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Amniotic fluid embolism syndrome: analysis of the United States International Registry

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Abstract

Background: Incidence, risk factors, and perinatal morbidity and mortality rates related to amniotic fluid embolism remain a challenge to evaluate, given the presence of differing international diagnostic criteria, the lack of a gold standard diagnostic test, and a significant overlap with other causes of obstetric morbidity and mortality.

Objective: The aims of this study were (1) to analyze the clinical features and outcomes of women, using the largest United States-based contemporary international amniotic fluid embolism registry, and (2) to investigate differences in demographic and obstetric variables, clinical presentation, and outcomes between women with typical versus atypical amniotic fluid embolism, using previously published and validated criteria for the research reporting of amniotic fluid embolism.

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Abstracts were presented at The Society for Maternal Fetal Medicine 38th and 39th Annual Pregnancy Meeting, Jan. 29–Feb. 3, 2018, Las Vegas, NV, and will be presented Feb. 11–16, 2020, in Dallas, TX.

Materials and Methods: The AFE Registry is an international database established at Baylor College of Medicine (Houston, TX) in partnership with the Amniotic Fluid Embolism Foundation (Vista, CA) and the Perinatology Research Branch of the Division of Intramural Research of the NICHD/NIH/DHHS (Detroit, MI). Charts submitted to the registry between August 2013 and September 2017 were reviewed, and cases were categorized into typical, atypical, non-amniotic fluid embolism, and indeterminate, using the previously published and validated criteria for the research reporting of AFE. Demographic and clinical variables, as well as outcomes for patients with typical and atypical AFE, were recorded and compared. Student *t* tests, χ^2 tests, and analysis of variance tables were used to compare the groups, as appropriate, using SAS/STAT software, version 9.4.

Results: A total of 129 charts were available for review. Of these, 46% (59/129) represented typical amniotic fluid embolism and 12% (15/129) atypical amniotic fluid embolism, 21% (27/129) were non-amniotic fluid embolism cases with a clear alternative diagnosis, and 22% (28/129) had an uncertain diagnosis. Of the 27 women misclassified as an amniotic fluid embolism with an alternative diagnosis, the most common actual diagnosis was hypovolemic shock secondary to postpartum hemorrhage. Ten percent (6/59) of the women with typical amniotic fluid embolism had a pregnancy complicated by placenta previa, and 8% (5/61) had undergone in vitro fertilization to achieve pregnancy. In all, 66% (49/74) of the women with amniotic fluid embolism reported a history of atopy or latex, medication, or food allergy, compared to 34% of the obstetric population delivered at our hospital over the study period ($P < .05$).

Conclusion: Our data represent a series of women with amniotic fluid embolism whose diagnosis has been validated by detailed chart review, using recently published and validated criteria for research reporting of amniotic fluid embolism. Although no definitive risk factors were identified, a high rate of placenta previa, reported allergy, and conceptions achieved through in vitro fertilization was observed.

Keywords

anaphylactoid syndrome of pregnancy; cardiovascular collapse; disseminated intravascular coagulopathy; history of atopy; hypotension; hypertension; neurologic injury; registry

INTRODUCTION

Amniotic fluid embolism (AFE) is a catastrophic obstetric complication typically presenting as a complex sequence of peripartum events that result in cardiovascular collapse and disseminated intravascular coagulation (DIC).^{1–9} The reported incidence of AFE ranges from 1 in 15,200 to 1 in 53,800 deliveries worldwide.^{9–22}

Recognition of the true incidence and mortality rates associated with AFE are confounded by several factors – most importantly, the absence of a definitive “gold standard” diagnostic test. In addition, many of the signs and symptoms of AFE overlap with those seen in other obstetric complications.^{10,13–15,23–27} The existence of several differing international criteria for the diagnosis of AFE further compound the challenges of defining risk factors, diagnosis, prognosis, and understanding of the underlying pathophysiology of this disease.^{10–12,21–23}

