# A Very Rare Cause of VP Shunt Dysfunction Following Contrast Injection into the Peritoneal Catheter during an Intra-Abdominal Procedure: A Case Report

Ahmed Najjar. MBBS, FRCSC[1,4], Mustafa S Alhasan. MBBS, DABR[2], Obai Raffah[3,5]*.

[1]*Department of General and Specialised Surgery, College of Medicine, Taibah University, Madinah, Saudi Arabia*

[2]*Department of Internal Medicine, College of Medicine, Taibah University, Madinah, Saudi Arabia.*

[3]*Al-Rayan Medical Colleges, College of Medicine. Madinah, Saudi Arabia*

[4]*Consultant neurosurgeon, Department of Surgery, KFSHRC-Madinah, Saudi Arabia.*

[5]*KFSHRC, Rotating student, Department of Surgery, KFSHRC-Madinah, Saudi Arabia*

***Correspondence:** Obai M Raffah MBBS, Medical Student, Al-Rayan Medical Colleges, College of Medicine, KFSHRC, Rotating student, Department of Surgery, KFSHRC-Madinah, Saudi Arabia, Tel: +966532528199

Obairaffah@gmail.com

Radiology Case. 2026 May; 20(5):1-13 :: DOI: 10.3941/jrcr.6164





**AUTHORS' CONTRIBUTIONS**

Obai Raffah drafted the entire manuscript, collected and organized the clinical data, performed the literature review, and coordinated all revisions. Ahmed Najjar supervised the case report, provided senior clinical oversight, contributed to case conceptualization, and critically reviewed the manuscript for intellectual content.

Mustafa Alhasan provided expert radiological interpretation, reviewed imaging findings, and contributed radiological feedback to the manuscript. All authors read and approved the final version of the manuscript.

**ACKNOWLEDGEMENTS**

If you would like to thank a particular person.

**DISCLOSURES**

No disclosures

**CONSENT**

Yes

**HUMAN AND ANIMAL RIGHTS**

All human rights are in intact and no violation

**ABSTRACT**

**Background:** Very late mechanical ventriculoperitoneal (VP) shunt failure is rare. Iatrogenic injury during radiologic procedures is an underreported cause.

**Case report:** A 24-year-old female with congenital hydrocephalus and myelomeningocele presented with clear fluid leakage along the VP shunt tract after complex urologic surgeries. Imaging demonstrated contrast opacification of the distal VP shunt following inadvertent contrast injection during fistula evaluation, resulting in catheter rupture and subcutaneous cerebrospinal fluid leakage. Cerebrospinal fluid cultures were repeatedly negative. Management included shunt externalization, targeted antimicrobial therapy, and delayed VP shunt reinsertion with good long-term outcome.

**Conclusion:** Awareness of VP shunt anatomy during contrast-based imaging and multidisciplinary coordination are essential to prevent rare but serious iatrogenic shunt complications.

# CASE REPORT

## BACKGROUND

Ventriculoperitoneal (VP) shunting remains the standard treatment for hydrocephalus particularly in patients with congenital central nervous system anomalies such as myelomeningocele [1,2]. Although shunt-related complications are common early after insertion, very late mechanical failures occurring decades later are rare [3,4].

Patients with neurogenic bladder often undergo complex urologic surgeries, thus increasing the risk of abdominal and

pelvic complications [5]. Interactions between long-standing VP shunts and repeated urologic interventions are rarely reported [6,7]. We present here a rare case of VP shunt rupture occurring 24 years after insertion following contrast injection during radiological evaluation of intra-abdominal fistulas.

### Rational

Ventriculoperitoneal shunt–related complications are well recognized, particularly in the early postoperative period; however, very late mechanical failures occurring decades after implantation remain uncommon [8,9]. Patients with congenital hydrocephalus and neurogenic bladder frequently require repeated abdominal, pelvic, and radiologic interventions throughout life, increasing the potential for distal shunt–related complications [10,11]. Interactions between long-standing ventriculoperitoneal shunts and complex urologic procedures are sparsely reported in the literature [12].

The present case was reported to highlight a previously underreported iatrogenic mechanism of very late VP shunt rupture, namely inadvertent radiologic contrast injection into the distal peritoneal catheter during evaluation of intra-abdominal fistulas. Reporting this case is clinically relevant because it underscores a preventable cause of shunt failure, emphasizes the importance of recognizing VP shunt anatomy during contrast-based imaging, and reinforces the need for multidisciplinary communication when managing shunt-dependent patients undergoing complex urologic or colorectal procedures. Increased awareness of this mechanism may help prevent similar complications and guide safer diagnostic practices in comparable clinical settings.

### Guidelines and Literature

Current standards of care for ventriculoperitoneal shunt complications emphasize early identification of mechanical failure, exclusion of central nervous system infection, and timely neurosurgical intervention [13].In cases of suspected contamination or distal shunt compromise, shunt externalization with temporary external ventricular drainage followed by delayed reinsertion after sterile cerebrospinal fluid cultures is considered standard practice [14]. Previously reported delayed ventriculoperitoneal shunt complications primarily include infection, migration, bowel perforation, and abdominal pseudocyst formation, with limited emphasis on iatrogenic injury during radiologic procedures [12,15].

Previous literature on delayed VP shunt complications has primarily focused on infection, migration, bowel perforation, and abdominal pseudocyst formation. Existing surgical and neurosurgical guidelines highlight the importance of multidisciplinary management in patients with complex abdominal pathology but do not specifically address the risk of shunt injury during radiologic contrast administration. This case complements existing literature by identifying a novel and preventable mechanism of shunt failure and supports the need for heightened procedural awareness and adherence to safe imaging practices in shunt-dependent patients.

