Anaesthesia for Caesarean section and cerebral aneurysm clipping

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A pregnant patient at 38 weeks gestation presented for a combined procedure of Caesarean section, tubal ligation and cerebral aneurysm clipping. Anaesthesia was induced with thiopental, succinylcholine was administered to facilitate tracheal intubation, and intravenous lidocaine and sodium nitroprusside were used to reduce the hypertensive response to tracheal intubation. Anaesthesia was maintained with nitrous oxide until delivery of the infant, after which time fentanyl, low-dose halothane and pancuronium were added for maintenance of anaesthesia during the neurosurgical procedure. Blood pressure was controlled during the case by administration of a sodium nitroprusside infusion and propranolol. Following completion of the surgical procedures, the patient promptly emerged from anaesthesia and was neurologically normal in the operating room. It is concluded that general anaesthesia can be used satisfactorily for a combined procedure of Caesarean section and cerebral aneurysm clipping.

Key words

Subarachnoid haemorrhage is a rare complication during pregnancy and is most commonly associated with an aneurysm or arteriovenous malformation.[1] Management which offers the best chance for a satisfactory maternal and neonatal outcome involves neurosurgical intervention, followed by

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labour and vaginal delivery at term gestation.[1] The incidence of haemorrhage tends to increase as gestation progresses, although few cases actually occur at term or during labour.[1] We recently encountered a pregnant patient at 38 weeks gestation with acute subarachnoid haemorrhage from a ruptured internal carotid artery aneurysm. The neurosurgical team advised early operative clipping of the aneurysm. As the patient was at term the obstetrical team felt the safest course was to proceed with a primary Caesarean section before the craniotomy. We describe the administration of general anaesthesia for both procedures and discuss the anaesthetic implications.

Case report

A 38-year-old woman, gravida 6, para 4, ectopic 1, presented with sudden onset of severe headache, photophobia, nausea, vomiting and decreased mental status. Bilateral cerebral arteriograms showed multiple intracranial aneurysms. The largest aneurysm, which was felt to have bled because of its size and location, was at the left internal carotid artery bifurcation. Two days after admission, the patient's neurological condition had improved to where she had only minor symptoms (grade 1). She was brought to the operating room for Caesarean section with tubal ligation, followed by craniotomy for ligation of the internal carotid artery aneurysm. Except for the subarachnoid haemorrhage, the patient's antenatal course had been unremarkable. Past medical history was significant for mild asthma. She was taking no medications. Physical examination was unremarkable except for a right narrowed palpebral fissure and decreased right lateral gaze. Her weight was 75 kg and her height was 163 cm.

The initial plan was to place a subarachnoid

catheter, as requested by the neurosurgical team for cerebrospinal fluid drainage, and utilize a continuous spinal technique for the Caesarean section. This was to be followed with general anaesthesia for the craniotomy. The patient, however, refused to have the catheter placed while she was awake, so we proceeded with general anaesthesia for both surgical procedures.

The patient was premedicated with cimetidine, 300 mg IM, two hours before surgery. A radial artery catheter for direct blood pressure measurement was placed upon arrival in the operating room. With cricoid pressure applied, general anaesthesia was induced with IV thiopental 250 mg, and succinylcholine 60 mg. Lidocaine 100 mg, and sodium nitroprusside (SNP), 50 μg, were given immediately following the succinylcholine to reduce the hypertensive response during tracheal intubation. The blood pressure increased transiently to 150/85 during induction before returning to its preinduction value of 120/80. Anaesthesia was maintained with 50% N_2O–50% O_2 until delivery of a 2640 gm male infant 4 min after induction. Apgar scores at 1 and 5 min were 7 and 9, respectively. After delivery of the infant, anaesthesia was maintained with 67% N_2O–33% O_2, pancuronium and fentanyl (250 μg immediately after delivery; 1125 μg total). Brain size was controlled by hyperventilation to a $PaCO_2$ of 28 and intravenous infusion of 60 gm of mannitol. Blood pressure was maintained at approximately 100/60 for the remainder of the case by administration of a SNP infusion and propanolol. Wheezing was noted 1.5 h after induction. Halothane 0.2–0.4 per cent, was then added with rapid resolution of this symptom. Following successful clipping of the aneurysm and completion of the surgical procedure, the patient promptly emerged from anaesthesia. She was awake, talking and neurologically normal in the operating room. Total anaesthesia time was 6 h and 40 min. Total blood loss was estimated at 800 ml.

The patient's postoperative course was uneventful until the sixth postoperative day when she developed a severe frontal headache and expressive aphasia. A CT scan revealed no evidence of bleeding of hydrocephalus. She improved with conservative therapy and was discharged on postoperative day 13 with only mild left side headache and slight residual aphasia. Twelve weeks postoperatively the patient was found to be normal

TABLE   Time of rupture of proven intracranial aneurysms*

Weeks gestation	Number of cases
6–10	4
11–15	6
16–20	12
21–25	11
26–30	17
31–35	23
36–40	17

*From references 2–13.

neurologically. The infant, who was discharged at age three days, had an evaluation at six weeks of age which was within normal limits.

