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Uncommon Complications of Ventriculoperitoneal Shunt Surgery: An Institutional Experience

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ABSTRACT

Background: Ventriculoperitoneal (VP) shunt implantation continues to be the most commonly used surgical intervention for cerebrospinal fluid (CSF) diversion in the treatment of hydrocephalus. Although safe when performed as an individual operation, VP shunting is associated with a wide variety of complications ranging from frequent to rare occurrences. Rare complications, although not frequent, pose great diagnostic and therapeutic difficulties due to their variable and unpredictable manifestations. Because of their scarcity, very little literature and no standardized management guidelines exist to address these rare complications.

Objective: The present study aims to analyze and share the institutional experiences in the identification, management, and outcomes of rare and atypical complications encountered following ventriculoperitoneal shunt surgeries.

Methods: This retrospective case series includes six patients who developed uncommon complications following VP shunt procedures. All patients were managed at the Department of Neurosurgery, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India for one year. Detailed clinical history, imaging findings, operative interventions, and outcomes were systematically analyzed to outline the clinical course of these unusual complications.

Results: Complications noted out of the six patients were: proximal migration of the shunt into the lateral ventricle, formation of epidural and subdural hematomas, extrusion of the shunt through abdominal and retro auricular incisions, and cellulitis along the course of the shunt. Prompt diagnosis and proper surgical management in the form of revision of the shunt, evacuation of hematomas, and infection control resulted in a good outcome in all the cases. Most patients had a smooth postoperative recovery with minimal morbidity.

Conclusion: With increasing utilization of ventriculoperitoneal shunt surgeries, uncommon complications are being reported more frequently. A high index of suspicion, prompt radiological evaluation, and timely intervention are essential to ensure optimal patient outcomes. Neurosurgeons should remain vigilant for such atypical presentations to reduce associated morbidity and mortality.

Keywords: *Ventriculoperitoneal shunt, Uncommon complications, Abdominal extrusion, Shunt migration, Hematoma, Shunt infection, Case series*

Ventriculoperitoneal (VP) shunting is one of the most commonly performed neurosurgical procedures for the management of hydrocephalus, a condition characterized by the pathological accumulation of cerebrospinal fluid (CSF) within the ventricular system of the brain. The VP shunt functions by diverting excess CSF from the ventricles into the peritoneal cavity, thereby relieving intracranial pressure and preventing further neurological deterioration **[1,2]**.

Despite being widely accepted and routinely performed, VP shunt surgery is not devoid of complications. The failure rates associated with VP shunts are relatively high, and a wide range of complications can arise along the entire length of the shunt pathway, extending from the cerebral ventricles to the peritoneal cavity **[3]**. These complications may present either in the early postoperative period or manifest years after the initial shunt placement. The most frequently encountered complications include shunt obstruction, infection, over-drainage, and catheter disconnection. However, apart from these common issues, neurosurgeons occasionally encounter unusual and rare complications that pose significant diagnostic and therapeutic challenges **[4,5]**.

The reported incidence of VP shunt complications ranges between 24% and 47%, with approximately 25% of these being attributed to abdominal complications. Among these abdominal issues, intestinal perforation is observed in about 0.1% to 0.7% of cases. In addition, shunt migration has been documented in various anatomical locations including the abdominal wall, gastrointestinal tract, vagina, bladder, scrotum, mediastinum, and even the oral cavity **[6,7]**.

Due to the relatively infrequent occurrence of such rare complications, there is a paucity of comprehensive guidelines or standardized protocols for their management in the existing literature **[8]**. Therefore, it becomes crucial for neurosurgeons to share institutional experiences and case series to enhance the understanding and awareness regarding these unusual events. Early recognition and timely management are pivotal to minimizing morbidity and achieving favorable outcomes **[9]**.

In this institutional case series, we aim to present and discuss our clinical experiences in managing several rare and uncommon complications associated with ventriculoperitoneal shunt surgeries at our tertiary care center, IGIMS Patna.

