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Case Report

Pulmonary Hypertension in Pregnancy: A Cardiological Approach to Maternal Outcomes as well as Neonatal and Therapeutic Management

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ABSTRACT

Background: Maternal morbidity and mortality with pulmonary hypertension in pregnancy usually occur during labor until early postpartum. Historical reports have shown mortality rates as high as 30–56%. We report a 32-year-old female patient pregnant with her second child, with complaints of bleeding from the birth canal since 1 hour before admission to the hospital and a history of atrial septal defect type secundum. **Case summary:** The patient was diagnosed with G2P1A0, 16–17 weeks pregnant, with death conception, thrombocytopenia, and ASD secundum with pulmonary hypertension. The patient was planned for dilation and curettage by the obstetrics and gynecology departments. As a result of consultation with the cardiology department, medication management was given, and the decision to tolerate CRI IV very high-risk surgery was given. **Conclusion:** Despite progress, pregnancy remains poorly tolerated in cases of pulmonary hypertension. Management should remain focused on contraceptive counseling and offering early termination when pregnancy does occur.

Highlights:

1. Pulmonary hypertension is threatening to both the mother and the infant in the womb.
2. This report discusses the complexity of physiological changes in pregnant women with pulmonary hypertension.

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Introduction

Heart disease during pregnancy has been a major cause of maternal death in both developed and developing countries [1]. Complex physiological changes that occur during pregnancy, including increased heart rate, blood volume, contractility, and heart rate, have acted as a physiological stress to the heart [2]. This leads to the development of a new heart disease or the decompensation of a pre-existing heart disease.[3]

These physiologic changes should also be considered, given the additional impact on the cardiovascular system of medications, anesthesia, and secondary hypovolemia on bleeding [2]. However, the safety of pregnancies in women with congenital heart disease can be enhanced with adequate risk assessment and pre-conception counseling.[4]

Morbidity and mortality in mothers with pulmonary hypertension due to congenital heart disease (CHD) usually occur during childbirth and early postpartum. Historically, mortality has been as high as 30–56% [5]. Although observed survival has increased in the era of specialized medical therapy for pulmonary hypertension, a series of recent cases of maternal mortality rates of 29% [6]. reflect still significant morbidity and mortality. As a result, the modification of the WHO's updated maternal cardiac risk classification classified pulmonary hypertension as a pregnancy risk category IV (high maternal cardiovascular risk).[7]

Therefore, knowledge of the effects of pregnancies on women with CHD and pulmonal hypertension is essential to avoid fatal management errors. Recognition of the underlying disease, increased understanding of cardiopulmonary patophysiology, and better management are imperatives to be examined. More importantly, a multidisciplinary approach will greatly improve the maternal and fetal outcomes in CHD patients with pulmonary hypertension.[8]

Case Presentation

Before being admitted to the hospital, a 32-year-old pregnant woman with her second child came with a bleeding complaint from the birth pathway for an hour. Up until the emergency installation, the estimated amount of bleeding is 2-3 underpads. The patient had a history of congenital senetic type atrial septal defect secondum heart disease, diagnosed two years before her second pregnancy. The physical examination revealed cold acrylic and peripheral cyanosis. Laboratory blood tests showed hemoglobin levels of 11.4 g/dL and thrombocytes of 92.000/L. The results of an electrocardiogram showed sinus arrhythmia with right axis deviation (RAD) and right ventricular hyperthropy (RVH).

