutional research committee and the WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Participants, as amended in 2024.

Consent to participate: Written informed consent was obtained from all participants or, in the case of pediatric patients, from their parents or legal guardians before inclusion in the study.

Written consent for publication: Written informed consent for publication of clinical details and accompanying images was obtained from the patients or, in the case of pediatric patients, from their parents or legal guardians.

Availability of data and material: The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

Code availability: Not applicable**.**

Clinical trial number: Not applicable.

Authors' contributions: Author contributions GC and MNK contributed substantially to the development of this work. GC was responsible for the study conception, manuscript structure, collected the clinical data and assisted in the detailed description of the case. GC drafted the first complete version of the

manuscript and prepared all figures and images. MNK were responsible for critical analysis of the clinical and imaging data. All authors reviewed and approved the final manuscript.

References

1. Pillai SV. Techniques and nuances in ventriculoperitoneal shunt surgery. Neurol India. 2021;69(Suppl):S471–5. https://doi.org/10.4103/0028-3886.332261.
2. Bue EL, Morello A, Bellomo J, Bradaschia L, Lacatena F, Colonna S, Fiumefreddo A, Stieglitz L, Regli L, Lanotte MM, Garbossa D, Cofano F. Ventriculoatrial shunt remains a safe surgical alternative for hydrocephalus: a systematic review and meta-analysis. Sci Rep. 2024;14:18460. https://doi.org/10.1038/s41598-024-62366-8.
3. Isaacs AM, Krahn D, Walker AM, Hurdle H, Hamilton MG. Transesophageal echocardiography-guided ventriculoatrial shunt insertion. Oper Neurosurg (Hagerstown). 2020;19:25–31. https://doi.org/10.1093/ons/opz353.
4. Oyon DE, Behbahani M, Sharma S, Coons DE, Pundy T, Fernandez LG 3rd, Gibson W, Tomita T. Ventriculopleural shunt outcomes for pediatric hydrocephalus: a single-institution experience. Childs Nerv Syst. 2023;39:2105–13. https://doi.org/10.1007/s00381-023-05928-x.
5. López-Sánchez C, Rozas-Muñoz E, Mir-Bonafé JF. Ventriculoperitoneal shunt infection. JAMA Dermatol. 2020;156:1366. https://doi.org/10.1001/jamadermatol.2020.2990.
6. Cigdem G, Boleken ME. Abdominal complications after ventriculoperitoneal shunt placement in pediatric patients with hydrocephalus. J Harran Univ Med Fac. 2025;22:172–8. https://doi.org/10.35440/hutfd.15929.
7. Wu D, Guan Z, Xiao L, Li D. Thrombosis associated with ventriculoatrial shunts. Neurosurg Rev. 2022;45:1111–22. https://doi.org/10.1007/s10143-021-01656-5.
8. Bakhaidar M, Wilcox JT, Sinclair DS, Diaz RJ. Ventriculoatrial shunts: review of technical aspects and complications. World Neurosurg. 2022;158:158–64. https://doi.org/10.1016/j.wneu.2021.11.025.
9. Aschoff A, Kremer P, Hashemi B, Kunze S. The scientific history of hydrocephalus and its treatment. Neurosurg Rev. 1999;22:67–93. https://doi.org/10.1007/s101430050035.
10. Ceja Espinosa A, Franco Jimenez JA, Reyes Vazquez P, Gutierrez Aceves GA, Ponce Ayala A. Endoscopic third ventriculostomy for obstructive hydrocephalus secondary to delayed intracerebellar hematoma. Cureus. 2021;13:e17302. https://doi.org/10.7759/cureus.17302.
11. Karasudani K, Ito Y, Muroi A, Sato M, Marushima A, Hayakawa M, Matsumaru Y, Ishikawa E. Endoscopic third ventriculostomy for noncommunicating hydrocephalus by vertebrobasilar dolichoectasia: a case report. Surg Neurol Int. 2022;13:166. https://doi.org/10.25259/SNI_1041_2021.
12. Montemurro N. Clinical and surgical outcome of endoscopic third ventriculostomy (ETV) and ventriculoperitoneal shunt (VPS) in patients with long-standing overt ventriculomegaly in adults

(LOVA): a systematic review. Neurol Res. 2024;46:81–8. https://doi.org/10.1080/01616412.2023.2257461.