Discussion

Rupture of intracranial aneurysms in pregnancy generally occurs prior to term gestation. Our literature review of 90 cases (Table)[2-13] revealed that 81 per cent occurred prior to the thirty-sixth week of pregnancy. In these cases, surgical intervention for aneurysm clipping, followed by vaginal delivery at full-term generally resulted in a satisfactory outcome for the mother and infant. In the case we report, however, aneurysm rupture occurred in a patient at full-term.

The neurosurgical consultants felt that early clipping of the aneurysm offered the best prognosis for the mother. This would, however, expose the foetus both to a prolonged general anaesthetic and a period of induced hypotension. As a consequence it was decided to deliver the infant first by Caesarean section, followed by the craniotomy. Delivery by Caesarean section would also avoid the risks associated with elevation of blood pressure during labour and vaginal delivery in a parturient with multiple intracranial aneurysms.[1] Additionally, the patient desired sterilization which could be performed during the Caesarean section. Thus, combining the procedures reduced the number of anaesthetics required. Although anaesthesia for combined Caesarean section and craniotomy has been performed before,[5] the details of the anaesthetic were not described.

Our anaesthetic plan involved initial placement of a subarachnoid catheter. This was requested by the neurosurgeons to provide cerebrospinal fluid drainage for good exposure during approach to the

aneurysm. Via this catheter, continuous spinal anaesthesia would be performed for delivery of the infant, followed by general anaesthesia when the Caesarean section was completed. The foetus would thus be exposed to fewer drugs (anaesthetic and hypotensive agents), and provided a substantial sympathetic block was obtained with spinal anaesthesia, we felt that hypertension during tracheal intubation for the craniotomy could be easily prevented. Unfortunately, the patient refused to have the subarachnoid catheter placed while she was awake. Therefore, it was necessary to give general anaesthesia for both the Caesarean section and the craniotomy.

A smooth controlled induction is important in patients with an intracranial aneurysm to avoid the possibility of causing further bleeding. Since the sympathetic nervous system response to tracheal intubation frequently will cause an undesired rise in blood pressure,[14] we routinely try to prevent this by a slow induction, deepening the patient with a combination of narcotics and inhalational anaesthesia. In the case we report, however, this was not appropriate because pregnant patients are at high risk for pulmonary aspiration of gastric contents, and because of the danger of depressing the infant. We chose instead to perform rapid sequence induction with cricoid pressure, blunting the rise in blood pressure with intravenous lidocaine[15] and SNP. During the craniotomy, when the patient developed mild bronchospasm, we administered halothane with good effect. Although it was planned not to use an inhalational anaesthetic because of the risk of uterine relaxation[16] with increased blood loss, the halothane concentrations we employed (0.2–0.4 per cent) are not associated with increased blood loss during Caesarean section.[17] Overall, blood loss for the combined procedure was quite acceptable.

The choice of hypotensive agent for the pregnant patient during anaesthesia is controversial. Some prefer trimethaphan[1] (TMP) since its relatively high molecular weight may impede placental transfer,[18] and it is rapidly eliminated.[19] We chose SNP because of its more rapid onset and shorter duration of action. Although concern has been expressed for the possibility of foetal and neonatal cyanide toxicity,[20] SNP has been used successfully for aneurysm surgery in patients during gestation.[12,13] In these three cases, vaginal delivery occurred 8–19 weeks after the craniotomy and no significant

adverse effects on the foetus or neonate were noted. Additionally exposure of the foetus to SNP during our case was only for the short period of time from induction of anaesthesia to delivery. This would be of considerably less risk to the foetus than in the cases cited where the total dose of SNP was 12.5 mg,[12] 60 mg[13] and 90 mg.[13] Finally, nitroglycerin (NTG) is also effective for blood pressure control during general anaesthesia in hypertensive parturients,[21] and it does not affect Apgar scores or newborn blood pressure, heart rate or blood gases.[22] This agent, however, like TMP and SNP, increases intracranial pressure by increasing cerebral blood flow,[23,24] and some have expressed concern for the safety of its use in parturients with intracranial aneurysms.[23]

In summary, we used general anaesthesia for a combined procedure of Caesarean section, tubal ligation and craniotomy for ligation of an internal carotid artery aneurysm. Low dose halothane was used to control intraoperative wheezing with no apparent increase in uterine blood loss. SNP was used for induced hypotension. Although we feel that the Caesarean section would have been optimally performed with regional anaesthesia, followed by general anaesthesia for the neurosurgical procedure, the technique utilized resulted in a satisfactory outcome for the mother and neonate.

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Résumé

Une femme enceinte de 38 semaines devait subir une césarienne, une ligature tubaire et une cure d'anévrisme cérébral au cours de la même anesthésie. On induisit l'anesthésie avec du thiopental et de la succinylcholine; de la lidocaïne et du nitroprussiate de sodium ont été utilisés pour réduire la réponse hypertensive à l'intubation. Jusqu'à la naissance de l'enfant on n'administra que du protoxyde d'azote. Après la naissance, l'anesthésie fut maintenue avec du fentanyl et des petites doses d'halothane et de pancuronium pour la durée de l'intervention neurochirurgicale. On contrôla la pression artérielle avec du propranolol et une infusion de nitroprussiate de sodium. Après l'intervention, la patiente se réveilla en salle d'opération en état neurologique normal: on conclut que l'anesthésie générale peut être utilisée de façon satisfaisante pour des interventions de ce type.