

Ventriculoperitoneal Shunt Malfunction in Pregnancy Worsened by Regional Anaesthesia for Caesarean Delivery: A Case Report

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ABSTRACT

Background: Ventriculoperitoneal (VP) shunts remain one of the viable treatment modalities for hydrocephalus. A growing number of shunt-dependent women are reaching reproductive age, yet pregnancy in the presence of a VP shunt poses significant risks, including shunt malfunction, raised intracranial pressure (ICP), and neurological deterioration. The choice of anaesthesia for operative delivery in shunted patients is a critical clinical decision, as regional anaesthesia may be relatively contraindicated in the setting of elevated ICP.

Case Presentation: We report the case of a 29-year-old woman with a five-year history of VP shunt insertion for late-onset aqueductal stenosis, who presented with sudden loss of consciousness immediately following Caesarean section performed under regional anaesthesia. She had a preceding 12-month history of progressive blurring of vision, with brain magnetic resonance imaging (MRI) during antenatal follow-up demonstrating ventriculomegaly. Physical examination following her acute deterioration revealed a Glasgow Coma Scale (GCS) score of 12/15 and bilateral papilloedema. Brain computed tomography (CT) confirmed marked ventriculomegaly with loss of white and grey matter differentiation and a ventricular catheter tip displaced within the brain parenchyma.

Management: Emergency VP shunt revision was performed under general anaesthesia. Intraoperatively, the shunt connection point was found to have migrated caudally, with the ventricular catheter disconnected from the valve. The old shunt hardware was removed and replaced with new hardware. The procedure was uneventful.

Outcome: By the first postoperative day, the patient's GCS had improved to 15/15 with marked reduction in visual symptoms. She was discharged on the fifth postoperative day with complete resolution of blurring of vision. At one-week follow-up, sustained neurological improvement was documented.

Conclusion: This case underscores the importance of multidisciplinary management of shunt-dependent pregnant women. Regional anaesthesia should be avoided in patients with known or suspected shunt malfunction and raised ICP. Preconception counselling, close antenatal neurosurgical surveillance, and timely surgical intervention are essential to prevent morbidity. In resource-limited settings such as Nigeria, heightened clinical suspicion and early referral remain paramount.

Keywords

Ventriculoperitoneal shunt, Hydrocephalus, Pregnancy, Regional anaesthesia, Raised intracranial pressure, Caesarean section, Shunt revision.

Introduction

The ventriculoperitoneal (VP) shunt has remained an effective treatment and widely employed method of cerebrospinal fluid (CSF) diversion for the treatment of hydrocephalus [1,10]. Since the early description of peritoneal drainage by Ames in 1952 and

the subsequent development of the Holter valve in 1956, modern VP shunt systems have been in widespread clinical use since the 1970s [11]. With advances in the management of hydrocephalus and improvements in paediatric neurosurgical care, a growing number of shunt-dependent women now survive to reproductive age [3,12].

Pregnancy is not contraindicated in women with VP shunts; however, the presence of a functioning shunt introduces unique challenges to the management of pregnancy, labour, and delivery [1,3,12]. Neurological complications, including raised intracranial pressure (ICP), exacerbation of seizures, and shunt obstruction, have been reported in a significant proportion of pregnancies in shunted women. In a landmark study, Wisoff et al. [3] reported neurological complications in up to 76% of pregnancies in patients with pre-existing CSF shunts. More recently, Liakos et al. [12] documented 18 shunt malfunctions or revisions in 138 pregnancies among shunt-dependent women.

The principal mechanism underlying shunt malfunction during pregnancy is the progressive increase in intra-abdominal pressure from the gravid uterus, which may compress the peritoneal catheter and impair CSF drainage, thereby leading to raised ICP [2,6]. Additionally, hormonal changes in pregnancy may alter CSF dynamics, compounding the mechanical strain on the shunt system [2]. Acute shunt malfunction may occur during the antepartum, intrapartum, or postpartum period, particularly following abdominal delivery [13-18]. Whilst neurological complications may resolve spontaneously in the postpartum period, others necessitate urgent surgical intervention [4,15]. Importantly, a prior episode of shunt malfunction does not contraindicate future pregnancies [16].