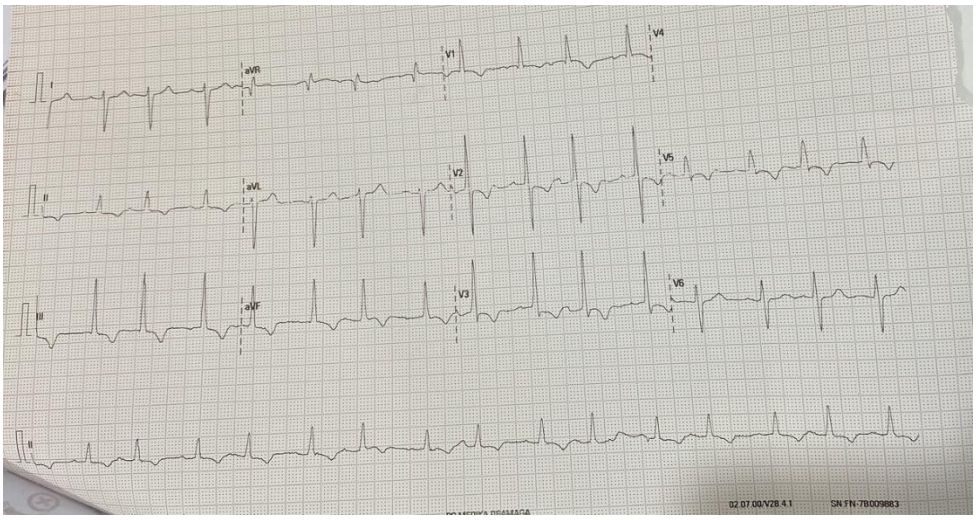

Figure 1. 12-lead EKG shows arrhythm sine rhythm with RAD and RVH.

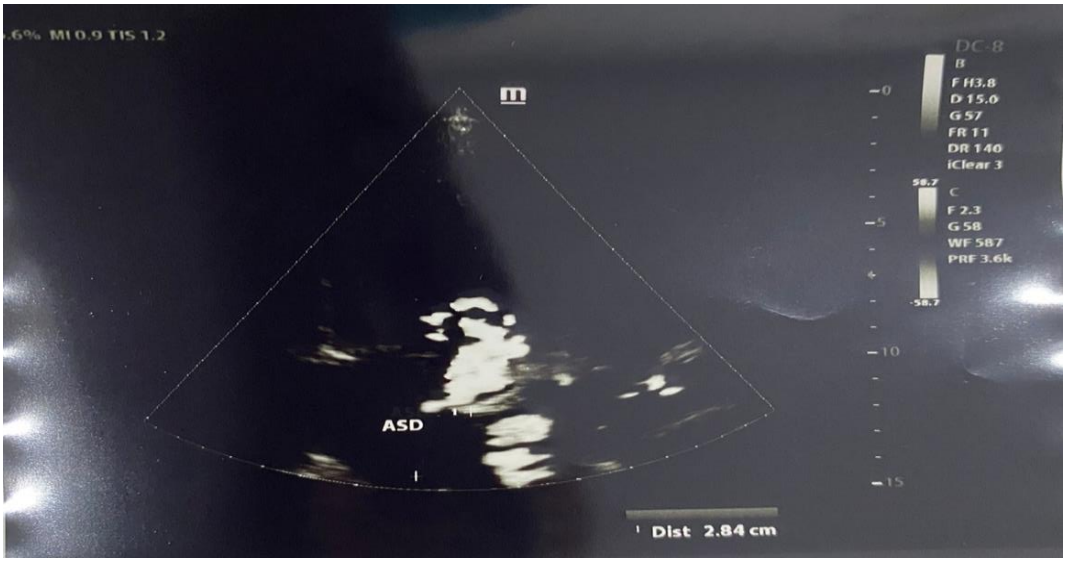

Figure 2. Echocardiography results

The results of the echocardiography in June 2021 showed atrial septal defect (ASD) secondum results with a left to right shunt and caused pulmonary hypertension, right atrial dilatation and right ventricular dilatation, and mitral valve prolapse-anterior mitral leaflet.

Patients were diagnosed with G2P1A0, pregnant 16–17 weeks, with death conception, thrombocytopenia, and secondary ASD with pulmonary hypertension. The obstetric and gynecological departments limit and curate the patient's planned action. As a result of the consultation with the cardiology department, a target Hb transfusion of 16 g/dL was administered with premedication of furosemide 40mg per blood bag, propranolol 2x20mg, spironolactone 1x25mg, and digoxin 1x0,25mg with CRI IV very high-risk tolerance.

