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Epidural Anesthesia for Vaginal Delivery in a Patient with Idiopathic Hypertrophic Subaortic Stenosis

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Idiopathic hypertrophic subaortic stenosis (IHSS) is a cardiomyopathy characterized by intermittent obstruction to left ventricular outflow secondary to asymmetric hypertrophy of the ventricular septum. This condition is also known as asymmetric septal hypertrophy (ASH) and hypertrophic obstructive cardiomyopathy (HOCM). Associated findings include abnormal stiffness of the left ventricule, elevation of left ventricular end-diastolic pressure, elevated left atrial, pulmonary venous and pulmonary capillary pressures, and hypercontractility of the left ventricle. There have been several reports of experience with IHSS in obstetric patients.[1–5] These have dealt primarily with the obstetric management, and have few comments concerning the anesthetic management of these patients. Following our recent experience, Boccio *et al.*[6] described the anesthetic management of an emergent cesarean delivery for a patient with IHSS. We describe the use of epidural anesthesia for relief of the pain of labor and delivery in a patient with IHSS.

REPORT OF A CASE

An 18-yr-old woman, gravida 2, para 0, ab 1, was referred to our outpatient prenatal clinic at approximately 31 weeks gestation with the diagnosis of severe IHSS for evaluation and planning of her labor and delivery process.

This patient had a heart murmur at 2–3 yr of age. No further cardiologic evaluation was done at that time. She remained asymptomatic until approximately 3 yr prior to admission, when she developed vertigo and syncope during strenuous exercise. Following a spontaneous abortion in January, 1986, she underwent a thorough cardiologic evaluation. Electrocardiogram suggested left ventricular hypertrophy and left atrial abnormality. Echocardiogram demonstrated markedly thickened interventricular septum, systolic anterior motion of mitral valve, and markedly dilated left atrium. Cardiac catheterization demonstrated a small, hyperkinetic left ventricle, and midseptal obliteration with the anterior mitral valve leaflet. There was no gradient noted between left ventricle and aorta at rest. However, Valsalva maneuver resulted in a 35-mmHg gradient, and inhalation of amyl nitrate resulted in a 75-mmHg gradient. Pulmonary capillary wedge pressure (PCWP) was 19 mmHg, with a prominent A-wave. Right ventricular function was noted to be normal. She was treated with propranolol p.o. following this evaluation with improvement of symptoms.

Her past medical history was otherwise unremarkable.

This pregnancy was diagnosed in April, 1986 (LMP 2/15/86), at which time she discontinued taking propranolol, without consultation with her physicians. Symptomatically, she improved during pregnancy, and noted no episodes of syncope or near-syncope, palpitations, or chest discomfort prior to referral. She was referred at 31 weeks gestation for planning management of her labor and delivery process. Repeat echocardiography at this time demonstrated IHSS with evidence of outflow obstruction and a dilated left atrium. Approximately 48 h after her outpatient evaluation, she began premature labor, which was readily controlled with an infusion of magnesium sulfate. She was discharged to home, and received no tocolytic agents 4 days after admission.

She was readmitted at approximately 36 weeks gestation with contractions occurring every 8–10 min, which were unresponsive to iv magnesium sulfate infusion. Amniocentesis performed 24 h prior to onset of contractions revealed on L/S ratio of 4.4. Following observation for 24 h with continued contractions every 8–10 min without cervical change, a plan for elective oxytocin induction was formulated.

Physical examination revealed an 18-yr-old, 162 cm, 60 kg woman with vital signs of BP 115/70 mmHg, HR 85/min, RR 24/min. Her lungs were clear to auscultation. Her heart examination revealed a harsh IV/VI holosystolic crescendo-decrescendo murmur heard at the lower left sternal border. There was no peripheral edema noted.