A multidisciplinary approach involving the neurosurgeon, obstetrician, and anaesthesiologist is essential for the optimal management of shunt-dependent pregnant women [1,5]. Clinical management should encompass preconception counselling with baseline neuroimaging, antenatal monitoring with serial MRI and ICP assessment, and carefully considered decisions regarding the mode of delivery [5]. In asymptomatic patients with functioning shunts, vaginal delivery with a shortened second stage is generally recommended. However, in neurologically unstable patients with suspected or confirmed raised ICP, Caesarean section under general anaesthesia is the preferred approach [3,7].

Regional anaesthesia, including epidural and spinal techniques, is relatively contraindicated in the presence of elevated ICP, as epidural injection may further increase ICP by compression of the dural sac, and neuraxial techniques carry a theoretical risk of contaminating the shunt system [7,8,19]. Conservative management with programmable shunts and non-invasive valve pressure adjustment is feasible in selected cases; surgical intervention is reserved for cases of neurological deterioration [15,17].

In Nigeria and much of sub-Saharan Africa, access to programmable valve systems is limited, and fixed-pressure valves remain the standard of care [20,21]. Late presentation is common, and the challenges inherent to resource-limited settings further complicate the management of these patients [21-23]. This case report highlights the risks of administering regional anaesthesia for Caesarean section in a shunted patient with unrecognised progressive shunt malfunction during pregnancy, and underscores the need for vigilant multidisciplinary care in this clinical scenario.

Case Presentation

Patient Demographics and Referral

A 29-year-old female was referred to the neurosurgical unit for urgent review following sudden onset of loss of consciousness immediately after Caesarean section performed under regional anaesthesia at a peripheral hospital.

History of Presenting Illness

The patient had a 12-month history of progressive blurring of vision predating the index pregnancy. The visual disturbance was of insidious onset, affecting both eyes, and was characterised by an inability to see objects at a distance. The symptoms had worsened progressively over the preceding three months. There were no identified aggravating or relieving factors. She denied tunnel vision, diplopia, headache, or projectile vomiting. There was no history of memory loss, gait abnormality, or urinary incontinence.

A systematic review of other systems was unremarkable: there was no history of trauma, jaundice, fever, chronic cough, night sweats, weight loss, anorexia, nausea, weakness, or dyspnoea.

Past Medical and Surgical History

Five years prior to presentation, the patient had been diagnosed with late-onset aqueductal stenosis following an acute episode of severe headache, projectile vomiting, and blurring of vision. She underwent emergency VP shunt insertion at a private neurological centre. There was no history of blood transfusion or drug allergy. She was not known to be diabetic, hypertensive, or asthmatic, and had no history of peptic ulcer disease.

Obstetric History

The patient had two previous vaginal deliveries within the three years preceding the index pregnancy, both of which were uncomplicated and without overt neurological sequelae.

Antenatal Neurosurgical Follow-up

During the index pregnancy, the patient attended the neurosurgical clinic on three occasions for evaluation of her progressive visual symptoms. Brain MRI performed during this period demonstrated ventriculomegaly. The VP shunt valve was assessed for functionality at each visit. The patient was counselled on the possible need for shunt revision surgery; however, she declined the procedure on each occasion.

Physical Examination

On examination following her acute deterioration, her Glasgow Coma Scale (GCS) score was 12/15 (E4, V3, M5). Bilateral pupils were 5 mm in diameter with brisk light reflexes. Fundoscopic examination revealed bilateral papilledema. Tone was normal in all four limbs, and knee and ankle jerks were not exaggerated.

Investigations

An urgent brain CT scan demonstrated marked ventriculomegaly with loss of white and grey matter differentiation. The ventricular catheter tip was identified within the brain parenchyma, consistent with catheter migration and shunt disconnection.

