A Pregnant Woman With Severe Pulmonary Hypertension Due to an Atrial Septal Defect That Was Triggered by Pregnancy

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Abstract

Background: Pregnancy is contraindicated in patients with pulmonary hypertension (PH). Here, we report a case of a pregnant woman with severe PH due to an atrial septal defect (ASD) that was triggered by pregnancy.

Case Presentation: A 27-year-old woman with gravida 3 and para 2 presented with dyspnea in the fifth or sixth month of pregnancy, which gradually worsened. At 35+4 weeks of gestation, echocardiography revealed a transtricuspid pressure gradient (TRPG) of 120 mmHg, a sign of right heart failure; thus, she was diagnosed with severe PH. Because it was unsafe to continue pregnancy, an elective cesarean section was performed at 35+6 weeks under general anesthesia. A female infant weighing 1880 g was delivered; her Apgar scores were 8 and 9 after 1 and 5 minutes, respectively. Intraoperative transesophageal echocardiography revealed an ASD in the mother's heart, a possible cause of PH. After the delivery, the mother was treated with an epoprostenol infusion via Hickman line, which was continued, along with home oxygen therapy, after she was discharged from the hospital. Nine months later, she underwent transcatheter closure for the ASD and her PH resolved.

Conclusion: In pregnant patients with PH, the baby should be delivered at the appropriate time to relieve the pressure on the patient's hemodynamics. This should be followed by strict circulation management including the requisite medical and surgical interventions to restore cardiac function.

Introduction

Pulmonary hypertension (PH) is a condition when the mean pulmonary arterial pressure (PAP) at rest is higher than 25 mmHg. Some causes of PH include pulmonary veno-occlusive disease, left heart disease, lung disease, and hypoxia [1, 2]. Currently, prognosis for pregnant women with PH is improving due to the development of new treatment methods. However, as per the 2015 ESC/ERS guidelines for the diagnosis and treatment of PH [3], pregnancy is contraindicated for PH patients. In some cases, PH may not be identified until the pregnancy leads to manifestation or exacerbation of symptoms such as fainting or dyspnea. Such cases should be managed under the supervision of a multidisciplinary medical team for perinatal and circulation management.

In this article, we report a case of a pregnant woman with PH due to an atrial septal defect (ASD) and became severe triggered by pregnancy.

Case Report

The patient was a 27-year-old woman, with gravida 3 and para 2. She had no history of pregnancy complications. Her first child was delivered via cesarean section due to cephalopelvic disproportion, and the second child was delivered via vaginal birth after cesarean section. However, during her third pregnancy, she presented with dyspnea at around 5 or 6 months of pregnancy. At 35+4 weeks of gestation, her dyspnea worsened, and her oxygen saturation fell to 80%. Echocardiography revealed an

