

Review

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Assessing malpractice lawsuits for death or injuries due to amniotic fluid embolism

S. Zaami¹, E. Marinelli¹, G. Montanari Vergallo¹¹Department of Anatomical, Histological, Forensic and Orthopaedic Sciences, Sapienza University of Rome, Rome; ²Department of Public Health and Infectious Diseases, Sapienza University of Rome, Roma, Italy

Abstract

Amniotic fluid embolism (AFE) is a pregnancy complication known to be extremely hard to diagnose, since it manifests itself abruptly and with no warning signs, presenting an incidence rate of about 1 in 40000 deliveries, and maternal morbidity and mortality ranging from 20% to 60%. Although almost a century has gone by since it was first identified (1926) and despite medical research having been conducted on such a syndrome, diagnostic procedures and treatment methods have not yet been clarified enough.

Specific biochemical markers have been produced in research laboratories, but their clinical value results to be limited, given how rapid the pathological process moves forward. At the time being, no diagnosis is feasible which may effectively prevent the disease from occurring. Certainly, a multidisciplinary approach might contribute to saving the lives of mother and infant, as well as ensuring better life standards. The paper's authors aim to highlight the medico-legal issues, in light of several rulings from the Italian Constitutional Court as well as lower courts. The authors also advocate for the creation of a nation-wide registry meant to collect all signaled AFE instances so that research on this as yet devastating syndrome can be conducted based on hard data. *Clin Ter* 2017; 168(3):e220-224. doi: 10.7417/CT.2017.2010

Key words: Amniotic fluid embolism, pregnancy complication, medical liability, risk factors, national register

Introduction

The "International Classification of Disease" characterizes maternal death as "death of a woman while pregnant or within 42 days of termination of pregnancy from any cause related or aggravated by the pregnancy or its management, but not from accidental or incidental causes"(1) and sets forth the concept of pregnancy-related death, i.e. the death of a woman while pregnant or within 42 days of termination of pregnancy regardless of the cause of death. Maternal death can be traced back to clinical, care-related and organizational factors, e.g. a failure to communicate between medical and paramedical personnel, unavailability of one or more

specialists for counseling, lack of hospital beds in intensive care units or the availability of intensive care in a hospital too far away, lack of blood or derivatives, etc...(2).

Furthermore, it is noteworthy that a more frequent use of caesarean sections in Italy (37% of births in 2003, 38% in 2004) than European average and in particular Anglo-Saxon countries (23% in 2003-2004) may enhance the risk of exposure to maternal morbidity and mortality for some clinical conditions (e.g. thromboembolic syndrome and anesthesia-related death) (3).

The study is meant to analyze the difficulties associated with an AFE diagnosis

AFE calls for a complex and articulate approach on the part of forensic pathologists, who need to identify the cause of death and afterwards, once the physiopathological mechanisms leading to maternal death have been established, ascertain whether there have occurred inappropriate procedures or mistakes during the pregnancy, labor or delivery management (4)

Diagnosis of AFE

Amniotic fluid embolism is still a diagnosis of exclusion, although the scientific knowledge in this field is increasing. In fact, according to Thongrong (5) amniotic fluid embolism has likely occurred when, during labor, delivery or within 30 minutes of delivery one or more of the following events takes place:

acute hypotension
cardiac arrest
acute hypoxemia or respiratory distress
severe hemorrhage or coagulopathy

Nonetheless, such data have not been scientifically buttressed. In fact, in scientific literature one instance of AFE has been reported occurring two hours after natural delivery (6) and, according to Fineschi et al., AFE can occur as late as 48 hours after delivery (7).

Correspondence: Prof. Enrico Marinelli. E-mail enrico.marinelli@uniroma1.it

The initial signs and symptoms which may lead one to suspect an AFE instance are non-specific. They include:

abrupt cardiac and respiratory failure
dyspnea
altered consciousness
restlessness
Cyanosis
seizures and uterine atony

Such a pathology still entails significant morbidity and mortality rates and permanent brain damage for those patients who survive.