1. CASE PRESENTATION

In this institutional case series conducted at the Department of Neurosurgery, IGIMS, Patna, six patients were encountered over the study period who developed rare and uncommon complications following ventriculoperitoneal (VP) shunt surgeries. Each case exhibited distinct and atypical presentations that required individualized diagnostic and surgical approaches. The clinical presentations, investigations, management, and outcomes are elaborated below.

Case 1

A 2-year-old female child presented with a history of persistent vomiting, progressive loss of appetite, and increasing lethargy over several days. She had previously undergone VP shunt surgery for hydrocephalus one year prior at our institute. On admission, neurological examination indicated signs of raised intracranial pressure. A non-contrast computed tomography (NCCT) scan of the head revealed complete proximal migration of the shunt catheter into the right lateral ventricle (Fig.-1), with the distal peritoneal end also coiled within the ventricle, accompanied by ventriculomegaly suggestive of active hydrocephalus. This rare complication of total upward migration of the entire shunt system into the cranial cavity necessitated prompt surgical intervention. The patient underwent removal of the migrated shunt apparatus, followed by contralateral placement of a new VP shunt on the left side. Postoperative recovery was smooth, and the child demonstrated good neurological improvement at the time of discharge.

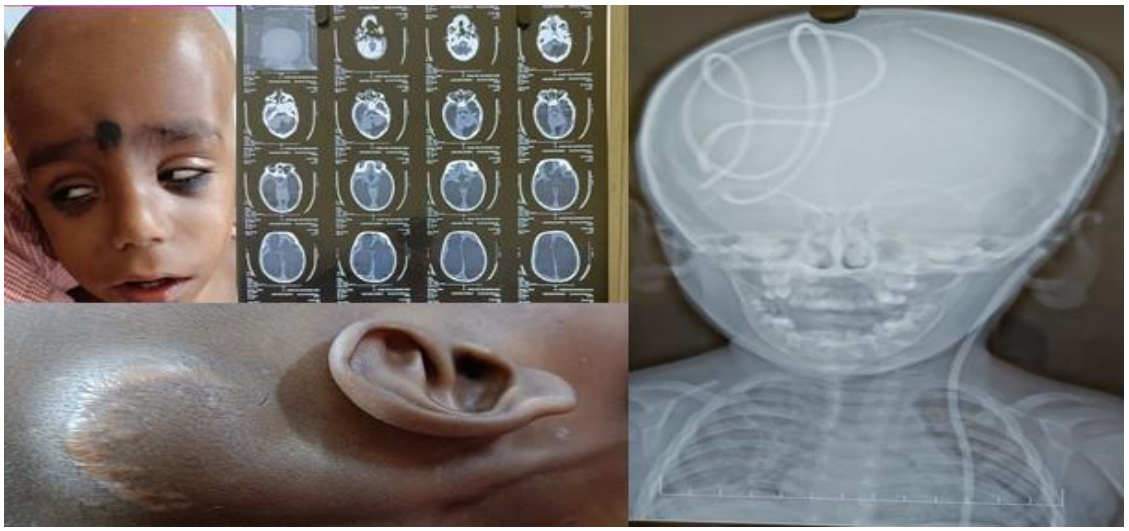


Fig.-1

Case 2

A 9-year-old female underwent VP shunt placement for congenital hydrocephalus. On the second postoperative day (POD-2), she developed acute onset right-sided hemiparesis and severe headache. Neurological evaluation confirmed motor weakness involving the right upper and lower limbs. An immediate NCCT head was performed, which demonstrated a large left fronto-parietal epidural hematoma (EDH) with significant mass effect on the adjacent brain parenchyma (Fig.-2). The EDH appeared as a hyperdense, biconvex lesion causing midline shift. The patient was promptly taken up for emergency neurosurgical intervention. A left-sided craniotomy was performed, and complete evacuation of the hematoma was achieved. Postoperatively, her neurological deficits gradually resolved, and full functional recovery was observed at the time of discharge.

