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# Anesthetic Management of Patient with Preeclampsia, Pulmonary Edema, and Peripartum Cardiomyopathy in Pregnancy Undergoing Caesarean Section: A Case Report

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## Abstract

Preeclampsia is a disease that occurs in pregnancy after 20 weeks of gestation with manifestations involving multi organ systems such as pulmonary edema and ventricle dysfunction. Cardiomyopathy is a heart disorder characterized by myocardial dysfunction unrelated to any other previous heart disease. Case: A 31-year-old woman diagnosed with G1P0A0 full-term pregnancy, preeclampsia, pulmonary edema, cardiomyopathy, and fetal distress, who underwent cesarean section. On physical examination, shortness of breath was found in semi-Fowler position. Patient had high blood pressure and global hypokinesia was found on echocardiography results. She was planned for general anesthesia with semi-closed intubation technique and breath controlled. Anesthetic management should optimize the preoxygenation, provide positive pressure ventilation with positive end-expiratory pressure (PEEP), maintain the minimal myocardial depressant effect of drugs, and maintain a normovolemic state. It could improve the good outcomes. Conclusion: Three things that must be considered when starting the induction are oxygenation, fluid status, and selection of drugs that do not make the heart work harder. The combination of fentanyl, midazolam, and sevoflurane is the drug of choice used for induction, because it can minimize the cardiac depressant effect.

**Keywords:** Preeclampsia, Pulmonary Edema, Cardiomyopathy, Anesthetic Management

## Introduction

Preeclampsia is a multi-organ disease found in pregnancies over 20 weeks of gestation. One of the manifestations is pulmonary edema caused by plasma leakage (Stoelting & Dierdorf, 2002). Peripartum cardiomyopathy is a heart disease that occurs during gestation characterized by myocardial dysfunction in which no underlying disease is

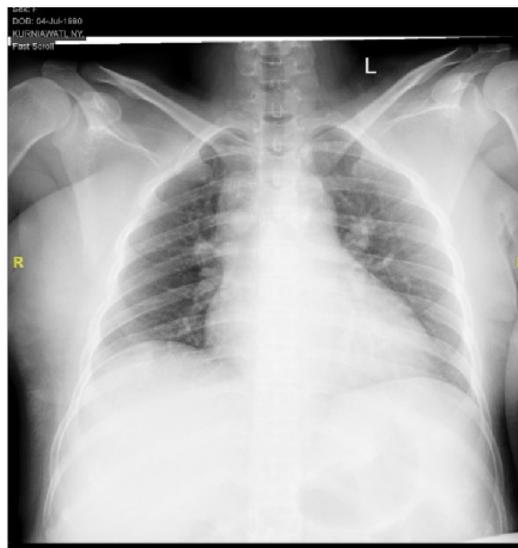
found (Stoelting & Dierdorf, 2002). Both cardiomyopathy and preeclampsia with pulmonary edema show almost the same symptoms which are: shortness of breath, fatigue, and edema (Cunningham, et al., 2011).

The prevalence of preeclampsia ranges from 2-10% of pregnancies while the prevalence of peripartum cardiomyopathy is around 1:1500 to 1:4000 pregnancies with a mortality rate of 18-56%. Cardiomyopathy in pregnancy is called PPCM (*Peripartum Cardiomyopathy*), with mortality rate of 70%; other types that can be found in pregnancy are HOCM (*Hypertrophic Cardiomyopathy*), with mortality rate of 4% and idiopathic dilated cardiomyopathy with mortality rate of 4%. Until this case report was made, the authors have not found definitive data on the incidence of severe preeclampsia accompanied by cardiomyopathy (Blackburn & Bracco, 2011).

In preeclampsia patients with pulmonary edema, general anesthesia with intubation is a treatment of choice. However, several problems might be encountered when starting anesthesia for these patients: 1) Oxygenation during induction and intubation in pulmonary edema patients in which the patient is experiencing hypoxia; 2) fluid management; 3) drug selection in patients with cardiomyopathy.

### Case

A 31-year-old female patient came with a diagnosis of G1P0A0 gestation with preeclampsia, pulmonary edema, and peripartum cardiomyopathy. The patient was planned to undergo an emergency cesarean section. The patient had experienced shortness of breath for one month before entering Hasan Sadikin Hospital and was getting worst for five days before entering the hospital. The patient slept comfortably in a semi-sitting position. The patient's vital signs were blood pressure of 160/110 mmHg, sinus pulse of 120 beats per minute, respiratory rate of 30 breaths per minute, and oxygen saturation of 88-90% with an oxygen mask of 10 liters per minute. The patient had been treated with furosemide 2x20 mg intravenously, methyldopa 3x500 mg orally, and nifedipine 2x10 mg orally. On physical examination, the shortness of breath was found in the semi-Fowler position. On thoracic examination, crackles were found at the lung bases, widened ictus at ICS 6 on the anterior axillary line, and legs edema. In addition, global hypokinesis was found on echocardiography results. The platelets were found decreased to 125,000/ml on laboratory examination, and proteinuria was 500 mg/dl on urinalysis.