Studies based on administrative data sets consistently demonstrate both a higher incidence and a lower mortality rate than those based on data from individual chart review, suggesting that former studies likely contain significant numbers of patients with conditions other than AFE.^{10,13–24, 28}

Diagnostic criteria for the research reporting of AFE have been published to promote uniformity in data collection, validate prior studies, refine the identification of clinical risk factors, and improve treatment strategies for AFE.²⁴ When applied to the largest United States-based contemporary international registry for AFE, the diagnostic performance of this criteria set demonstrated a sensitivity of 79.4% and a specificity of 100% for the diagnosis of AFE in 115 enrolled women.²⁵ The aims of the present study were to analyze the clinical features and outcomes of women in this registry, and to investigate differences in clinical presentation and outcomes between women with typical vs atypical AFE.

MATERIALS and METHODS

Following Institutional Review Board approval in 2012, an international AFE registry was established at Baylor College of Medicine, (Houston, TX) in collaboration with the Amniotic Fluid Embolism Foundation, (Foundation; Vista, CA) and the Perinatology Research Branch of the Division of Intramural Research of the Eunice Kennedy Shriver National Institute of Child Health and Human Development/National Institutes of Health/US Department of Health and Human Services (Detroit, MI). Charts submitted to the registry between August 2013 and September 2017 were reviewed for this descriptive study. Cases identified prior to 1995 and included in the original registry for AFE were excluded.² All cases were initially identified as survivors or family members of decedents who contacted the Foundation's website and were invited to submit the medical records through the Foundation to the investigators. All consented individuals were informed that the result of case categorization would not be disclosed to them. No cases originated as medico-legal consultations to authors of the study. Charts, analyzed by the four authors with expertise in the field of AFE and critical care obstetrics, were categorized as one of the following:

1. Typical amniotic fluid embolism. These charts met current published and validated diagnostic criteria recommended for the research reporting of AFE.^{14,24,25}
2. Atypical amniotic fluid embolism. This group included women who, while not strictly meeting each of the above criteria, were felt by the reviewing experts to have a clinical course that could not be explained by any recognized pathophysiologic process other than a forme fruste of AFE.^{24,25}
3. Non-amniotic fluid embolism. A critical review of the medical records for these women suggested an alternative medical diagnosis much more likely than AFE.
4. Indeterminate. For this group, medical records were not consistent with typical or atypical AFE, but a definitive alternative diagnosis could not be reached. In most cases, the medical records submitted were insufficiently detailed to allow a definitive alternative diagnosis.

Inter-reviewer agreement was determined by independent review of each case by three different authors reviewing cases and were categorized only with agreement, using the published and validated criteria for the research reporting of AFE as well as predetermined categories of indeterminate and non-AFE. Demographic and clinical variables, as well as outcomes for patients with typical and atypical AFE, were recorded and compared. Data were reported as means and percentages. Student's *t* tests, χ^2 tests, and ANOVA tables were used to compare the groups, as appropriate, using SAS/STAT® software, version 9.4 (SAS Institute, Cary, NC).

RESULTS

Of the 136 cases submitted to the registry, 129 had charts available for review. Sixteen international cases were included. Of these, 46% (59/129) met the criteria for typical AFE, 12% (15/129) were considered atypical AFE, 21% (27/129) appeared to represent a different condition, and 22% (28/129) were considered to have an uncertain diagnosis (Figure 1). Available demographic and pre-event medical and obstetric features of patients with typical and atypical AFE are described in Tables 1 and 2. Of all women with AFE, only 2 (3%) had twins. Racial/ethnic makeup was self-reported as 70% white, 7% Hispanic, 3% Asian, 1% black, and 19% mixed or unspecified. In all, 66% (49/74) of women with AFE reported a history of atopy, or latex, medication, or food allergy, compared to 31% (4739/15091) of the obstetric population delivered at our hospital over the study period ($P < .05$), and 10% (6/59) of women with AFE had placenta previa at term. Clinical features and maternal outcomes associated with the occurrence of AFE are presented in Table 3. Maternal death occurred in 10% of cases of typical AFE. Of all women with AFE, 17.6% (13/74) delivered vaginally and 79.7% (59/74) underwent cesarean delivery, of which 32.2% (19/59) were emergent, in response to clinical AFE. Fewer maternal deaths were seen among women with atypical AFE; however, given the small number of deaths in the overall population, this difference did not reach statistical significance. Both pulmonary edema and maternal neurologic injury were significantly more frequent among survivors of typical AFE ($P = .04$, $P = .02$, respectively).

