Obstetrical and Pediatric Anesthesia

Craniotomy for suprasellar meningioma in a 28-week pregnant woman without fetal heart rate monitoring

[La craniotomie pour un méningiome suprasellaire chez une femme enceinte de 28 semaines, sans monitoring de la fréquence cardiaque fœtale]

Mrinalini Balki MBBS MD, Pirjo H. Manninen MD FRCPC

Purpose: To illustrate the anesthetic management of a craniotomy for suprasellar meningioma in a 28-week pregnant woman and to review the considerations for fetal monitoring during surgery.

Clinical features: A 33-yr-old woman presented at 28 weeks of gestation with rapidly deteriorating vision in her right eye. Neuroradiological investigations revealed a large suprasellar meningioma extending into the frontal lobe. She underwent a craniotomy for excision of the tumour at 28 weeks gestation because of the risk of irreversible blindness. Anesthetic management was tailored for pregnancy and an intracranial tumour. Intraoperative blood pressure was maintained within 10% of baseline and respiratory variables were stable. No fetal heart rate monitoring was used during the surgery, as there was no plan to perform an emergency Cesarean delivery even in the event of change in fetal monitoring. The aim was to treat the mother aggressively for any untoward events. She made a good neurological recovery after the procedure and had a spontaneous vaginal delivery at 40 weeks of gestation without any neonatal complications.

Conclusions: Anesthetic management of a brain tumour during pregnancy should be tailored to the individual patient according to the circumstances. It is possible to perform this type of procedure without fetal heart rate monitoring. The decision regarding fetal monitoring should be based on the consensus of the multidisciplinary care team and the mother.

Objectif : Illustrer la composante anesthésique d'une craniotomie pour méningiome suprasellaire chez une femme enceinte de 28 semaines et revoir ce qui justifie l'usage du monitoring fœtal peropératoire.

Éléments cliniques : Une femme de 33 ans a consulté à 28 semaines de grossesse pour une rapide détérioration de la vision à l'œil droit. Les examens neuroradiologiques ont révélé un important méningiome suprasellaire s'étendant dans le lobe frontal. Étant donné le risque de cécité irréversible, l'excision de la tumeur a été réalisée lors d'une craniotomie d'urgence. L'anesthésie a été planifiée en fonction de la grossesse et de la tumeur intracrânienne. La tension artérielle peropératoire a été maintenue dans les limites de 10 % des conditions initiales et les variables respiratoires ont été stables. Le monitoring peropératoire de la fréquence cardiaque fœtale n'a pas été utilisé, car on n'avait pas planifié de césarienne d'urgence, même dans l'éventualité de changement au monitoring fœtal. L'objectif était un traitement rigoureux de la mère quoiqu'il arrive. La récupération neurologique a été bonne et suivie d'un accouchement par voie vaginale à 40 semaines, sans complications néonatales.

Conclusion : Le programme anesthésique de l'excision d'une tumeur cérébrale pendant la grossesse doit s'adapter à la patiente et aux circonstances. On peut réaliser ce type d'opération sans le monitoring fœtal. Mais c'est une décision qui doit être fondée sur un consensus de l'équipe multidisciplinaire de soignants et de la mère.

From the Department of Anesthesia, The Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada.

Address correspondence to: Dr. Pirjo H. Manninen, Department of Anesthesia, The Toronto Western Hospital, 2 EC-046, 399 Bathurst Street, Toronto, Ontario M5T 2S8, Canada. Phone: 416-603-5118; Fax: 416-603-6494; E-mail: Pirjo.Manninen@uhn.on.ca

Accepted for publication October 10, 2003.

Revision accepted March 24, 2004.

THE anesthetic management of a patient with an intracranial tumour while pregnant presents a challenge, as it requires a balance of maternal safety and neonatal considerations. The overall frequency of non-obstetric surgery during pregnancy is generally considered to be low and surgery for intracranial brain tumours is rare.¹⁻⁵ When urgent surgery is required there is controversy as to the role and need for intraoperative fetal heart rate (FHR) monitoring. We present the management of a pregnant patient for craniotomy without the use of FHR monitoring.

