DOI: 10.21088/ijaa.2349.8471.13426.9

Indian Journal of Anesthesia and Analgesia
Volume 13 Number 4 October-December 2026

CASE REPORT

Anesthetic Challenges in a Pediatric Patient with Hydrocephalus and Thoracic Meningomyelocele Undergoing MPVP Shunt: A Case Report

Atul Kumar Singh[1], Sonali Gupta[2], Ritwik Mohan[3]
S Sudhanshu[4], Logesh Vaibhavw VV[5]

HOW TO CITE THIS ARTICLE:

Atul Kumar Singh, Sonali Gupta, Ritwik Mohan et. al, Anesthetic challenges in a Pediatric Patient with Hydrocephalus and Thoracic Meningomyelocele Undergoing MPVP Shunt: A Case Report. Ind J Anesth Analg. 2026; 13(4): 211-216.

ABSTRACT

Background: Pediatric patients with congenital spinal dysraphism frequently present with associated hydrocephalus and neurological abnormalities, making anesthetic management challenging. Thoracic meningomyelocele may be associated with respiratory dysfunction, altered spinal anatomy, positioning difficulties, and a potentially difficult airway. The presence of raised intracranial pressure secondary to hydrocephalus further increases the risk associated with induction and perioperative hemodynamic and respiratory disturbances.

Case presentation: We present the perioperative anesthetic management of an 8-months old female infant with hydrocephalus and thoracic meningomyelocele scheduled for medium pressure ventriculoperitoneal shunt (MPVP) shunt procedure. Preoperative assessment focused on neurological status, signs of raised intracranial pressure, respiratory function, nutritional status, airway evaluation, and assessment of the meningomyelocele sac. Particular attention was paid to airway management and prevention of pressure injury to the thoracic swelling during positioning. General anesthesia was administered with appropriate precautions to avoid hypoxia, hypercarbia, hypotension, and sudden changes in intracranial pressure. The infant was successfully managed perioperatively and shifted to neonatal intensive care unit (NICU) for close postoperative neurological and respiratory monitoring.

AUTHOR'S AFFILIATION:

[1] Associate Professor, Department of Anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

[2] Senior Resident, Department of Anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

[3] Senior Resident, Department of Anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

[4] Junior Resident, Department of Anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

[5] Junior Resident, Department of Anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

CORRESPONDING AUTHOR:

Atul Kumar Singh, Associate Professor, Department of Anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

E-mail: atulksingh84@gmail.com

➢ **Received:** 27-08-2026 ➢ **Accepted:** 02-10-2026

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Conclusion: Anesthetic management of pediatric patients with hydrocephalus and thoracic meningomyelocele requires meticulous preoperative assessment, careful positioning, avoidance of secondary brain injury, anticipation of difficult airway and respiratory problems, and vigilant postoperative monitoring.

KEYWORDS:
• Hydrocephalus • Intracranial Pressure • Meningomyelocele • Spinal Dysraphism • Ventriculoperitoneal Shunt

INTRODUCTION

Meningomyelocele is one of the most severe forms of neural tube defect and is frequently associated with hydrocephalus, Chiari II malformation, neurological deficits, and abnormalities of the vertebral column.[1] Open neural tube defects (NTDs), including anencephaly, myelomeningocele, and craniorachischisis, arise from failure of primary neurulation, with persistence and degeneration of the exposed neural tube in utero leading to neurological deficits below the level of lesion.[2]

Hydrocephalus is a breakdown in cerebrospinal fluid (CSF) balance that causes brain ventricles to expand. Infants show a growing head size, while older children show signs of high brain pressure. It can be congenital from genetic defects or acquired later from infections, bleeding, or fluid blocks.[3] Anesthetic management in these infants is challenging because of the coexistence of neurological, respiratory, musculoskeletal, and airway-related abnormalities.

Hydrocephalus may result in raised intracranial pressure and impaired cerebral autoregulation. During anesthesia, hypoxemia, hypercarbia, hypotension, excessive stimulation, coughing, and inadequate depth of anesthesia may further increase intracranial pressure and compromise cerebral perfusion.[4]

Thoracic meningomyelocele presents additional challenges. The posterior swelling may interfere with supine positioning during mask ventilation, endotracheal intubation, and impairs venous return. Pressure on the sac can potentially cause neurological injury or rupture, while associated thoracic deformity may contribute to restrictive respiratory physiology.

We report the anesthetic management of an 8-months old female infant with hydrocephalus and thoracic meningomyelocele undergoing MPVP shunt placement, emphasizing important perioperative anesthetic considerations.