Neonatal outcomes are listed in Table 4. A total of 30 newborns (51%) born to women with typical AFE had Apgar scores < 7 at 1 minute and were acidemic (mean arterial pH was 6.95). Neonatal mortality was 6%; however, no neonatal deaths were reported by women with atypical AFE. Table 5 outlines the frequency with which each of the 5 criteria necessary for the diagnosis of AFE was met by both typical and atypical cases. Maternal hypotension was the only criterion that was significantly less common among atypical AFE cases ($P = .001$).

Of the 27 women misclassified as having AFE with a definitive alternative diagnosis, the most common actual diagnosis was hypovolemic shock secondary to postpartum hemorrhage ($n=21$, 77.7%), followed by anesthetic complications ($n = 4$, 14.8%) and sepsis-related cardiovascular collapse ($n = 2$, 7.4%).

Among women who survived either atypical or typical AFE, long-term complications that include medical and psychological manifestations involving depression and post-traumatic

stress disorder (PTSD) symptoms, were recorded from those contacted and available for interview at least 1 year post-event. Of 29 survivors available for interview, 2 reported thyroid abnormalities, 1 reported persistent liver dysfunction, and 16 (55.1%) endorsed symptoms consistent with PTSD, including anger outbursts, self-destructive behavior, and flashbacks. Only 1 case (3%) of PTSD was associated with fetal/neonatal demise. All of the patients who reported post-traumatic stress symptoms were surveyed about their mental health resources and were referred to local facilities for mental health care.

Seven women who experienced either typical or atypical AFE had a subsequent pregnancy: 1 miscarried, and the other 6 had an uncomplicated pregnancy and delivered at term with no recurrence of AFE.

COMMENT

Principal findings

1. Strict diagnostic criteria for the research reporting of AFE were developed to reduce or eliminate the likelihood of including non-AFE cases in published data, thus providing valid data sets for improved analysis.^{23–25} These criteria have been applied and validated, using the largest contemporary United States-based international AFE registry.²⁵
2. In this current report of the registry, these criteria have been applied to identify risk factors, determine outcomes, and distinguish typical from clinically atypical cases of AFE. This analysis more accurately describes the current clinical spectrum of this disease than do older studies, especially those based on administrative and coding data. With the exception of hypotension at presentation, criteria for typical and atypical cases of AFE did not differ.
3. Although no definitive risk factors were identified, in vitro fertilization, reported history of allergy, and placenta previa were notably increased among women with AFE, and both maternal and neonatal outcomes were comparably improved in relation to other research studies and the original national registry.^{2,28–39} Our data represent the largest available series of women with AFE whose diagnosis has been validated by chart review, according to recently published criteria, and support the following findings.^{24,25}

Results in the Context of What is Known

First, the maternal mortality rate found in this analysis was 10% with a neurologically intact survival of 46%, compared to other studies, including the original registry, where maternal mortality was 61% with a neurologically intact survival rate of 15%.² While recognizing the limitations, including reporting bias, of any registry-derived outcome data, these data suggest that maternal outcomes may be improving due to increased recognition and evolving critical care medicine, likely linked to our enhanced understanding of the pathophysiology of this condition.^{2,8,9,23,29–32,40–43} The fact that neurologic injury in survivors was also less frequent in atypical cases would be expected, given the less extensive nature of their disease process.

