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CASE REPORT

Anaesthetic Management of a Patient with Obstructive Hydrocephalus who had Undergone Craniectomy Posted for Ventriculoperitoneal Shunting

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ABSTRACT

Introduction: Hydrocephalus, it is an excessive accumulation of cerebrospinal fluid within the head. It can be due to congenital or acquired. It leads to increase in intracranial pressure, seizures, permanent disability and sudden death, for which patients has to undergo external ventricular drain, lumbar shunts or ventricular shunts. Patients with intracranial pathology have high risk of perioperative complications, which needs specific anaesthetic management.

Case Report: A 32 year old male a case of status post right temporo-parietal craniectomy with obstructive hydrocephalus posted for ventriculo-peritoneal shunting. He sustained head injury 2 months back for which he had undergone craniectomy and also tracheostomised. Then he was newly diagnosed as diabetic and hypertensive for which he was on medication. And his blood investigations showed hyponatremia for which he was started on sodium correction. In between, he had developed left cephalic vein thrombosis for which he was started on injection Heparin. After 2 months of craniectomy he developed cerebral edema following which his GCS was also worsened. So ventriculoperitoneal shunting was done under general anaesthesia and it was uneventful.

Conclusion: As the patient was posted for ventriculoperitoneal shunting with known history of status post craniectomy, hyponatremia and high blood sugars; early hemodynamic management and intensive care was extremely useful to these patient in view of anticipation of seizures, bleeding. In this case, the anaesthetic management was handled successfully without any consequences.

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Key Messages: In patients with increased intracranial pressures due to various reasons, shunting is advised to reduce the pressures by draining the excess cerebrospinal fluid into the peritoneum. This gives temporary relief to the brain, reducing the edema and reversing the effects of increased pressures in the central nervous system. Our patient was a post traumatic case presented with hyponatremia requiring ventriculo-peritoneal shunt. We had to correct the hyponatremia anticipating convulsions, utmost care was taken perioperatively with a successful outcome.

KEYWORDS

• Crainectomy • Hydrocephalus • Ventriculoperitoneal shunting

INTRODUCTION

Hydrocephalus, it is an excessive accumulation of cerebrospinal fluid within the head. Cerebrospinal fluid (CSF) is normally free to flow between cranial and spinal compartments and is a mediator of intracranial compliance. It can be due to congenital or acquired. It leads to increase in intracranial pressure, seizures, permanent disability and sudden death, for which patients has to undergo external ventricular drain, lumbar shunts or ventricular shunts. Symptomatic hydrocephalus often requires surgical intervention to shunt excess CSF away from the ventricular system or the spinal thecal space, usually into the peritoneal cavity. Patients with intracranial pathology have high risk of perioperative complications, which needs specific anaesthetic management. Perioperative complications like seizures, permanent disability, hyponatremia, may need of mechanical ventilation, may need blood and blood products.

CASE REPORT

A 32 year old male a case of status post right temporo parietal craniectomy with obstructive hydrocephalus posted for ventriculo peritoneal shunting. He sustained head injury due to road traffic accident 2 months back. He was diagnosed with right frontotemporo parietal subarachnoid haemorrhage following RTA, so he underwent right frontotemporo parietal craniectomy 2 months back.

After craniectomy he was newly diagnosed as diabetic and hypertensive for which he was on medication. And his blood investigations showed hyponatremia for which he was started on sodium correction. In between, he had developed with left cephalic vein thrombosis for which he was started on injection Heparin. After 2 months of craniectomy he developed cerebral edema following which his GCS was also worsened. Then he was diagnosed with obstructive hydrocephalus for which he was posted for ventriculo-peritoneal shunting.

As this was a major surgery in view of anticipated hemodynamic changes, seizures, bleeding and neurological complications. Patient was operated under general anaesthesia. For better hemodynamic resuscitation, right subclavian central venous catheter was placed. Injection Heparin was stopped prior to surgery.

Surgery was done under general anaesthesia. Patient was induced with fentanyl and propofol. Muscle relaxant vecuronium and Isoflurane was used for maintenance of anaesthesia. Nitrous oxide was avoided in this case. Intra operatively injection 3% Nacl was onflow. Shunting was done without any consequences. Anaesthesia was uneventful.

Intraoperatively blood pressure was around 110/70mmHg, pulse rate is around 90-96 bpm and the saturation was maintained. Main concerns of this surgery were to maintain blood pressure, control seizures, blood sugars, hyponatremia and bleeding. Utmost care was taken for fluid management, blood loss and sodium correction. Then patient was on postoperative observation to see for hemodynamic changes, blood sugars and hyponatremia.

DISCUSSION

Hydrocephalus is a neurological condition characterized by an abnormal accumulation of cerebrospinal fluid (CSF) within the ventricles of the brain, which can increase intracranial pressure (ICP) and cause neurological deterioration.[1] It can be either congenital or acquired, with the latter

often resulting from traumatic brain injury, subarachnoid hemorrhage, or infections. The pathophysiology of hydrocephalus in this patient, who developed obstructive hydrocephalus post-craniectomy, is likely due to altered CSF dynamics following surgery, leading to the obstruction of normal CSF flow.

In such cases, managing hydrocephalus involves procedures to divert the CSF, such as ventriculoperitoneal (VP) shunting, which is the intervention chosen in this patient.[1,3] The VP shunt offers a means of preventing further complications like increased ICP, seizures, and neurological deficits.

