CASE REPORTS

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Epidural Anesthesia for Cesarean Section in Patients with Hypertrophic Cardiomyopathy: A Report of Three Cases

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HYPERTROPHIC cardiomyopathy (HCM) is a genetically transmitted cardiac disease with a broad clinical and morphologic spectrum that is now recognized with increasing frequency.[1] Although the dynamic characteristics of this disease are influenced by ventricular volume and vascular resistance,[2] pregnancy and delivery are usually well tolerated in patients with HCM, and only sporadic cases of maternal mortality have been reported.[3–5]

In most cases, HCM patients had undergone vaginal delivery safely;[3,5] however, cesarean section may be carried out for cardiac or obstetric indications.[3,6,7] Anesthetic management has not been determined in these cases, but epidural anesthesia is relatively contraindicated because of vasodilation and reduction in central blood volume.

We report three consecutive patients with HCM who underwent cesarean section for cardiac indications, safely treated with epidural anesthesia.

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Case Reports

Case 1

A 25-yr-old woman, primigravida, presented at 37 weeks of gestation with a known diagnosis of HCM, which was diagnosed at age 20 yr after a presyncopal episode. At approximately 32 weeks of gestation the patient complained of dyspnea on mild exertion and palpitations. Echocardiographic examination demonstrated HCM features with a peak outflow gradient of 36 mmHg, left atrial enlargement, and mild mitral insufficiency. The patient was treated with oral propranolol and diuretics with some clinical benefit. Cesarean section was scheduled under epidural anesthesia at 37 weeks of gestation. Just before surgery the patient was asymptomatic; at physical examination arterial blood pressure was 100/60 mmHg, and heart rate was 85 beats/min. Before anesthesia a catheter was inserted into the right atrium *via* the right internal jugular vein for central venous pressure (CVP) monitoring; arterial blood pressure and oxygen saturation were monitored noninvasively. CVP was 8 cm H_2O in the supine position with left uterine displacement. An initial bolus of lactated Ringer's solution, 200 ml, was given *via* a peripheral 20-gauge intravenous catheter immediately before placing an epidural catheter through an 18-gauge Tuohy needle at the L3–L4 interspace, using the loss-of-resistance technique with the patient in the sitting position. The patient was then placed in the supine position with left uterine displacement to avoid hypotension by aortocaval compression. After a 2-ml test dose of lidocaine, 2%, fentanyl, 0.05 mg, was given through the epidural catheter, followed by lidocaine, 2%, in 4-ml increments over 20 min for a total volume of 16 ml (320 mg) lidocaine, when a sensory anesthesia level of T4–S5 was reached. The patient was breathing 35% O_2 *via* a face mask achieving 100% oxygen saturation. Intraoperative analgesia was excellent, and surgery proceeded uneventfully. A 2,570-g female infant was born with Apgar score of 8/9 at 1 and 5 min, respectively. Systemic arterial pressure remained stable at 95–100/60 mmHg; CVP ranged between 9 and 11 cm H_2O before fetus extraction, although an increase in CVP to 15 cm H_2O was observed 5 min after infusion of 5 U oxytocin. Total fluid administration during surgery was 1,500 ml of Ringer's lactate.

Case 2

A 40-yr-old woman, gravida 3, presented at 38 weeks of gestation with a diagnosis of HCM, which was made at age 31 yr. Two previous pregnancies with spontaneous vaginal delivery, at 28 and 33 yr, were well tolerated. At 10 weeks of gestation the patient

became symptomatic with dyspnea on mild exertion and palpitations; electrocardiographic Holter monitoring revealed three episodes of nonsustained ventricular tachycardia. The patient was then treated with sotalol and furosemide. On prepartum visit (37 weeks) the echocardiogram revealed a mild left ventricular (55 mm) and left atrial (45 mm) dilation. On admission in the operating room arterial blood pressure was 95/70 mmHg, and heart rate was 76 beats/min. The patient was breathing 35% O_2 *via* a face mask achieving 99% oxygen saturation. A 16-gauge peripheral intravenous catheter was placed in the right antecubital vein, and a central catheter was located in the right atrium *via* the right internal jugular vein. An epidural catheter was inserted through an 18-gauge Tuohy needle at the L3–L4 intervertebral space, detecting epidural space with a loss-of-resistance to saline injection technique. CVP was 8 cm H_2O preoperatively, and fluid administration was attempted carefully under CVP guide to avoid acute preload modifications. A sensory anesthesia level of T5–S5 was achieved with the administration of a 3-ml test dose and 15 ml lidocaine, 2%, in boluses of 5 ml every 5 min and fentanyl, 0.1 mg, in the epidural catheter. During the cesarean section the patient was hemodynamically stable; she received approximately 800 ml lactated Ringer's solution and 800 ml glucose, 5%, solution. A 2,970-g female infant was born with Apgar score of 8/9. After fetus extraction, the patient, although asymptomatic, became mildly hypotensive with blood pressure of 85/60 mmHg. Oxytocin was then administered in glucose, 5%, solution at 10 U/h.