### Timeline of Events

**Birth:** Myelomeningocele repair and VP shunt insertion

**Childhood–Adolescence:** Neurogenic bladder; bladder augmentation

**2020:** Urologic surgery complicated by bladder rupture and peritonitis

**Subsequent period:** Development of vesicocutaneous and vesicocolonic fistulas

**Radiologic evaluation:** Inadvertent contrast injection into VP shunt catheter

**Presentation:** Subcutaneous CSF leakage and shunt dysfunction

**Management:** Shunt externalization, antimicrobial therapy, and delayed reinsertion

**Follow-up:** Stable clinical status at >2 years

## CASE REPORT

Patient Information

### Demographic Details

A 24-year-old female with a known history of congenital hydrocephalus and myelomeningocele.

### Presentation

The patient presented to the neurosurgery department with clear fluid leakage from a stoma site along the ventriculoperitoneal (VP) shunt tract. She was referred following multiple urologic and colorectal surgical interventions performed at different institutions.

### Past Medical and Surgical History

At birth, the patient underwent myelomeningocele repair and VP shunt insertion, resulting in persistent motor deficits affecting the lower limbs. She later developed neurogenic bladder, for which she underwent bladder augmentation.

In 2020, she developed recurrent bladder stones and underwent urologic surgery at a private hospital. This procedure was complicated by bladder rupture, leading to peritonitis. She was admitted to a public hospital where she underwent exploratory surgery with creation of an ileostomy and placement of a Foley catheter, and was later referred to our institution for further management.

Subsequent evaluation revealed vesicocutaneous and vesicocolonic fistulas. Following multidisciplinary discussion with the colorectal surgery team, she underwent vesicocolic fistula takedown, segmental sigmoid resection, partial anastomosis, and loop colostomy reversal. She later developed a recurrent vesicocutaneous fistula that was managed with drainage, nephrostomy placement, and left ureteral catheter

insertion. Despite these interventions, persistent clear fluid and urine leakage continued.

**Drug History and Allergies**

At presentation, the patient was not on long-term medications. During admission, she received targeted antimicrobial therapy as outlined below. No drug allergies or adverse drug reactions were reported.

**Family and Social History**

Family history was non-contributory. Social history was unremarkable, with no reported smoking, alcohol, or recreational drug use. The patient required ongoing medical care related to her neurological and urologic conditions.

**Review of Systems**

The patient denied headache, fever, altered mental status, visual disturbance, or other symptoms suggestive of raised intracranial pressure or central nervous system infection.

**Clinical Findings**

On examination, the patient was afebrile, hemodynamically stable, and neurologically at baseline. There were no signs of meningeal irritation or raised intracranial pressure. Local examination revealed clear fluid leakage along the VP shunt tract near the stoma site.

Diagnostic Assessment and Interpretation
Diagnostic Assessment

**Laboratory investigations:**

Fluid cultures obtained from the drainage site grew multidrug-resistant Klebsiella species. Serial cerebrospinal fluid (CSF) cultures remained negative. Routine laboratory tests showed no evidence of systemic infection.

**Imaging:**

Chest and pelvic radiographs demonstrated contrast opacification of the VP shunt catheter following inadvertent contrast injection, extending along the intra-abdominal and intrathoracic segments (Figure 1). Computed tomography (CT) of the brain revealed no acute intracranial abnormalities and no evidence of meningitis or ventriculitis. Subsequent imaging demonstrated localized fluid collections along the distal shunt tract in the chest wall and breast region (Figure 2).

**Invasive investigations:**

Ultrasound-guided drainage of the chest wall collection was attempted but was unsuccessful. Definitive diagnostic clarification was achieved during neurosurgical exploration.

**Diagnostic Challenges**

Diagnosis was challenging due to the absence of classical symptoms of VP shunt infection or raised intracranial pressure, despite positive bacterial cultures from the drainage site. The patient's complex surgical history and the unusual mechanism of injury further complicated diagnostic interpretation. These challenges were addressed through multidisciplinary collaboration between neurosurgery, urology, radiology, colorectal surgery, and infectious diseases teams.

**Diagnostic Reasoning**

Differential diagnoses included VP shunt infection, distal shunt disconnection, abdominal pseudocyst, and cerebrospinal fluid leakage related to fistula contamination. Shunt infection was considered but deemed unlikely due to negative CSF cultures and absence of clinical or radiological signs of meningitis. Mechanical disconnection and pseudocyst formation were excluded based on imaging findings. The diagnosis of distal VP shunt rupture secondary to inadvertent contrast injection was established through radiographic evidence and clinical correlation.

**Prognostic Characteristics**

The absence of central nervous system infection and early neurosurgical intervention were favorable prognostic factors. Long-term prognosis was assessed clinically and radiologically, with stable findings on follow-up.

**Intervention**

**Pre-operative Optimization**

The patient received targeted antimicrobial therapy and close neurological monitoring prior to surgical intervention.

**Surgical and Medical Interventions**

The patient was treated with intravenous ceftazidime/avibactam (2.5 g every 10 hours for 10 days) and daptomycin (750 mg once daily for 14 days). Vancomycin (1,250 mg intravenously) was administered initially and later discontinued based on culture sensitivities. Oral linezolid (600 mg every 12 hours for 6 days) was prescribed on discharge.

Given persistent local complications, the patient underwent externalization of the VP shunt with placement of an external ventricular drain (EVD).

**Specific Details of the Intervention**

Following eight days of negative CSF cultures and clinical stability, a new VP shunt was inserted (Figure 3).

**Setting and Operator Details**

The neurosurgical interventions were performed at a tertiary care center with multidisciplinary involvement.