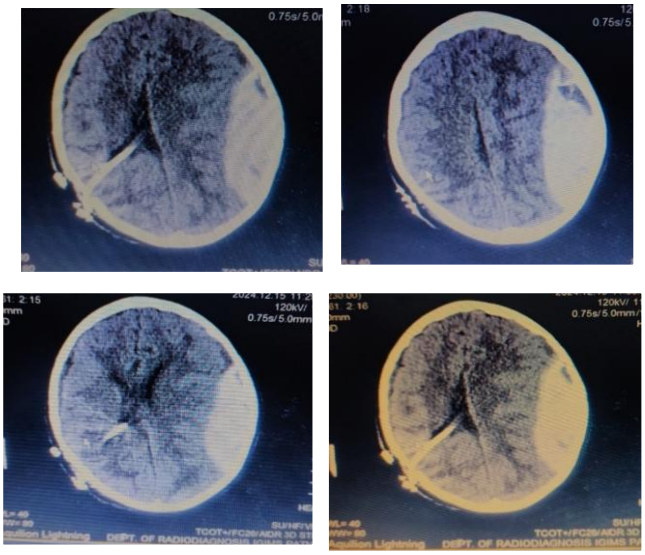


Fig.-2

Case 3

A 30-year-old male presented with extrusion of the VP shunt tubing through a previously healed abdominal wound site. His prior medical history was significant for right-sided VP shunt insertion performed three months earlier for hydrocephalus management. Following the shunt placement, he had also undergone sub-occipital craniotomy and gross total resection (GTR) of a posterior fossa sarcoma, followed by adjuvant radiotherapy targeting the brain and entire spinal axis. On presentation, local examination revealed extrusion of the distal catheter through the abdominal wall, exposing the shunt tubing externally (Fig.-3). No signs of systemic infection were present. This rare complication of shunt extrusion was managed surgically with removal of the extruded shunt system, followed by reinsertion of a new VP shunt from the contralateral (left) side. The patient had an uneventful postoperative course and was discharged in stable condition.