13. Behrendt H, Nau HE. Ventriculo-renal shunt in the therapy of hydrocephalus. Urologe A. 1987;26:331–3.
14. Hetet JF, Hamel O, Rigaud J, Karam G, Lajat Y, Bouchot O, Le Normand L. Ventriculo-ureteric shunt without associated nephrectomy for the treatment of hydrocephalus. Prog Urol. 2004;14:390–3.
15. Lescure V, Descazeaud A, Caire F, Salle H. The ventriculo-ureteral shunt: an underused, valuable neurosurgical approach. Neurochirurgie. 2021;67:640–2. https://doi.org/10.1016/j.neuchi.2020.12.007.
16. Sandvik U, Bartek J Jr, Edström E, Jönsson M, Stenman J. Percutaneously inserted ventriculo-ureteral shunt as a salvage treatment in paediatric hydrocephalus: a technical note. Childs Nerv Syst. 2023;39:249–54. https://doi.org/10.1007/s00381-022-05673-7.
17. Maggi G, Ambrosio A, Profeta G. Value of the ventriculo-ureteral shunt after the failure of other shunts for hydrocephalus (case report). J Neurosurg Sci. 1974;18:12–5.
18. Szuflita N, Kirkham A, Gerald T, Delaney J, Miller C, Curry B, Cartwright L, Hawksworth J, Davidson L. Native ureter ventriculo-ureteral shunt placement for management of refractory hydrocephalus in a child with a history of renal transplant: case report and technical note. Urology. 2021;148:260–3. https://doi.org/10.1016/j.urology.2020.07.033.
19. Pittman T, Steinhardt G, Weber T. Ventriculo-ureteral shunt without nephrectomy. Br J Neurosurg. 1992;6:261–3. https://doi.org/10.3109/02688699209002936.
20. Ames CD, Jane JA Jr, Jane JA, Sr, Campbell FG, Howards SS. A novel technique for ventriculovesical shunting of congenital hydrocephalus. J Urol. 2001;165:1169–71.
21. Morosanu CO, Priscu A, Rahota RG, Florian IS. Ventriculorenal shunts in the treatment of pediatric and adult hydrocephalus—historical perspective and analysis of current practice. Childs Nerv Syst. 2023;39:403–15. https://doi.org/10.1007/s00381-022-05684-4.
22. Lou PY, Chen H, Wu ZH, Wang B. The clinical application of ventriculovesical shunts. Zhonghua Yi Xue Za Zhi. 2019;99:41–3. https://doi.org/10.3760/cma.j.issn.0376-2491.2019.01.009.
23. Ibrahim AK. Urinary bladder stone complicating ventriculovesical shunt. Sultan Qaboos Univ Med J. 2014;14:e142–4. https://doi.org/10.12816/0003351.
24. Shahul Hameed AS, Yousaf I, Choudhari KA. Urinary bladder calculi complicating ventriculo-vesical shunt. Br J Neurosurg. 2005;19:449–50. https://doi.org/10.1080/02688690500390458.
25. Matson DD. Ventriculo-ureterostomy. J Neurosurg. 1951;8:398–404. https://doi.org/10.3171/jns.1951.8.4.0398.