**Deviation from the Initial Management Plan**

Initial conservative management was escalated to surgical intervention due to persistent fluid collections and concern for distal shunt injury.

**Outcome and Follow-Up**

At more than two years of follow-up after shunt revision, the patient remained clinically stable. She has reported no headaches, no CSF leakage, and no symptoms suggestive of VP shunt dysfunction. Neurological examination was at her baseline, and she continued regular follow-up without further complications (Figures 4A,4B).

## DISCUSSION

This case represents a rare example of ventriculoperitoneal (VP) shunt dysfunction occurring 24 years after initial insertion. While most VP shunt complications occur within the first few years following implantation, delayed mechanical failures decades later have been reported but remain rare [1, 3]. The mechanism of injury in the present case was particularly unusual: It resulted from inadvertent contrast injection into the distal shunt catheter during radiological evaluation of urologic fistulas. To the best our knowledge, this might be the only case in the literature.

Long-standing VP shunts are susceptible to material fatigue, calcification, and loss of elasticity over time, thus rendering them vulnerable to mechanical injury even with minimal external stress [3, 4]. In patients with neurogenic bladder, repeated abdominal and pelvic surgical and radiological interventions are frequently required, thus increasing the risk of distal shunt complications through catheter manipulation, traction, or exposure to inflammatory and infectious processes [5, 6].

Delayed VP shunt complications reported in the literature most commonly include infection, migration, bowel perforation, and abdominal pseudocyst formation [6, 7]. In contrast, direct rupture of the shunt catheter secondary to radiologic contrast injection represents a previously unreported mechanism of failure. This highlights the importance of strict awareness of VP shunt anatomy during contrast studies and invasive imaging—particularly in patients with complex urologic reconstructions.

Despite cerebrospinal fluid contamination and positive cultures, the absence of clinical or radiological meningitis in this patient underscores the importance of early recognition and prompt multidisciplinary management. Shunt externalization with temporary external ventricular drainage followed by shunt reinsertion remains a well-established strategy to minimize infectious complications while preserving neurological stability [1, 3]. This case emphasizes the need for careful identification of VP shunt anatomy during radiological and surgical procedures and highlights the critical role of collaboration between neurosurgery, urology, colorectal surgery, and radiology teams.

## CONCLUSION

Very late VP shunt dysfunction is a rare but serious complication that can occur following complex urologic and radiologic interventions. Awareness of VP shunt presence and trajectory is essential when managing patients with extensive urologic surgical histories. Early neurosurgical involvement and multidisciplinary collaboration are key to favorable outcomes.

## TEACHING POINT

VP shunt complications may occur decades after insertion

Radiologic contrast injection can cause mechanical shunt rupture

Multidisciplinary coordination is essential in complex urologic cases

Early shunt externalization and delayed reinsertion can prevent infection

## QUESTIONS

Question 1: Which imaging finding most directly suggested inadvertent contrast injection into the ventriculoperitoneal (VP) shunt catheter?

1. Ventricular enlargement on brain CT
2. Peritoneal free fluid on abdominal CT
3. Contrast opacification of the VP shunt catheter on radiographs (applies)
4. Pneumocephalus on skull radiographs
5. Enhancement of ventricular walls on post-contrast CT

**Explanation:** Contrast material was visualized within the VP shunt catheter along its expected intrathoracic and intra-abdominal course on chest and pelvic radiographs, directly indicating inadvertent contrast injection into the shunt system. [Imaging Findings]

Question 2: Which clinical feature helped exclude ventriculoperitoneal shunt infection in this patient?

1. Presence of multidrug-resistant organisms in wound cultures
2. Elevated inflammatory markers
3. Absence of fever and negative cerebrospinal fluid cultures (applies)
4. History of multiple abdominal surgeries
5. Presence of subcutaneous fluid collections

**Explanation:** Despite positive cultures from the drainage site, repeated cerebrospinal fluid cultures remained negative and the patient showed no clinical or radiologic signs of meningitis or ventriculitis. [Diagnostic Reasoning]

Question 3: Which mechanism best explains the ventriculoperitoneal shunt failure described in this case?

1. Catheter fracture due to calcification alone
2. Shunt obstruction from proteinaceous debris
3. Bowel perforation by the distal catheter
4. Mechanical rupture following inadvertent contrast injection (applies)
5. Proximal ventricular catheter malposition

**Explanation:** The shunt failure resulted from inadvertent radiologic contrast injection into the distal peritoneal catheter,

leading to mechanical rupture and cerebrospinal fluid leakage. [Discussion – Clinical and Imaging Findings]

Question 4: What was the most appropriate management strategy for this patient's ventriculoperitoneal shunt complication?

1. Immediate shunt removal without replacement
2. Conservative management with antibiotics only
3. Shunt revision without externalization
4. Shunt externalization followed by delayed reinsertion after sterile cultures (applies)
5. Endoscopic third ventriculostomy

**Explanation:** Standard management of suspected distal shunt compromise includes shunt externalization, temporary external ventricular drainage, exclusion of infection, and delayed shunt reinsertion after sterile cerebrospinal fluid cultures. [Management and Follow-Up]

Question 5: Which differential diagnosis was considered but excluded based on imaging and clinical findings?

1. Distal shunt rupture
2. Abdominal pseudocyst
3. Ventriculoperitoneal shunt infection
4. Distal shunt disconnection (applies)
5. Cerebrospinal fluid leakage

**Explanation:** Imaging demonstrated an intact shunt course without radiographic evidence of disconnection, and cerebrospinal fluid leakage was attributed to catheter rupture rather than disconnection. [Diagnostic Reasoning]

## REFERENCES

[1] Tuli S, Drake J, Lawless J, Wigg M, Lamberti-Pasculli M. Risk factors for repeated cerebrospinal shunt failures in pediatric patients with hydrocephalus. *J Neurosurg.* 2000; 92(1): 31-38. PMID: 10616079.