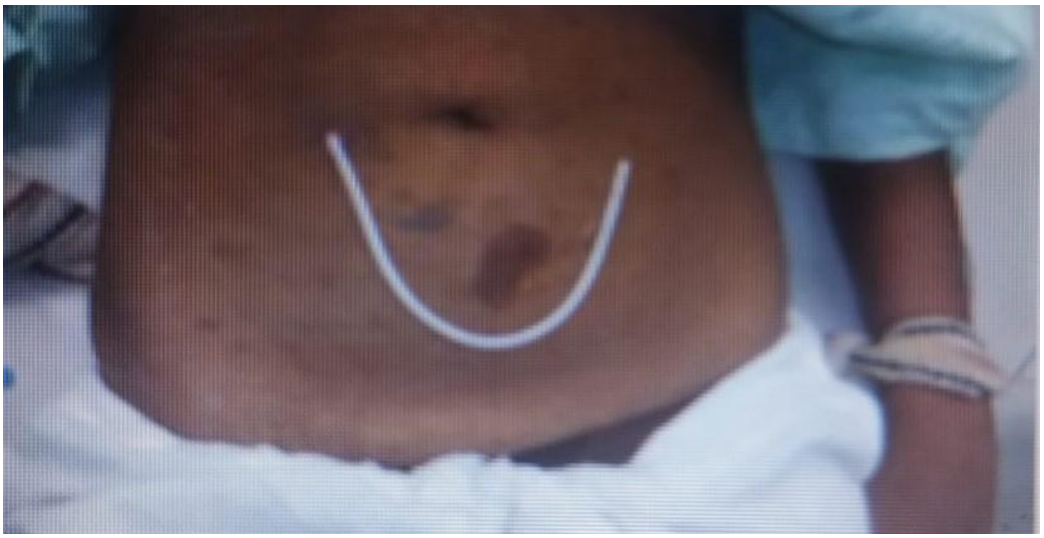


Fig.-3

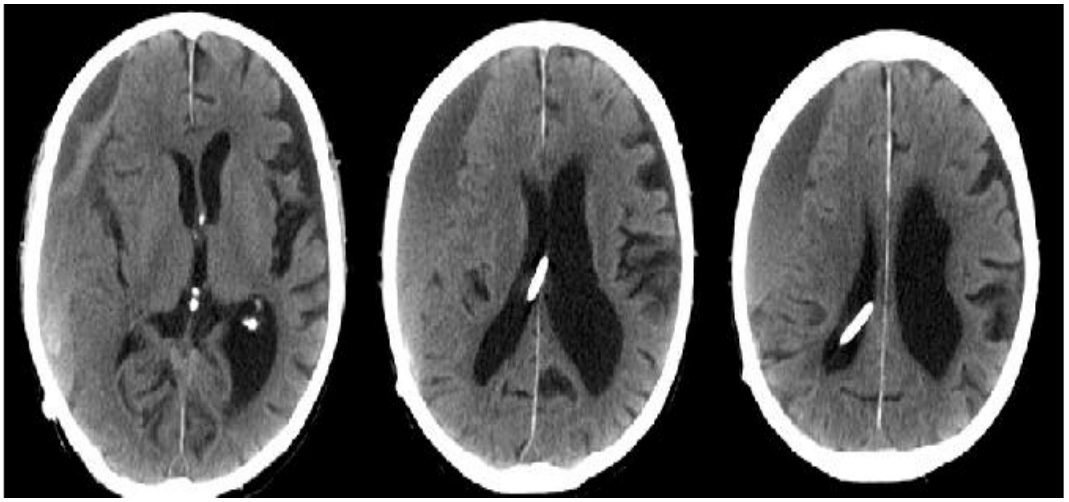
Case 4

A 30-year-old male reported to the neurosurgical unit with complaints of persistent headache, nausea, vomiting, and blurring of vision. His neurological evaluation demonstrated features of raised intracranial pressure. Neuroimaging with NCCT brain revealed communicating hydrocephalus. He underwent VP shunt placement to alleviate the hydrocephalus. However, six months postoperatively, the patient developed wound breakdown behind the right ear, with exposure of the shunt chamber through the skin. On examination, the exposed chamber was visible externally (Fig.-4), but there was no active discharge or signs of local infection. The shunt system was subsequently removed, and a new VP shunt was inserted on the left side. The patient recovered well postoperatively and was discharged in satisfactory condition.

Fig.-4

Case 5

An 18-year-old male presented with complaints of progressive headache. His medical history included right-sided VP shunt placement two years earlier at PGI Chandigarh for hydrocephalus management. On evaluation, an NCCT scan of the head revealed a right-sided chronic subdural hematoma (SDH) characterized by a crescentic hypodense collection over the cerebral convexity (). This uncommon delayed complication was addressed surgically by performing a right-sided burr hole craniostomy followed by hematoma evacuation. Postoperative recovery was uneventful with complete resolution of headache, and the patient was discharged in stable condition.



Case 6

A 10-year-old male presented with a triad of headache, vomiting, and progressive blurring of vision. Fundoscopic

examination revealed grade-1 papilledema suggestive of raised intracranial pressure. NCCT brain demonstrated hydrocephalus, and the patient underwent VP shunt insertion for CSF diversion. Two months following surgery, the patient developed localized signs of infection, including fever, erythema, and tenderness over the right infraclavicular and chest wall regions along the subcutaneous shunt pathway. The diagnosis of localized shunt-related cellulitis was established. The shunt was promptly removed to control the infection. After appropriate antibiotic therapy and resolution of infection, a new VP shunt was placed on the contralateral side. The patient was subsequently discharged with no neurological deficits.

2. DISCUSSION

Ventriculoperitoneal (VP) shunt placement remains one of the most frequently performed surgical procedures for the management of hydrocephalus across all age groups. Its efficacy in diverting cerebrospinal fluid (CSF) from the ventricular system to the peritoneal cavity makes it a widely accepted treatment modality **[10]**. However, despite its widespread use and relative technical simplicity, VP shunt procedures are associated with a significant risk of complications, both common and uncommon. The complication rates reported in literature range between 24% and 47%, with abdominal complications constituting approximately 25% of all shunt-related complications **[11]**. While common complications such as infection, shunt obstruction, and mechanical failure are well documented and extensively studied, rare and atypical complications remain sparsely reported, resulting in a lack of comprehensive management guidelines for these unusual clinical scenarios **[12]**.

In the present case series, we encountered a diverse spectrum of rare complications following VP shunt procedures, highlighting the unpredictable nature of these events and the need for vigilant postoperative monitoring.