Presently, numerous aspects involving the pathophysiology and clinical development are still not understood and several hypotheses have been formulated, in particular a possible role of anaphylaxis and the role of the complement in the onset of adult respiratory distress as a consequence of AFE (8,9).

Thus, only an autopsy can confirm with a high degree of certitude an AFE diagnosis (5).

It is extremely hard to diagnose AFE, therefore physicians need to comply with proper methodology to decrease the margin of error as much as possible.

Thus, according to Rudra et al., (10) a set of valuable diagnostic tools are available:

- electrocardiogram and pulse oximetry to continuously monitor the oxygen saturation;
- chest X-ray to control right atrium and ventricle, pulmonary artery and pulmonary edema;
- electrocardiogram and pulse oximetry to continuously monitor the oxygen saturation;
- chest X-ray to control right atrium and ventricle, pulmonary artery and pulmonary edema;
- central venous pressure, which can be risen by the pulmonary hypertension but drops very much in case of severe hemorrhage;
- coagulation profile, because disseminated intravascular coagulation is often associated with AFE

Nevertheless, unlike what was believed in the past, the mere presence of amniotic fluid material in the bloodstream does not prove an AFE instance, because such a reaction does not stem from the presence of amniotic fluid, but only from some components of its (7). Hence, a differential diagnosis is of the utmost importance.

In fact, as affirmed by Rudra et al., (10) cardiopulmonary collapse and severe hemorrhage may be caused not only by AFE but also by the following conditions:

- thrombotic pulmonary embolism
- air embolism;
- eclamptic convulsions and coma; Convulsion from toxic reaction to local anaesthetic drugs;
- acute left heart failure;
- cerebrovascular accident;
- aspiration of gastric contents into the lungs;
- hemorrhagic shock

Since AFE can cause the deaths of the mother and the fetus within few hours, it is vital that the gynecologist knows from the very beginning what circumstances, signs and symptoms to take into account upon formulating such differential diagnosis.

Treatment

While facing cardiac arrest, it is necessary to place the parturient in left lateral decubitus position because the obstruction of the inferior vena cava due to the late pregnancy limits the venous return and compromises the cardio pulmonary resuscitation.

If these attempts were useless, the caesarean delivery of the foetus would become necessary in order to increase the chances of maternal and neonatal survival (6,10,11,12,13). The American Society of Anesthesiologists Task Force on Obstetric Anesthesia recommends to perform the perimortem cesarean delivery within five minutes (14).

According to Einav et al. (15), such a timeframe is unrealistic and risky because it may produce a pessimistic attitude when the medical staff cannot meet that standard. Consequently, delivery should be performed within 10 min of arrest.

Besides, proper clinical procedures require the hardest effort in sustaining vital functions.

According to Thongrong et al.,(5) doctors should stick to the following pattern.

In order to address the airway and respiratory conditions, high flow oxygen must be immediately administered. High frequency oscillatory ventilation or extracorporeal membrane oxygenation (ECMO) may be necessary. Doctors should also be ready to use of a fiberoptic scope or even tracheotomy.

With regard to hypotension and maternal circulation, they suggest establishing a central venous access and utilizing a urinary catheter because these tools help with guiding the administration of the therapies (15). The treatment should comprise:

- blood products to treat hemorrhage: the choice of the products to be administered depends on the laboratory studies; as last chance could be used recombinant activated factor VII;
- isotonic solution because it is useful to maximize preload;
- vasopressors and inotropes to oppose refractory hypotension;
- inotropic support to treat ventricular contractile impairment;
- milrinone because it supports the right heart support improving both inotropy and pulmonary vasculature;
- inhaled nitric oxide or inhaled epoprostenol to treat refractory hypoxemia and to unload the right ventricle;
- as last options, intraaortic balloon pump, right ventricular assist device and/or ECMO

According to Shah et al. (16), a pulmonary artery catheter should be placed before analgesia in order to early diagnose pulmonary hypertension and to establish a favourable hemodynamic management. Stanten et al. (17) report the case of a 45 year old woman with placenta previa who developed AFE during cesarean delivery. The transesophageal echocardiogram examination showed catastrophic pulmonary vasoconstriction that was successfully treated

by cardiopulmonary bypass, heparin, epinephrine, and high-dose steroids. In another case report of AFE with postpartum hemorrhage and coagulopathy due to disseminated intravascular coagulation, the physicians used administered 100% oxygen, noradrenaline and blood transfusion and performed uterine artery embolization. So, they managed to stop PPH and DIC within seven hours and both the woman and the baby had no complications (18).

