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Amniotic Fluid Embolism Diagnosis & Treatment Pathway

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Introduction of the Problem

Amniotic fluid embolism (AFE) is a rare occurring medical emergency in obstetric patients. The lack of staff experience with AFE as well as a knowledge deficit in identifying hallmark symptoms and treatment options led to the development of an educational opportunity. This project aimed to provide annual education for all staff nurses on recognizing signs and symptoms of AFE and understanding the treatment and monitoring options available at a small rural hospital in central California.

Literature Review

AFE is a potentially fatal obstetric emergency that defies definitive diagnostic technology (Sundin & Mazac, 2017). Numerous sources identify the prevalence of AFE to be between 1.7 and 6.6 cases per 100,000 pregnancies; these low rates of occurrence reflect both rarity and difficulty in diagnosing (Metodiev et al., 2018, Fitzpatrick et al., 2019, Fardelmann & Alian, 2020 and Stafford et al., 2020). The problem for rural healthcare providers, regarding AFE, revolves around a low incidence-high mortality condition, lack of provider experience, and no clearly identified diagnostic or treatment pathway for AFE.

AFE results in a cascade of events resulting in extreme loss of vascular tone, disseminated intravascular coagulation (DIC), cardiopulmonary collapse, and often death (Stafford et al., 2020). In the United States, the definition created by Clark and colleagues is the widely accepted standard based on four criteria (a) quick onset cardiopulmonary arrest (b) sudden onset of DIC not caused by blood loss (c) clinical symptoms onset either during labor or within 30 minutes after placental delivery (d) patient remains afebrile during labor (Fitzpatrick et al., 2019). The presence of fetal cells and/or amniotic fluid in the maternal circulation causes

the release of endothelin, leukotrienes, and thromboxane A₂, resulting in profound pulmonary vasoconstriction followed by an acute right-sided heart failure (Pacheco et al., 2016).

Within minutes of AFE onset, acute respiratory failure and severe hypoxemia occur. As the soliloquy of events progresses right-sided heart failure that is followed by total collapse hemodynamics. In response to these preceding events, cardiac output decreases further compounding systemic hypotension and pulmonary edema (Pacheco et al., 2016). A second set of events also occur leading to disseminated intravascular coagulation (DIC), resulting in life-threatening coagulopathy initiated by the presence of fetal cells and/or amniotic fluid entering the maternal bloodstream (Sundin & Mazac, 2017).

Identifying risk factors for AFE occurrence can hasten diagnosis and treatment. Retrospective studies based on data from more than 950,000 obstetric patients in Washington state correlated increased AFE rates with advanced maternal age above 39 years old (Lisokova et al., 2017b). Stafford et al. (2020) identified three unique trends in patients diagnosed with AFE: abnormal placental implantation, presence of allergic reactions to latex, medications, or foods, and lastly conception via in vitro fertilization. Sudin & Mazac (2017) and Lisonkova & Kramer (2019) found additional risk factors to include multiple pregnancies, cervical lacerations, augmented rupture of membranes (AROM), operational vaginal deliveries, and cesarean sections.

With no available specific diagnostic tool available, the Society for Maternal-Fetal Medicine (SMFM) maintains AFE is a clinical diagnosis (Fardelmann & Alian, 2020). Providers can only rule in or rule out AFE diagnosis by conducting a thorough physical assessment, performing diagnostic tests, and ordering laboratory studies. Newer coagulation studies like rotational thromboelastometry (ROTEM) and a transesophageal echocardiogram (TEE) can

provide useful guidance for managing any sudden and unexplained altered mental status, seizures, or unresponsiveness that could be an early indication of AFE (Fardelmann & Alian, 2020). If AFE is suspected, the clinical presentation should guild the interdisciplinary team's treatment plan.

Treatment of AFE is focused on supportive effects to mitigate cardiac, pulmonary, and hematologic symptoms (Fardelmann & Alian, 2020). If cardiac arrest is a presenting factor the witnessing staff should initiate code blue protocols including cardiopulmonary resuscitation (CPR) (Lisonkova & Kramer, 2019). Immediate involvement of all available members of the interdisciplinary team is required to address the multiple physiological systems that AFE affects. As the coagulopathy component of AFE evolves, a goal-directed approach to DIC is required including activation of a massive obstetric transfusion (MOBT) protocol (Sundin & Mazac, 2017).

In addition to treating the resulting symptoms of AFE, numerous case reports suggest considering a novel treatment plan: AOK+T (atropine, ondansetron, ketorolac, tranexamic acid). These medications are commonly used across the medical community; however, their unique pharmacodynamics seem to abruptly mitigate the cascade of events caused by AFE. Emerging research suggests considering the AOK+T treatment plan immediately upon recognizing symptoms suggesting AFE (Rezai et al., 2017, Partilt & Roth, 2019 & Jain, 2021).

Project Methods

The goal of this quality improvement project was to assess for knowledge deficits of AFE followed by an educational teaching session that addressed the areas of deficits. Key components of the process included assessing the staff's ability to recognize symptoms of AFE and the subsequent action plan required to mitigate progressing symptoms related to AFE's effect on

pathophysiology. The target population for this teaching project was the nursing staff of a 50-bed rural hospital in central California. The project was declared exempt from the Institutional Review Board at Southern Illinois University at Edwardsville, due to its non-experimental nature, quality improvement design, and lack of any patient information being obtained.

To assess baseline knowledge of AFE, a pretest was administered to 20 obstetric staff in November of 2022. The thirteen-question pre-test included five demographic and eight knowledge questions in the form of true/false. After the pretest was given, an educational PowerPoint presentation identifying the condensed key points of the literature review was presented to the staff. A follow-up post-test utilizing the same form as the pre-test was administered to evaluate the effectiveness of the PowerPoint presentation.

Evaluation

The pre-test survey identified that respondents had some prior knowledge and understanding of AFE. Prior to the PowerPoint presentation, a lack of knowledge was identified about AFE treatment medications as well as risk factors associated with AFE. After the PowerPoint education, a statistically significant increase in the number of respondents correctly identified the risk factors and medication treatments associated with AFE. With score improvements between the pre-test: Median 75.0 (68.8 – 87.5) and post-test: Median 100.0 (87.5 – 100.0), resulting in a p-value of 0.002.

Impact on Practice

Implementing a crisis management blueprint for AFE requires the collaboration of the medical staff, anesthesia staff, as well as obstetric department director of nursing, and all nursing personnel. Due to the rare nature of this disease and lack of staff hands-on experience with AFE, annual refresher educational modules will be added to competency requirements. The ID badge

checklist for AFE diagnosis, risk factors, and treatment can be utilized during any suspected AFE event. An annual review of AFE treatment as well as an easily accessible checklist will improve patient outcomes of future AFE events.

Conclusions

This quality improvement project met the goal of increasing awareness of risk factors, diagnostic methodologies, and treatment options for AFE. Limitations to the project are that not all nurses, doctors, or nurse anesthetists participated in the teaching sessions. At the completion of the education, the participating staff demonstrated an increased understanding of hallmark symptoms and treatments for AFE. The project can be sustained by adding the educational PowerPoint to annual competencies and offering the ID badge checklist to all new staff.

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