Picture 1: Patient Chest Xray

The patient was planned for general anesthesia with a semi-closed intubation technique and breath controlled. After the patient was placed on the operating table, the patient was pre-oxygenated with 100% oxygen using a face mask. The patient's body was placed in the semi-Fowler position until the oxygen reached maximum saturation (96% within 5 minutes). The Induction was performed with a combination of midazolam 5 mg, fentanyl 150 mg, and sevoflurane, which was started with a concentration of 2%, then gradually increased until the patient was induced. The position of the patient was lying down while being given breathing support with positive pressure ventilation. Rocuronium 50 mg was given for intubation. The Sellick maneuver was performed, followed by

intubation with direct laryngoscopy, then an endotracheal tube (ETT) number 6.5 was placed with a balloon. Anesthesia was maintained by sevoflurane 1.5-2 vol%, and oxygen and air with a ratio of 50%. The duration of the operation was 60 minutes.

During surgery, the patient's blood pressure and heart rate were stable with a systolic blood pressure of 130-150 mmHg, a diastolic blood pressure of 70-100 mmHg, a pulse of 90-100 beats per minute, and oxygen saturation of 94-98%. A live baby boy was born and started crying immediately with an APGAR score of 6-8. At the end of the surgery, the patient's blood pressure was 148/94 mmHg, pulse rate was 102 beats per minute, and oxygen saturation was 96%. The recapitulation of fluid for the first hour is 500 cc with an estimated blood volume of 5300 cc with an allowed blood loss (ABL) of 1412 cc. During surgery, 1000 cc of crystalloid was given, with blood loss of 600 cc.

Based on the results of post-anesthesia monitoring in the recovery room, the general condition of the patient was fully conscious with a blood pressure of 142/95 mmHg, a pulse of 98 times per minute, breathing of 24 times per minute, oxygen saturation of 96% with oxygen mask of 6 liters per minute. Fentanyl 25 mcg per hour was given as postoperative analgesia. The patient was given ondansetron 4 mg intravenously if nausea and vomiting occurred. In addition, antibiotics were also given postoperatively. The administration of furosemide and antihypertensive therapy was continued. The patient's vital signs, such as consciousness, blood pressure, pulse, and breathing, were monitored every five minutes during observation in the recovery room. We proceeded to transfer the patient into the HCU. The patient was treated for one day in HCU with hemodynamics within normal limits, then transferred to the standard care room.

## Discussion

Preeclampsia is a disease found after 20 weeks of gestation characterized by hypertension, proteinuria, or thrombocytopenia if there is no proteinuria (Stoelting & Dierdorf, 2002) (Roberts, et al., 2013). It is said to be severe preeclampsia if there are advanced complications of preeclampsia such as pulmonary edema, myocardial infarction, stroke, kidney failure, coagulopathy, and retinal injury (Roberts, et al., 2013) (Oh, 2003). Preeclampsia occurs due to the failure of the spiral arteries remodeling in the placenta, resulting in ischemia of the placenta, which triggers the release of inflammatory mediators, and causes increased permeability and generalized vasoconstriction (Reed & Yudkowitz, 2005).

Generalized vasoconstriction also occurs in the heart, causing myocardial ischemia. In addition, the increased afterload can lead to left ventricular hypertrophy and left ventricular dysfunction. Pulmonary edema in preeclampsia is primarily due to plasma leakage but can also occur due to a combination of plasma leakage and fluid retention caused by left ventricular dysfunction (Stoelting & Dierdorf, 2002).

Cardiomyopathy is a heart disorder characterized by myocardial dysfunction in the absence of other underlying heart diseases. Based on morphology and hemodynamics, cardiomyopathy is divided into four types: dilatation, restriction, hypertrophy, and obliteration (Stoelting & Dierdorf, 2002). As stated in the introduction, the most common cardiomyopathy in pregnancy is PPCM. Peripartum cardiomyopathy can occur in the last trimester of pregnancy or 1-5 weeks postpartum (Stoelting & Dierdorf, 2002) (Stergiopoulos, et al., 2011).