Figures

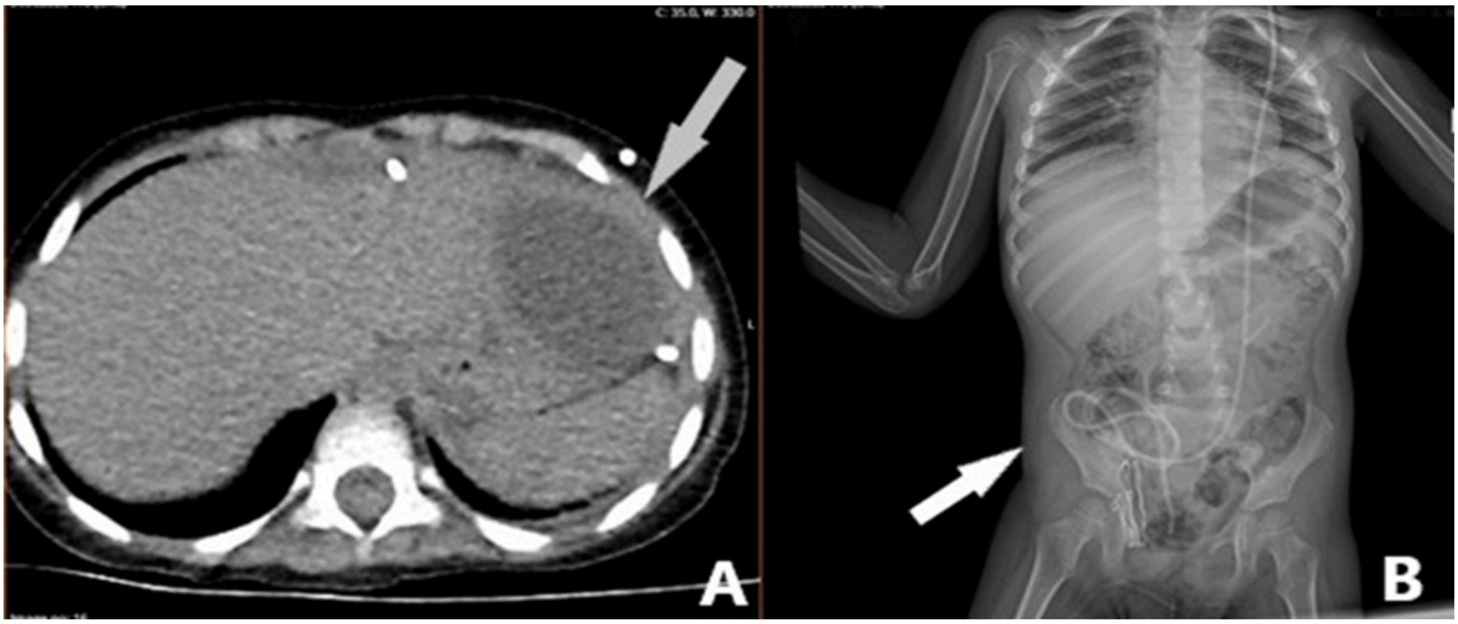


Figure 1

A Axial abdominal CT image, the grey arrow is demonstrating a well-defined abdominal pseudo cystic lesion inside the abdominal cavity. **B** Postoperative X-ray, the white arrow shows a ventriculovesical shunt with the distal catheter coiled within the abdominal cavity.

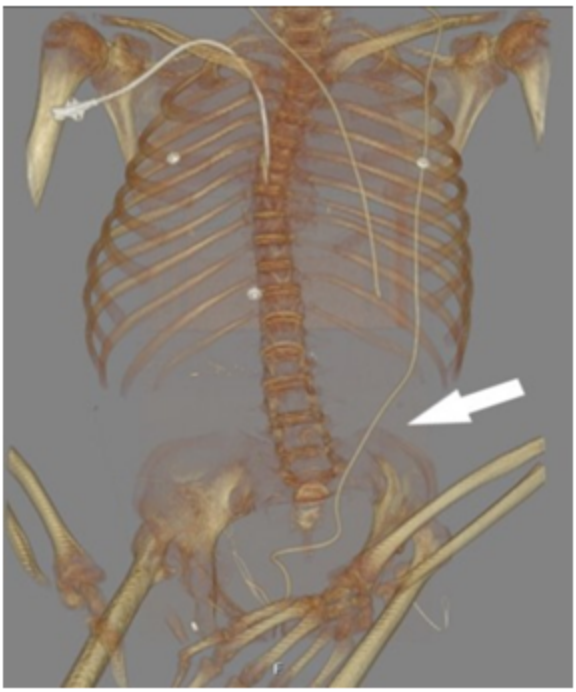


Figure 2

The white arrow indicates the distal segment of the shunt tubing into the pelvis.