[2] Bowman RM, McLone DG, Grant JA, Tomita T, Ito JA. Spina bifida outcome: A 25-year prospective. *Pediatr Neurosurg.* 2001; 34(3): 114-120. PMID: 11359098.

[3] Reddy GK, Bollam P, Caldito G. Long-term outcomes of ventriculoperitoneal shunt surgery in patients with hydrocephalus. *World Neurosurg.* 2014; 81(2): 404-410. PMID: 23380280.

[4] Piatt JH, Carlson CV. A search for determinants of cerebrospinal fluid shunt survival: Retrospective analysis of a 14-year institutional experience. *Pediatr Neurosurg.* 1993; 19(5): 233-241. PMID: 8398847.

[5] Gonzalez R, Reinberg Y, Burke B. Neurogenic bladder in myelomeningocele: Long-term urological outcomes. *J Urol.* 1993; 149: 1006-1009.

[6] Abode-Iyamah KO, Khanna R, Rasmussen ZD, Flouty OE, Dahdaleh NS, Greenlee JDW. Abdominal complications of ventriculoperitoneal shunts: A review of the literature. *Surg Neurol Int.* 2017; 8: 256.

[7] Rainov NG, Schobess A, Heidecke V, Burkert W. Abdominal complications following ventriculoperitoneal shunt implantation in adults. *Acta Neurochir.* 1994; 127: 73-78.

[8] Reddy GK, Bollam P, Caldito G. Long-term outcomes of ventriculoperitoneal shunt surgery in patients with hydrocephalus. *World Neurosurg.* 2014; 81(2): 404–410. PMID: 23380280.

[9] Piatt JH, Carlson CV. A search for determinants of cerebrospinal fluid shunt survival: Retrospective analysis of a 14-year institutional experience. *Pediatr Neurosurg.* 1993; 19(5): 233–241. PMID: 8398847.

[10] Bowman RM, McLone DG, Grant JA, Tomita T, Ito JA. Spina bifida outcome: A 25-year prospective study. *Pediatr Neurosurg.* 2001; 34(3): 114–120. PMID: 11359098.

[11] Gonzalez R, Reinberg Y, Burke B. Neurogenic bladder in myelomeningocele: Long-term urological outcomes. *J Urol.* 1993; 149(5): 1006–1009.

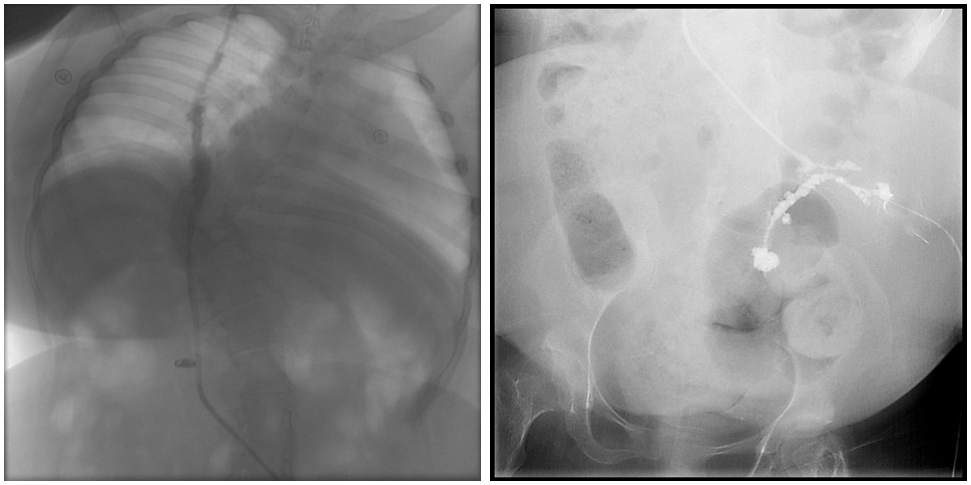
[12] Abode-Iyamah KO, Khanna R, Rasmussen ZD, et al. Abdominal complications of ventriculoperitoneal shunts: A review of the literature. *Surg Neurol Int.* 2017; 8: 256.

[13] Tuli S, Drake J, Lawless J, Wigg M, Lamberti-Pasculli M. Risk factors for repeated cerebrospinal fluid shunt failures in pediatric patients with hydrocephalus. *J Neurosurg.* 2000; 92(1): 31–38. PMID: 10616079.

[14] Whitehead WE, Riva-Cambrin J, Kulkarni AV, et al. Guidelines for the management of cerebrospinal fluid shunt infection. *J Neurosurg Pediatr.* 2017; 19(6): 505–515.

[15] Rainov NG, Schobess A, Heidecke V, Burkert W. Abdominal complications following ventriculoperitoneal shunt implantation in adults. *Acta Neurochir (Wien).* 1994; 127(1–2): 73–78.

## FIGURES



A B

**Figure 1:** ***(A)*** Chest X-ray and ***(B)*** pelvic X-ray demonstrating contrast opacification of the ventriculoperitoneal (VP) shunt catheter along its expected course. The shunt system is visualized on both images without radiographic evidence of disconnection on the shunt series.