The etiology of PPCM is still unclear. Several factors suspected to be the cause of PPCM are inflammation (myocarditis, cytokines), viral infection, autoimmunity, abnormal hemodynamic responses during pregnancy, oxidative stress which triggers endothelial cell damage, and vascular cell apoptosis (Bhakta, et al., 2011) The risk factors for PPCM are obesity, malnutrition, advance maternal age, multipara, gestational hypertension, preeclampsia, smoking, and family history (genetic). According to Cunningham et al., oxidative stress that contributes to or is a stimulant of preeclampsia is a crucial concept in the occurrence of cardiomyopathy. There are four criteria for establishing the diagnosis of PPCM: 1) heart failure occurring in the last trimester of pregnancy or 1-5 months after delivery; 2) no underlying disease that causes heart failure; 3) no signs and symptoms of heart failure in the first and second trimesters; 4) left ventricular ejection fraction < 45%. (Cunningham, et al., 2011) Based on the clinical presentation, severe preeclampsia complicated with pulmonary edema and cardiac disorders is very difficult to distinguish from PPCM. Both showed the same symptoms: dyspnea, orthopnea, cough, fatigue,

and edema.

It was difficult to diagnose whether this patient only suffered from preeclampsia or preeclampsia with cardiomyopathy. However, the patient's chest X-ray showed significant cardiomegaly, and global hypokinesis was found on echocardiography results, so it could be said that there is a possibility of impaired myocardial contractility, a pathognomonic sign of cardiomyopathy. Although the diagnosis and type of cardiomyopathy could not be established with certainty, this patient could still be considered to be diagnosed with cardiomyopathy or PPCM.

The anesthetic technique of choice in preeclampsia with pulmonary edema was general anesthesia with intubation technique (Cunningham, et al., 2011). Ideally, this patient requires invasive monitoring such as CVC placement, arterial line, and Swan-Ganz, but this patient only uses standard monitoring (NIBP, ECG, pulse oximetry). Anesthetic management in preeclampsia with pulmonary edema and ventricular dysfunction with PPCM is the same: maintaining normovolemic state, preventing increased afterload, maintaining contractility, maintaining hemodynamic stability, preventing tachycardia, and maintaining adequate uteroplacental oxygenation. During the use of medication, avoid using drugs that depress the myocardium (Cunningham, et al., 2011) (Sahoo, et al., 2010) (Bilehjani, et al., 2008) (Neuenschwander & Baliga, 2007).

Induction is the administration of intravenous drugs to make the patient from conscious to unconscious. In severe pulmonary edema, almost all of the alveoli are filled with fluid, so these patients have no residual functional volume, especially when the patient is in supine position. Fluid will fill all three lung zones when the patient is in supine position so that desaturation will occur immediately when the patient is induced. Therefore, pre-oxygenation is carried out so that oxygen reserves in the blood can be optimal. After the patient is induced, oxygenation is carried out with positive ventilation by giving PEEP (Neuenschwander & Baliga, 2007).

The choice of drug at induction is crucial. Bilehjani et al., in their case report, wrote about the benefits of using remifentanyl and etomidate in patients with peripartum cardiomyopathy; however, at our hospital, neither of these drugs was available (Bilehjani, et al., 2008) (Stoelting & Hillier, 2006).

Fentanyl is one of the opioid agonists with a rapid and immediate onset after administration, but the analgesic effect or respiratory depression is not seen within a few minutes. Effects that can be seen through intravenous administration are generally obtained after 30 to 60 minutes. Fentanyl has the effect of drug-induced bradycardia and depresses the SA node, resulting in slower heart rate, longer diastolic and coronary filling times, and can reduce oxygen demand. Fentanyl also has a peripheral vasodilating effect, making it beneficial in patients with pulmonary edema. Fentanyl can cross the placenta and depress the fetus, but in this case, the APGAR score was still normal (Stoelting & Hillier, 2006) (Neuenschwander & Baliga, 2007).

Midazolam is a benzodiazepine drug that has a sedative and rapid effect. The decrease in blood pressure due to decreased SVR tends to be milder than propofol. Midazolam also does not decrease cardiac output. Among other inhaled agents, sevoflurane depresses the myocardium the least. In addition, sevoflurane is also an anesthetic gas that is used as ischemic preconditioning in the myocardium. In this patient, induction of anesthesia was performed by combining these three drugs. By combining drugs, the dose given is smaller than the induction dose so that the adverse effects on the heart can be minimized and the beneficial effects still exist. (Stoelting & Hillier, 2006) (Sahoo, et al., 2010) (Morgan, et al., 2006) (Neuenschwander & Baliga, 2007).

## Conclusion

Cardiomyopathy is challenging to distinguish from ventricular hypertrophy/dysfunction in preeclampsia patients with pulmonary edema. For this reason, adequate diagnostic support is needed to establish a definite diagnosis of cardiomyopathy.

Three things must be considered when starting the induction are oxygenation, fluid status, and selection of drugs that do not make the heart work harder. Pre-oxygenation is needed to optimize blood oxygen levels. In addition, CVC placement should be done to ensure the patient remains in a normovolemic state. The combination of

fentanyl, midazolam, and sevoflurane is the drug of choice used for induction, because it can minimize the cardiac depressant effect. However, the beneficial effects on the heart are still obtained.

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