Infants with meningomyelocele requires a latex-free environment to minimize the incidence of developing latex allergy, the prevalence of which may be as high as 64% in these cases.[5]

CASE PRESENTATION

An 8-months old female infant weighing 2.6 kg was scheduled for placement of MPVP shunt for management of hydrocephalus. The infant had a known diagnosis of thoracic meningomyelocele involving the D8-D12 region (Figure 1) with obstructive hydrocephalous due to aqueductal stenosis (Figure 2).



Figure 1: Large thoracic meningomyelocele presenting as a prominent, tense, unruptured sac covered swelling over the thoracic spine with areas of discoloration

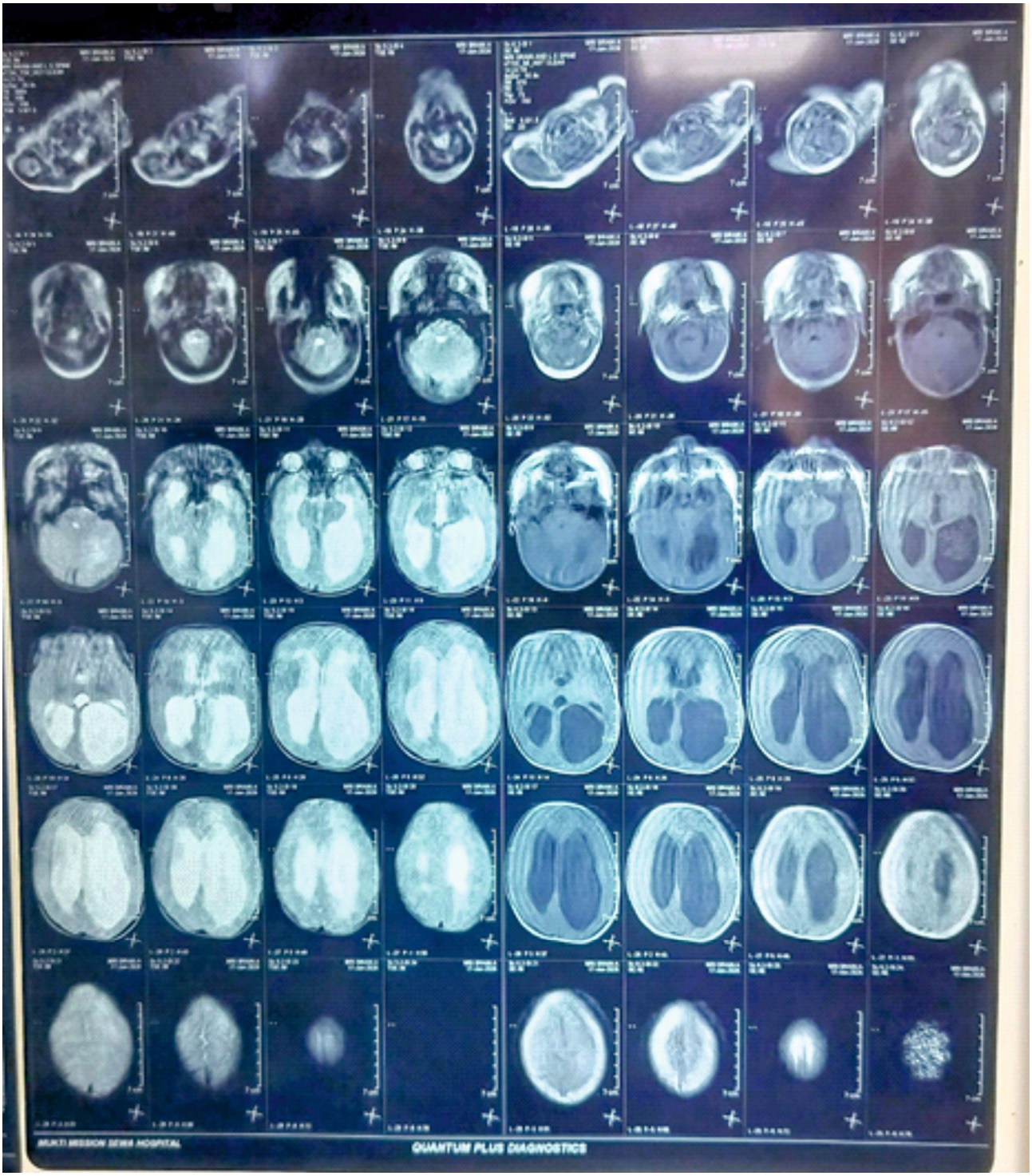


Figure 2: Magnetic resonance imaging (MRI) of the brain showing marked dilatation of the lateral ventricles, consistent with severe hydrocephalus

On preoperative evaluation, the infant had bilateral lower limb paralysis with bladder/bowel dysfunction. Clinical features suggestive of raised intracranial pressure included increasing head circumference since birth, tense fontanelle, sun-set sign was present, but there was no complain of vomiting and altered sensorium.