Management

Following appropriate preoperative counselling, informed consent was obtained for VP shunt revision surgery. Her family was counselled regarding the risks of the procedure, including bleeding, cortical vessel injury, shunt infection, and recurrent shunt obstruction.

The operation was performed under general anaesthesia with cuffed endotracheal intubation. Prophylactic antibiotics were administered perioperatively. The patient was positioned supine with a left lateral tilt, using a head ring and shoulder bolsters on a Stryker operating table. The right frontoparietal region was shaved and the surgical field was prepared with 0.3% cetrimide and 3% chlorhexidine solution. A curvilinear incision was made at Kocher's point, through the previous scar, extending down to the pericranium. A self-retaining retractor was applied and haemostasis was secured. The point of connection between the ventricular catheter and the valve was identified and found to have migrated caudally. The ventricular catheter was disconnected from the valve, and clear cerebrospinal fluid (CSF) was observed egressing under pressure. A transverse incision was made at the epigastrium, and the anterior rectus sheath was exposed. The peritoneal catheter of the old shunt system was identified. The old shunt hardware was carefully removed and replaced with new shunt hardware. The wound was closed in layers and a sterile dressing was applied.

Anaesthesia was reversed and the patient was extubated successfully. There were no intraoperative complications. Thromboembolic deterrent (TED) stockings were applied for venous thromboembolism (VTE) prophylaxis. The patient was transferred to the recovery area in stable condition. Postoperative care comprised chest physiotherapy, early ambulation from the first postoperative day, continuation of TED stockings, and appropriate postoperative analgesics.

Outcome and Follow-Up

By the first postoperative day, the patient's GCS had improved to 15/15, and she reported a marked reduction in blurring of vision. She participated actively in chest physiotherapy and was ambulated without difficulty. The patient was discharged on the fifth postoperative day with complete resolution of her visual symptoms. TED stockings were removed at the time of discharge.

At one-week follow-up after discharge, sustained neurological improvement was documented with no evidence of recurrent shunt malfunction or other complications.

Discussion

VP shunt is one of the most effective methods of CSF diversion for the management of hydrocephalus [10]. Despite its widespread use, shunt revision rates in adults remain significant, with studies reporting revision rates of 21–32% over the lifetime of the shunt [24,25]. In Nigeria, VP shunt complication rates in tertiary centres have been reported to be as high as 28–30.4% [20,22].

Shunt malfunction during pregnancy is primarily attributable to the progressive increase in intra-abdominal pressure from the gravid uterus, which may result in mechanical compression of the peritoneal catheter, obstruction of the distal catheter, or migration of the ventricular catheter [2,6,14]. These effects are compounded by the hormonal changes of pregnancy, which may alter CSF production and absorption dynamics [2]. From a cardiovascular perspective, blood volume increases by 40–45% and cardiac output increases by 30–50% during pregnancy [5]. CSF pressure remains within the normal range (7–15 mmHg) in uncomplicated pregnancy but rises sharply during labour, reaching up to 39 mmHg during the first stage and up to 71 mmHg during the second stage [7]. These physiological changes place significant additional stress on a shunt system already under mechanical strain.

The clinical presentation of shunt malfunction in pregnancy may include headache, nausea, vomiting, visual disturbances, and exacerbation of seizures [1,3,4]. These symptoms may closely mimic those of pre-eclampsia, making prompt diagnosis challenging [5,26]. Visual disturbance, as observed in our patient, is a particularly important presenting feature: papilledema from raised ICP causes progressive blurring of vision and is ominous, warranting urgent neuroimaging [5]. In the index case, the patient's lone symptom of progressive visual blurring was underappreciated until acute neurological deterioration occurred following Caesarean delivery.

