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CASE REPORT

Successful provision of inter-hospital extracorporeal cardiopulmonary resuscitation for acute post-partum pulmonary embolism

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Mortality during pregnancy in a well-resourced setting is rare, but acute pulmonary embolism is one of the leading causes. We present the successful use of extracorporeal cardiopulmonary resuscitation (eCPR) in a 22-year old woman who experienced cardiopulmonary collapse following urgent caesarean section in the setting of a sub-massive pulmonary embolus. Resources and personnel to perform eCPR were not available at the maternity hospital and were recruited from an adjacent pediatric hospital. Initial care used low blood flow extracorporeal membrane oxygenation (ECMO) with pediatric ECMO circuitry, which was optimized when the team from a nearby adult cardiac hospital arrived. Following ECMO support, the patient experienced massive hemorrhage which was managed with uterotonic agents, targeted transfusion, bilateral uterine artery embolisation and abdominal re-exploration. The patient was transferred to an adult unit where she remained on ECMO for five days. She was discharged home with normal cognitive function. This case highlights the role ECMO plays in providing extracorporeal respiratory or mechanical circulatory support in a high risk obstetric patient.

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Introduction

Severe acute pulmonary disorders, such as thromboembolic disease, aspiration, pulmonary edema and amniotic fluid embolism can occur during pregnancy and the peripartum period.^{1–3} Cardiorespiratory failure, refractory to conventional treatment, may arise and lead to cardiac arrest. The incidence of acute respiratory failure during pregnancy is reported as less than 1 in 1000, while cardiac arrest is 1 in 30000.^{1,4} Implementation of timely advanced cardiac life support (ACLS) procedures is paramount but not always sufficient. The use of extracorporeal cardiopulmonary resuscitation (eCPR) may be the only method to establish meaningful cardiorespi-

ratory support until the underlying issues of acute cardiopulmonary failure can be addressed. We report the successful provision of inter-hospital eCPR after prolonged postpartum hemodynamic compromise.

Case history

A 22-year old pregnant female at 36 weeks of gestation presented to a regional hospital following a two day history of dyspnea. Past medical history included only treated hypothyroidism. She was hypoxic on room air (PaO₂ 87%), tachycardic (140 beats/min) with a metabolic acidosis (pH 7.31) and an elevated lactate (3.8 μmol/L) suggestive of tissue hypoperfusion. Transthoracic echocardiography at the referring hospital had indicated significant right to left septal deviation with obvious

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right heart strain but no visible left atrial or pulmonary trunk clot. CT pulmonary angiography indicated central pulmonary emboli (PE) with segmental and sub-segmental branches bilaterally (Fig. 1). After deliberation the patient was given 8000 IU intravenous heparin and transferred to the tertiary maternity hospital.

Cardiotocography demonstrated fetal tachycardia with shallow decelerations followed by a prolonged bradycardia. This prompted a decision to perform an emergent cesarean delivery under general anesthesia resulting in the delivery of a profoundly acidotic female infant who did not survive. After wound closure hemodynamic instability prompted the start of ACLS, but despite good quality ACLS and sporadic reversion to sinus rhythm and output, spontaneous circulation could not be established. The nearby adult extracorporeal life support (ECLS) centers were unable to provide timely eCPR, and the ECLS team at the neighboring pediatric hospital (located 500 m away) was alerted. Thrombolytic therapy using the recombinant tissue plasminogen activator tenecteplase 50 mg (Metalyse, Boehringer Ingelheim Pty Ltd. North Ryde 2113) was commenced 60 min after initiating cardiopulmonary resuscitation (CPR).