Despite a high percentage (36 %) of fetuses delivered by emergency cesarean or operative vaginal delivery due to maternal cardiovascular instability or collapse, there were only 3 neonatal deaths in women with AFE; in the report of an earlier national registry 3 decades ago, fetal or neonatal death rates approached 60% with one-half of the newborns experiencing neurologic sequelae.² As with the apparently improved maternal outcome statistics, improved neonatal outcomes may reflect an increased appreciation for the importance of prompt delivery in the face of preventing maternal cardiovascular collapse and improving neonatal care.^{23,44} International registries and case series have also demonstrated improved perinatal outcomes secondary to early recognition and prompt resuscitation efforts for suspected cases.^{17–22,28–32,38,40,43} Recommendations for the management of AFE have been published to assist providers with key lifesaving maneuvers, e.g., early involvement of advanced cardiac life support, management of cardiovascular changes, and transfusion recommendations, all of which have contributed to provider education and training.^{10,23,49}

Second, our data confirm the frequent misdiagnosis of AFE; almost one-half of patients whose diagnosis was believed to be sufficiently secure to prompt submission to the national registry did not, upon careful review of medical records, have confirmed AFE. The implications for the accuracy of general, administrative data-derived diagnoses of AFE are clear.^{2–4,9,10,14–22,24–26,35–39,45–47}

Third, as demonstrated in Table 5, patients with typical vs atypical AFE were differentiated by the absence of 1 or more criteria needed to confirm the diagnosis for research reporting purposes, rather than demonstrating different timing of the onset of signs or symptoms of this condition. This is consistent with the recognized pathophysiology of AFE.

Finally, while our data suggest few demographic or obstetric differences between women with AFE and those in the general population, 3 observations were noteworthy. Ten percent of women with typical AFE had placenta previa complicating their pregnancy, compared to a rate at term of < 1% in the general population, suggesting that abnormal placentation may increase the risk of activation of pathogenic pro-inflammatory or reactive mediators during the delivery process, or may enhance the opportunity for large volumes of amniotic fluid to enter maternal circulation. Other studies have found similar rates of placenta previa in women who have suffered AFE.^{30,42} Additionally, 66% of women with AFE reported a history of atopy, or latex, medication, or food allergy, compared to 34% of the obstetric population delivered at our hospital over the study period ($p < .05$). This doubling of reported atopy among cases suggests that an anaphylactoid reaction may be the inciting event for the cascade of adverse events that characterize AFE.^{2,33} Lastly, we also noted that 8% of women with typical AFE conceived through in vitro fertilization. This compares to 1–2% of women in the general US population.²⁶ While valid statistical conclusions regarding the significance of such data are not possible, the recognized involvement of an abnormal immune response in the pathogenesis of AFE makes these data intriguing.^{2,3,8,48}

Clinical implications

The classic clinical signs of AFE, including peripartum respiratory distress, hypoxia, profound hypotension, cardiovascular collapse, and disseminated intravascular coagulopathy, have been consistently reported in the literature as commonalities in AFE,

regardless of varying global case definitions.^{8,15–22,24,30–32,40–43,46–49} When applying these diagnostic criteria for the research reporting of AFE to our registry, 100% of typical and 67% of atypical AFE cases met the definition.²⁴

Clinical features of AFE also include profound cardiovascular changes. Available evidence suggests that the hemodynamic response to AFE initially presents with increased pulmonary vascular resistance, and right ventricular failure, followed by left ventricular dysfunction.^{9,14–22,25,35–39} In all registries and research reports, 83–100% of patients demonstrated laboratory abnormalities or clinical findings consistent with DIC, regardless of mode of delivery.^{6,14–22,24,25,46,47} Although debated, the reporting criteria used for the diagnosis of DIC in AFE-related coagulopathy has mainly relied on the scoring system of Scientific and Standardization Committee on DIC of the ISTH (International Society on Thrombosis and Haemostasis), modified for pregnancy, which, in one study, showed low sensitivity for critical care parturients. This limitation should be interpreted with caution as AFE cases were not included in the study.^{24,44}