Shunt migration is one of the recognized, yet uncommon, complications, which can involve movement of the shunt tubing into various anatomical sites. In our series, Case 1 illustrated an extreme form of proximal shunt migration where the entire shunt system, including the distal peritoneal catheter, had retracted into the lateral ventricle. Such migration can result from multiple factors including inadequate fixation, excessive subcutaneous slack, negative pressure gradients, or patient-related factors such as growth in paediatric patients. Early diagnosis with imaging and timely revision surgery can prevent neurological deterioration in these cases **[13,14]**.

Intracranial haemorrhagic complications represent another significant category of unusual complications. Epidural hematoma (EDH), as seen in Case 2, and chronic subdural hematomas (SDH), observed in Cases 2 and 5, are relatively infrequent but potentially life-threatening events following shunt placement. The proposed mechanisms include rapid CSF decompression leading to tearing of bridging veins or dural vessels, especially in patients with pre-existing brain atrophy or coagulopathy. Burr hole evacuation for SDH and craniotomy for EDH proved effective in our cases, underscoring the importance of prompt neuroimaging when new neurological deficits arise post-shunt placement **[15,16]**.

Shunt extrusion, though rare, was observed in Case 3 and Case 4. Extrusion through the abdominal wall, as seen in Case 3, may occur due to poor wound healing, local infection, adhesions, or prior radiation therapy that compromises tissue integrity. Similarly, retroauricular extrusion of the shunt chamber, as seen in Case 4, may result from chronic wound dehiscence and pressure necrosis. In both scenarios, surgical removal of the compromised shunt system followed by reinsertion of a new VP shunt at an alternate site led to favourable outcomes. Such cases emphasize the importance of meticulous surgical technique, adequate subcutaneous tunnelling, and close postoperative wound monitoring, particularly in patients with prior surgeries or radiotherapy **[17,18]**.

Shunt-related infections remain a persistent concern and can manifest as localized cellulitis along the shunt pathway, as seen in Case 6. Although systemic signs of sepsis were absent, the localized erythema, warmth, and tenderness necessitated urgent removal of the infected hardware. Delayed reimplantation after adequate antimicrobial therapy ensured eradication of infection while allowing safe re-shunting. These cases highlight the critical role of early detection and aggressive management in reducing long-term morbidity associated with shunt infections **[19,20]**.

Throughout our experience, we utilized medium pressure Chhabra shunt systems with soft silicone peritoneal tubing in all cases. The choice of soft silicone material is known to reduce foreign body reactions and potentially lower the incidence of mechanical complications such as obstruction or extrusion **[21]**.

The occurrence of these rare complications reinforces the need for heightened clinical awareness and a multidisciplinary approach to their management. Although uncommon, such complications can lead to significant morbidity if not identified and treated promptly. The favourable outcomes observed in our series were primarily attributable to timely diagnosis, individualized surgical planning, and diligent postoperative care.

3. CONCLUSION

The experience from our institutional case series emphasizes that while ventriculoperitoneal (VP) shunt surgery remains an essential and effective procedure for managing hydrocephalus, it is not without significant risks, particularly in the form of uncommon and unpredictable complications. The wide spectrum of rare complications encountered, including complete

shunt migration, intracranial hematomas, shunt extrusion through both abdominal and retroauricular wounds, and localized infections, highlights the necessity for constant vigilance and individualized patient monitoring postoperatively.

Timely identification through appropriate clinical evaluation and imaging, followed by prompt and tailored surgical intervention, has the potential to prevent the progression of these complications and significantly improve patient outcomes. Neurosurgeons must remain aware of such rare complications, as delayed recognition may result in serious morbidity or even mortality. The favourable outcomes achieved in all six patients in this series underscore the importance of early diagnosis, meticulous surgical technique, careful postoperative wound management, and aggressive infection control protocols.

As the overall utilization of VP shunt procedures continues to rise, neurosurgeons should continually update their knowledge regarding both common and rare complications associated with this procedure. Close clinical surveillance, multidisciplinary teamwork, and sharing of institutional experiences such as this case series are essential to improving the understanding and management of these unusual yet clinically significant presentations..

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