Management of anesthesia for her labor and delivery process included cardiovascular monitoring of ECG, PA, and arterial pressures continuously, followed by early institution of epidural anesthesia (during latent phase of labor) using bupivacaine 0.125% with fentanyl 5 μg/ml of local anesthetic. This combination was administered in fractional doses (total of 10 ml) to provide adequate analgesia. The patient was maintained in the lateral position throughout labor. An initial iv bolus of lactated Ringer's solution, 200 ml, was given immediately prior to institution of epidural blockade. Crystalloids were then given iv at 50 ml/h, with boluses given as necessary to maintain pulmonary artery diastolic pressures in the range of 17–20 mmHg. This range was selected as this seemed to provide optimal cardiac output and blood pressure. She received a total of approximately 650 ml of crystalloid prior to delivery of the infant. Perineal anesthesia was obtained using bupivacaine 0.25% 10 ml total in incremental doses with the patient placed in 60° head-up position. The perineal dose was administered when cervical dilatation was 9 cm. After adequate perineal anesthesia and complete cervical dilatation were achieved, a low forceps vaginal delivery was performed. The patient was very comfortable throughout labor and delivery. A male infant weighing 2140 gm with Apgar scores of 8/8 at 1 and 5 min, respectively, was delivered. The patient had an uneventful post-partum period with observation in ICU for 18 h, and was discharged home on post-partum day 3.

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TABLE 1. Measured and Calculated Cardiovascular Variables

	(1)	(2)	(3)	(4)	(5)	(6)
TIME	2000	0745	1100	1300	1515	0600
HR	90	80	88	90	88	76
BP (mmHg)	100/50	114/60	104/61	107/62	107/64	94/59
CVP (mmHg)	6	2	6	4	4	4
PAP (mmHg)	45/27	38/18	35/21	35/19	46/21	41/17
PCWP (mmHg)	25	17	19	17	24	20
CI (l/min/m^2)	2.91	3.13	3.68	3.85	3.90	3.48
SVRI (dyn·s·cm^{-5})	1676	1942	1456	1516	1426	1450

(1) Pre-labor (evening prior to oxytocin induction); (2) Latent phase; (3) Early active phase; (4) Late active phase; (5) Post-partum, 1 h; (6) Post-partum, 16 h. HR = heart rate; BP = blood pressure; CVP = central venous pressure; PAP = pulmonary arterial pressure; PCWP = pulmonary capillary wedge pressure; CI = cardiac index; SVRI = systemic vascular resistance index. NOTE: Epidural anesthesia was instituted at 0755, using bupivacaine 0.125% with fentanyl 5 mcg/ml (10 ml) with level of T_{10} obtained; top-up doses (10 ml each) of this combination were given at 1020 (T_8 level) and 1235 (T_8 level). A perineal dose of bupivacaine 0.25% (10 ml) was given at 1345 (T_{10} level). Delivery of infant occurred at 1413.

Table 1 provides a summary of measured and calculated cardiovascular variables and anesthetic interventions during the peripartum period. It should be noted that delivery occurred approximately 7.5 h after initiation of the oxytocin infusion. The patient required re-injection with local anesthetic/narcotic combination approximately every 140 min (total of three doses bupivacaine 0.125% 10 ml with fentanyl 50 mcg). Anesthesia was rated as excellent by the patient, and she experienced minimal abdominal or lower extremity muscle weakness.

DISCUSSION

The cardiovascular changes which accompany pregnancy (*e.g.*, increased blood volume, decreased systemic vascular resistance, increased heart rate) may have a variable effect on the symptom complex of patients with IHSS. Therefore, these patients may note either worsening, improvement, or no change[2-5] of their symptoms during pregnancy. In addition to these normal physiologic alterations, the effect of stress or pain with resultant catecholamine release or various anesthetic techniques may unfavorably alter the various factors determining outflow obstruction.

The mainstay of medical therapy for patients with IHSS has been propranolol. Several authors[2,3,5,7] recommend maintaining propranolol therapy throughout pregnancy, and using iv supplementation with propranolol during labor to block the effects of catecholamine release. Calcium channel blockers are also used for the treatment of IHSS.

