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EXTRACORPOREAL LIFE SUPPORT AS SALVAGE THERAPY FOR MASSIVE PULMONARY EMBOLUS AND CARDIAC ARREST IN PREGNANCY

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□ **Abstract—Background: Massive pulmonary embolus (PE) with prolonged cardiac arrest in the setting of pregnancy has few treatment options. Selections are further restricted if there are contraindications to the standard therapies of embolectomy and thrombolysis. We report a case of extracorporeal life support (ECLS) used as salvage therapy for a critically ill pregnant patient. Case Report: A 21-year-old woman presented to a small rural hospital with chest pain, dyspnea, hypoxia, and syncope. In their emergency department, she suffered 2 episodes of cardiac arrest requiring cardiopulmonary resuscitation, and fetal demise followed. A computed tomography scan revealed a saddle PE. She was transferred to our tertiary care hospital and arrived critically ill, on multiple vasopressors, and in cardiogenic shock. Because standard treatments, namely thrombolysis and embolectomy, were contraindicated in this case, ECLS was employed for 7 days. She was discharged home after 23 days, and at follow-up 5 months after her admission, she was found to have made a near-complete recovery. Why Should An Emergency Physician Be Aware of This?: ECLS is a viable option as salvage therapy for pregnant patients with massive PE who have contraindications to thrombolysis and embolectomy.** © **2018 Elsevier Inc. All rights reserved.**

□ **Keywords—critical care; extracorporeal life support; extracorporeal membrane oxygenation; pregnancy; pulmonary embolus**

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INTRODUCTION

Although precise criteria have not been established, a massive pulmonary embolus (PE) is characterized most fundamentally by arterial hypotension and cardiogenic shock (1). A systolic blood pressure (SBP) of <90 mm Hg or a drop in SBP of ≥40 mm Hg for ≥15 min are designated as arterial hypotension, provided that they are not accounted for by a new-onset dysrhythmia, hypovolemia, or sepsis (2). Cardiogenic shock includes arterial hypotension, but it additionally manifests with clinical signs of tissue hypoperfusion and hypoxia, including a urine output of <30 mL/hr, altered mental status, and cold, clammy extremities (2). In pregnant patients, the suspicion of massive PE may be hindered by physiologic changes which include a 40–50% increase in minute ventilation, a 45% increase in cardiac output, and in the first and second trimesters a 5–10 mm Hg decrease in blood pressure (3,4).

Management options for massive PE are limited. Anticoagulation, fibrinolysis, open surgical embolectomy, catheter thrombectomy, and extracorporeal life support (ECLS), also known as extracorporeal membrane oxygenation (ECMO), can be used (1,5). Unfortunately, selections are further restricted in the setting of pregnancy, particularly with hemodynamic compromise or contraindications precluding the use of embolectomy and thrombolysis, such as distal clot location or prolonged cardiopulmonary resuscitation (CPR) (6–8).

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We report a case of ECLS used as salvage therapy to treat massive PE successfully in a critically ill pregnant patient despite prolonged cardiac arrest and fetal demise.

CASE REPORT

A 21-year-old woman presented to a local rural hospital emergency department complaining of chest pain, dyspnea, hypoxia, and syncope. She was gravida 3, para 2 with a viable pregnancy at 24 weeks' gestation. Shortly after arrival, she suffered circulatory collapse; spontaneous circulation was re-established after 2 to 3 min of CPR. A computed tomography (CT) scan of the chest with contrast revealed a saddle PE. She then experienced a second cardiac arrest, and after intubation, multiple doses of epinephrine, and approximately 20 min of CPR, circulation returned again. Spontaneous rupture of the amniotic membranes occurred during CPR, but her cervix remained closed. She received enoxaparin sodium and was transferred to our facility on maximal intravenous infusions of dopamine, epinephrine, and dobutamine.

During the transfer, emergency medical services reported a loss of fetal heart sounds. Upon arrival to our emergency department, the patient had a pulse of 45 beats/min, a blood pressure of 80/40 mm Hg, a temperature of 33.7°C (92.7°F), a respiratory rate of 16 breaths/min on a ventilator, and blood oxygen saturation of 73%. She was otherwise healthy, took no medications, and had no known drug allergies.

A physical examination revealed an intubated female with spontaneous but nonpurposeful movements. The endotracheal tube contained red, frothy secretions. She displayed cyanosis of her lips and fingers and ecchymoses across her anterior chest. Coarse breath sounds were present in all lung fields. Her abdomen was gravid, and a bedside ultrasound depicted an intrauterine pregnancy but no fetal movement or cardiac activity. A bedside echocardiogram (ECHO) revealed that the patient had a markedly dilated right ventricle. Dopamine, dobutamine, and epinephrine infusions were discontinued and norepinephrine was started and quickly titrated to the maximum dose of 30 mcg/min. Still hypotensive and hypoxic, she received an epinephrine infusion and inhaled nitric oxide which eventually improved her blood pressure and oxygen saturation. A repeat CT scan showed that the clot burden had relocated to the right peripheral lung vasculature, and diffuse airspace opacities consistent with pulmonary contusions or acute respiratory distress syndrome (ARDS) were also visible.

Despite a minute ventilation exceeding 16 L, the patient's pH was <6.7, and her partial pressure of carbon dioxide was >120 mm Hg. Because the distal clot location and prolonged CPR respectively precluded embolectomy and thrombolysis, cardiothoracic surgery and critical care staff were consulted for possible initiation of ECLS to treat the ineffective oxygenation. The patient was taken to the operating room, where an additional 3 mins of chest compressions were performed before the procedure. She underwent left femoral vein and artery cannulation and initiation of venoarterial ECLS. She was then transferred to the surgical intensive care unit.

The patient subsequently developed disseminated intravascular coagulation. An obstetrics consultant believed this to be partly caused by the intrauterine fetal demise. Intravaginal misoprostol was administered for induction of labor, and the fetus was delivered with vacuum assistance. Her postpartum course was complicated by retained products of conception leading to sepsis, necessitating a bedside dilation and curettage.

She also developed acute kidney injury that required continuous renal replacement therapy. This was discontinued on day 7 in the hospital, as was ECLS. An ECHO at that time showed improving right ventricle function. She was extubated on day 9 and transferred out of the intensive care unit 10 days later with normal mental status. She was discharged after a 23-day hospital course on sildenafil for persistent pulmonary hypertension along with warfarin. An ECHO on the day of her discharge revealed normal right ventricle size with only mildly decreased right ventricular systolic function. At a clinic visit 5 months after her initial admission, another ECHO showed a left ventricle ejection fraction of 60% with normal right ventricle size and function; consequently, she was taken off sildenafil. She was otherwise found to be restored to her functional baseline having made a near-complete recovery.

DISCUSSION

Although more commonly used in pediatric patients, an increasing number of adults are receiving ECLS after experiencing cardiac or respiratory failure (9). To our knowledge, its use during pregnancy is uncommon and was described exclusively in case reports and case series until systematic reviews in 2015 and 2016 (10–12). Emerging evidence from the growing number of cases suggests that ECLS has a wide variety of indications in pregnant patients. Its value has been demonstrated in the settings of ARDS, cardiomyopathy, amniotic fluid embolism, pulmonary hypertension, and other conditions involving cardiorespiratory failure (13).

PE occurs in 0.05% of all pregnancies and is the most common cause of maternal mortality in the developed world (14,15). While standard therapy for massive PE includes embolectomy and thrombolysis, contraindications can prevent their use, severely limiting treatment options (1). In this case report, prolonged CPR with