GOAL ORIENTED C-SECTION IN PATIENT WITH A VP SHUNT

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ABSTRACT

Study Objective: Pregnant women with conditions leading to ventriculo-peritoneal (VP) shunt dependency are now more likely to be subject to anaesthetic procedures. Case reports or small studies remain an important source of knowledge and experience. This case report discusses an area of controversy that will continue to occur in obstetrics due to the surviving population reaching childbearing years.

Case Report: A 40-year-old G3P1 woman presented at 36 weeks' gestation for an elective repeat cesarean section. She reported several neurosurgical procedures and the placement of a VP shunt secondary to removal of a cavernous sinus meningoiiata. The patient expressed a strong preference for an epidural technique. Following consultations between the neurosurgeon, the obstetrician and the anaesthesiologist, the decision was made to proceed with elective repeat cesarean with general anaesthesia and the risks of epidural were explained to the patient (dural puncture and the associated risk of infection and brain herniation). A rapid sequence induction was performed and anaesthesia was maintained with sevoflurane, titrated to maintain the stability of the mean arterial pressure. A live 2080 g infant was born, with Apgar scores 8/10 at 1 and 5 min respectively. Following delivery, oxytocin and intraoperative analgesia was administered. Her post-operative period was uneventful.

Conclusions: General anesthesia remains a safe and dependable technique in parturients with VP shunt who require cesarean section. Well defined management goals should be outlined (rapid sequence induction, hemodynamic stability and adequate postoperative pain control) and the anaesthetic technique tailored to meet these goals. We recommend a team approach involving anaesthesia, obstetrics and neurosurgery in order to select the most appropriate management options for these parturients.

Keywords: Ventriculo-peritoneal Shunt, Anesthesia, Cesarean, Pregnancy.

Introduction

Although the first report of pregnancy and maternal shunt dependency was published in 1979,1 there is still very limited anaesthetic experience to guide the management of such patients. Women with conditions leading to hydrocephalus are now more likely to survive to childbearing age and be subject to anaesthetic procedures. There are limited controlled trials on this subject and case reports or small studies remain an important source of knowledge and experience.2–5 We describe the anaesthetic management of a multiparous woman posted for elective cesarean whose history included several neurosurgical secondary to a meningioma of the sella turca and placement of a ventriculoperitoneal (VP) shunt.