Research implications

Since AFE was first being recognized as a distinct clinical syndrome, over 1300 case reports and series have been published in efforts to clarify the etiology, risk factors, and pathogenesis.^{1–8,10–12,15–22,27,34–39,44–47,50} Historically, such analyses have often been challenged by inconsistent reporting criteria.³⁵ Series relying mainly on hospital diagnostic codes for case identification are often inaccurate, as coding may report the cause of maternal death as AFE with inclusion of patients who, in fact, did not have AFE, in the absence of diagnostic validation.^{3,9,13,14,24} Such errors may be related to the nature of the coding process, in which any diagnosis considered and ultimately discarded, regardless of how temporary or speculative, often finds its way into a list of diagnostic codes at the time of discharge, and will be identified as a case in any electronic data extraction process. Such errors complicate calculations of frequency, risk factors, and morbidity and mortality associated with this uncommon condition.^{9–11,14–25}

Continued erroneous reliance on the detection of squamous cells in the pulmonary circulation as a pathognomonic criterion for AFE diagnosis regardless of clinical presentation also plays a role in erroneous diagnoses.²⁸ Romero et al hypothesize subclinical infection as an etiology of AFE based on 2 cases of proposed AFE where supralesional maternal plasma TNF- α levels were present prior to the clinical AFE event.⁴⁸ Laboratory analyses of various substances found in amniotic fluid or thought to be involved in the pathophysiologic response (zinc coproporphyrin, Sialyl Tn antigen, serum tryptase, complement C3 and C4, intrinsic and extrinsic immunologic pathways) have been studied and reported, but, to date, none appear reliable in predicting or diagnosing AFE.^{11–13,20,24}

As a result of these inconsistencies, the recognition of disease, pathophysiology, and treatment strategies have remained elusive, and further studies that will involve a more comprehensive analysis of maternal and fetal biomarkers collected from women who have had typical and unequivocal AFE are necessary and a priority for the authors.^{9,14,24,25}

Strengths and Limitations

Strengths of this study include the extensive experience of the authors in clinical AFE research and publication as well as the nature of the data origin; the investigators who analyzed the data had no part in determining submission of cases through the Foundation website for analysis. In addition, this represents the largest reported series of patients with AFE that has been diagnosed and analyzed by expert chart review. Limitations of the study include those of any investigation based on voluntary self-reporting of data. Rational, but speculative, arguments exist supporting the concept that such a database may be biased to include either more, or fewer, patients with adverse outcomes than actually exist in the general population. For example, it seems likely that atypical and, hence, less severe cases of AFE are underrepresented in the reported registry data and that fatal cases may not have been entered due to family or provider enrollment apprehension. There is also a potential of over-reporting according to socioeconomic status. Thus, extrapolations of data describing specific mortality rates to the general population of women experiencing AFE would be invalid. However, we believe that a comparison of these data to those in the original registry report of 1995 and to other research studies and registries remains instructive and supports an improvement in maternal and neonatal outcome since that time. While this large, contemporary series represents a useful picture of the clinical details of women with AFE in contemporary practice, the nature of registry data precludes a direct statistical comparison of demographic variables and medical/obstetric risk factors between women with and without AFE. Such comparisons have been attempted using large populations derived from administrative data sets; however, the contamination of such data with significant numbers of women who did not have AFE makes such data equally problematic. Although our data suggest a possible relationship between in vitro fertilization, maternal atopic history, and placenta previa, the absolute risk of AFE for women with any of these conditions is so small as to preclude their use in clinical management; at the present time, no risk factors exist that would alter standard obstetric care. AFE remains both unpredictable and unpreventable.

Conclusion

Future collaborations and ongoing collection of cases and lab specimens in this international registry will help clarify various aspects of this critical condition and will allow for improved diagnosis and management.

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AJOG MFM at a Glance

Why was this study conducted?

To analyze the largest United States-based international amniotic fluid embolism (AFE) registry, using the published and validated criteria for the research reporting of AFE, and to determine whether there were differences in clinical characteristics and outcomes between patients with typical vs atypical AFE.