elevated transtricuspid pressure gradient (TRPG) of 120 mmHg, a sign of right heart failure. Consequently, she was diagnosed with severe PH. At 35+5 weeks of gestation, she was transferred to the intensive care unit (ICU) in our hospital for circulation management. Her cervical examination results on admission were as follows: dilatation, 3 cm; effacement, 50%; station, -3; cervical consistency, medium; and position of cervix, posterior, correlating to a Bishop score of 4. Despite the estimated fetal weight being only 1992 g (-1.6 standard deviation [SD]), which indicated fetal growth restriction, the fetus's condition appeared normal. Cardiac investigations further confirmed right heart failure as echocardiogram revealed a TRPG of 90 mmHg, and right heart catheterization showed an elevated PAP of 89/39 mmHg (mean PAP, 58 mmHg). Blood biochemistry investigations showed that brain natriuretic peptide (BNP) was elevated at 89.7 pg/mL, which is a strong indicator of heart failure. Chest computed tomography showed an enlarged pulmonary arterial trunk; however, no obvious thrombus was detected. Thus, pulmonary thromboembolism was ruled out. Next, dobutamine and nitric oxide (NO) were administered to manage PH. To relieve pressure from the PH and prevent patient mortality, urgent delivery of the baby was deemed necessary, and we had a joint conference about mode and timing of delivery and anesthesia method in the Departments of Anesthesiology, Cardiology, Cardiovascular Surgery, and Obstetrics and Gynecology. At 35+6 weeks of pregnancy, an elective cesarean section and bilateral tubal ligation were performed under general anesthesia. During the surgery, a percutaneous cardiopulmonary support system with sheaths inserted into the femoral artery and femoral vein was kept ready, should the need arise for a cardiopulmonary bypass. A female infant weighing 1880 g was born with an Apgar score of 8 and 9 after 1 and 5 minutes, respectively. The pH of the umbilical artery blood was 7.36. Intraoperative trans esophageal echocardiography revealed an ASD with bidirectional shunt; thus, the mother was diagnosed with ASD, which was the original cause of PH that became severe with pregnancy. The cesarean section was completed without any major complications. Immediately after the surgery, prostaglandin I2 (PGI2) administration was started. Additionally, phosphodiesterase 5 (PDE5) inhibitors and endothelin (ET) receptor antagonists were administered from postoperative days 5 and 8, respectively. Consequently, her mean PAP gradually decreased (Fig. 1). After delivery, she remained in the ICU for 12 days. Continuous administration of PGI2 and weaning slowed the uterine recovery. However, the rest of the postpartum recovery was uneventful. On postoperative day 29, the patient's mean PAP improved to 32 mmHg (Fig. 1), and she was discharged on postoperative day 38. Upon discharge, the PGI2 infusion was continued via a Hickman line and the patient received home oxygen therapy (HOT). Nine months after the cesarean section, the patient underwent transcatheter closure of ASD. Currently, she is on PDE5 inhibitor and ET receptor antagonist therapy and in a stable condition. The PGI2 and HOT were discontinued post ASD closure. The baby was admitted to a neonatal intensive care unit as she was born preterm with a low birth weight. The baby was discharged at 1 month of age, with good weight gain and normal neurodevelopment.

Discussion

In recent years, the mortality rate among pregnant women with PH has been considerably high, at approximately 25% [4, 5]. Even in patients who receive targeted therapy against PH, the mortality rate is

still approximately 16% [4, 5]. Moreover, the mortality rate in pregnant women with severe PH who develop Eisenmenger syndrome is very high, ranging from 40–50% in one study [6] and 23% in another [5]. PH during pregnancy is reported to worsen between the 20th and 24th weeks of gestation [7]; the mortality rate is the highest during puerperium, the week immediately following delivery [4, 8].

During pregnancy, the circulating plasma volume increases and is approximately 50% greater than that in the non-pregnant state [9]. Additionally, in pregnancy, cardiac output is 30–50% higher [10], and systemic vascular resistance is reduced by up to 40% due to the vasodilating effects of estrogen and progesterone and the formation of the placental circulation [11]. However, in pregnant women with PH, pulmonary vasodilatory capacity is reduced [12]; therefore, mean PAP and pulmonary vascular resistance (PVR) increase significantly. Consequently, the right ventricle cannot handle the afterload, resulting in right heart failure.

A pregnant woman with PH may become hypoxemic, which may affect fetal development. In Eisenmenger syndrome, preterm labor (50–64%) and fetal growth failure (37–50%) are highly prevalent [13, 14]. In the current case, the birth weight of the newborn was 1880 g (-1.7 SD), which is low for her gestational age.

Patients with PH are generally advised not to get pregnant. However, there are cases when the disease becomes apparent only during the pregnancy, such as the discovery of a left-right shunt due to an ASD. Even when the disease severity is high, the pregnancy and childbirth are often completed without any major complications. Additionally, the probability of complications from PH is low, i.e., less than 10% [15]. In the current case, the patient did not experience complications until her third pregnancy. The previous two deliveries were asymptomatic, and ASD was not detected. However, as per electrocardiogram findings, she had some strain in the right side of her heart at the time of her first delivery. This suggests that pulmonary artery remodeling due to PH may have occurred during the first pregnancy. The shunt blood flow may have increased after two pregnancies, and this pregnancy may have pushed the symptoms further.