Case report

A 33-yr-old woman, gravida 1 at 28 weeks of pregnancy, was referred to a neurologist with rapid onset of painless loss of vision in her right eye over five days. Prior to this, she had progressive deterioration of right eye vision over five to six weeks for which she did not seek medical attention. Her left eye vision was normal. She had no history of headaches, nausea, vomiting, hypertension, convulsions or any other neurological symptoms. Her past history was unremarkable and her pregnancy had been uneventful.

On examination, the patient's cardiovascular and respiratory systems were normal and body mass was 64 kg. Neurological examination was also normal except for her right eye. Right eye visual acuity was 20/400 and left eye 20/20. She had loss of vision in the entire right hemifield and lower left field of the right eye. Fundoscopic examination showed disc swelling in the right eye. On obstetrical examination, uterine height and obstetrical ultrasound were normal for dates.

Brain magnetic resonance imaging (MRI) showed a suprasellar meningioma extending centrally and boring into the right frontal lobe. Tumour size was 2 cm × 1.7 cm × 2.6 cm. Patient was started on dexamethasone 8 mg four times a day to reduce brain edema. Following consultations among the neurosurgeon, obstetrician, neonatologist, anesthesiologist, and the patient, a decision was made to perform a craniotomy for tumour resection under general anesthesia. Also after considering the pros and cons of fetal monitoring and with the mother's consent, it was decided not to perform intraoperative fetal monitoring. As well, no plans were made for emergency Cesarean delivery. Maternal optimization and resuscitation were considered the primary goal in the event of a crisis.

On the day of surgery, the patient received 30 mL sodium citrate half an hour prior to surgery as prophylaxis against aspiration. In the operating room, a wedge was placed under the right buttock to prevent

FIGURE The coronal section of a brain magnetic resonance image demonstrating suprasellar meningioma compressing the optic chiasma and boring into the right frontal lobe.

aortocaval compression. Initial monitoring included electrocardiogram, non-invasive blood pressure, pulse oximeter and capnography. A modified rapid sequence induction with cricoid pressure was carried out using *iv* fentanyl 100 µg, lidocaine 80 mg, thiopentone sodium 200 mg and succinylcholine 120 mg to facilitate endotracheal intubation. Anesthesia was maintained with 60% O₂ in air, isoflurane, intermittent fentanyl boluses and rocuronium. She received clindamycin 600 mg as an antimicrobial prophylaxis and dexamethasone 10 mg intravenously. Invasive monitoring included an intra-arterial catheter, central venous catheter in the right internal jugular vein, urinary catheter, esophageal temperature probe, peripheral nerve stimulation and somatosensory evoked potentials. Body temperature was kept normal with a warming blanket. Preoperative FHR monitoring had been performed with an ultrasound and was normal. Intraoperative FHR monitoring was not performed.

The surgical procedure was performed with the patient supine with 30° head up position. The MRI

based guidance was used for accurate localization of the tumour. The tumour arose predominantly from the jugum sphenoidal area extending into the diaphragma sella enveloping the optic chiasma and both optic nerves and burrowing into the right frontal lobe. The entire tumour was excised without any vascular or neural damage.

Intraoperative hemodynamic and respiratory variables were stable throughout the procedure with systolic blood pressure between 110 to 120 mmHg, heart rate 60 to 70 beats·min⁻¹, SpO₂ of 99%, ETCO₂ 30 to 35 mmHg, central venous pressure 10 to 12 mmHg and temperature 36 to 37°C. Arterial blood gases revealed pH 7.43, PaO₂ 260 mmHg, PaCO₂ 35 mmHg, HCO₃ 28 mEq·L⁻¹ and hemoglobin 116 g·L⁻¹. Blood glucose was checked every two hours and remained within normal limits. Estimated blood loss was 400 mL and intraoperative fluid administration consisted of 4000 mL crystalloid. The surgical procedure lasted for six hours. At the end of the procedure, *iv* dimenhydrinate 50 mg was administered for preventing postoperative nausea and vomiting. Neuromuscular blockade was reversed using neostigmine and glycopyrrolate. The patient was extubated fully awake and neurologically intact in the operating room and then transferred to the intensive care unit. Postoperative FHR monitoring was normal. She recovered without any complications and was discharged from the hospital after a week.

At the three week postoperative visit, the patient's vision had improved significantly, with right eye visual acuity at 20/30 and visual fields had returned to normal. She delivered a healthy baby weighing 3 kg with Apgar scores of 9 at one minute and 9 at five minutes, at 40 weeks of gestation by spontaneous vaginal delivery.