What are the key findings?

1. There were no consistent differences in demographic or obstetric variables in women with typical vs atypical AFE. Women with AFE were twice as likely to report a history of atopy, latex, medication, or food allergy than the obstetric population delivered at our hospital during the same time period, several times more likely to have conceived through in vitro fertilization, and more than 10 times more likely to have placental previa than the general US population. Overall maternal and neonatal morbidity and mortality were improved compared to those in previously published reports.
2. Of women misclassified as having an AFE with an alternative diagnosis, the most common diagnosis was hypovolemic shock secondary to postpartum hemorrhage, followed by anesthetic complications and sepsis-related cardiovascular collapse.
3. There were no instances of recurrence of AFE among the women with either typical or atypical AFE in subsequent pregnancies.

What does this study add to what is already known?

Contemporary clinical characteristics and perinatal outcomes of women with AFE are defined through an analysis of the largest available medical records-based data set, using the criteria published for the research reporting of AFE. Although no definitive risk factors were identified, an unexpected observation was the high rate of reported allergy, consistent with a putative mechanism of disease – an anaphylactoid reaction.

Figure 1:
AFE Classification using Diagnostic Criteria Recommended for the Research Reporting of AFE.^{14,24}

Table 1:Demographic Data for Patients with *Typical* and *Atypical* Amniotic Fluid Embolism

Variable	Typical AFE	Atypical AFE	P-Value
Maternal Age (years)	33.2 (± 4.7)	33.3 (± 4.5)	0.9
Primiparous	1(1,2)	1(1,2)	0.4
Parous	4(3,5)	4(3,5)	
Maternal BMI (kg/m ²) on admission	31.4 (± 7.2)	30.9 (± 3.9)	0.8
Maternal Weight Gain (lbs)	21.4 (± 15.1)	37.4 (± 15.2)	0.002
Gestational age at delivery (weeks)	37.9 (± 4.1)	38.4 (± 3.4)	0.6
Birth Weight (gm)	3539 (± 507.1)	3277 (± 855.3)	0.2
Living Children	1.1 (± 1.7)	0.9 (± 1.2)	0.6
Number of Prenatal Visits	12.8 (± 4.2)	12.8 (± 3.8)	0.9

Data expressed as mean and SD or median (1st, 3rd quartile).

BMI, body mass index.

Table 2:

Obstetrical and Medical characteristics for Patients with *Typical* (N=59) and *Atypical* Amniotic Fluid Embolism (N=15)

Variable	Typical AFE	Atypical AFE:	P-value
Atopy	8/47 (17.02)	0/15 (0)	0.1
Asthma	4/54 (7.41)	2/14 (14.29)	0.4
Thyroid	4/53 (7.55)	0/15 (0)	0.3
Latex Allergy	0/59 (0)	1/15 (6.67)	0.1
Food Allergy	8/59 (13.56)	2/15 (13.33)	0.9
Medication Allergy	23/59 (38.98)	7/15 (46.67)	0.3
Gestational Diabetes	6/49 (12.24)	0/15 (0)	0.2
Pre-gestational Diabetes	1/54 (1.85)	0/15 (0)	0.6
Gestational Hypertension	5/49 (10.20)	0/15 (0)	0.2
Cancer	1/51 (1.96)	1/14 (7.14)	0.3
Thrombophilia	0/59 (0)	1/13 (7.69)	0.1
Cerclage	1/50 (2.00)	0/15 (0)	0.6
Tobacco	2/53 (3.77)	1/15 (6.67)	0.6
Prior ethanol use	5/52 (9.62)	4/15 (26.67)	0.1
In vitro-fertilization	4/48 (8.83)	1/13 (7.69)	0.8
Amniotic Fluid:			
Oligohydramnios	1/57 (1.75)	0/15 (0)	0.8
Polyhydramnios	4/57 (7.02)	1/15 (6.67)	
Normal Fluid	44/57 (77.19)	13/15 (86.67)	
Placenta Previa	6/59 (10.17)	0/15 (0)	0.4
Induction:			
Oxytocin	31/40 (77.50)	8/9 (88.89)	0.4
Prostaglandin	11/46 (23.91)	4/13 (30.77)	0.6
Induction Agents: Gel	6/11 (54.55)	0/15 (0)	0.1
Induction Agents: Tablets	5/11 (45.45)	3/3 (100)	
Anesthesia:			
Epidural/spinal	42/50 (84.00)	13/15 (86.67)	0.7
General/combined	8/50 (16.00)	2/15 (13.33)	