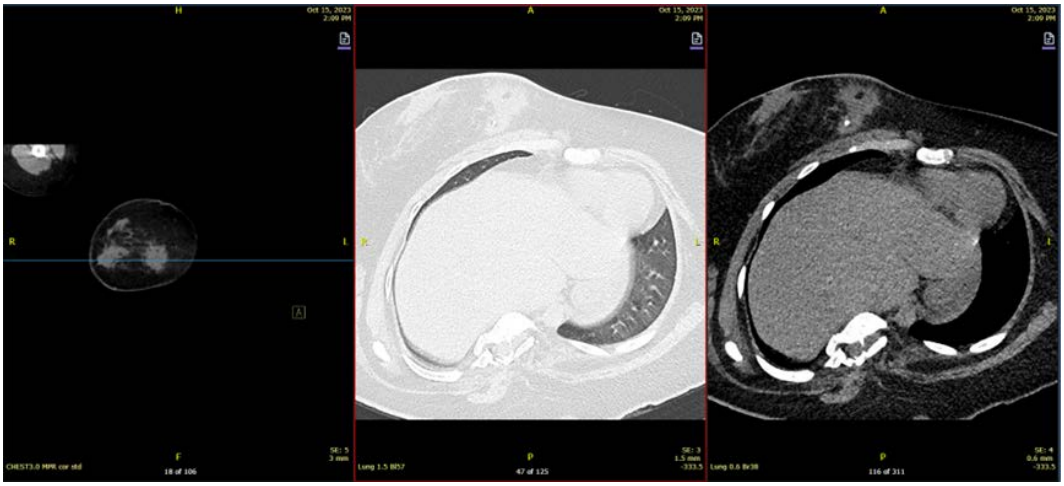


**Figure 2:** Non-contrast computed tomography demonstrating complications along the distal ventriculoperitoneal (VP) shunt tract. *(A)* Coronal soft-tissue window showing surrounding soft tissue thickening and fluid collection along the right-sided VP shunt tract. *(B)* Coronal window with adjusted contrast demonstrating hyperdense fluid collection extending from the level of the third rib to the seventh costochondral junction. *(C)* Axial image confirming focal fluid collection with surrounding fat stranding along the VP shunt tract in the right chest wall extending into the medial aspect of the right breast.

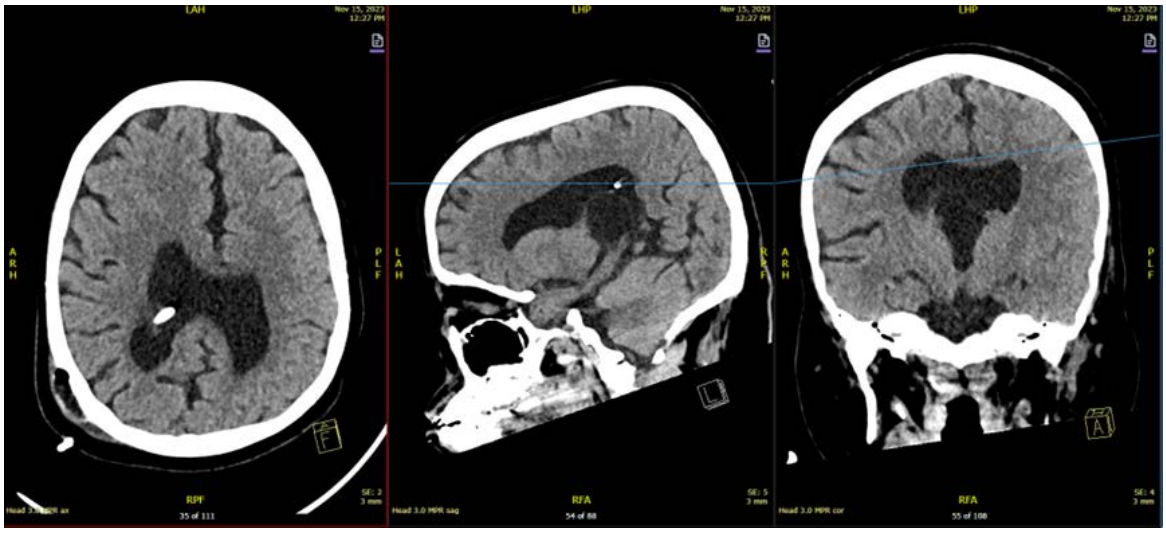
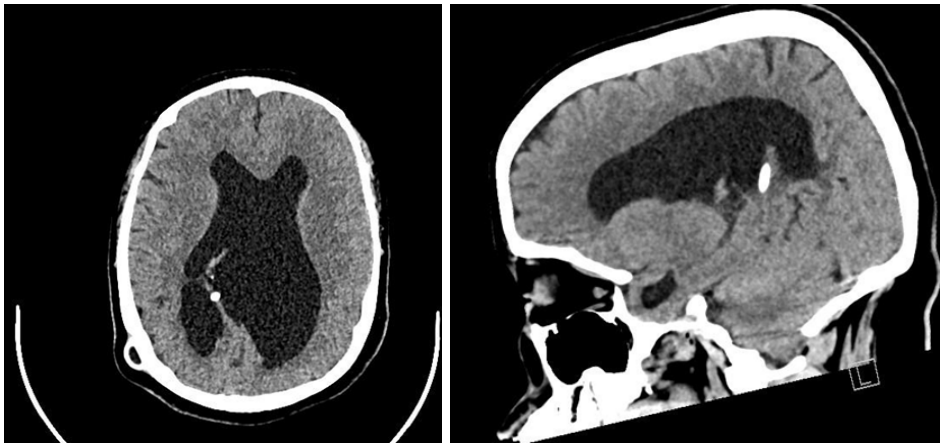


**Figure 3:** Postoperative non-contrast computed tomography (CT) of the brain demonstrating ventricular catheter placement and ventricular changes. ***(A)*** **Coronal**, ***(B)*** **sagittal**, **and** ***(C)*** **axial** images showing interval replacement of the ventriculoperitoneal shunt with a ventricular catheter with the catheter tip located in the right parietal horn. There is mild improvement of chronic supratentorial ventricular dilatation without evidence of transependymal edema. No intra-axial or extra-axial hemorrhage is identified. A known midline cystic lesion in the pineal region demonstrates interval increase in size with stable Chiari type I malformation and tonsillar ectopia.