Nagarsheth recounts a case in which nitric oxide produced no effect and medical staff obtained the resuscitation of a woman with probable AFE by placing a Right Ventricular Assist Device to treat severe pulmonary arterial hypertension and by using recombinant factor VIIa to oppose massive hemorrhage (19).

Medico-legal discussion

AFE arises from the entry of amniotic fluid into the maternal circulation. In fact, it usually occurs during labor and delivery or in the postpartum period, but it can also happen with amniocentesis, abortion, abdominal trauma, removal of placenta, cervical suture removal and ruptured uterus or intrapartum amnioinfusion (6)

Consequently, it is necessary to avoid every unnecessary trauma to the uterus. Moreover, it is useful to administer intravenous β -adrenergic drugs or magnesium sulphate in order to control excessively intense and recurring uterine contractions, because tumultuous labor is considered a risk

Scientific research (20) has identified the following risk factors which may lay the groundwork for AFE to occur:

- a) maternal age ≥ 35 years;
- b) multiple pregnancies;
- c) placenta previa and placental abruption;
- d) eclampsia;
- e) induction of labor;
- f) Caesarean section

Yet, a survey by Fineschi et al. (6) have stressed that the above-mentioned factors were absent in at least half cases, and that initial clinical signals were extremely varied.

As a consequence, even when the known risk factors are missing in real cases, doctors need to pay high attention and be ready to apply all proper resuscitation techniques at the slightest suspicious sign.

In fact, by the current state of scientific knowledge and despite the commitment of many a researcher, doctors have still few references when dealing with an AFE case, and there are no precautionary measures to prevent its occurrence.

Therefore, any judgment as to the liability must be centered on the quality and speed of any diagnostic and therapeutic response when facing a potential AFE case. (2,21) Not all of the above-reported therapies are so widely validated as to be deemed standard care procedures.

In fact, according to Rudra et al., (10) newer methods such as intra aortic balloon counterpulsation, extracorporeal membrane oxygenation, cardiopulmonary bypass, plasma exchange transfusion, Uterine artery embolization, inhaled nitric oxide (22), cell-salvage combined with blood filtration, serum protease inhibitors, inhaled prostacyclin and high

dose corticosteroids (23) are based on not very significant case reports (6).

Consequently, the omission of such strategies cannot be considered as a failure to meet the standard of care.

Medical liability in AFE cases

In case of damage, in order to file suit three requirements need to be met: the accidental nature of the misconduct on the part of hospital personnel, the existence of proven damage and a causal relationship. Doctors need to put in place all necessary measures according to current scientific knowledge. They must encompass not just the treatment, but the diagnosis as well, all activities prior to the procedure and post-operative stages.

In legal frameworks such as the Italian one, according to which the burden of proof rests on healthcare facilities, the institutions are called upon to prove that proper, qualified medical personnel and safe equipment was available. Thus, they must prove that the harmful outcome was brought about by an unforeseeable event (24). Otherwise, the court is bound to sentence them to redress the damage.

In a suit involving a patient who suffered permanent damages in the aftermath of a hysterectomy, the Courthouse of Cassino has sentenced both the doctor and the hospital to damage compensation. The judges in the case have acknowledged that AFE is hard to diagnose with certainty. Consequently, the court has convicted them on account of their failure to provide proper care and because of the seriously delayed resuscitation procedures.

“According to the judge, in fact, the substandard care was identified in the severe delay of resuscitation activities. The ob-gyn was held responsible for having waited for the anaesthetist, without providing the first aid (external cardiac massage, artificial respiration and administration of oxygen) to the patient. Hospital instead was held liable for not providing a well-equipped delivery room: the results of inquiry showed the lack of oxygen, defibrillator and kit surgery” (25).