The pediatric surgical and perfusion team arrived 65 min after CPR had started. While CPR continued, surgical exposure of the femoral artery and vein was performed. An 8 mm graft was sewn side to end on the femoral artery and a 21Fr multistage cannula (Medtronic. Minneapolis, MN. USA) was inserted in the femoral vein. Extracorporeal membrane oxygenation (ECMO) support using a pediatric ECMO Permanent Life Support (PLS) circuit (MAQUET Getinge, Rastatt. Germany) began 100 min after CPR commencement and 35 min after the perfusion team had arrived in the OR. Due to the smaller pediatric circuit, initial ECMO circulatory support was limited to approx 2 L/min, and this was changed to an adult ECMO circuit

(Maquet PLS and RotaFlow) when the adult ECLS team arrived, permitting ECMO blood flows of 3.6 L/min.

Although transfer to the adult cardiothoracic surgical center for further management was planned, persisting hemodynamic instability prevented early transfer.

Emergency Venoarterial (VA) ECMO restored organ perfusion but unmasked an acquired coagulopathy following prolonged CPR with organ failure, which was worsened by the thrombolytic agent. Attempted correction of coagulopathy was guided using thromboelastography (TEG[®]), and active management with uterotonic agents, uterine balloon tamponade and bilateral uterine artery embolization via the right brachial artery was performed. Continued bleeding with abdominal distension required transfusion of red cells and other blood products including fibrinogen concentrate (CSL Behring, USA) (see Table 1). A repeat laparotomy evacuated 3 L of fresh blood from the abdominal cavity, which was processed through a cell-saver and returned to the patient. No uterine bleeding source was identified, but bleeding was identified in the rectus muscles and hemostasis was achieved prior to wound closure. Hysterectomy was not performed due to concerns it would precipitate further hemorrhage.

Approximately 14 h after CPR had begun, the patient was transferred by road to the intensive care unit at the local adult cardiothoracic hospital. Pulmonary embolectomy, possibly with an ECMO-based right ventricular device, was planned, but the patient stabilized on VA ECMO and it was not required. Rotational thromboelastometry (ROTEM[®]) and Multiplate[®] (Tem Innovations GmbH, Switzerland) were performed on arrival, revealing a lengthened clotting time with low fibrinogen and significant platelet dysfunction. The local transfusion protocol using platelets and cryoprecipitate was followed, which normalized clotting within 24 h. Extracorporeal membrane oxygenation was weaned on day 5.

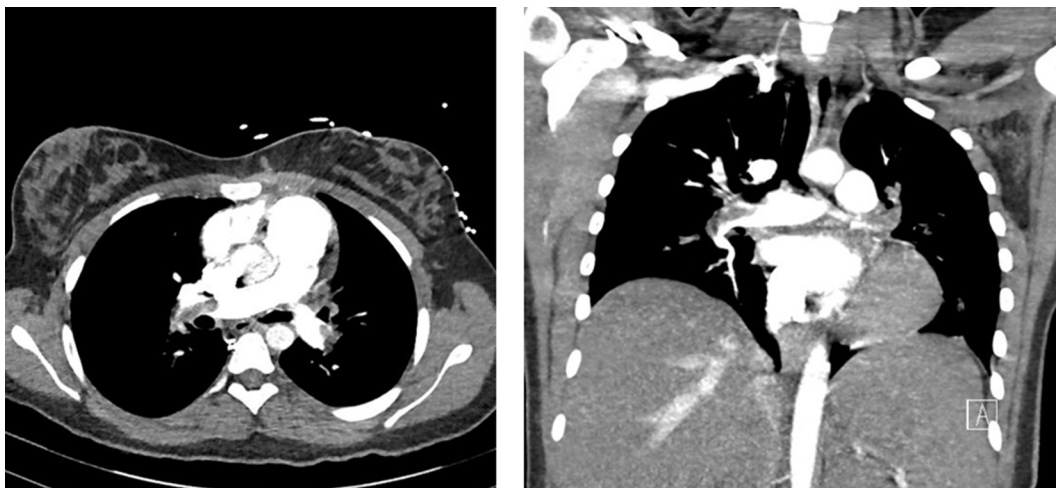


Fig. 1 CT pulmonary angiography (CTPA) depicting central pulmonary emboli

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