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Amniotic Fluid Embolism during Dilation and Evacuation during 2nd Trimester Treated by ACLS Guidelines, ECMO and Dialysis: A Case Report

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Abstract

Amniotic fluid embolism (AFE) is a rare and often fatal complication of pregnancy. While supportive therapy is in the primary goal, more invasive measures have been introduced in an attempt to improve outcomes in severe cases. We present the case of a 35 year old G3P2 female with an intrauterine fetal demise who underwent outpatient dilation and evacuation during her second trimester. AFE presentation and management are discussed including utilization of Extracorporeal Membrane Oxygenation as a supportive intervention in cases of profound and rapid cardiovascular collapse.

Introduction

Amniotic fluid embolism (AFE) is a serious and often fatal complication of pregnancy. Affecting approximately 1 in 8,000 to 1 in 80,000 parturients, mortality rates range from 0.4 to 1.3 per 100,000 live births and case fatality rates range from 11 - 61%[1,2]. Mortality due to AFE has been associated with a pathologic process similar to a type I hypersensitivity reaction that results in anaphylaxis and can mimic the clinical progression of septic shock. Additionally, AFE is historically associated with delivery in the third trimester. However, a few reports of AFE following termination of pregnancy in the 2nd trimester have been published[3,4] Although supportive care is the foundation in management of acute AFE, more invasive measures, such as Extracorporeal Membrane Oxygenation (ECMO), have been introduced and may help to improve outcomes[5].

Case Description

A 35-year-old G3P2 female was scheduled for outpatient dilation and evacuation two days after diagnosis of an intrauterine fetal demise. The patient's medical history included hypertension, diet-controlled type II diabetes mellitus, tobacco and marijuana abuse, and obesity (BMI 30.4 cm^2/kg). Obstetrical history included a classical cesarean section in her first pregnancy secondary to pre-eclampsia and an uncomplicated, term repeat cesarean delivery for her second pregnancy. She had one hospitalization at 21 weeks gestation for hypertensive urgency that was treated with intravenous medications and transitioned to oral therapy prior to discharge.

This pregnancy had reached 24 weeks gestation by 14 week ultrasound; however, routine 24 week gestation ultrasound demonstrated a fetal demise measuring 19 weeks by fetal biometry with a normal amniotic fluid volume. As the patient elected to undergo surgical treatment, osmotic cervical dilators were placed the next day. Her procedure was scheduled the day following dilator placement (two days following diagnosis of fetal demise). On the day of dilation and evacuation, preoperative laboratory tests were drawn (Table 1). All laboratory values were within normal limits and an EKG from one month prior was unremarkable.

Table 1: Patient's hematologic laboratory values before, during, and after surgery.

Laboratory Item (Reference Range)	Pre-Operative	Intra-operative	Post-Operative
Hemoglobin (12.0 - 16.0 gms/dL)	12.6 gm/dL	9.1 gm/dL	14.8 gms/dL
Platelets (140 - 440 k/cumm)	255 k/cumm	Not obtained	112 k/cumm
INR	0.97	4.49	1.78
Prothrombin Time (PT) (12.0 - 15.1 sec)	13.2 sec	45.8 sec	21.6 sec
Activated Partial Thomboplastin Time (aPTT) 23.3 - 35.7 sec	25.2 sec	> 150 sec	> 150 sec
Fibrinogen (mg/dL)	Not obtained	126 mg/dL	147 mg/dL
Activated Clotting Time (74 - 137 sec)	Not obtained	294 sec	277 sec

In the operating room, general anesthesia induction and intubation were uneventful. Osmotic dilators were removed, further cervical dilation was achieved with Pratt dilators, and a 14 mm cannula inserted for evacuation via suction. Rupture of amniotic membranes was noted and an expected amount of amniotic fluid was evacuated using suction (65 mmHg). Approximately 2 minutes after amniotomy, $ETCO_2$ dropped (34 to 11) followed quickly by hypotension (60/40), oxygen desaturation and bradycardia. Treatment with epinephrine and atropine briefly improved hemodynamics, but Pulse less Electrical Activity (PEA) developed within 30 seconds.

Advanced Cardiac Life Support (ACLS) was initiated. The differential diagnosis included allergic reaction, pulmonary embolism, and amniotic fluid embolism. In addition to epinephrine and vasopressin per ACLS protocol, intravenous (IV) heparin was initiated to treat possible pulmonary embolism. Both central IV and arterial access were obtained. Chest compressions were monitored to be high quality by the mean arterial pressure on the arterial line and capnography. Transesophageal echocardiography (TEE) was performed. Spontaneous cardiac activity was never noted on TEE throughout the resuscitation and PEA continued.

Arterial blood gases (ABG) and coagulation studies also deteriorated throughout the resuscitation (Table 1). ABGs demonstrated profound metabolic and respiratory acidosis (pH < 6.82, pO_2 = 41, pCO_2 > 104, HCO_3 = 15, BE = -21) and hyperkalemia. Sodium bicarbonate, calcium, furosemide, albuterol were used to treat rising potassium. An acute and severe coagulopathy, consistent with disseminated intravascular coagulation, was also noted and the massive blood transfusion protocol activated. Considering the patient's age and immediate resuscitation after her PEA diagnosis, the Extracorporeal Membrane Oxygenation (ECMO) team was consulted. Veno-venous ECMO was successfully initiated 90 minutes after the initial event. Once ECMO was established, active vaginal bleeding and growing abdominal distension were addressed and under ultrasound guidance all fetal and placental tissue was evacuated before intensive care unit (ICU) transfer. Hemoperitoneum was thought to be due to profound coagulopathy versus uterine rupture.

