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Epidural Anesthesia for Cesarean Delivery in a Patient With Severe Pulmonary Artery Hypertension and a Right-to-Left Shunt

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ABSTRACT

A 38-year-old woman with severe pulmonary artery hypertension and a right-to-left shunt of unknown etiology presented at 32 weeks' gestational age. Determination of the cause of her pulmonary hypertension by transesophageal echocardiography was delayed until after delivery secondary to anesthetic risk. She was successfully anesthetized for cesarean delivery using epidural anesthesia. Systemic vascular resistance was maintained using phenylephrine hydrochloride before delivery and vasopressin after delivery. Transesophageal echocardiography after delivery revealed a patent foramen ovale, indicating a diagnosis of idiopathic pulmonary artery hypertension and a very poor prognosis. Differentiating between Eisenmenger syndrome and idiopathic pulmonary artery hypertension may not be important for determining the optimal anesthetic management of patients with pulmonary hypertension but is important in assessing long-term prognosis.

INTRODUCTION

Idiopathic pulmonary artery hypertension (IPAH) and Eisenmenger syndrome (ES) are progressive diseases associated with a maternal mortality of 30% to 40%.[1,2] In ES, a left-to-right shunt through a congenital heart defect causes pulmonary hypertension, with eventual reversal of shunt flow. IPAH is diagnosed when the mean pulmonary artery pressures exceed 25 mmHg at rest without demonstrable cause. A right-to-left shunt may also develop in IPAH if increased right heart pressures cause right atrial pressures to exceed left atrial pressures, causing a patent foramen ovale (PFO) to open. Both ES and IPAH may be associated with severe hypoxia. Transesophageal echocardiography (TEE) can differentiate the two, as visualization of a PFO indicates IPAH. However, this procedure often requires significant sedation, which involves risk to the mother and fetus. We report the successful use of epidural anesthesia for cesarean delivery in a parturient presenting with severe pulmonary hypertension and hypoxemia due to a right-to-left shunt. To determine the etiology, TEE was not performed until after delivery.

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CASE

At 32 weeks' gestational age, a 38-year-old gravida 6, para 5 Spanish-speaking woman presented to the emergency department with shortness of breath and fatigue for the past 3 years that had worsened during the past 3 months. She had received no prenatal care. The onset of symptoms at rest prompted her to seek medical treatment. She had 5 previous vaginal deliveries, the last 7 years earlier. Her arterial oxygen saturation was 91% on room air, her lungs were clear to auscultation, and she had bilateral pedal edema. A chest radiograph (Figure) showed cardiac prominence, a prominent pulmonary outflow tract, and pulmonary vascular congestion.

The patient's oxygen saturation improved to 94% with 3 L/min of supplemental oxygen by nasal cannula. Lower extremity Doppler evaluation and computed tomography of the chest were negative for deep vein thrombosis and pulmonary embolism, and myocardial enzymes were negative. Transthoracic echocardiography at 32 weeks' gestation revealed severe pulmonary artery hypertension, a mildly dilated and thickened right ventricle, normal right ventricular systolic function, and a right-to-left atrial shunt. The study was technically difficult, with suboptimal views, and it was impossible to determine whether the atrial shunt was through a congenital heart defect (indicating a diagnosis of ES) or via a newly opened PFO (indicating a diagnosis of IPAH). TEE was not

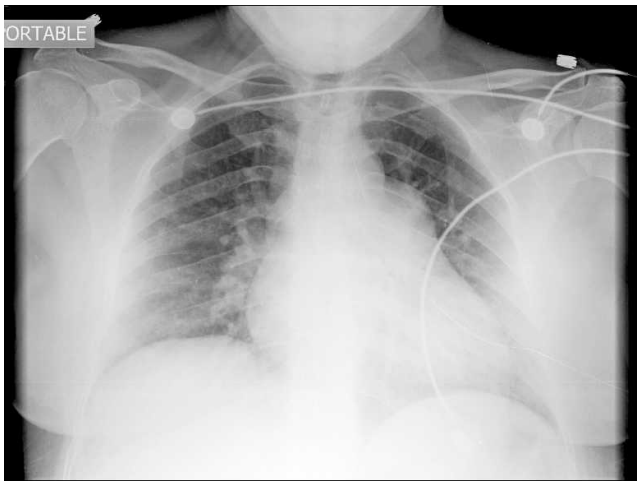

Figure. Chest radiograph showing cardiac prominence, a prominent pulmonary outflow tract, and pulmonary vascular congestion.

performed before delivery at 34 weeks' gestation because of the risks of anesthesia for the procedure.

The patient began receiving furosemide, and her shortness of breath improved. A pulmonary artery catheter placed under fluoroscopy in the intensive care unit revealed a pulmonary artery pressure of 71/34 mmHg, with a pulmonary capillary wedge pressure of 8 mmHg. A nitric oxide challenge test showed that the patient was nonreactive. Epoprostenol sodium (an intravenous prostacyclin) was initiated and was increased to 5 ng/kg of body weight per minute. The pulmonary artery catheter was removed, and the patient received heparin while awaiting delivery. The obstetricians considered inducing labor, but because of an unfavorable cervix, the decision was made to proceed with a cesarean delivery at 34 weeks' gestational age. The patient also requested a bilateral tubal ligation. Heparin was discontinued the night before the procedure.