Perioperative considerations in hydrocephalus patients

Patients with a history of brain surgery, especially craniectomy, face unique perioperative challenges, particularly due to their altered intracranial dynamics, risk of bleeding, and potential for cerebral edema, so proper preoperative assessment is helpful in these conditions.[2] Furthermore, the presence of obstructive hydrocephalus in this case created an additional concern regarding ICP elevation. Managing these patients requires meticulous monitoring and anaesthetic strategies that ensure stable hemodynamics, adequate cerebral perfusion, and prevent excessive fluid shifts that may exacerbate their condition.

Seizures are a known complication of both hydrocephalus and brain surgery, especially in the context of traumatic brain injury or craniectomy. In this patient, the risk of perioperative seizures was heightened due to the pre existing cerebral pathology. Antiepileptic drugs (AEDs) may have been considered preoperatively to reduce seizure risk, and intraoperative seizure monitoring could be beneficial in detecting subclinical seizures.

Hemodynamic stability is crucial in this patient, as fluctuations in blood pressure can lead to secondary brain injury or worsened cerebral edema. Maintaining normotension is especially important to avoid exacerbating the hydrocephalus. In this case, blood pressure management was aimed at keeping it around 110/70 mmHg, which is likely an appropriate target for avoiding both under- and over-perfusion of the brain. Careful fluid management and use of vasopressors as necessary would have been part of the anaesthesia strategy to maintain a stable perfusion pressure.

Challenges with Comorbidities: Diabetes, Hypertension, and Hyponatremia

Managing comorbid conditions such as hypertension and diabetes is essential in the perioperative setting. In the case of hypertension, the goal is to avoid extreme fluctuations in blood pressure that can lead to complications such as cerebral hemorrhage or ischemia. In this patient, blood pressure was maintained within the target range intraoperatively. The use of antihypertensive medications such as beta-blockers or calcium channel blockers may have been considered to maintain control over the patient's blood pressure.

Diabetes presents additional concerns in the perioperative period, particularly regarding blood glucose control. Hyperglycemia can increase the risk of infection, delayed wound healing, and neurological dysfunction, while hypoglycemia can lead to neurological impairment. Monitoring blood glucose levels frequently and adjusting insulin administration during surgery would have been important for preventing these complications. Intraoperative use of short-acting insulin and glucose infusions, or managing the patient with a basal-bolus regimen, are typical strategies.

Hyponatremia, a key finding in this patient, requires careful management to prevent complications like seizures and cerebral edema. The correction of sodium levels should be gradual to avoid osmotic demyelination syndrome. In this patient, sodium correction would have been carefully monitored both intraoperatively and postoperatively, using fluid restrictions and slow infusion of hypertonic saline if necessary.

Anticoagulation therapy

The patient's left cephalic vein thrombosis treated with heparin adds another layer of complexity to his management. Anticoagulation therapy increases the risk of perioperative bleeding, especially in neurosurgical cases where precise hemostasis is critical. Managing this risk involves careful coordination between the surgical and anaesthetic teams to decide when to withhold anticoagulation preoperatively and when to resume therapy postoperatively.

In this case, **heparin** was likely paused before surgery, with careful monitoring of coagulation parameters such as activated partial thromboplastin time (aPTT) or international normalized ratio (INR).[4] Bridging therapy with low molecular weight heparin or direct oral anticoagulants might also have been considered, depending on the patient's thrombotic risk.[5]

Anaesthetic Management and Intraoperative Concerns

The anesthetic management in this case was tailored to address several key concerns:

- **General anaesthesia** was administered, with careful monitoring of **airway management** (to prevent aspiration) and **depth of anaesthesia** to ensure adequate cerebral protection.
- **Fluid Management**: The delicate balance between ensuring adequate perfusion and avoiding overhydration or underhydration was crucial in this case, especially given the patient's risk of **cerebral edema** and **hyponatremia**. Intraoperative monitoring of fluid balance and electrolytes, including sodium, would be essential to avoid worsening his condition.
- **Blood loss and hemodynamic stability**: Given the risk of bleeding during craniectomy and VP shunt insertion, a transfusion protocol, including monitoring hematocrit and hemoglobin, might have been established. Intraoperative blood salvage techniques or administration of blood products might also have been used, depending on the surgical blood loss.

Postoperative considerations

Postoperative care is critical in patients undergoing neurosurgery, particularly those with a complex medical history. After the VP shunting procedure, the patient was closely monitored for complications such as:

- **Seizures**: Close observation for early signs of seizures is necessary, and anti-seizure medications are often continued postoperatively in high-risk patients.
- **Hydrocephalus-related complications**: Postoperative imaging, such as CT or MRI, may be performed to assess the position of the shunt and the resolution of hydrocephalus.
- **Electrolyte imbalances**: Postoperative sodium levels should continue to be monitored and corrected as necessary to avoid complications of overcorrection.
- **Hemodynamics**: Regular monitoring of blood pressure, glucose levels, and fluid balance was crucial in managing this patient's recovery.

CONCLUSION

In this case, careful preoperative, intraoperative, and postoperative management allowed for successful anaesthetic management in a patient with a complex history of traumatic brain injury, hydrocephalus, comorbidities, and anticoagulation therapy. Key aspects such as hemodynamic control, seizure management, fluid balance, and electrolyte correction were integral to the patient's stable recovery. This case emphasizes the importance of a multidisciplinary approach and the need for vigilant monitoring in such high-risk patients undergoing neurosurgical intervention.

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