The published literature consistently highlights the vulnerability of shunted women during pregnancy. Wisoff et al. [3] reported neurological complications in 76% of pregnancies with pre-existing shunts, whilst Liakos et al. [12] documented 18 shunt malfunctions or revisions in 138 shunt-dependent pregnancies. More recently, Alotaibi et al. [18], in a 2024 multicentre cohort study involving 85 pregnancies, reported no shunt malfunctions during pregnancy itself; however, 5.9% experienced postpartum malfunction, highlighting the postpartum period as a high-risk window. Adult shunt placement was associated with a higher postpartum malfunction risk (odds ratio 4.2) [18].

Conservative management strategies, including bed rest, valve pressure adjustment with programmable shunts, and serial clinical and radiological monitoring, may suffice in mild cases [15,17]. However, surgical intervention in the form of shunt revision or

replacement is mandated in the setting of progressive neurological deterioration [4,6].

The choice of anaesthesia for Caesarean section in shunted patients warrants careful consideration. Epidural and spinal anaesthesia are relatively contraindicated in the presence of elevated ICP, as reduced intracranial compliance means that epidural injection may further increase ICP through compression of the dural sac [7,8]. Furthermore, neuraxial techniques carry a theoretical risk of introducing infection into the shunt system [8,9]. General anaesthesia is therefore preferred for neurologically unstable patients, as it provides airway control, permits the use of ICP-lowering agents such as propofol (which reduces cerebral metabolic rate and ICP), and avoids the risk of CSF infection associated with neuraxial techniques [7]. Casas PG and Moreno ME [19], in a 2024 descriptive review, noted that neuraxial anaesthesia may be used in patients with appropriately functioning VP shunts, but emphasised that individualised evaluation is essential when shunt malfunction is suspected. In the index case, regional anaesthesia was administered to a patient with progressive, though unrecognised, shunt malfunction, precipitating acute neurological deterioration, which is a critical learning point for clinicians.

Postpartum shunt malfunction following Caesarean section may be partly attributable to the acute change in intra-abdominal pressure following delivery, which may transiently alter CSF dynamics and unmask previously subclinical shunt dysfunction [14,18]. This mechanism likely contributed to the acute deterioration observed in our patient.

In Nigeria and other resource-limited settings, fixed-pressure shunts remain the standard of care due to the prohibitive cost of programmable valve systems [20,21]. VP shunt complication rates in Nigerian tertiary centres have been reported at 28–30.4% [20,22]. Late presentation remains the most important risk factor for poor outcomes in these settings [21,23]. Rivers State University Teaching Hospital (RSUTH) and the University of Port Harcourt Teaching Hospital (UPTH) serve as the principal tertiary neurosurgical referral centres for Rivers State, and neurosurgical capacity at both centres continues to expand, nevertheless, awareness of the risk of shunt malfunction during pregnancy among primary care providers and obstetric teams in Nigeria requires strengthening. A multidisciplinary approach is particularly critical in settings where neurosurgical resources are limited and patients may present late [21,22].

Postoperative VTE prophylaxis with TED stockings is appropriate and recommended in neurosurgical patients, as was implemented in this case [10]. Preconception counselling is essential for all women with VP shunts who are contemplating pregnancy, and should include baseline neuroimaging, valve function assessment, and an individualised delivery plan [3,5,16].

Conclusion

VP shunt placement is not a contraindication to pregnancy; however,

shunt-dependent women require a robust multidisciplinary team approach encompassing the preconception, antenatal, and postnatal periods. Key elements of management include preconception neuroimaging and valve function assessment, close antenatal neurosurgical surveillance with serial MRI monitoring, and proactive counselling regarding the potential need for shunt revision before clinical deterioration occurs.

The choice of anaesthesia for Caesarean section in shunted patients is a critical clinical decision. General anaesthesia is the preferred option in patients with known or suspected shunt malfunction or raised ICP, whereas regional anaesthesia should be employed with caution and only after confirming a functional shunt and normal ICP.

Early neurosurgical intervention in the setting of shunt malfunction prevents significant morbidity and mortality. In resource-limited settings such as Nigeria, heightened clinical suspicion, early referral to tertiary neurosurgical centres, and multidisciplinary collaboration are essential to optimise both maternal and foetal outcomes.

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