A B

**Figure 4:** Follow-up non-contrast computed tomography (CT) of the brain obtained two years postoperatively. ***(A)*** Coronal and ***(B)*** **sagittal** images demonstrate redemonstration of the ventriculoperitoneal (VP) shunt with the catheter tip located posterior to the pineal gland. There is interval progression of chronic supratentorial ventricular dilatation without evidence of transependymal edema. The previously described midline cystic lesion in the pineal region is no longer discretely visualized. No intra-axial or extra-axial hemorrhage is identified. Stable Chiari type I malformation with tonsillar ectopia is noted.

| **Time point** | **Clinical event** |
|---|---|
| **Birth** | Myelomeningocele repair and ventriculoperitoneal (VP) shunt insertion |
| **Childhood–Adolescence** | Development of neurogenic bladder; bladder augmentation performed |
| **2020** | Urologic surgery for recurrent bladder stones, complicated by bladder rupture and peritonitis |
| **Post-2020 period** | Development of vesicocutaneous and vesicocolonic fistulas |
| **Radiologic evaluation** | Inadvertent contrast injection into the distal VP shunt catheter during fistula assessment |
| **Presentation to neurosurgery** | Subcutaneous cerebrospinal fluid leakage and VP shunt dysfunction |
| **Management** | VP shunt externalization, targeted antimicrobial therapy, and delayed VP shunt reinsertion |
| **Follow-up** | Clinically stable with no shunt-related complications at >2 years |

| SCARE Guideline Checklist 2025 | | | |
|---|---|---|---|
| **Topic** | **Item** | **Description** | **Page number** |
| **Title** | 1 | - The words 'case report' should appear in the title.<br>- The title should be concise and highlight the area of focus (e.g. presentation, patient population, diagnosis, surgical intervention, or outcome). | 1 |
| **Key Words** | 2 | - Include three to six keywords that identify what is covered in the case report (e.g. patient population, diagnosis or surgical intervention).<br>- Include 'case report' as one of the keywords. | 1 |
| **Highlights** | 3 | - Include three to five bullet points that capture the novel findings of the report.<br>- These should focus on providing a brief background to the report. Include the key results, their clinical relevance, and any validation performed. | 3 |
| **Abstract** | 4a | **Structure**<br>- Provide a structured abstract that includes the following headings: (1) introduction and importance, (2) presentation of case, (3) clinical discussion, and (4) conclusion. | 2 |
| | 4b | **Introduction and Importance**<br>- Describe what is known currently on this topic, what is important, unique or educational about the case, and what this adds to the surgical literature. | |
| | 4c | **Presentation of Case**<br>- Detail the presenting complaint(s), clinical and demographic details, and the patient's main ideas, concerns, and expectations.<br>- Detail the clinical findings, investigations performed, main differentials, and subsequent diagnosis.<br>- Describe the rationale for choosing the intervention.<br>- Describe what was the outcome. | 3 |
| | 4d | **Clinical Discussion**<br>- Discuss the clinical findings in relation to what is currently known. | 5 |
| | 4e | **Conclusion**<br>- Describe the relevance and impact of the report.<br>- Detail the main take away lessons or potential implications for clinical practice (minimum of three). | |
| **Artificial Intelligence (AI) (some journals may prefer this in the methods and/or acknowledgments section and it should also be declared in the cover letter)** | 5 | **Declaration of whether any AI was used in the research and manuscript development**<br>**If no, proceed to item 6.**<br>**If yes, proceed to item 5a** | |
| | 5a | **Purpose and Scope of AI Use**<br>- Precisely state why AI was employed (e.g. development of research questions, language drafting, statistical analysis/summarisation, image annotation, etc).<br>- Was generative AI utilised and if so, how?<br>- Clarify the stage(s) of the reporting workflow affected (planning, writing, revisions, figure creation).<br>- Confirmation that the author(s) take responsibility for the integrity of the content affected/ generated | |
| | 5b | **AI Tool(s) and Configuration**<br>- Name each system (vendor, model, major version/date).<br>- State the date it was used<br>- Specify relevant parameters (e.g. prompt length, plug-ins, fine-tuning, temperature).<br>- Declare whether the tool operated locally on-premises, or via a cloud API and any integrations with other systems. | |
| | 5c | **Data Inputs and Safeguards**<br>- Describe categories of data provided to the AI (patient text, de-identified images, literature abstracts).<br>- Confirm that all inputs were de-identified and compliant with GDPR/HIPAA.<br>- Note any institutional approvals or data-sharing agreements obtained. | |
| | 5d | **Human Oversight and Verification**<br>- Identify the supervising author(s) who reviewed every AI output.<br>- Detail the process for fact-checking, clinical accuracy checks<br>- State whether any AI-generated text/figures were edited or discarded.<br>- Acknowledge the limitations of AI and its use | |