Data expressed as N (%)

Table 3:Clinical Signs and Symptoms of patients with *Typical* and *Atypical* AFE

Variable	Typical AFE	Atypical AFE	P-value
Bronchospasm	5/34 (14.7)	2/10 (20.0)	0.7
Chest Pain	6/48 (12.5)	3/13 (23.1)	0.3
Cough	2/48 (4.1)	2/13 (15.4)	0.1
Cyanosis	11/41 (26.8)	3/11 (27.3)	0.9
Dyspnea	29/45 (64.4)	8/13 (61.5)	0.8
Headache	3/50 (6.0)	4/13 (30.8)	0.01
Hypotension	54/54 (100.0)	8/10 (80.0)	0.001
Pulmonary Edema	9/46 (19.6)	5/10 (50.0)	0.04
Seizure	11/53 (20.8)	2/13 (15.4)	0.7
Transient Hypertension	7/48 (14.6)	1/11 (9.1)	0.6
Uterine Atony	28/51 (54.9)	3/11 (27.2)	0.1
Uterine Tachysystole	4/41 (9.8)	2/10 (20.0)	0.4
Maternal Death	6/59 (10.2)	1/15 (6.7)	0.7
Neurological Injury	32/59 (54.3)	3/10 (20.0)	0.01

Data expressed as N (%)

Table 4:Neonatal Outcomes in cases of *Typical* and *Atypical* AFE

Variable	Typical AFE (N=59)	Atypical AFE (N=15)	P-value
Birth Weight (gm)	(48/59) 3539.1 ($\pm$ 507.06)	(11/15) 3277.2 ($\pm$ 855.28)	0.2
Umbilical artery pH	(18/59) 6.95 ($\pm$ 0.20)	(6/15) 7.01 ($\pm$ 0.24)	0.6
Female	29/59 (49)	5/15 (33)	0.3
Male	21/59 (36)	7/15 (47)	
5 min APGAR: 1–3	11/59 (18.6)	6/15 (40.0)	0.2
5 min APGAR: 4–6	19/59 (32.2)	4/15 (26.7)	
5 min APGAR: 7–10	29/59 (49.2)	5/15 (33.3)	
Neonatal Death	3/59 (5)	0	0.4

Data expressed as mean (SD) or N (%)

Table 5:

Clinical Criteria for Patients with *Typical* (N=59) and *Atypical* Amniotic Fluid Embolism (N=15)

Criterion Number	Typical AFE	Atypical AFE
1	100%	66.7%
2	100%	78.6%
3	100%	78.6%
4	100%	100%
5	100%	92.9%

Data expressed as (%)

Criterion 1: Sudden onset of cardiorespiratory arrest or hypotension (systolic blood pressure <90 mm Hg)

Criterion 2: respiratory compromise (dyspnea, cyanosis, or peripheral capillary oxygen saturation (SpO₂) <90% or respiratory arrest.

Criterion 3: Documentation of overt disseminated intravascular coagulation (DIC) using the scoring system of the Scientific and Standardization Committee on Disseminated Intravascular Coagulation of the International Society on Thrombosis and Hemostasis (ISTH), modified for pregnancy.

Criterion 4: Clinical onset during labor, cesarean delivery or dilation and evacuation or within 30 minutes of delivery of the placenta.

Criterion 5: No fever (38.0°C) and absence of any other significant confounding condition or explanation for the signs and symptoms observed.

Amniotic fluid embolism outcomes