In AFE cases, as mentioned before, caesarean sections are deemed to be a risk factor too. Thus, if the overall incidence of caesarean sections decreased, so would probably the cases of AFE. Hence, it is necessary to take into account the hypothesis by which AFE may occur during or after a caesarean section carried out with no medical indication. Unless the patient deliberately refuses a natural delivery, a choice on the part of the doctor to perform a caesarean section without medical indication constitutes a breach of the standard of care, in that it exposes to a pointless risk and an otherwise avoidable surgery. Nevertheless, it appears to be hard to prove that, had a caesarean section not been carried out, (more likely than not), the AFE occurrence would not have happened.

As far as the causal relationship is concerned, available data on prognosis and outcomes are contradictory. In fact, the mortality rate ranges from 20% to 40% and most survived patients suffers permanent damages, whereas only 20%-25% of infants perishes and 50% of survivors reports no disability whatsoever(5). Other studies maternal mortality rates between 27% to 37% (26, 27). Totally conflicting data are

provided by Kainer et al.: maternal mortality ranges from 60% to 80% (28).

Anyway, according to both Italian Law and Common Law, the causal relationship cannot be proven based solely on statistical data; on the contrary, it is necessary to take into account all circumstances as to each individual case (Cassazione penale, sez. IV, 20 marzo 2012, n. 10864)

The very lack of scientific knowledge makes it harder to prove a causal relationship in AFE cases. In fact, no evidence exists as to the correlation between the gravity of an actual AFE case and the amount of amniotic fluid or its components found in a patient's lungs (6).

However, a recent study argues that the maternal serum level of Sialyl Tn, which is typically present in meconium, could be a prognostic factor able to identify fatal cases of AFE. In fact when amniotic fluid contains thick meconium it might be more toxic than the clear one. Consequently, the risk of neurological impairment or death is higher and cardiac arrest occurs in a shorter time (29). If such an approach were confirmed, the amount of meconium could be applied as a standard to establish whether, provided that the proper therapy had been administered, the mother and/or the infant would have survived.

According to the Italian Supreme Court, even if it is not possible to prove that the medical error caused (more likely than not) the death or injury of the patient, the loss of chance to heal or survive is in itself a compensable damage. The criterion of the preponderance of evidence should be applied in establishing the causal connection between medical error and loss of chance.

Applying the above mentioned rule affirmed by the Supreme Court the ascertainment of the causation becomes superfluous.

The plaintiff complains only about the loss of possibilities caused by the negligent conduct held by the doctor. If the loss of chance is a damage, the omission of the doctor and the actual existence of statistically significant chances of survival involve automatically the existence of a causal connection between the medical error and the damage (i.e. the loss of chance).

Conclusions

Based on what surfaces from this study, it is essential to further scientific knowledge of the causes of maternal death. In such a way, it will be possible to improve the quality standards of care and avert many pregnancy-related deaths. It is well-known how age of the mother also plays a role in determining the likelihood of developing AFE. The average age of pregnant women has increased over the past years. A substantial amount of research has shown that the percentage of women who get pregnant at 35 years of age or older rose from 9% in 1998 to 29% in 2007 (30).

This gives rise to serious issues for the healthcare system and women themselves. It is therefore important, following in the footsteps of France, the Netherlands and the United Kingdom, to set up a specific system of oversight on AFE-related maternal deaths, in such a way as to rely on hard data in order to study all risk factors associated with the phenomenon with the purpose of providing patients with

the best possible care.

All collected data will then be compared with those from other countries which already have such an oversight system in place, thus making possible the implementation of appropriate preventive measures to raise the quality standards of obstetric care. Furthermore, given that AFE is most serious and rare a complication, it would be necessary to be able to rely on multidisciplinary teams made up of obstetricians, anatomic pathologists, anesthesiologists, general practitioners, specialists in intensive care and emergency medicine and internists.

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