Discussion

Meningiomas are the most common primary intracranial neoplasms in the adult population, representing about 24% of all brain tumours. The occurrence of a meningioma during pregnancy is extremely rare. In a series of 126,413 pregnancies from 1983 to 1995, Isla *et al.* observed only seven women with a brain tumour and only two were meningiomas.¹ Surgery for a cerebellopontine angle meningioma in the sitting position at 25 weeks gestation has been described.³

The signs and symptoms of a meningioma may initially appear during the second or third trimester of pregnancy and then subside in the postpartum period. As with this patient, the most frequent symptoms of a brain tumour such as headache, visual disturbance, nausea and vomiting are often attributed to pregnancy itself and hence the diagnosis may be delayed. It is believed that the presence of hormone receptors, mainly progesterone

receptors are responsible for the worsening symptoms of meningioma.^{1,2,5} The fluctuations in the hormonal milieu of pregnancy as a result of increase in the blood volume, redistribution of body water between intracellular and extracellular fluid compartments and the influence of steroid hormones may increase the tumour size and peritumour edema.

Anesthetic considerations for surgery during pregnancy involve the safety of two patients, the mother and the fetus.⁶⁻⁸ Alterations in the maternal anatomy and physiology have clinical anesthetic implications and in addition an intracranial mass presents the problems of potential increased intracranial pressure (ICP) and preservation of cerebral perfusion. Rapid sequence induction has been advocated for all pregnant patients beyond 20 weeks gestation, but needs modification to decrease the stimulation of laryngoscopy and intubation with agents such as lidocaine when an intracranial mass is present. Controversy exists for the intraoperative management of ICP in a pregnant patient. Hyperventilation may adversely affect the fetus by reducing cardiac output due to reduced venous return, thus decreasing uterine blood flow, producing hypocapnic induced uterine/umbilical artery vasoconstriction, and by producing alkalosis induced shift of the O₂ - hemoglobin dissociation curve to the left, thus reducing O₂ delivery to the fetus.^{4,9} Animal and human studies suggest that the use of an osmotic diuretic, such as mannitol, may cause redistribution of water from the fetus to the mother leading to fetal hypovolemia and dehydration.⁷ Maternal hydration should be maintained to prevent fetal hypovolemia. Furosemide may be a better alternative to mannitol. The use of steroids in the pregnant neurosurgical patient has two effects; reduction of peritumoural edema and the acceleration of fetal lung maturity by increasing the production of surfactant.^{1,5} Hemodynamic stability is important for maintaining maternal cerebral perfusion as well as prevention of uterine hypoperfusion and fetal hypoxia.

Intraoperative fetal asphyxia may be caused by a number of events such as decreased uterine blood flow, maternal hypotension, hypoxia and depression of the fetal cardiovascular system from anesthetic agents.⁸ To prevent intraoperative fetal catastrophes, close monitoring of maternal blood pressure, intravascular volume and respiratory variables is essential. Since fetal distress would most likely occur because of maternal compromise, optimizing maternal conditions should be the first priority in such situations.

Continuous intraoperative as well as postoperative FHR monitoring has been advocated during maternal surgery after 16 weeks of gestation.^{6-8,10} This can be

achieved by using electronic fetal monitoring, Doppler, external abdominal ultrasound, transabdominal ultrasound transducer or even by a transesophageal echocardiography probe placed directly on the uterus. Technical problems such as obesity may limit the use of continuous fetal monitoring. However, there is considerable controversy to the usefulness of intraoperative FHR monitoring.^{10,11} Fetal heart variability, which typically is a good indicator of fetal well being, is present by 25 to 27 weeks' gestation. Maternal anesthesia may decrease the baseline FHR and beat-to-beat variability but does not usually cause spontaneous decelerations. Misinterpretations of FHR monitoring can lead to unsafe interventions.¹¹ Intraoperative FHR monitoring requires the presence of additional trained operating room personnel. In addition, there should be a plan regarding how to proceed in the event of persistent fetal distress, including whether to perform an emergency Cesarean delivery. Also intervention and therefore continued FHR monitoring will depend upon availability of appropriate personnel and facilities to care for a preterm infant. Many obstetricians feel that FHR monitoring during surgery is not useful because derangements in maternal physiologic variables can be assessed and treated without reference to FHR analysis.^{6,12} No fetal hypoxic mortality or morbidity has been documented without the occurrence of maternal hypoxic complication regardless of the use of FHR monitoring or whether alterations of the FHR occurred.¹⁰ In a survey from United States hospitals in 1995; it was found that only 60% of hospitals routinely used some form of fetal or uterine monitoring during maternal non-obstetric surgery.¹² With the patient presented here, it was the strong opinion of both the obstetrician and neonatologist that FHR monitoring was not of any benefit as there was no plan to intervene should a change in the FHR occur. The aim was to treat the mother aggressively for any untoward event. This issue was clearly discussed with the mother and she was agreeable to this plan of action.