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Case Report

A 40-year-old G3P1 woman with history of meningioma presented at 36 weeks’ gestation for anaesthetic consultation for an upcoming elective repeat cesarean section. She reported eight neurosurgical procedures due to removal of a cavernous sinus meningioma. The first surgery was 12 years previously and the procedures included several surgeries due to tumour reappearance, removal of the left trigeminal nerve and reconstruction of the mandible, temporal bone and zygoma. Despite this, her present MRI maintained an apparently stable sphenocavernous tumour with no contact with the optic chiasm, in neurosurgical surveillance. Complications of the procedures included raised intracranial pressure (ICP) and new onset epilepsy, several suture infections and temporal osteomyelitis. In her last surgery a ventricular-peritoneal shunt was placed and epilepsy symptoms wore off. There were no reports of anaesthetic complications during these procedures. She also had history of moderate aortic insufficiency due to bicuspid aortic valve, with no significant clinical evolution and no haemodynamic repercussion. She became pregnant for the first time at the age of 37, four months after the last intervention, and pregnancy was uneventful. An elective cesarean section was performed under general anaesthesia at 37 weeks and the patient delivered a 3150 g baby girl with Apgar scores 8/10 at 1 and 5 min respectively. She became pregnant 2 years later but had a spontaneous abortion at 8 weeks. She remained asymptomatic during the present pregnancy. On presentation, she was a 1.71 m, 58 kg, alert patient with a pulse of 76 beats per min, blood pressure 86/51 mmHg and O₂ saturation of 98% on room air. Physical examination revealed a face asymmetry due to absence of left temporal squamous process and zygomatic arch. Airway examination revealed a Mallampati class I airway, thyromental distance 3 fingers’ breadth, adequate mouth opening and neck movement. Cardiovascular examination revealed a II/IV decrescendo diastolic murmur. The remainder of the physical examination was unremarkable, including a normal neurological examination and fundoscopy. Laboratory investigation was within normal limits for a patient at term and she was classified as ASA III. The patient expressed a strong preference for an epidural technique, since her neurosurgeon had told her that extradural procedures were theoretically exempt of risk. Following consultations between the neurosurgeon, the obstetrician and the anaesthesiologist, the decision was made to proceed with elective repeat cesarean with general anaesthesia and the risks of epidural were explained to the patient, namely dural puncture and the associated risk of infection and brain herniation. On the day of surgery, with the patient in the supine, left lateral tilt and 30° head up position, an IV line was secured and a rapid infusion of Ringer’s lactate solution was administered. The initial blood pressure was 90/65 mmHg, the electrocardiograph (ECG) revealed sinus rhythm with heart rate (HR) of 72 beats per minute and oxygen saturation was 99%. Pre-oxygenation and permissive hyperventilation were carried out for 3 min. A rapid sequence induction was performed with thiopentone sodium 375 mg, fentanyl 50 μg and succinylcholine 100 mg, and the airway was readily secured. After confirmation of correct placement of the tracheal tube, anaesthesia was maintained with a 50% O₂/air mixture and sevoflurane 1.5%, titrated to maintain the stability of the mean arterial pressure (MAP) at a 60 mmHg±20%. Additionally, rocuronium 0.4 mg·kg⁻¹·h⁻¹ was used to maintain low peak airway pressures and tidal volume and respiratory rate were adjusted to maintain end-tidal CO₂ between 21-25 mmHg. The O₂ saturation remained between 98-99%. Rescue medications for seizure control and vasopressors were readily available.

A live 2080 g female infant was delivered seven minutes after skin incision, with Apgar scores 8, 10 at 1 and 5 min respectively. Following delivery, 5 units of oxytocin iv, followed by an infusion of 20 units L⁻¹ in Ringer’s lactate were administered and intraoperative analgesia was achieved with fentanyl 100μg, acetaminophen 1 g and tramadol 100mg. At the end of the surgery, the patient was extubated awake within five minutes of discontinuing sevoflurane. No remarkable increases of the MAP were registered, although there was a slight increase of the end-tidal CO₂ and the HR after emergence. On arrival at the Post-Anesthesia Care Unit (PACU), blood pressure was 128/77 mmHg, HR 88 beats.min⁻¹ and O₂ saturation of 99%. She was talkative and pain free. The post-operative analgesic orders included acetaminophen 1g iv q8hr, magnesium metformole iv 2 g q8hr and tramadol 100 mg/metoclopramide 10 mg iv prn.

Her PACU stay was uneventful and neuropsy signs remained stable. She experienced no nausea or vomiting during the post-operative period. She was transferred to the post-partum ward on the 12th hour post-surgery and was discharged home on the 4th day post-partum. The patient remained symptom-free at the 30th day post-surgery.

Discussion

Primary central nervous system tumours occur in approximately 6 in 100,000 females.\(^6\) Meningioma is the most common primary intracranial neoplasm and can alter its growth pattern after oestrogen and progesterone receptor stimulation.\(^6\) The incidence of brain tumours is not known to be increased in pregnant women although some of these neoplasms tend to become larger and show accelerated growth during gestation.\(^6\) A body of literature exists, which indicates that the hormonal milieu
of pregnancy may influence the growth of some tumours due to increased blood volume, redistribution of total body water between the intracellular and extracellular fluid compartments and the influence of steroid hormones. These changes may result in increased tumour size, consequent compression on surrounding structures and changes in intracranial pressure (ICP). Another problem to be considered is that pregnant women appear to be at a relatively high risk of shunt malfunction and other shunt-related complications (mechanical, functional and infectious) during their pregnancy. One postulated etiology is that, as pregnancy progresses, the increase in intra-abdominal pressure causes retrograde or absent flow in the shunt, but such theory has not been proved. However, concern about retrograde flow and subsequent increased ICP has led to the practice of minimizing second stage effort, suggesting that these patients have assisted vaginal deliveries with good analgesia or cesarean section. There is still no validation to this concern, and women with normal ICP who are shunt-dependent are not at risk of sudden neurological decompensation. Given the increase in ICP seen with uterine contractions and pain, relief remains that flow will be overall sustained in the appropriate direction. Apart from this, functioning of the shunt can be easily ascertained on clinical questioning in the majority of cases. Testing the palpable reservoir of the shunt is unlikely to be of any benefit although previous articles discussed the use of intermittent pumping or even direct aspiration of the reservoir to control increases in ICP. Radiological imaging, such as CT scanning or MRI, is not indicated on a routine basis in the parturient as long as she remains clinically well, as in our case. Owing to the relatively high occurrence of shunt-related complications during pregnancy and in the first six months postpartum, the authors of a previous review made the following observations:

1. Distinguishing transient third trimester headaches and other symptoms of shunt failure presents a clinical challenge. Headaches occur more frequently in the later stages of pregnancy and may result from the increasing size of the uterus and resultant increases in intra-abdominal pressure. Magnetic resonance imaging (MRI) is recommended as a safe and effective means of evaluating ventricular dilatation when patients exhibit symptoms.

2. Decisions should be based on the neurological status of the patient and obstetric considerations. Absence of labour may be desirable to prevent protracted Valsalva manoeuvres and longer periods of ICP.

3. Cesarean section may be associated with the risk of intra-abdominal infection and adhesion formation around the distal end of the VP shunt catheter. The most commonly recovered organisms are coagulase-negative staphylococci (50%), Staphylococcus aureus (20%) and various other species including aerobic Gram-negative bacilli, streptococci, Enterococcus, Propionobacterium species, coryneforms and yeasts. The effectiveness of prophylactic antibiotic therapy is unknown, although its use to prevent a shunt infection may be sufficient to justify therapy if there are no existing contraindications.

4. Shunt failure in pregnancy occurs more frequently with VP shunts than with other shunt configurations such as ventriculoatrial (VA) shunts.

We believe that, at the time of delivery, our patient did not exhibit neither raised ICP nor shunt malfunction, due to lack of clinical signs and symptoms, so further studies were not in order. In the term neurologically stable patient, opinion varies on the preferred method of delivery and anesthesia. Most authors suggest that patients who are fully compensated with functioning VPS may receive either general or regional anesthesia.