| | | | |
|---|---|---|---|
| | 5e | **Bias, Ethics and Regulatory Compliance**<br>- Outline steps taken to detect and mitigate algorithmic bias (e.g. cross-checking against under-represented populations).<br>- Affirm adherence to relevant ethical frameworks.<br>- Disclose any conflicts of interest or financial ties to AI vendors. | |
| | 5f | **Reproducibility and Transparency**<br>- Provide the exact prompts or code snippets (as supplementary material if lengthy).<br>- Supply version-controlled logs or model cards where possible.<br>- if applicable, state repository, hyperlink or digital object identifier (DOI) where AI-generated artefacts can be accessed, enabling attempts at independent replication of the query/input. | |
| **Introduction** | 6a | **Background**<br>- Describe the area of focus and the relevant background contextual knowledge | 4 |
| | 6b | **Rationale**<br>- Describe why the case is different to what is already known in the literature.<br>- Describe why it is important to report this case. Is the case rare or interesting for the specific healthcare setting, population or country? | |
| | 6c | **Guidelines and Literature**<br>- Give reference to relevant surgical literature and current standards of care, including any specific guidelines or reports (e.g. government, national, international). | |
| **Guideline Citation** | 7 | - At the end of the introduction, include reference to the SCARE 2025 publication by stating: 'This case report has been reported in line with the SCARE checklist [include citation]'. | 4 |
| **Timeline** | 8 | - Summarise the sequence of events leading up to the patient's presentation.<br>- Report any delays from presentation to diagnosis and/or intervention.<br>- Use tables or figures to illustrate the timeline of events if needed.<br>- Use standardised units of time (mm:hh) and dates (dd/mm/yyyy). | 5 |
| **Patient Information** | 9a | **Demographic Details**<br>- Include de-identified demographic information (e.g. age, sex, ethnicity, occupation).<br>- Where relevant, include other useful information (e.g. body mass index, hand dominance, income, level of education, marital status). | 6 |
| | 9b | **Presentation**<br>- Describe the patient's presenting complaint(s).<br>- Include a collateral account of the history if relevant.<br>- Describe how the patient presented (e.g. self-presentation, ambulance or referred by family physician or other hospital clinicians).<br>- Describe where the patient presented (e.g. outpatient clinic, type of hospital, etv). | 6 |
| | 9c | **Past Medical and Surgical History**<br>- Include any previous interactions (e.g. prior admissions to hospital), medical or surgical interventions, and relevant outcomes. | 7 |
| | 9d | **Drug History and Allergies**<br>- Specify any acute, repeat, and discontinued medications.<br>- Specify any contraindications to re-starting regular medicines e.g. increased bleeding risk.<br>- Specify any allergies and/or adverse reactions. | 8 |
| | 9e | **Family History**<br>- Include health information regarding first-degree relatives, specifying any inheritable conditions.<br>**Social History**<br>- Indicate any smoking, alcohol, and recreational drug use.<br>- Indicate the level of social independence, the presence of any carers, driving status, and type of accommodation.<br>**Review of Systems**<br>- Provide any other information outside of the focused history (e.g. headaches, blurred vision, palpitations, abdominal pain, joint pain). | 99 |
| **Clinical Findings** | 10 | - Describe the general and significant clinical findings based on initial inspection and physical examination. | 99 |

| | | | |
|---|---|---|---|
| **Diagnostic Assessment & Interpretation** | 11a | **Diagnostics Assessment**<br>- Bedside (e.g. urinalysis, electrocardiography, echocardiography).<br>- Laboratory (e.g. biochemistry, haematology, immunology, microbiology, histopathology).<br>- Imaging (e.g. ultrasound, X-ray, CT/MRI/PET).<br>- Invasive (e.g. endoscopy, biopsy). | 9 |
| | 11b | **Diagnostic Challenges**<br>- Where applicable, describe what was challenging about the diagnoses (e.g. access, financial, cultural).<br>- Describe how these challenges were overcome. | |
| | 11c | **Diagnostic Reasoning**<br>- Describe the differential diagnoses, why they were considered (e.g. given the initial presentation or after assessment and investigation), why and how they were excluded. | 10 |
| | 11d | **Prognostic Characteristics**<br>- Include where applicable (e.g. tumour staging) and how this was performed. | 1 |
| **Intervention** | 12a | **Pre-Operative Patient Optimisation**<br>- Lifestyle (e.g. weight loss).<br>- Medical (e.g. medication review, treating any relevant pre-existing medical concerns).<br>- Procedural (e.g. nil by mouth, enema).<br>- Other (e.g. psychological support). | 11 |
| | 12b | **Surgical Interventions**<br>- Describe the type(s) of intervention(s) used (e.g. pharmacological, surgical, physiotherapy, psychological, preventative).<br>- Describe any concurrent treatments (e.g. antibiotics, analgesia, antiemetics, venous thromboembolism prophylaxis).<br>- Medical devices should have manufacturer and model specifically mentioned. | 11 |
| | 12c | **Specific Details Regarding the Intervention**<br>- Describe the rationale behind the treatment offered, how it was performed and time to intervention.<br>- For surgery, include details on the intervention (e.g. anaesthesia, patient position, skin preparation used such as chlorhexidine or shaving, use of other relevant equipment, sutures, devices, surgical stage).<br>- For surgery, include any post-operative instructions (e.g. how long to keep an abdominal drain for, when to remove sutures or staples).<br>- The degree of novelty for a surgical technique/device should be mentioned (e.g. 'first in human').<br>- For pharmacological therapies, include information on the formulation, dosage, strength, route, and duration. | 11 |
| | 12d | **Operator Details**<br>- Where applicable, include operator experience and position on the learning curve, prior relevant training, and specialisation (e.g. 'junior trainee with 3 years of surgical specialty training').<br>Setting of Intervention<br>- Specify the setting in which the intervention was performed (e.g. district general hospital, major trauma centre).<br>- Specify the level of experience that the centre has with performing the intervention.<br>- Specify whether the procedure was performed in collaboration with another speciality (e.g. a hybrid procedure). | 12 |
| | 12e | **Deviation from Initial Management Plan**<br>- State if there were any changes in the planned intervention(s).<br>- Provide an explanation for these changes alongside the rationale (e.g. delays to intervention, a laparoscopic procedure converted to open due to operative difficulties). | 12 |