The surgical options for this patient were to continue the pregnancy till term and operate after delivery while closely monitoring visual function and neurological status; to operate now with possible Cesarean delivery; or to operate now and continue the pregnancy till term. Fetal viability begins at 24 weeks of gestation but the neonatal outcome in terms of survival and long term neurological development improves with increasing gestational age. Every attempt is, usually, made to bring the fetus to term. Maternal morbidity and fetal loss increase when maternal disease is advanced. The patient had rapidly escalating symptoms with a risk of irreversible blind-

ness and a risk of increase in ICP due to intracranial extension of the tumour. Waiting until term may have increased the risks of emergency craniotomy and possibly a worse outcome for both the mother and the fetus. Hence it was decided to operate immediately without interrupting the pregnancy.

The management of a pregnant patient with a brain tumour must be individualized and the final decision should be based on the intracranial pathology, gestational age and the mother's wishes after full consultation with all members of the team. A multidisciplinary and cooperative approach of the neurosurgeon, anesthesiologist, obstetrician and neonatologist are required to ensure a successful outcome.

References

- 1 Isla A, Alvarez F, Gonzalez A, Garcia-Grande A, Perez-Alvarez M, Garcia-Blazquez M. Brain tumor and pregnancy. *Obstet Gynecol* 1997; 89: 19–23.
- 2 Ismail K, Coakham HB, Walters FJ. Intracranial meningioma with progesterone positive receptors presenting in late pregnancy. *Eur J Anaesthesiol* 1998; 15: 106–9.
- 3 Giannini A, Bricchi M. Posterior fossa surgery in the sitting position in a pregnant patient with cerebellopontine angle meningioma. *Br J Anaesth* 1999; 82: 941–4.
- 4 Beni-Adani L, Pomeranz S, Flores I, et al. Huge acoustic neurinomas presenting in the late stage of pregnancy. Treatment options and review of literature. *Acta Obstet Gynecol Scand* 2001; 80: 179–84.
- 5 Swensen R, Kirsch W. Brain neoplasms in women: a review. *Clin Obstet Gynecol* 2002; 45: 904–27.
- 6 Goodman S. Anesthesia for nonobstetric surgery in the pregnant patient. *Semin Perinatol* 2002; 26: 136–45.
- 7 Gianopoulos JG. Establishing the criteria for anesthesia and other precautions for surgery during pregnancy. *Surg Clin North Am* 1995; 75: 33–45.
- 8 Rosen MA. Management of anesthesia for the pregnant surgical patient. *Anesthesiology* 1999; 91: 1159–63.
- 9 Johnson MD, Zavisca FG. Intracranial and spinal cord lesions. In: Gambling DR, Douglas MJ (Eds). *Obstetric Anesthesia and Uncommon Disorders*. Pennsylvania: W.B. Saunders Inc.; 1998: 219–37.
- 10 Horrigan TJ, Villarreal R, Weinstein L. Are obstetrical personnel required for intraoperative fetal monitoring during nonobstetric surgery? *J Perinatol* 1999; 19: 124–6.
- 11 Immer-Bansi A, Immer FF, Henle S, Spörri S, Petersen-Felix S. Unnecessary emergency caesarean section due to silent CTG during anaesthesia? *Br J Anaesth* 2001; 87: 791–3.
- 12 Kendrick JM, Woodard CB, Cross SB. Surveyed use of fetal and uterine monitoring during maternal surgery. *AORN J* 1995; 62: 386–92.