The child had a head circumference of 48.50 cm. Neurological examination revealed no spontaneous movement in both lower limbs. Examination of the thoracic meningomyelocele showed a swelling measuring approximately (36x12x25: craniocaudal x anteroposterior x transverse mm) at age of 1 month which gradually increased over time to the current

size of (120x50x60 mm). The swelling was intact, with no evidence of CSF leakage or infection.

Airway assessment was within normal limits for age apart from enlarged head circumference. Respiratory examination revealed normal breath sounds with no signs of respiratory distress. Baseline oxygen saturation was 98 per cent on room air. There was no history suggestive of recent upper/ lower respiratory tract infections.

Preoperative investigations included complete blood count, serum electrolytes, renal function tests, coagulation profile, and neuroimaging. MRI demonstrated hydrocephalus with (ventricular dilatation without Chiari II malformation and other associated abnormalities).

After multidisciplinary discussion involving pediatric surgery, pediatric medicine, and anesthesiologist, the child was scheduled for surgery.

Anesthetic Management

The infant was kept nil per oral according to age-appropriate fasting guidelines. Appropriate intravenous access was secured. Standard monitoring including ECG, non-invasive blood pressure, pulse oximetry, capnography, and temperature monitoring was instituted.

A major concern during induction was maintaining cerebral perfusion while avoiding increases in intracranial pressure. Preoxygenation was performed carefully. Anesthesia was induced with oxygen with sevoflurane (2-4%) and intravenous fentanyl (2 mcg/kg), while maintaining adequate depth of anesthesia and avoiding hypoxia and hypercarbia.

Following administration of cisatracurium (0.2 mcg/kg), tracheal intubation was performed using a 3.5 mm uncuffed endotracheal tube. Endotracheal tube position was confirmed with bilateral chest auscultation and end-tidal CO_2 monitoring. Precordial stethoscope was placed over precordium region and care was taken to avoid excessive neck flexion or extension significant increases in intracranial pressure due to impairment of venous drainage.

Anesthesia was maintained with sevoflurane (2-3%) in an oxygen-air mixture, supplemented with paracetamol (10mg/kg). Ventilation was controlled to maintain normoxia and normocapnia. Hemodynamic parameters were closely monitored, and hypotension was avoided to preserve cerebral perfusion.

Positioning

Positioning was particularly challenging because of the posterior thoracic meningomyelocele. Adequate padding was provided with double dough-nut made from sterile sheet with cotton, and direct pressure on the meningomyelocele sac was avoided. The child was positioned according to the surgical requirement using appropriate supports to prevent compression of the swelling. Care was taken to avoid pressure-related injury to the sac, eyes, pressure points, and peripheral nerves.

Intraoperative Course

The surgical procedure lasted approximately 45 minutes. Hemodynamic parameters remained stable throughout the procedure. There were no episodes of significant hypoxia, hypercarbia, hypotension, bradycardia. Blood loss was approximately 10 mL and was managed with crystalloid (0.9% normal saline).

At the completion of surgery, neuromuscular blockade was reversed with neostigmine/ glycopyrrolate combination as per weight requirement. The child was sedated with adequate spontaneous ventilation and acceptable neurological and respiratory parameters. The patient was transferred to the pediatric intensive care unit for postoperative monitoring and delayed extubation.

Postoperative Course

Postoperatively, the child was monitored for neurological deterioration, respiratory compromise, shunt-related complications, and signs of raised intracranial pressure.

Analgesia was provided using multimodal analgesia with paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs) as rescue agent.[6] Neurological status remained stable. There was no evidence of postoperative respiratory depression, seizures, CSF leak, or acute neurological deterioration.

The trachea was extubated in the NICU after 2 hours surgery when the infant become active and subsequently shifted to ward. The postoperative course was uneventful,

and the patient was discharged on 7th postoperative day with proper instructions. Parents were counselled for surgery for thoracic meningomyelocele after resolution of symptoms of raised intracranial pressure.

DISCUSSION

The anesthetic management of children with meningomyelocele and hydrocephalus requires careful consideration of both intracranial and spinal pathology.

1. Raised intracranial pressure

Hydrocephalus may result in increased intracranial pressure. Anesthetic goals include maintaining adequate cerebral perfusion and avoiding secondary brain injury. Hypoxemia, hypercarbia, hypotension, fever, excessive airway stimulation, coughing, and inadequate depth of anesthesia should be avoided.