| | | | |
|---|---|---|---|
| **Follow-Up and Outcomes** | 13a | **Specify Details Regarding the Follow-up**<br>- When (e.g. how long after discharge in months or years, frequency, maximum follow-up length at time of submission).<br>- Where (e.g. home via video consultation, primary care, secondary care).<br>- With whom (e.g. appointment with the original operating surgeon).<br>- How (e.g. telephone consultation, virtual or digital follow-up, clinical examination, blood tests, imaging).<br>- Any specific long-term surveillance requirements (e.g. imaging surveillance for endovascular aneurysm repair or clinical exam/ultrasound of regional lymph nodes for skin cancer).<br>- Any specific post-operative instructions (e.g. postoperative medications, targeted physiotherapy, psychological therapy). | 12 |
| | 13b | **Intervention Adherence and Compliance**<br>- Where relevant, detail how well the patient adhered to and tolerated the advice provided (e.g. avoiding heavy lifting for abdominal surgery, or tolerance of chemotherapy and pharmacological agents).<br>- Explain how adherence and tolerance were measured.<br>- Explain whether these results will have an impact on the long-term applicability of the intervention in clinical practice. | 12 |
| | 13c | **Outcomes**<br>- Expected versus attained clinical outcome as assessed by the clinician. Reference literature used to inform expected outcomes.<br>- When appropriate, include patient-reported measures (e.g. questionnaires including quality-of-life scales).<br>- Detail when the outcomes were recorded (e.g. at how many months or years post-operative). | 1 |
| | 13d | **Complications and Adverse Events**<br>- Precautionary measures taken to prevent complications (e.g. antibiotic or venous thromboembolism prophylaxis).<br>- All complications and adverse or unanticipated events should be described in detail and ideally categorised in accordance with the Clavien-Dindo Classification (e.g. blood loss, length of operative time, wound complications, re-exploration or revision surgery).<br>- If relevant, whether the complication was reported to the relevant national agency or pharmaceutical company.<br>- Specify the duration of time between completion of the intervention and discharge, and whether this was within the expected timeframe (if not, why not).<br>- Where applicable, the 30-day post-operative and long-term morbidity/mortality may need to be specified.<br>- Where applicable, specify whether any complications or adverse outcomes were discussed locally (e.g. during team or morbidity and mortality meetings).<br>- State if there were no complications or adverse outcomes. | 13 |
| **Discussion** | 14a | **Summary of Results**<br>- Provide a clear summary of the key findings of the report.<br>- Provide a rationale for the conclusions drawn. | 13 |
| | 14b | **Relevant Literature**<br>- Include a brief discussion of the relevant literature and, if appropriate, similar published cases. | |
| | 14c | **Future Implications**<br>- Describe the future implications for clinical practice and guidelines. | 13 |
| | 14d | **Take Away Lessons**<br>- Outline the key clinical lessons from this case report.<br>- Discuss any differences in approach to diagnosis, investigation, or patient management which the authors might adopt in future cases, based on their experience of the current report. | 13 |
| **Strengths and Limitations** | 15a | **Strengths**<br>- Describe the key strengths of the case.<br>- Detail any multidisciplinary or cross-specialty relevance. | 2 |
| | 15b | **Weaknesses and Limitations**<br>- Describe the relevant weaknesses or limitations of the case.<br>- If applicable, describe how these challenges were overcome.<br>- For novel techniques or devices, outline any contraindications and alternatives, potential risks and possible complications if applied to a larger population. | 2 |

| | | | |
|---|---|---|---|
| **Patient Perspective** | 16 | - Where appropriate, the patient should be given the opportunity to share their perspective on the intervention(s) they received (e.g. sharing quotes from a consented and anonymised interview). | |
| **Informed Consent** | 17 | - The authors must provide evidence of consent, where applicable, and if requested by the journal.<br>- Consent should be provided for both the original intervention or procedure and publication of the current case report.<br>- State the method of consent at the end of the article (e.g. verbal, written, digital/virtual).<br>- If not provided by the patient, explain why (e.g. death of patient and consent provided by next of kin). If the patient or family members were untraceable, then document the tracing efforts undertaken. | |
| **Additional Information** | 18 | - Please state any author contributions, acknowledgements, conflicts of interest, sources of funding, and where required, institutional review board or ethical committee approval.<br>- Disclose whether the case has been presented at a conference or regional meeting.<br>- Disclose whether this case is under consideration at any other journal. | |
| **Clinical Images and Videos** | 19 | - Where relevant and available, include clinical images to help demonstrate the case pre-, peri-, and post-intervention (e.g. radiological, histopathological, patient photographs, intra-operative images).<br>- Where relevant, ensure images are adequately annotated.<br>- Where relevant and available, a link (e.g. Google Drive, YouTube) to the narrated operative video can be included to highlight specific techniques or operative findings.<br>- Ensure all media files are appropriately captioned and indicate points of interest to allow for easy interpretation. | |

KEYWORDS

*Ventriculoperitoneal shunt, Shunt rupture, Contrast injection, Hydrocephalus, Iatrogenic complication, Case report*

ABBREVIATIONS

VP shunt = Ventriculoperitoneal Shunt
CSF = Cerebrospinal Fluid
CT = Computed Tomography
EVD = External Ventricular Drain
CNS = Central Nervous System
MRI = Magnetic Resonance Imaging
X-ray = Radiography
MDRO = Multidrug-Resistant Organism