With a Spanish interpreter at the bedside, the patient was taken to the operating room. Epoprostenol was continued throughout the cesarean delivery. After administering aspiration prophylaxis and antibiotics, an epidural catheter was placed. A radial arterial line was inserted, and a right internal jugular central venous line was placed with ultrasonographic guidance. Air filters (Ultrasite Filtered Extension Set; Braun, Melsungen, Germany) were connected to all intravenous catheters. The patient was positioned supine with left uterine displacement. A T4 level of anesthesia was achieved using titrated doses of 2% lidocaine with epinephrine and fentanyl citrate (100 μg) epidurally. As the epidural medication took effect, the patient began to develop systemic hypotension. Maintenance of systemic blood pressure was accomplished using phenylephrine boluses before delivery. A viable infant was delivered. After delivery, a vasopressin infusion was started to maintain systemic blood pressure. Oxytocin was infused and was discontinued as soon as adequate uterine tone was achieved. The patient's oxygen saturations were maintained throughout the procedure on 3 L of oxygen by nasal cannula.

After surgery, the patient was transferred to the cardiac intensive care unit. Epidural morphine sulfate, a hydromorphone hydrochloride patient-controlled analgesia pump, and bilateral transversus abdominis plane blocks were used for postoperative analgesia. The patient was easily weaned off of the vasopressin infusion. Before discharge, TEE performed after intravenous sedation showed clear evidence of a right-to-left shunt through a PFO, indicating IPAH. The patient was informed of her poor prognosis. She was weaned off of epoprostenol and oxygen. Thirteen days after delivery, she could ambulate short distances without shortness of breath and was discharged with plans for outpatient follow-up.

Six weeks after discharge, the patient presented to the emergency department with shortness of breath. She was admitted and intubated because of respiratory failure. After a prolonged intensive care unit stay, she was extubated and discharged home with hospice care. Six months after delivery, she was admitted to the hospital again with evidence of a cerebral vascular accident and severe hypoxemia, had a cardiac arrest, and died shortly thereafter.

DISCUSSION

Severe pulmonary hypertension is associated with a high maternal mortality rate. This case is unique because the condition was not recognized until 32 weeks' gestational age and the etiology was unknown. Anesthesia for TEE during the third trimester of pregnancy involves risk to the parturient and the fetus. Typically, deep sedation is required to maintain patient comfort during TEE. Patients in the third trimester of pregnancy are at higher risk of regurgitation of gastric contents and aspiration due to decreased lower esophageal sphincter tone and distortion of gastric anatomy. Difficult mask ventilation and problematic intubations are more frequently encountered in pregnant patients because of capillary engorgement of the respiratory mucosa. Also, decreased functional residual capacity and increased oxygen consumption may result in the rapid development of hypoxemia during periods of hypoventilation in parturients. However, inadequate anesthesia in this patient might have led to acute worsening of her pulmonary hypertension. Considering the risks of anesthesia in this patient and the fact that determining the etiology of her pulmonary

hypertension would not affect its management, TEE was deferred until after delivery.

Scheduled cesarean delivery avoided a possible difficult induction of labor. Also, delivery in a controlled setting with appropriate monitoring and care delivered by a team familiar with the patient's history was ensured. Scheduling her delivery also allowed an interpreter to be present to improve communication with the patient.

Epoprostenol, an intravenous prostacyclin, has been used for the management of pulmonary hypertension in the United States since 1995. It is a potent vasodilator that produces relaxation of vascular smooth muscle by inducing the production of cyclic adenosine monophosphate.[3] Its successful use in pregnancy with positive outcomes is reported in the literature, but no randomized trial data are available.[4] This drug has a very short half-life (3 minutes) and is effective only through continuous administration, a property that makes it suitable for use in the perioperative period.[5]

Epidural anesthesia may cause less cardiopulmonary compromise in patients with pulmonary hypertension than general or spinal anesthesia. General anesthesia was avoided because of the parturient's heightened risk of aspiration and the risk of rapid changes in systemic vascular resistance and increased pulmonary vascular resistance with a rapid-sequence intubation. Positive pressure ventilation may decrease venous return and increase pulmonary vascular resistance. Spinal anesthesia was avoided because of the risk of a rapid sympathectomy and sudden decrease in the systemic vascular resistance.

Vigilant monitoring by the anesthesiologist is necessary to ensure adequate treatment of hypotension. Systemic hypotension may increase the degree of shunting and worsen hypoxia. Vasopressin, a nonadrenergic systemic vasoconstrictor with possible pulmonary vasodilating properties, may have advantages over other vasopressors for the treatment of hypotension after delivery in patients with pulmonary artery hypertension, as it may have differential effects on pulmonary and systemic circulations.[6] It is a potent uterine vasoconstrictor and therefore was not used before delivery, but the increase in uterine tone after delivery of the infant is beneficial. Using the lowest dose of oxytocin that is necessary to provide adequate uterine tone also minimizes hypotension.

Reducing the risk of embolization is also important with a right-to-left shunt. Because of the patient's increased risk of thrombosis and the potential devastating effects of a pulmonary embolism, she received heparin and the pulmonary artery catheter was removed while she awaited surgery. In the operating room, air filters were used on all intravenous drips to minimize the risk of air embolism. Removing the filters might have been necessary if hemorrhage had occurred and the patient required a high rate of fluid administration for resuscitation, as the filters significantly increase intravenous line resistance.

Postoperative pain control was also an important aspect of care to avoid increases in pulmonary hypertension. A transversus abdominis plane block was used in conjunction with epidural morphine and intravenous narcotics, as these blocks decrease pain and reduce narcotic requirements after cesarean delivery.[7]

Although maternal mortality rates associated with ES and IPAH are estimated to be similar, IPAH is associated with a much poorer long-term prognosis than ES, possibly because of preserved right ventricular function with ES.[8] As previously mentioned, TEE results were not expected to change the anesthetic management; therefore, this procedure was delayed until after delivery. It was performed before the patient's discharge mainly to determine her prognosis.

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