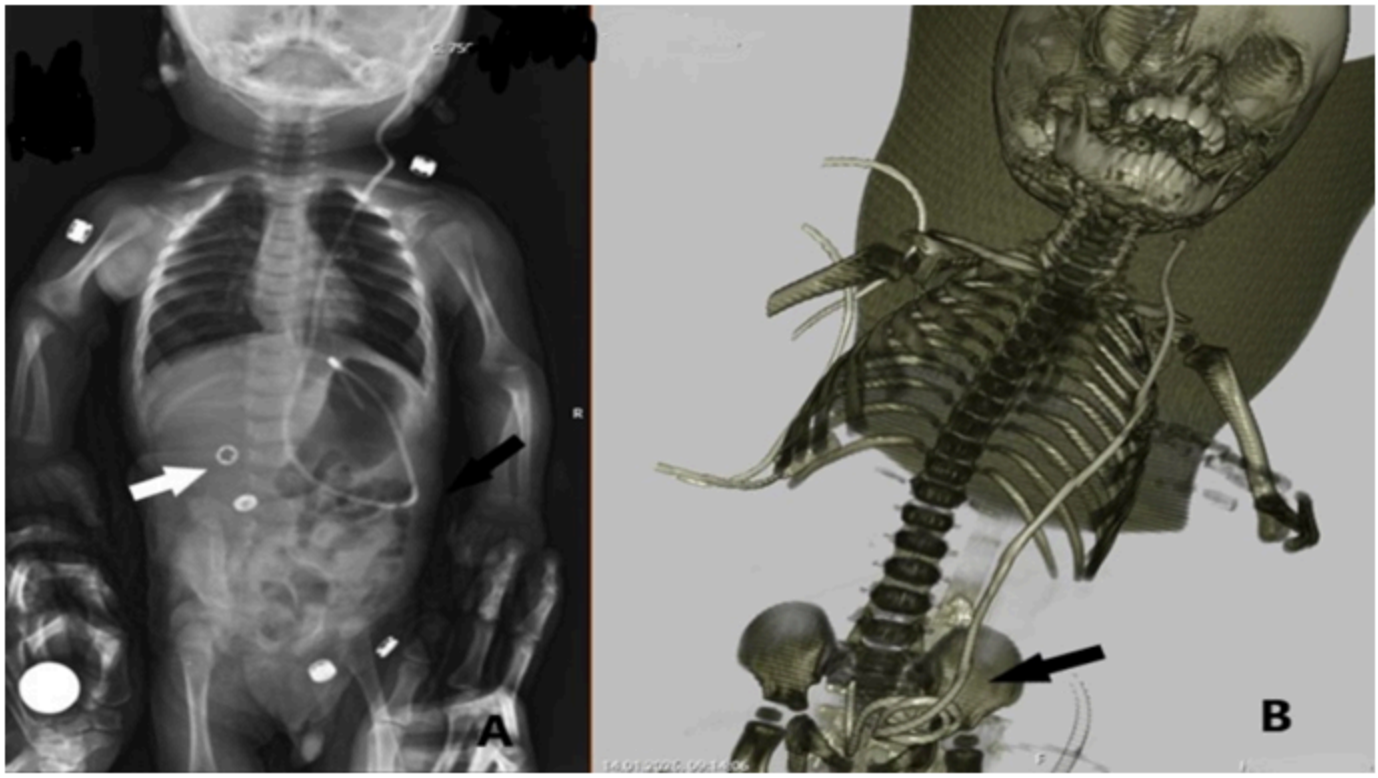


Figure 3

A An anteroposterior preoperative X-ray, the white arrow indicates a colostomy site with visible openings in the abdominal wall. The bowel loops shifted to the left side of the abdomen. A ventriculoperitoneal shunt catheter coursing into the abdominal cavity. **B** postoperative 3-D CT scan, the black arrow points to the distal end of the shunt, which is visualized within the urinary bladder.