In the ICU, general surgery performed a paracentesis in an attempt to alleviate intra-abdominal pressure and improve ECMO perfusion. Following removal of 8 liters of blood from her abdomen, ECMO perfusion remained unsatisfactory with a MAP of 30 mmHg. Concomitantly, profound acidosis and hyperkalemia (K^+ 7.8) were further complicated by renal failure. Continuous renal replacement therapy was initiated and run simultaneously with ECMO. During the resuscitation and ICU stay the patient received 23 units of packed red blood cells, 10 units of fresh frozen plasma, and 4 packs of platelets. Despite all efforts, her condition continued to deteriorate. Family and medical team elected to withdraw care. The patient died after 9 hours of resuscitative efforts. Autopsy did not show evidence of pulmonary embolism, coronary artery blockage, or uterine rupture/perforation. Post-mortem Fraser Lendem stains of the lungs highlighted irregular cells within the vasculature, consistent with fetal squames. Based on clinical presentation and autopsy findings, AFE was ruled the cause of death.

Discussion

AFE is a known but poorly understood complication of pregnancy. As cases are rare, there are not studies comparing treatment modalities and outcomes. Since 1941, when AFE was initially reported, there has been little improvement in maternal survival[2,6]. Consequently, publication and reporting of cases is important in order to improve awareness, morbidity, and mortality. Notably, an AFE patient registry has been started at Baylor College of Medicine in Houston, TX for this reason[7].

AFE should be considered in any parturient with rapid cardiopulmonary collapse, even outside the labor and delivery ward. Documented risk factors include increasing maternal age, induction of labor, placenta previa, and placental abruption[1,2]. Unfortunately, data remains limited by low prevalence rates and selection bias. Although less common than third trimester reports, a few cases of AFE have been documented in the second trimester, both before and during uterine evacuation[3,4]. Our case supports these few prior publications that AFE can occur in the second trimester. In cases of maternal survival in AFE, the diagnosis is purely clinical without any objective evidence. Our case demonstrates that, with concrete evidence, AFE can occur as early as the second trimester. Given that the majority of second trimester reports of AFE occur in the setting of surgical uterine evacuation, the procedure of dilation and evacuation may contribute to maternal risk of AFE. Similarly, although AFE may occur with vaginal delivery, Cesarean delivery is a known risk factor. Consequently, an unrecognized relationship may exist between relaxed uterine tone and an increased risk for AFE[1,2].

Early recognition of potential AFE is key and invasive monitoring (e.g., arterial line and echocardiogram) can provide vital information. However, as demonstrated in the presented case, even immediate recognition and supportive care does not guarantee maternal survival. More contemporary and invasive resuscitative measures including ECMO and application of right ventricular assist device may provide additional support mechanisms during resuscitation; although, no data exists to confirm improved mortality rates as a result of these measures[5].

Although our patient did not survive, this case demonstrates that ECMO can be successfully initiated in patients with

rapidly progressive cardiopulmonary collapse. ECMO has been reported successfully in treatment of AFE in two other case reports during cesarean sections[8,9]. To our knowledge this is the first case where ECMO was used to treat a second trimester AFE that occurred during Dilation and Evacuation. This is relevant due to the new 2015 updated Advanced Cardiac Life Support (ACLS) guidelines issued by the American Heart Association (AHA). The new guidelines discuss extracorporeal techniques, such as ECMO, as alternatives to CPR for select patients with cardiac arrest if the cause of arrest is reversible[10]. ECMO is not recommended for unwitnessed cardiac arrest. Our case demonstrates a witnessed arrest followed with high quality CPR and immediate resuscitation in which ECMO was perceived a viable option.

While survival rate for adults receiving ECMO is approximately 41%[11] ECMO complications are common and can be severe. Contraindications to ECMO can be seen in Table 2. These contraindications may differ from hospital to hospital and ECMO always requires complex clinical decision making. However, ECMO may continue for 3 to 10 days and it may permit time for additional therapeutic interventions and improvement in organ function. According to the Extracorporeal Life Support (ELSO) Registry. 53% of patients that have received ECMO were neonates, 25% were pediatric, and only 23% adults[10]. Disadvantages to ECMO include high expense, strict selection criteria, and lack of availability at small hospitals and surgery centers.

Table 2: Contraindications to ECMO[10].

Unwitnessed Cardiac Arrest
Prolonged CPR without adequate tissue perfusion
Disseminated malignancy
Known severe brain injury
Severe chronic pulmonary hypertension
Advanced age: (age > 75)
Contraindications for anticoagulation
Severe organ derangement: cirrhosis, renal failure, and emphysema

Limitations

Limitations in the treatment of AFE are greatly influence by location. Our case occurred in an ambulatory operating room located on the campus of a major academic hospital; although, it is in a different building and connected by walkways above the street. For this reason, a cardiac anesthesiologist was able to assist and bring equipment for the TEE. A general surgeon was able to arrive quickly to place the large cannulas for ECMO and the ICU intensivist to run the EMCO machine with his team. In a free standing surgical center having a TEE, ECMO cannulation, and transfer to the ICU within 1.5 hours of the event would be impossible. Small centers and rural areas would not the ability to perform ECMO either. A free standing of office based surgery would not be able to perform point of care blood gases as were done frequently in the care of this patient. Further, blood products were more accessible in this emergency compared to some office based or free standing surgical centers.

Conclusion

AFE can and does occur in second trimester Dilation and Evacuations. AFE can occur in the ambulatory operating room and awareness and vigilance is important during amniotomy. All centers performing these procedures should be aware of this risk and known if ECMO for cardiopulmonary arrest is possible as the AHA-ACLS 2015 updated guidelines now recommended ECMO for certain cases. Finally, as AFE remains rare, experiences in AFE treatment must be shared to improve survival.

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