The optimal timing of delivery in pregnant women with PH is still uncertain; therefore, it is important to weigh the risk of continuing the pregnancy against the risk of premature birth of the newborn. If a pregnant woman with PH is stable, planned delivery at 34–36 weeks is recommended; however, if a patient is unstable, the baby should be delivered at 32–34 weeks [16, 17]. The method of delivery needs to be evaluated on a case-by-case basis. Although vaginal delivery is not contraindicated with Eisenmenger syndrome, early cesarean section is recommended in cases with deterioration of maternal or fetal health [18].

In vaginal delivery, frequent use of the Valsalva maneuver may decrease venous perfusion due to increased intrathoracic pressure. Additionally, decreased venous perfusion due to vagal reflex caused by labor pain and increased heart rate due to sympathetic nervous system stimulation may lead to labor-induced acidosis, hypercarbonate plasma, hypoxemia, and increased pulmonary artery pressure. Effective epidural analgesia should be used [7]. After delivery, there may be rapid autotransfusion from the uterus

and increased venous perfusion due to the release of inferior vena cava obstruction. Therefore, vaginal delivery is hemodynamically unstable and requires careful blood pressure control. In addition, oxytocin can cause hypotension and tachycardia; therefore, it should be administered slowly [16]. In pregnant women with PH, the possibility of preterm labor is high due to deterioration of maternal hemodynamics; therefore, cesarean section is often the choice.

In elective cesarean delivery, pregnant women with PH can avoid labor pain and autotransfusion associated with uterine contractions. The cesarean section is performed under anesthesia with hemodynamic optimization [17]. During cesarean section in PH patients, general anesthesia further increases PVR via positive-pressure ventilation and PAP via tracheal intubation. Intra-aortic pressure and ventilation volume should be controlled at a low level. To avoid the above risks, epidural anesthesia or a combination of spinal subarachnoid anesthesia and epidural anesthesia is preferable [7].

In the current case, the patient was multigravida, cervical ripening was observed, and the delivery time was expected to be short. The possibility of vaginal delivery was discussed, due to the advantage of avoiding bleeding risks. However, cesarean section was selected as invasive monitoring was difficult in the delivery room and the patient's condition was worsening. In addition, general anesthesia was chosen over epidural and spinal subarachnoid anesthesia to allow swift initiation of percutaneous cardiopulmonary support system during the cesarean section.

After delivery, a rapid increase in circulating plasma volume via autotransfusion due to uterine recovery and migration of peripheral edema into the vascular system can cause sudden death in mothers with PH [19]. Additionally, these women are at a higher risk of thrombosis [20]. Therefore, treatment with pulmonary vasodilators and anticoagulation therapy is imperative after delivery [7, 20]. In the current case, NO was administered both before and immediately after the delivery. In addition, the patient was treated with a multidrug combination of PGI2 and PDE5 inhibitors and ET receptor antagonists. Intravenous administration of PGI2 should be performed cautiously to prevent the risk of infection [17]. ET receptor antagonists are limited to postpartum use because of their known teratogenicity [21]. In the present case, the mother had no hope to get pregnant again; therefore, we used ET receptor antagonists for her treatment.

In recent years, "Treat and Repair" strategy, in which PH is controlled by the abovementioned PH-specific medications followed by transcatheter shunt closure, has been attracting attention for PH caused by shunt disease [22]. This strategy is also mentioned in the 2020 adult congenital heart disease guidelines [23] and was applied to to the present case. However, there is no clear evidence on the severity of the disease and the long-term prognosis of treat and repair, and further data analysis is needed.