When confronted with this patient, a review of the literature revealed a disappointingly small amount of information regarding the anesthetic management of the labor and delivery process in the pregnant patient with IHSS. The recommendations of three standard obstetric anesthesia texts[8,9,10] include the use of parenteral narcotics, paracervical and pudendal blocks, and avoidance of spinal and epidural anesthesia. The first two texts cite the experience of Loubser *et al.*[11] involving the use of spinal anesthesia in a nonpregnant elderly woman for hip surgery in their recommendation for avoidance of major conduction anesthesia during labor.

Various options for the anesthetic management of the labor and delivery process include the use of parenteral narcotics for the first step of labor with pudendal block for the second stage, intrathecal narcotics, and continuous epidural anesthesia using local anesthetic, narcotic, or local anesthetic/narcotic combination. The use of intrathecal narcotics for relief of pain in labor has been described by Abboud *et al.*[12] However, use of intrathecal narcotics has the disadvantage of limited duration and the need for repeat lumbar puncture if labor outlasts analgesia. Writer *et al.*[13] found that epidural morphine alone did not provide adequate relief for pain for labor. However, Cohen *et al.*[14] demonstrated a more prolonged and intense analgesia with the use of a combination of epidural bupivacaine and fentanyl.

In consideration of the unfavorable effect of catecholamine release with pain and stress in this patient who had not previously received beta adrenergic blockers, it was felt that a segmental continuous epidural anesthetic utilizing dilute concentration of bupivacaine and fentanyl would provide an acceptable anesthetic technique. The extensive cardiovascular monitoring was undertaken secondary to the documented severity of disease in this patient, as well as the expected sympathetic blockade with even a segmental technique. The use of a continuous epidural anesthetic technique, administered in small fractional doses, allowed for control of anesthetic level and slower onset of sympathetic blockade than spinal anesthesia. Cardiovascular parameters were closely observed, and preload maintained to prevent worsening of outflow obstruction, using systemic blood pressure and cardiac output to assess status. Possible hazards with the use of epidural anesthesia in this patient include decreased systemic vascular resistance and venous return with resultant left ventricular

hypovolemia and hypotension. Maintenance of preload was our primary means of preventing hypotension. However, if she had developed hypotension, we would have initially increased preload with additional iv crystalloids. Had this not proved sufficient, we would have used an alpha-adrenergic agonist, *i.e.*, phenylephrine, in doses sufficient to maintain arterial blood pressure at a satisfactory level. We were aware that these agents have been demonstrated in several animal models to cause uterine artery vasoconstriction and possible adverse fetal effects. However, the use of beta-adrenergic agonists with the resultant increased inotropic and chronotropic effects in this patient would pose a significant risk of increasing outflow obstruction and decreasing cardiac output further, with potential adverse effects for both mother and fetus. It is important to re-emphasize that, in this patient, the prevention of hypotension, whether or not epidural anesthesia were employed, by maintenance of preload with crystalloids was our primary goal. Only if this were not sufficient would vasopressors have been utilized.

An appropriate question to consider at this time is what technique would we have used had the patient required cesarean section? Boccio *et al.*[6] utilized general anesthesia for an emergent abdominal delivery, although that paper had not been published when we encountered our patient. Our plan, if abdominal delivery were required for a non-emergent delivery, was to gradually raise the level of anesthesia in our patient with a more concentrated solution of bupivacaine until surgical anesthesia was obtained, while continuing to infuse crystalloids to maintain preload and using left uterine displacement or lateral position to maintain venous return. If any deterioration in cardiovascular parameters had occurred, which were not responsive to fluids and vasopressors, *i.e.*, increased heart rate, decreased arterial blood pressure, increased PCWP, we would have induced general anesthesia using low doses of halothane as our maintenance agent and smaller, more rapid tidal volumes to prevent decreased venous return. In the case of an emergent cesarean delivery, we would have opted for general anesthesia rather than attempt increasing the epidural level.

In conclusion, spinal anesthesia should probably be avoided in patients with IHSS because of the inability to titrate the anesthetic level to effect without excessive sympathetic blockade. Administration of epidural anesthesia with dilute concentrations of local anesthetic, and narcotic with appropriate cardiovascular monitoring, proved a viable alternative for anesthetic management of the pain of labor in this patient with IHSS.

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