Society for Maternal-Fetal Medicine Special Statement: Checklist for initial management of amniotic fluid embolism

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Society for Maternal-Fetal Medicine Special Statement: Checklist for initial management of amniotic fluid embolism

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Abstract

Amniotic fluid embolism is a rare syndrome characterized by sudden cardiorespiratory collapse during labor or soon after delivery. Because of its rarity, many obstetrical providers have no experience managing amniotic fluid embolism and may therefore benefit from a cognitive aid such as a checklist. We present a sample checklist for the initial management of amniotic fluid embolism based on standard management guidelines. We also suggest steps that each facility can take to implement the checklist effectively.

Key words: cardiac arrest, cardiopulmonary resuscitation, critical care, implementation, perimortem cesarean, pulmonary hypertension, resuscitative hysterotomy, right heart failure

Condensation: The Society for Maternal-Fetal Medicine presents a checklist to guide the initial management of amniotic fluid embolism.

Introduction

Amniotic fluid embolism (AFE) is a rare syndrome characterized by sudden cardiorespiratory collapse during labor or within 30 minutes after delivery of the placenta.¹ The syndrome is believed to be triggered by the abnormal release of trophoblast or other material into the maternal circulation.² Despite its name, AFE likely has no direct relation to either amniotic fluid or embolism.^{2, 3} The reported incidence is

1.9 to 6.1 per 100,000 births, and the case-fatality rate has been reported to exceed 50% in "classic" cases characterized by cardiovascular collapse and coagulopathy.²

Because of its rarity, many obstetrical providers have no experience managing AFE and many facilities will encounter only one or two cases per decade. Faced with a catastrophic, unfamiliar emergency in a highly emotionally charged environment, providers often find it difficult to think clearly or to recall the steps for appropriate management. The result may be panic, confusion, chaos, poor communication and coordination between providers, and a suboptimal patient outcome.

Managing AFE can benefit greatly from a cognitive aid such as a checklist. We present a sample checklist for initial management of AFE based on management guidelines proposed by the Society of Maternal-Fetal Medicine,⁴ a recent expert review,⁵ and a hospital system management flowchart.⁶ We suggest steps that each facility can take to implement the checklist effectively.

Checklist

A sample checklist is presented in the Box. We sought specifically to cover the immediate management of AFE on the labor and delivery (L&D) unit when a rapid response is critical. Once the patient is stabilized and transferred to the intensive care unit, there is usually more time for reflection, reading, and discussion. Therefore, management at this later stage is not covered in this presentation.

A driving principle was to keep the checklist concise and uncluttered. We excluded items that we felt were unlikely to be overlooked (for example, summoning help, calling a "code," initial use of 100% oxygen, securing intravenous access, use of bag-and-mask or intubation for

ventilation). We followed common checklist design principles, such as use of a sans-serif font, minimizing use of color, and inclusion of a version date. The checklist is designed to be a single-page document, printable on 8.5 x 11-inch paper.

We focused on providing guidance for the personnel likely to be present in the patient's room (obstetrician, anesthesiologist, L&D nurses) rather than attempting to guide the responses of diverse personnel throughout the hospital (such as blood bank, pharmacy, rapid response team, intensive care team). A broader, hospital-wide response algorithm is available elsewhere.⁶

The differential diagnosis of AFE includes pulmonary embolism, myocardial infarction, air embolism, high spinal block, and sepsis. The initial management of all these conditions focuses on the same "ABCs": support of airway, breathing, and circulation. The clinical finding that will ultimately confirm the diagnosis of AFE is the rapid appearance of disseminated intravascular coagulation (DIC).²

Cardiac arrest accompanies many cases of AFE, but not all.⁴ After running several maternal cardiac arrest drills at our hospitals, we concluded that it is too complex to combine a detailed cardiac arrest checklist and an AFE checklist. Therefore, the focus of our checklist is on the management of AFE *after* the patient has been resuscitated from cardiac arrest, and we include only rudimentary guidance regarding resuscitation, primarily to remind the care team that cesarean delivery should be started within 4 minutes of maternal cardiac arrest if maternal circulation has not been restored.

We assume that a nurse or other provider will initiate basic life support (BLS) with a transition to advanced cardiac life support (ACLS) once skilled providers and resources are available. However, general management of cardiac arrest is a broader topic with additional considerations (for example, timing and frequency of defibrillation or dosage and route of

medications). Thus, we believe that facilities should have a separate flowsheet or checklist for cardiac arrest in pregnancy. Excellent examples can be found in an American Heart Association Scientific Statement.⁷

Cesarean delivery will improve maternal hemodynamics and should be started within 4 minutes in a patient undergoing cardiopulmonary resuscitation (CPR) to increase the probability of successful resuscitation.^{5, 7} Indeed, the term "resuscitative hysterotomy" has been proposed to replace the term "perimortem cesarean" to more accurately reflect the potential maternal benefits of the procedure.⁸ The procedure is most often performed where the patient is located to save time. Moving the patient to an operating room can be considered if it can be accomplished within 1 to 2 minutes. Once the infant is delivered, the obstetrical care provider's attention should be directed toward preventing and managing hemorrhage and DIC.