Discussion

The circulation in the lungs cannot handle changes in blood flow when a woman has pulmonary hypertension. This is because the woman probably already had problems with her right ventricle, the lungs' vascular resistance is higher, the caval compression is lower, and there are rapid changes in blood flow during delivery [5,8]. Therefore, pulmonary vascular pressure will increase as the heart rate increases. Furthermore, the ventricles are unable to withstand the increased heart rate, resulting in shortness of breath or dyspnea, heart failure, and syncope. In addition, increased heart rate and a systemic decrease in vascular resistance increase the right to the left shunt, which subsequently decreases the oxygen saturation of arterial blood, causes symptoms and signs of increased hypoxemia [9], and can lead to cardiorespiratory collapse and death.[5]

During childbirth, hypotension due to blood loss or vasovagal response can lead to a decrease in systemic blood pressure, which can harm hemodynamics in heart conditions with pre-loaded dependencies such as pulmonary hypertension. It is very challenging for clinicians to manage the complexity of physiological changes in women with pulmonary hypertension. Patients with pulmonary hypertension have a greater tendency to experience bleeding. These hemostatic disorders will increase when the mother has an underlying bleeding risk, such as placenta previa, abruptio placenta, and hemorrhagic events during the third trimester of pregnancy.[5,8]

Maternal Outcomes

Patients with pulmonary hypertension and low cardiac reserves will tolerate poorly additional myocardial demands during pregnancy, as there is a decrease in right ventricular compliance and a relatively stable lung blood vessel resistance. As a result, Eisenmenger's syndrome has a very high incidence of mortality, reaching 9.7%.[10]

In recent years, the maternal mortality rate among pregnant women with pulmonary hypertension has decreased from 25%–56% to 17%–33%, mostly associated with target therapy for pulmonary hypertension and advances in the management of high-risk pregnancies in intensive care units. (ICU). However, the maternal mortality rate of mothers with pulmonary hypertension remains high [11]. Approximately 75% of maternal deaths occur within the first 3–4 weeks after childbirth. The most common heart complications during pregnancy are heart failure (20%) and severe hypoxemia (25%).[9]

In a recent study, maternal mortality rates in women with congenital heart disease reached 28% (very high). Maternal mortality rates are high shortly after childbirth due to causes such as heart failure, thromboembolism, pulmonary hypertension crises, and sudden cardiac death.[12]

Yap et al. found that maternal complications were arrhythmia (4%) and transitional ischemic attacks (1%). A history of carythmia in pregnancy and a mother's age >30 years is a risk factor for maternal heart complications. Compared to the general population, women with uncorrected ASD have an increased risk of developing pre-eclampsia, miscarriage, and low birth weight.[13]

In order to determine the risk of maternal outcomes, patients should be evaluated on a number of parameters that include not only the condition of the mother's heart but also the presence and/or potential residual effects such as reduced ventricular function, arrhythmias, or thrombotic events that may contribute to the overall risk [14]. The medical history should also take into account a range of social factors that may affect the delivery plan, including geographical distance to the hospital and the patient's ability to comply with the management plan.15

Neonatal Outcomes

Pregnant women with synthetic CHD had an increase in the incidence of spontaneous abortion (7–50%), birth death (0–14%), small for the pregnancy age of growth retrix (28–39%), and premature delivery (36–85%). The highest incidence of spontaneous abortion was in the group with pulmonary hypertension, single ventricle, or systemic right ventriculus. This can be attributed to the lower heart rate in this group of patients compared to patients with a normal heart.]

A study in China of 23 patients found that therapeutic abortion was performed in 13 patients in the first pregnancy group with pulmonary hypertension and 10 in the second pregnancy group with pulmonary hypertension. The proportion of early termination of pregnancies was 41.7% in the first pregnancy compared to 62.5% in the second, and the percentage of babies with low birth weight was 24.2% in the first pregnancy compared with 44.7% in the second.[11]

The incidence of congenital heart disease in the fetus ranges from 2 to 50% and is higher when the mother has heart disease. The highest risk is for single-gene disorders and/or chromosomal abnormalities such as Marfan syndrome, Noonan syndrome, and Holt-Horam syndrome.[17]

Indeed, fetal growth depends not only on the oxygenation of the mother but also on the mother’s cardiovascular adaptation to an unoptimal pregnancy. In a study by Presbitero et al., arterial oxygen saturation was the strongest predictor of perinatal outcomes. The rate of live birth is also in reverse correlation with the concentration of the mother's hemoglobin. Mother's oxygen saturation and hemoglobin concentration are causally linked to the occurrence of premature births and fetal growth restrictions.[18]