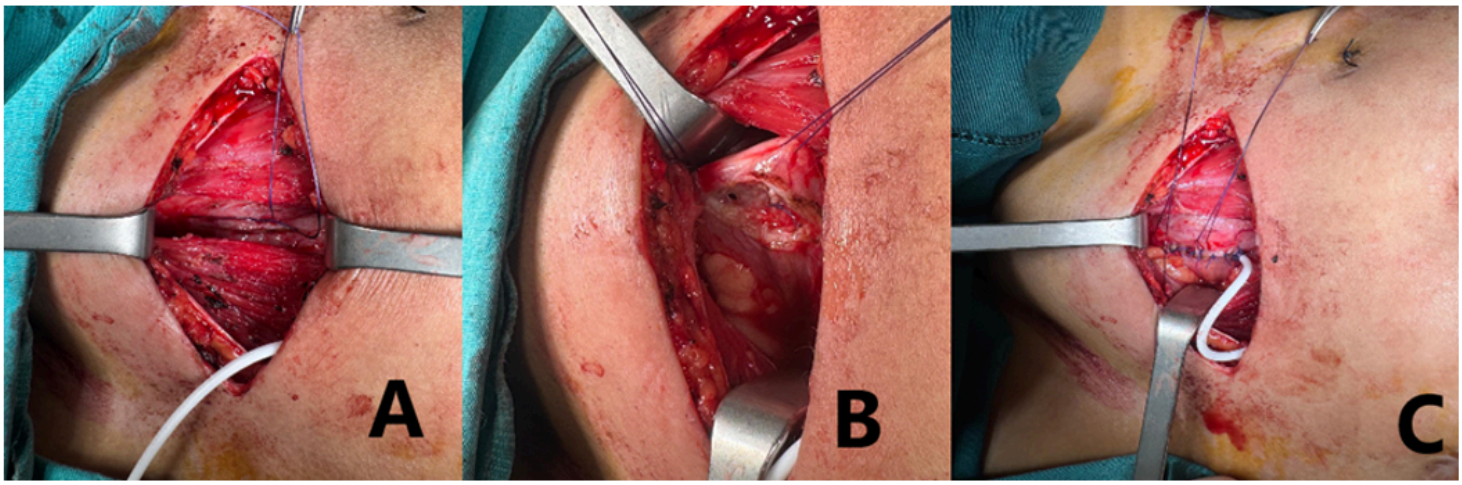


Figure 4

Ventriculovesical shunt insertion—operative steps. **A** A horizontal Pfannenstiel incision with exposure of the bladder; the detrusor muscle are identified and dissected to create a controlled entry site. **B** Bladder

wall opened to access the lumen under direct visualization; careful retraction and hemostasis are maintained. **C** Placement of the distal catheter into the bladder with fixation using purse-string sutures; watertight closure of the bladder wall is performed around the catheter to prevent leakage.

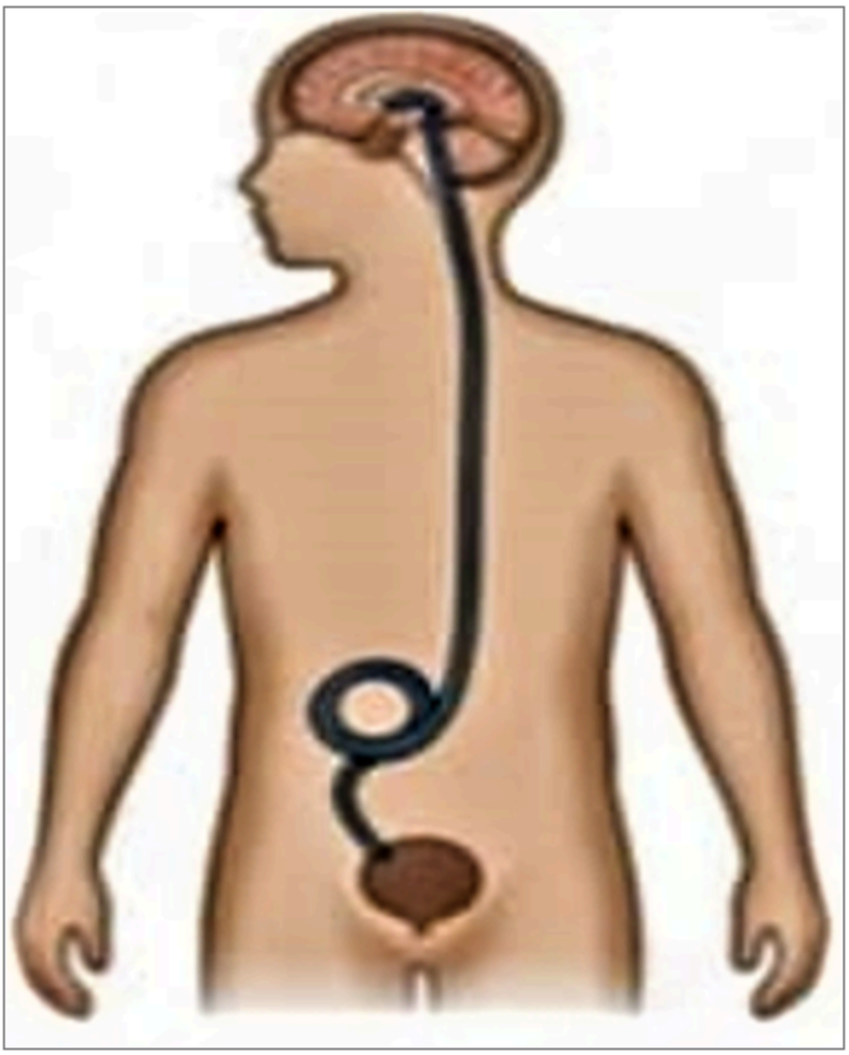


Figure 5

Schematic of a ventriculovesical shunt isdemonstrating a catheter originating in the cerebral ventricle, coursing subcutaneously along the neck and trunk to the lower abdomen, and terminating in the urinary bladder. The distal segment is shown coiled within the subcutaneous fatty layer of the abdominal wall for the additional length.