In the section "Anticipate uterine atony, DIC, hemorrhage," we remind clinicians to be prepared for these complications and suggest steps that may reduce morbidity, including use of uterotonic agents, administration of tranexamic acid,⁹ and initiation of the hospital's protocol for massive transfusion. DIC accompanies over 80% of AFE cases.⁴ Typical massive transfusion protocols call for replacement of red cells, platelets, and fresh/frozen plasma in approximately a 1:1:1 ratio. However, cryoprecipitate is preferred over fresh/frozen plasma in the setting of AFE to minimize the risk of volume overload.⁵

In the section "Manage pulmonary hypertension and right ventricular failure (Anesthesiology, Critical Care, or Cardiology)," we focus attention on pulmonary hypertension and right heart failure that are characteristic of AFE^{4, 5} and provide guidance regarding inotropic medications and afterload reducing agents. Of course, the anesthesia provider will assume a key role in management of the airway, ventilation, fluids, and administration of other medications.

However, these roles are not specifically delineated in the checklist because they are not likely to be overlooked by a skilled anesthetist.

Avoidance of fluid overload is an important management principle of pulmonary hypertension and right heart failure. We recommend using blood products for volume resuscitation rather than crystalloid or colloid. Inotropes and pulmonary vasodilators are the mainstays of management. Transthoracic or transesophageal echocardiography can be used to guide therapy. Extracorporeal membrane oxygenation (ECMO) can be considered if there is severe right ventricular dysfunction that remains refractory to medical management.⁵

A debriefing is recommended soon after the patient is moved to the intensive care unit or, if the patient expires, to the morgue. The purposes of the debriefing are to discuss which aspects of the care were managed well and to identify areas where systems or processes need to be improved. In addition, there should be a brief discussion of the need for psychological and emotional support of the patient, family members, and clinical staff. Resources for patient and family support are included in a patient safety bundle, *Support After a Severe Maternal Event*, by the Council on Patient Safety in Women's Healthcare.¹⁰ Other support resources are offered by the Amniotic Fluid Embolism Foundation.¹¹ Healthcare providers can also be "second victims" who feel traumatized by adverse medical events; therefore, it is important to address their needs as well.¹² Finally, we recommend that all cases of suspected AFE be submitted to the international registry maintained by the Amniotic Fluid Embolism Foundation.¹¹ Reports based on the registry have yielded valuable insights regarding risk factors, clinical correlates¹³ and outcomes of AFE.¹⁴ Future analyses of the registry data may reveal management strategies associated with improved outcomes. The registry will be most valuable if all cases are reported, even if the outcome is not favorable.

Suggestions for Implementation

The sample checklist is presented as general guidance and shows one approach to the initial stabilization and management of a patient with AFE. Facilities should modify and adapt it to fit their unique attributes. Such attributes include whether the facility has trainees (residents, medical students, nursing students), 24-hour in-house anesthesia coverage, a hospital-wide rapid-response team, an in-house blood bank, anesthesia carts, or "crash carts" stocked with the medications listed, and several other facility-specific considerations.

Optimal implementation requires several steps, which we encourage each facility to follow. Additional guidance on these steps is covered in two recent overviews^{15,16} regarding the development and implementation of checklists.

- Assemble a multidisciplinary team to review the checklist and make modifications to fit facility-specific requirements. Relevant stakeholder groups will likely include obstetric providers (generalists, hospitalists, maternal-fetal medicine specialists), obstetric anesthesia providers (anesthesiologists and nurse anesthetists), L&D nursing (leadership and staff), medicine subspecialists (cardiology, pulmonary/critical care), blood bank, pharmacy, rapid response team, and the emergency department. Each stakeholder group should have at least one member on the team.
- Decide where the checklist should be kept. Almost all AFE cases occur in a labor room, delivery room, or operating room. It is likely impractical to post the checklist on a wall in every relevant room. A likely place to keep it would be in a pocket on the side of the "crash cart" or "hemorrhage cart" on the L&D unit. Units with a readily accessible computerized system for storing and accessing such material may consider keeping the checklist there.

- Pilot-test the checklist by having the development team run through some simulated scenarios. Identify problem items and make modifications as needed to address them. Then pilot-test again.
- Make announcements. Once the finalized checklist is in place, communicate to all relevant clinical staff (obstetrical providers, obstetric anesthesia, and L&D nurses) where it is kept. Review the contents of the checklist during nursing in-service training, grand rounds, and/or obstetrics and anesthesia department meetings. Discuss at board report and during change-of-shift huddles.
- Run simulations and drills of AFE to familiarize all relevant staff with the location of the checklist and to give them practice using it to guide the performance of the interventions.
- Conduct a sentinel event analysis after each case of AFE. Identify systems or processes that can be improved, such as delays involving medications, blood products, or personnel.
 Discuss any changes needed to improve the checklist contents or location.

Use of a readily available checklist by providers who have practiced using it should result in a coordinated, controlled response to AFE and improve outcomes by ensuring that patients who suffer this rare, catastrophic event receive timely and optimal care.



Abbreviations: CPR, cardiopulmonary resuscitation; DIC; disseminated intravascular coagulation, ECMO, extracorporeal membrane oxygenation; FFP, fresh/frozen plasma; FiO_2 , inhaled fraction of oxygen; IV, intravenous

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