Management

Pregnant patients with pulmonary hypertension should be very careful about their pregnancy, and termination should be discussed first with the patient and, ideally, with their partner. Termination, if done early (less than trimester 2), is not associated with complications. However, termination should be carried out at a reference center with expertise in treating patients with pulmonary hypertension.[19]

Women who choose to continue pregnancy should be immediately referred to a health center with a pulmonary hypertension and treated by a multidisciplinary team. Hospitalization in the second trimester is sometimes necessary in conditions of the threat of premature delivery or hemodynamic complications. Evaluation for lung transplantation should be done in time, as this may be necessary in the event of an emergency.[8]

Target pulmonary hypertension therapy used before pregnancy should be continued, but it is recommended that the endothelin receptor antagonist, which is teratogenic, be discontinued and replaced by another drug (usually prostatocycline or sildenafil/tadalafil). Literature suggests that the use of these drugs only during childbirth and postpartum is associated with worse outcomes than if they were started earlier [8]. Epoprostenol intravenous (IV) remains the only target therapy with maternity benefits, and there is evidence to support its use in pregnancy. In a report of 3 patients with pulmonary hypertension who were given epoprostenol IV, all survived without post-partum complications.[20]

Epoprostenol and iloprost inhalation have also been used for the management of pulmonal hypertension in pregnancy. However, prostanoid inhalation should be limited to individuals with less severe symptoms. Because of intermittent doses with nebulization, there is concern that the short half-life of the drug may cause a rebound of pulmonary hypertension. Oral treprostinil, approved for management of pulmonary hypertension in 2013, and selexipag, another oral prostanoid, were approved in 2015.[6]

Healthcare providers have also used PDE5 inhibitors, such as sildenafil and tadalafil, as monotherapy or in combination with prostaglandins to manage pulmonary hypertension during pregnancy. In a systematic review of 16 studies evaluating the use of sildénafil for pulmonal hypertension in pregnancies, it was concluded that there appeared to be no significant maternal or fetal/neonatal loss effects.[21]

Planned early delivery at 32–36 weeks, prior to clinical worsening, is an important contributor to a good outcome. In this setting, the optimal delivery mode remains controversial. However, the literature supports the use of elective cesarean births.[22] The mode of delivery is discussed in a multidisciplinary manner. Although pervaginal delivery is usually preferred, vasovagal responses and vasava

maneuvers during pervaginal delivery can decrease venous return, causing a rapid hemodynamic decline.[6,8]

Caesarean electively is a way to avoid often prolonged labor. In addition, caesarean surgery can be performed in a controlled environment with strict monitoring and supervision of oxygenation of extrakorporal membranes and under regional anesthesia if possible because general anesthetics are associated with a fourfold increase in the risk of death in pregnant patients with pulmonary hypertension associated with CHD [6,8]. Caesarean delivery is a major surgical procedure with a higher potential for blood loss.[8]

Epidural anesthesia is preferred to general anesthesia if possible. Spinal anesthesia is usually contraindicated due to the risk of sudden hypotension, whereas epidural or combined spinal-epidural anesthetics allow gradual titration anesthesies to minimize hemodynamic fluctuations.[23]

In these patients, the highest risk of death is during the first 4 weeks after childbirth, with most deaths due to right ventricle failure. Factors contributing to right-ventricular failure include autotransfusion of blood, excessive increases in pulmonary vascular resistance, and thromboembolic events.[8]

Conclusion

Despite making progress in managing and improving outcomes, cases of pulmonary hypertension still do not tolerate pregnancies well. Management focus should remain on counseling contraception and offering early termination when pregnancy actually occurs, especially in nulliparent women with increased pulmonary vascular resistance, which may indicate worse outcomes.

However, for patients who still want to resume pregnancy despite the risks that have been delivered, the management focus should be dealt with in a specialized health center with a multidisciplinary approach. Further research on pulmonary hypertension during pregnancy should be continued, as it can improve understanding of the disease process and outcome for future patients.

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