2. Airway management

Children with neural tube defects may have associated craniofacial abnormalities and Chiari II malformation. Brainstem dysfunction can contribute to apnea, swallowing dysfunction, abnormal respiratory patterns, and impaired airway reflexes. Difficult airway equipment should be immediately available, and excessive neck movement should be avoided when Chiari malformation or cervical abnormalities are present.

3. Respiratory considerations

Thoracic meningomyelocele may be associated with spinal deformity and restrictive respiratory mechanics. Neurological impairment may additionally affect respiratory muscle function. Intraoperatively, ventilation should be adjusted to maintain adequate oxygenation and normocapnia.

4. Positioning challenges

The posterior swelling makes routine supine positioning difficult and increases the risk of compression and rupture of the meningomyelocele sac. Careful positioning with adequate padding is essential. The anesthesiologist should coordinate closely with the surgical team during turning and positioning.

5. Associated Chiari II malformation

Chiari II malformation is commonly associated with myelomeningocele and hydrocephalus. Brainstem compression may produce apnea, swallowing dysfunction, abnormal respiratory patterns, and cardiovascular instability. These possibilities should be considered during induction, emergence, and postoperative monitoring.

6. Management of fluid and hemodynamics

Maintenance of adequate intravascular volume and cerebral perfusion is important. Excessive fluid administration should be avoided, particularly in infants, while hypovolemia and hypotension should be promptly corrected. Normoglycemia, normothermia, and appropriate electrolyte balance should also be maintained.

7. Postoperative care

Postoperative respiratory and neurological monitoring is essential. Patients with hydrocephalus and associated brainstem or spinal abnormalities may have delayed emergence or postoperative respiratory compromise. Monitoring should include neurological status, respiratory pattern, oxygenation, hemodynamics, and signs of shunt malfunction or raised intracranial pressure.

CONCLUSION

The combination of hydrocephalus and thoracic meningomyelocele presents multiple anesthetic challenges in pediatric patients. The major priorities are careful assessment of raised intracranial pressure and associated neurological abnormalities, anticipation of airway and respiratory difficulties, meticulous positioning to protect the meningomyelocele sac, maintenance of cerebral perfusion, avoidance of hypoxia and hypercarbia, and vigilant postoperative monitoring. A multidisciplinary approach involving pediatric anesthesiologists, pediatric surgeons, pediatricians, and intensive care specialists is essential for safe perioperative management.

Declaration of parents' consent

All appropriate consent was taken from the parents. The parents given their consent for the clinical and radiological information of their infant to be reported in the journal.

Authors contribution

All authors reviewed and approved the final version of the manuscript.

Data availability statement: The data supporting the findings of the case report can be obtained from the corresponding author upon request.

Financial support: Nil

Conflict of interest: There are no conflicts of interest.

Acknowledgement

We would like to thank the management staff of operation theatre and postoperative ward for their continuous support.

REFERENCES

1. Hartigan S, Walsh B. Perioperative management of patients with spina bifida. BJA Educ. 2024 Jun;24(6):203-209. doi: 10.1016/j.bjae.2024.02.004. Epub 2024 Mar 27. PMID: 38764443; PMCID: PMC11096439.
2. Copp AJ, Greene ND. Neural tube defects--disorders of neurulation and related embryonic processes. Wiley Interdiscip Rev Dev Biol. 2013 Mar-Apr;2(2):213-27. doi: 10.1002/wdev.71. Epub 2012 May 29. PMID: 24009034; PMCID: PMC4023228.
3. Kahle KT, Klinge PM, Koschnitzky JE, Kulkarni AV, MacAulay N, Robinson S, Schiff SJ, Strahle JM. Paediatric hydrocephalus. Nat Rev Dis Primers. 2024 May 16;10(1):35. doi: 10.1038/s41572-024-00519-9. PMID: 38755194; PMCID: PMC12091269.
4. Kumari N, Sai A, Sharma A, Kachhap A, Singh D, Kumar T. Anesthetic management in a huge hydrocephalus. Ann Afr Med. 2024 Jan-Mar;23(1):100-103. doi: 10.4103/aam.aam_171_23. PMID: 38358179; PMCID: PMC10922186.
5. Rendeli C., Nucera E., Ausili E., et al. Latex sensitisation and allergy in children with myelomeningocele. Childs Nerv Syst. 2006;22:28–32. doi: 10.1007/s00381-004-1110-4.
6. Mestdagh FP, Lavand'homme PM, Pirard G, et al. Pain management after elective craniotomy: A systematic review with procedure-specific postoperative pain management (PROSPECT) recommendations. Eur J Anaesthesiol. 2023;40(10):747–757. doi: 10.1097/EJA.0000000000001877.