Anaesthetic management of appendectomy in a patient with cerebral arteriovenous malformation

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Abstract

Background: The aim of anaesthetic management for appendectomy in a patient with cerebral arteriovenous malformation (AVM) is to maintain a stable cardiovascular system. As this condition is rare, there are no definitive guidelines regarding the anaesthetic management of such patients.

Case report: We report a case of appendectomy in a patient with cerebral AVM. The patient was diagnosed with cerebral AVM four years prior to presentation with acute appendicitis and was advised surgical intervention, which he refused. Management of this patient presenting with acute appendicitis is discussed.

Conclusion: General anaesthesia may be used successfully for appendectomy in a patient with cerebral AVM if haemodynamic fluctuations at times of stress are minimised.

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Introduction

Cerebral arteriovenous malformation (AVM) has an incidence of approximately 1:100 000 per year in an unselected population and accounts for 9% of subarachnoid haemorrhages in the general population.[1] The choice of anaesthetic technique for surgery in these patients is influenced by urgency, the type of surgery, and the need to maintain a stable cardiovascular system in order to reduce the risk of haemorrhage.[2]

Case report

An 18-year-old male patient, weighing 60 kg, presented to the emergency department with a history of pain in the right iliac fossa with associated nausea and fever of two days duration. The patient revealed a history of seizures for the last four years for which he was on regular treatment with oral phenytoin 300 mg at night. Despite treatment, he continued to have seizures every two to three months, with the last episode having occurred four to five months previously. A history of transient weakness of the left side of the body was also present. A magnetic resonance imaging angiogram of the brain was performed four years previously and it revealed a 15 x 14 x 11 mm AVM in the left frontal region with a 'steal' phenomenon. The patient was advised to undergo neurosurgical intervention, which he refused. On examination, the patient was conscious, cooperative and oriented with regard to time, place and person. He was febrile with an axillary temperature of 37.7 °C. All other vital parameters were normal and the neurological, respiratory and cardiovascular systems were within normal limits. Examination of the abdomen revealed tenderness and guarding in the right iliac fossa. Routine blood tests and urine analysis were within normal limits. An ultrasound of the abdomen confirmed the clinical diagnosis of acute appendicitis. A diagnosis of acute appendicitis with AVM was made and he was booked for an emergency appendectomy. In view of the AVM, the high-risk nature of the procedure was emphasised to the patient at the time of obtaining consent. General anaesthesia was planned, adequate fasting was ensured and the patient was premedicated with glycopyrrolate 0.2 mg. Fentanyl 100 µg and lignocaine 90 mg were given 90 seconds before induction, which was performed with thiopentone 300 mg and rocuronium 50 mg. Electrocardiography, invasive blood pressure, pulse oximetry, end tidal carbon dioxide, temperature and blood loss were monitored intraoperatively. A

size 4.0 ProSeal™ laryngeal mask airway (PLMA) was placed on the first attempt and its position confirmed by passing the gastric tube through the drainage port. Anaesthesia was maintained with oxygen, nitrous oxide, intermittent boluses of rocuronium and a propofol infusion. Surgery lasted for 45 minutes and intraoperatively the patient required a nitroglycerine infusion to maintain blood pressure in the target range. (Preoperatively the patient's blood pressure was 140/70 mmHg; the target range kept for systolic blood pressure was 130–150 mmHg and for diastolic blood pressure 60–80 mmHg). The patient remained normotensive thereafter. Ondansetron 6 mg was given as an antiemetic and the patient was reversed with neostigmine 2.5 mg and glycopyrrolate 0.4 mg. The PLMA was removed once the patient could open his mouth on command. Nitroglycerine infusion was continued for five hours postoperatively. The patient remained normotensive thereafter.

Discussion

Anaesthetic management of incidental surgery in a patient with intracranial AVM has not been highlighted in the literature except in pregnant patients undergoing Caesarean section. We hereby describe the anaesthetic management of appendectomy in a patient with intracranial AVM. The aim of the anaesthetic approach is to maintain oxygenation and stable systemic and cerebral haemodynamics and to avoid increased intracranial pressure.[3]

AVMs are errors in the development of the cerebral vasculature and consist of abnormal direct communications between small arteries and veins without intervening capillaries. Together with the effects on blood flow, this may lead to a focal arteriovenous shunt, which is a low-resistance, high-flow shunt. AVMs most commonly present between 20 to 45 years of age with a peak in the fourth decade. Deleterious effects on brain function may occur via several mechanisms, including mass effects, metabolic depression and seizure activity. It is likely that the local mass effect produced by abnormal vessels of the AVM is more important than local haemodynamic failure in causing symptomatic focal neurological deficits unrelated to intracranial haemorrhage or seizure activity. The most common presentation is spontaneous intracranial haemorrhage (30–86% of adults and 75–80% of children), either into the ventricle or into the parenchyma.[4,5]

The most important problem in anaesthetic management is the risk of gross alteration of perfusion pressures of the AVM because of alterations in systemic blood pressure, resulting in haemorrhage if perfusion pressure increases or cerebral steal if pressure decreases.[4,5] However, Young et al have suggested that spontaneous haemorrhage during the perioperative period as a result of variations in systemic blood pressure is unlikely, probably because of a 'buffering capacity' of the fistula on changes in systemic pressure.[6,7]

The use of different volatile anaesthetics, regional anaesthetic techniques and antihypertensive agents has been described. However, it is impossible to select one of these methods as definitely superior to the others. A regional anaesthetic technique may be considered because it avoids the haemodynamic stress associated with intubation and extubation, but with the judicious use of currently available anaesthetic drugs, haemodynamic fluctuations during general anaesthesia can be minimised. Vomiting, apprehension and discomfort during regional anaesthesia can increase intracranial pressure and can be dangerous. Therefore, we planned general anaesthesia in this patient. The haemodynamic stress response was minimised by administration of fentanyl and lignocaine before induction and by the use of the PLMA. The use of the PLMA for appendectomy is controversial. Usually, tracheal intubation is employed as part of rapid-sequence induction in acute abdominal surgeries. We used the PLMA as there is now sufficient evidence in literature supporting its use in emergency and elective abdominal surgeries.[8,9] The PLMA creates a high pharyngeal seal and offers protection against regurgitation and aspiration.[10,11] Invasive blood pressure monitoring is not done routinely in such cases. In our case we inserted an arterial line after induction when the nitroglycerine infusion was started to maintain blood pressure in the target range.

Intravenous anaesthetics, with the exception of ketamine, reduce cerebral blood flow (CBF) and cerebral metabolic requirement of oxygen ($CMRO_2$), thereby providing brain protection in a patient with AVM, especially when the brain is at risk of ischaemia.[4] On the other hand, most inhalational anaesthetics (except nitrous oxide) increase CBF and decrease $CMRO_2$. In this patient, we avoided the use of volatile anaesthetics altogether, and anaesthesia was maintained with a propofol infusion. The effects of an opioid on CBF, $CMRO_2$ and intracranial pressure (ICP) are variable. However, the combination of fentanyl and droperidol has no significant effect on CBF and $CMRO_2$. Muscle relaxants cause minimal change in CBF and ICP, if respiration is well controlled, whereas succinylcholine may increase ICP because of fasciculations. We

therefore avoided succinylcholine and intubated the patient with rocuronium.[4]

We successfully used general anaesthesia for appendectomy in a patient with intracranial AVM, and with rational use of currently available anaesthetic drugs, it was possible to minimise blood pressure fluctuations at times of haemodynamic stress.

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