Conclusion

Pregnancy is contraindicated in patients with PH. However, in cases where PH becomes apparent only during pregnancy, the appropriate time and method of delivery should be chosen carefully. After delivery,

strict circulation management, including the requisite medical and surgical interventions to restore cardiac function, should be performed with interdisciplinary cooperation.

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Compliance with ethical standards

Not applicable.

Consent to participate/publish

Patients signed informed consent regarding publishing their data.

Conflict of interest

The authors declare that they have no conflict of interest.

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Figures

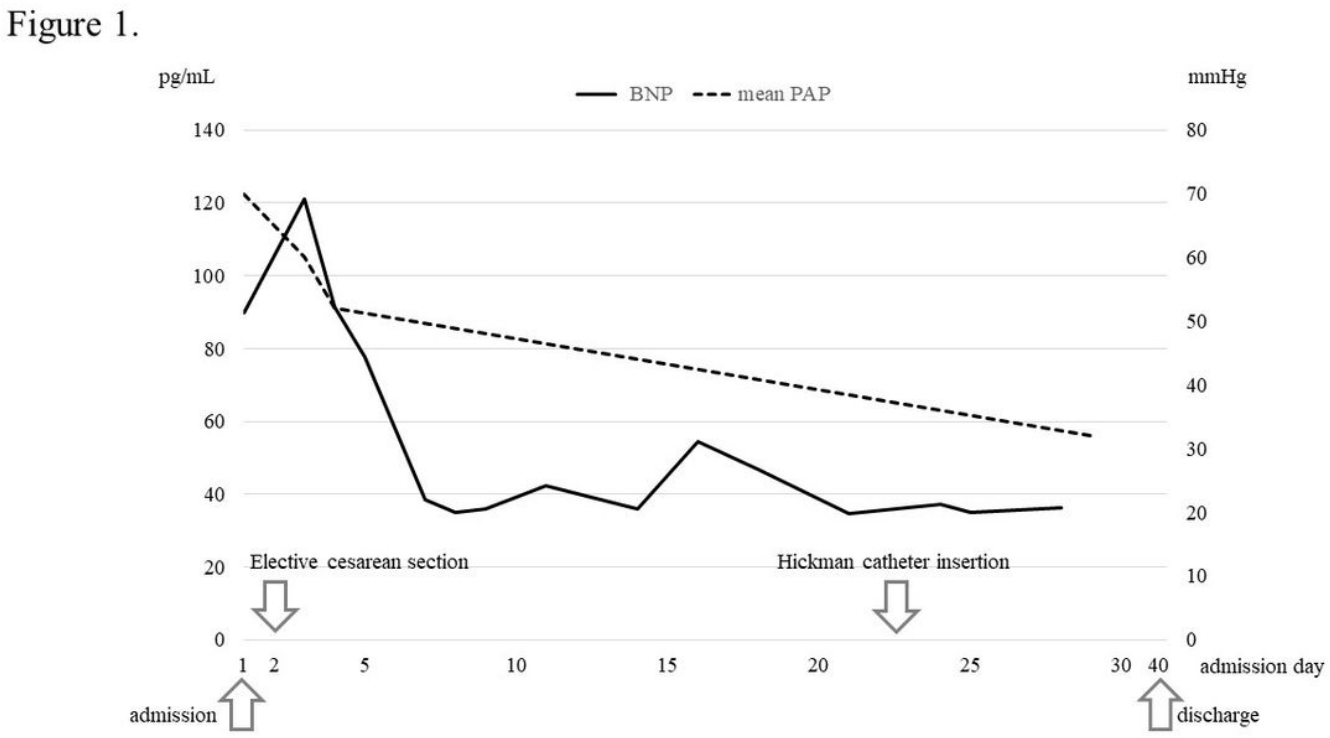

Figure 1

Changes in BNP level and mean pulmonary arterial pressure (mean PAP) from the day of admission to the day of discharge