In agreement with Tewari et al., our obstetric team suggested expeditious Cesarean section, both because the patient had had a previous cesarean and to minimize the pains of labour and the consequences of bearing down in the second stage, as they do result in marked increases in CSF pressure. From the Anesthesiology team point of view, both a regional technique and general anaesthesia were theoretically possible, but the safest solution was chosen. Epidural anaesthesia may be considered a low risk procedure by some, but there is the possibility of inadvertent dural puncture. In this event, the cerebrospinal fluid space could be potentially contaminated and differential pressure altered. Meticulous aseptic technique is mandatory for regional anaesthesia and prophylactic antibiotics are generally recommended. Other authors reveal less concern about dural puncture causing brain herniation. They state that patients with controlled ICP via their shunt will simply compensate for the decrease in CSF pressure by having less flow through the shunt. The authors did not find any reference in the literature as to treatment of PDPH is concerned. In agreement with other authors, we believe that the risk of accidental dural puncture is increased by gestation-related factors (epidural vessels ingurgitation), so this technique is not exempt of risk. The volume of lumbar epidural injection has been related with increased ICP by a CSF shift to the brain and neuraxial blocks may produce sympathetic block and result in hypotension, with consequent decrease in brain perfusion. This decrease becomes critical in patients with increased intracranial pressure. Inadvertent dural puncture may have disastrous consequences, and clinical deterioration and death have been reported.
This is why, after consultations with the patient, obstetrician, anesthesiologist and neurosurgeon, general anesthesia, adapted to specific management goals, was our choice for the surgical delivery of this patient. Our anaesthetic plan was designed to ensure overall maternal and fetal wellbeing, forestall fluctuations in ICP and maintain hemodynamic stability. At the same time, a sufficient depth of anesthesia and a rapid recovery were considered essential. To reduce fluctuations in ICP and cerebral blood flow secondary to the intubation-induced hypertensive response or anesthesia-induced hypotension, a smooth rapid sequence induction with pharmacological ablation of the response to laryngoscopy is recommended, we used fentanyl for this purpose. Conflicting results exist regarding the risk of neonatal respiratory depression in parturients undergoing Cesarean sections, so a neonatologist was readily available for possible neonatal resuscitation with naloxone. Although not supported by good levels of evidence, aspiration prophylaxis is considered to be important before anesthesia during pregnancy. On the other hand, rapid-sequence induction is routinely used to reduce the risk of maternal aspiration, but there is little evidence in the literature to indicate whether any pharmacological approach is preferable. Thiopental is still frequently used as the IV induction drug of choice for general anesthesia during pregnancy. We chose it for induction because it decreases brain blood flow and intracranial pressure, maintaining perfusion pressure associated to decreased brain oxygen consumption. Propofol, which also decreases brain-blood flow and intracranial pressure and better attenuates the haemodynamic response to laryngoscopy, may promote adverse effects in patients with brain tumours by critically decreasing brain perfusion pressure. In addition, in several countries, propofol is stated by the manufacturer to be contraindicated during pregnancy. When adequate doses of thiopental (4-5 mg/kg) are followed by succinylcholine (1-1.5 mg/kg), there may be a transient, but clinically unimportant, increase in ICP. The choice of a nondepolarizing neuromuscular blocking drug for tracheal intubation is controversial because of possibility of difficult intubation.

Maternal systolic BP of 90 mmHg and maternal etCO₂ of 22 mmHg for seven minutes did not result in any adverse effect on the newborn. Oxygen 100% was initially administered because it results in higher umbilical venous O₂ saturation and higher Apgar scores. Haemodynamic stability was achieved with sevoflurane, a fluorinated inhalation agent that has been shown to have a good maternal and neonatal safety profile and allow for the patient's rapid recovery. The MAC of most volatile anesthetics is reduced by approximately 25% during pregnancy, and so initial end-tidal sevoflurane concentrations of 1.5% were appropriate. Nitrous oxide was avoided because it may worsen cerebral vasodilatation, especially when used with a potent inhalational agent. The use of oxytocic drugs in patients with history of intracranial tumour has not been fully investigated. Syntocinon, a synthetic oxytocin, is the drug of choice. It has been used in patients with intracranial tumours without any adverse effect. Finally, in accordance with other authors, a multimodal analgesia approach was chosen to allow adequate control of pain with minimal side effects.

The management of the pregnant patient with a brain tumour must be individualized. We recommend a team approach involving anesthesia, obstetrics, neurosurgery and nursing in order to select the most appropriate management options for these parturients. The Obstetrical Anesthesia Clinic provided an important venue to assess this patient electively. We valued the opportunity to obtain previous medical records, search current literature, consult with other specialists and address the patient's questions and concerns.

The major concerns of an anesthesiologist caring for a parturient with a VP shunt are control of ICP, functioning of the shunt, risk of infection (meningitis) with the use of regional anesthesia/analgesia and intraabdominal procedures (cesarian section), risk of tonsillar herniation in the case of dural puncture, risk of shunt malfunction following regional anesthesia and/or treatment of its complications, and eventually management of postpartum headache.

Well defined management goals should be outlined and the anesthetic technique tailored to meet these goals. General anesthesia remains a safe and dependable technique in parturients with VP shunt who require cesarean section and allows one not to worry about the concerns of regional techniques. Maternal hyperventilation, permitted by tracheal intubation, is useful to control raised intracranial pressure. Hemodynamic stability can be achieved to maintain cerebral perfusion. Adequate postoperative pain control is equally relevant in the peroperative period.

Bibliografía