Case 3

A 28-yr-old woman, primigravida, presented at 38 weeks of gestation, with HCM diagnosed at age 19 yr because of two episodes of syncope. At 37 weeks of gestation she complained of dyspnea on mild exertion; therapy with oxprenolol had been started 8 months before pregnancy. Echocardiogram showed a severe hypertrophy of the left ventricle involving the anterior (38 mm) and posterior septum (21 mm) and anterolateral free wall (20 mm). A slight anterior motion of the mitral valve was also present, without mitral leaflet–septal contact. On arrival in the operating room a catheter was inserted into the right atrium *via* the right internal jugular vein for CVP monitoring; management included monitoring of heart rate and arterial blood pressure by means of Dynamap (Datascope Accutor Plus, Paramus, NJ) and oxygen saturation by an arterial cannula. After an infusion of 500 ml lactated Ringer's solution and 100% oxygenation with Venturi mask, 35%, a 20-gauge epidural catheter was positioned at the L2–L3 interspace and tested with 3 ml of lidocaine, 2%. The patient was placed in the left lateral decubitus position and epidural fentanyl, 0.05 mg, was then administered. Subsequently ropivacaine, 7.5 mg/ml, was given through the epidural catheter in fractional doses for the next 16 min for a total dosage of 127.5 mg. Before the anesthetic block (S5–T4 sensory anesthesia level) a further dose of 500 ml lactated Ringer's solution was given under hemodynamic control to increase CVP from baseline level of 4 to 8 cm H_2O. After 25 min, cesarean section was started. During surgery a mild decrease in blood pressure from 115/75 to 97/66 mmHg was observed. A 2,860-g male baby was born with Apgar score of 8/9. After delivery, CVP increased to 15 cm H_2O after 20 U oxytocin administration. Oxygen saturation remained stable throughout the perioperative period.

Discussion

Physiologic changes that occur in patients with HCM during pregnancy, labor, and delivery have been reviewed by Kolibash[4] and more recently by Shah.[5] The hemodynamic state of HCM is strongly influenced by loading conditions, especially in patients with the obstructive form of the disease. A reduction of preload and afterload results in unfavorable hemodynamic changes (increase of outflow gradient and reduction of left ventricular filling). The pathophysiologic characteristics in pregnancy are a decrease in systemic vascular resistance and an increase in blood volume. In the late phases of pregnancy, aortocaval compression or major blood loss during labor and delivery may decrease preload drastically; moreover, pain and stress of delivery cause sympathetic stimulation, increasing heart rate and contractility and deteriorating the hemodynamic conditions of HCM. A review of HCM and pregnancy reported the experience on 67 pregnancies among 32 patients.[5] From these data, pregnancy was well tolerated in the majority of patients. Cesarean section was carried out for cardiac or obstetric indications in 11 of 56 patients. Information is not available regarding the type of anesthesia used for the cesarean section. General anesthesia is recommended in a review of noncardiac surgery in HCM.[8] Specialized literature reported two cases of cesarean section with systemic anesthesia.[6,7] Regional anesthesia is considered to be dangerous in these patients, especially in those with obstructive HCM:[3,6,9–11] vasodilation associated with sympathetic blockade of the lower extremities may lead to a critical reduction of preload and afterload. Nonetheless, epidural anesthesia alone[12] or combined with spinal anesthesia[13] has been used safely for vaginal delivery in patients with HCM. Our report indicates that cesarean section also may be managed safely with epidural anesthesia in patients with HCM, by using CVP monitoring and maintaining euvolemia or slight hypervolemia. Hypotension can be avoided using drug titration under preload and afterload monitoring. This allows only slight hemodynamic changes that, if necessary, can be adjusted with fluid balance. None of our three cases required the use of vasoconstrictors for hypotension. In a patient with hypotension unresponsive to fluid administration, phenylephrine could be preferred to increase afterload because of its shorter duration of action. Concerning the regional anesthetic to be used to induce the central neuraxial block, we believe that

currently ropivacaine should be considered the drug of choice because it has lower cardiotoxicity than bupivacaine and a longer onset time of block than lidocaine—the longer the onset time of block, the milder the effects on cardiovascular hemodynamics. As for oxytocin, it must be administered carefully because of its vasodilation properties (and compensatory tachycardia) and the abrupt inflow of a large amount of blood into the systemic circulation (central blood volume increase of 10–25%) as a consequence of uterine contraction that can adversely affect cardiac performance.

A retrospective analysis of Hawkins,[14] carried out in the United States from 1979 to 1990, showed that most maternal deaths resulting from anesthesia-related complications occurred during general anesthesia for cesarean section. Moreover, the case-to-fatality risk ratio for general anesthesia had increased to 16.7 times that for regional anesthesia. The importance of using regional anesthesia has therefore been emphasized. Epidural anesthesia, carefully titrated and with cardiovascular monitoring, can be safe and effective, without fetal exposure to depressant drugs and neonatal depression. As known, HCM has heterogeneous clinical and morphologic aspects, and only limited experience on the treatment of HCM parturients, including our small series, is available in the literature. Nevertheless, taking into account improvements in technique, we believe that epidural anesthesia should be considered first in these patients scheduled for elective cesarean section.

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