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Developing and Implementing Guidelines for Amniotic Fluid Embolism

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Introduction of the Problem

Amniotic fluid embolism (AFE) can have detrimental effects for women in the obstetric population. AFE can occur during labor or shortly after the delivery of the neonate (Society for Maternal-Fetal Medicine [SMFM], Pacheco, Saade, Hankins, & Clark, 2016). The condition is thought to be caused by the entrance of material from the fetal compartment, which contains the amniotic fluid, into maternal circulation (SMFM et al., 2016). AFE as an estimated incidence range of 1:15,200 to 1:53,800 births (Rezai et al., 2017). The incidence varies significantly due to the lack of universal diagnostic criteria, and Clark et al. (2016) reported that AFE is often used as a cause of maternal death despite sufficient evidence to confirm the diagnosis. It is critical for anesthesia providers to have a thorough understanding of AFE because they care for patients undergoing cesarean sections and can play a crucial role in diagnosis and management.

With such a high rate of morbidity and mortality associated with AFE, accurate and timely identification of the condition could mean the difference in maternal and/or fetal outcome. A checklist including the signs of AFE, management options, and differential diagnoses would be beneficial for those providing care to women during labor and recently postpartum. Knowing that AFE is such a rare but harmful condition, a hospital in Metro-East St. Louis requested the creation of a checklist to ensure that all anesthesia providers quickly recognize and initiate appropriate management for AFE.

Literature Review

Evidence suggests AFE is precipitated by the entrance of material from the fetal compartment that triggers a cascade of pro-inflammatory mediators similar to what would be seen in an anaphylactoid reaction (Gist et al., 2009; Benson, 2012). In AFE, the entrance of fetal substances into maternal circulation leads to pulmonary vasoconstriction and obstruction in the

pulmonary vasculature. Platelets are entrapped due to the pulmonary vasoconstriction and are activated by thromboxane. The activation of thromboxane causes the activation of additional platelets, only worsening the pulmonary vasoconstriction, which in turn signals release of additional serotonin which further exacerbates pulmonary vasoconstriction (Rezai et al., 2017). Simultaneous with the cardiopulmonary collapse, a pro-coagulant cascade is triggered. Due to the presence of amniotic fluid in maternal circulation, Factor VII and platelets are activated. Disseminated intravascular coagulation (DIC) is consequently occurring, and the body's inflammatory response further enables clotting (SMFM et al., 2016).

Typically, AFE is a diagnosis of exclusion. The classic triad of symptoms for AFE includes sudden hypoxia, severe hypotension, and subsequent coagulopathy (Clark et al., 2016 & Yufune et al., 2016). Differential diagnoses include myocardial infarction, pulmonary embolism, air embolism, anesthetic complications, hemorrhage, anaphylaxis, eclampsia, and sepsis (SMFM et al., 2016).

According to the guidelines set forth by SMFM et al. (2016), a multi-disciplinary team made up of additional anesthesia providers, respiratory therapists, critical care providers, and maternal-fetal medicine physicians should all be called to help with the care of the patient in the event of an AFE. The maintenance of vital signs should be the initial goal. Vasopressor medications such as phenylephrine, ephedrine, and epinephrine can all be given to correct the hemodynamic instability. A fluid bolus of crystalloid or colloid should also be initiated (Kaur et al., 2016), but excessive fluid resuscitation should be avoided due to the risks of creating a dilutional coagulopathy (SMFM et al., 2016).

The use of vasopressors and inotropic agents in the initial management of AFE is strongly indicated (SMFM et al., 2016). While crystalloid and blood products can both restore

fluid volume, blood products are favored due to the ability to restore oxygen-carrying capacity (Kaur et al., 2016). Since coagulopathy may follow or precede cardiovascular collapse, a massive transfusion protocol should be initiated. Early and aggressive resuscitation with packed red cells, fresh-frozen plasma, and platelets at a ratio of 1:1:1 has led to improved outcomes (SMFM et al., 2016). A hysterectomy should be considered if uterine hemorrhage cannot be controlled (SMFM et al., 2016).

A more novel management strategy for AFE is the administration of Atropine, Ondansetron, and Ketorolac (A-OK) (Rezai et al., 2017). With the proposed pathophysiology of AFE better understood, anti-serotonin, anti-thromboxane, and vagolytic therapy have led to successful resuscitations in AFE patients. A-OK therapy should be considered in addition to traditional management options (Rezai et al., 2017). It has been theorized that the ondansetron blocks serotonin release which reduces pulmonary vasoconstriction and platelet activation (Rezai et al., 2017). The Ketorolac works by blocking thromboxane which further reduces the release of inflammatory mediators. Ketorolac may also work by preventing the activation of the coagulation cascade (Rezai et al., 2017). Atropine works by blocking the vagal reflex which should increase vasomotor tone. Although there is limited evidence on the effectiveness of A-OK, recently published case reports have demonstrated successful resuscitation efforts with the use of A-OK to manage AFE (Rezai et al., 2017).

Project Methods

The quality improvement project involved identifying the best evidence and collaborating with facility stakeholders to implement the use of an updated, evidence-based checklist to guide providers in the care of patients. The anesthesia staff were provided with education via a PowerPoint presentation about AFE that included information regarding statistics, risk factors,

pathophysiology, presenting signs, management, and differential diagnoses of AFE. The goal of the education was not only to provide education about AFE, but to stress the importance of a checklist to facilitate management of AFE. A video published by the Stanford School of Medicine demonstrating the why and how of implementing an emergency checklist was shown to the anesthesia providers. A simulation of a patient experiencing an AFE was presented at the start of the education. At the conclusion of the education, the same AFE scenario was presented and the anesthesia providers used the AFE checklist to work through the simulation.

A copy of the AFE checklist published by Stanford Anesthesia Cognitive Aid Group was discussed, handed out to all anesthesia personnel, and placed on the anesthesia carts in the obstetric operating rooms. Copies were placed on the epidural carts in the obstetric units. The stakeholders and facility approved the selected checklist for implementation.

The project took place at a hospital at a small urban city in mid-Illinois. The participants included certified registered nurse anesthetists (CRNAs) and anesthesiologists who provide care to patients in the obstetric population. All anesthesia providers who were not able to attend the presentation on the day the project was implemented, received the PowerPoint presentation. Student registered nurse anesthetists were also in attendance on the day of project implementation.

Human Subjects Protection

The project was submitted to the SIUE Institutional Review Board, and the hospital's Community Institutional Review Board and Evidence Based Practice/Research Council. It was declared exempt. Participation in the project was voluntary and participants were not identified.

Evaluation

There was a post education presentation survey on the education provided, the

simulation, and the implementation of the checklist. The survey was given to the anesthesia providers in attendance on the day of implementation. The survey was developed collaboratively with the stakeholders. A series of yes or no questions were asked and there was a space provided for additional comments. Items were designed to determine if participants believed the education provided increased their knowledge of AFE and if using a visual cognitive aid in an emergency situation would be effective. The feasibility of using the AFE checklist in the event of a suspected AFE was also assessed. Data from the surveys were evaluated to assess both the education provided and the success of implementing the checklist.

There was a total of 13 anesthesia providers in attendance on the day of project implementation and all 13 providers completed the post education presentation survey. There were 10 CRNAs, 2 SRNAs, and 1 anesthesiologist. Six providers had greater than 10 years of experience, two providers had between 6 to 10 years of experience, two providers had between 3 to 5 years of experience, and three providers had less than 2 years of experience. Two of the thirteen respondents reported that one of their patients had experienced an AFE while under their care.

Data results from the survey were overwhelmingly positive. All thirteen participants agreed that the provided education increased both their knowledge of AFE and their ability to recognize AFE. All thirteen participants also agreed that the education and simulation increased their preparedness to manage AFE. When asked if in the event of an AFE, would they use the AFE checklist, all 13 providers answered “yes.” When asked if prior to the presentation, were they aware of the novel therapeutic regimen A-OK to manage AFE, 11 providers answered “yes”, and 2 providers answered “no.” When asked if they had used a visual cognitive aid to manage an emergency situation in the past, 7 providers answered “yes”, and 6 providers

answered “no.” To follow up that question the respondents were asked if based on the simulation and education provided, were they more likely to incorporate a visual cognitive aid to help manage an emergency situation. Eleven of the thirteen providers answered “yes”, one provider answered “no”, and one provider answered “unsure.” When asked in an open response format if there was anything else about the presentation, simulation experience, or checklist they wanted to share, three respondents provided an answer. The responses were “Great Job!”, “Good Presentation!”, and “Well Prepared and Great Presentation.” When the respondents were asked in an open response format to provide ideas about how the guidelines and information they received could best be incorporated into obstetric anesthesia practice, there were no responses from the providers.

The project stakeholders were extremely pleased with the presentation and the implementation of the checklist. The stakeholders continued to receive positive feedback from the anesthesia providers that were in attendance on the day the project was implemented. The survey results were overwhelmingly positive. The stakeholders were impressed and thankful for the implementation of the AFE checklist at their facility.

One of the biggest limitations of this project was the ability to reach all anesthesia providers that worked at the facility. The anesthesia group provides services at another facility, so not all providers of the group were physically able to be in attendance on the day of project implementation. Although all providers of the group received the PowerPoint presentation regarding AFE, not all of the providers had the ability to physically attend and simulate the use of the checklist on the day the project was implemented. Another barrier to the project was the lack of published guidelines regarding the management of AFE. Due to the rarity of the condition and the inability to replicate the condition in laboratory studies, the lack of published

guidelines did not come as a surprise. As more becomes known about AFE, and the pathophysiology of the condition, more guidelines will become published to better manage and/or prevent AFE.

Impact on Practice

The post education presentation survey responses demonstrated the impact on practice of the anesthesia providers at the facility. All of the providers' knowledge was increased by the education provided and all of the providers are more likely to recognize AFE. In addition, all of the providers said they are likely to use the AFE checklist in the event of a suspected AFE. Ultimately this project has the potential to save a life at the facility.

In the long term, the goal would be to continue to update the AFE checklist as new guidelines become available for the management of AFE. In addition, the use of checklists in emergency situations should increase. The facility already had other emergency checklists in place for use, however, these were limited. Given the current availability of well referenced guidelines, the hope is that anesthesia providers at the facility understand the importance and the efficiency of using a checklist in an emergency situation and work to implement additional checklists.

To sustain the project, the anesthesia providers should continue to be provided with the latest guidelines regarding the management of AFE. Simulations should continue to take place with an emphasis placed on the use of checklists in emergency situations. Stakeholders indicated that these types of simulations will continue to occur annually, and the checklists will be periodically reviewed to ensure they follow the latest evidence-based guidelines.

Conclusion

To close, the project on developing and implementing guidelines for AFE was

successfully implemented. The anesthesia providers at the facility received information on the latest guidelines regarding the management of AFE and were also educated on the importance of using a checklist in an emergency situation. The AFE checklist was successfully implemented at the facility and the stakeholders provided positive feedback on the project in its entirety. In the future, the AFE checklist will need to be updated to reflect the latest guidelines for the management of AFE.

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