

CHAPTER 5

Amniotic fluid embolism

ROBIN VLIES on behalf of the Editorial Board

Amniotic fluid embolism: recommendations

Audit

All cases of suspected or proven amniotic fluid embolism, whether fatal or not, should be reported to the National Amniotic Fluid Embolism Register:

UKOSS, National Perinatal Epidemiology Unit, University of Oxford, Old Road Campus, Old Road, Headington, Oxford OX3 7LF.

Service provision

Guidelines, protocols and training

Cardiac arrests are rare in maternity units but they can and do happen and their management may be suboptimal. All medical and midwifery staff should be trained to a nationally recognised level: Basic Life Support, Immediate Life Support or Advanced Life support (BLS, ILS and ALS), as appropriate. Emergency drills for maternal resuscitation should be regularly practised in clinical areas in all maternity units. These drills should include the identification of the equipment required and appropriate methods for ensuring that cardiac arrest teams know the location of the maternity unit and theatres in order to arrive promptly. Specialised courses such as Advanced Life Support in Obstetrics (ALSO) and Managing Obstetric Emergencies and Trauma (MOET) provide additional training for obstetric, midwifery and other staff.

Individual practitioners

All staff should be aware that a sudden change in a woman's behaviour may be an early feature of the onset of hypoxia and a toxic confusional state. The early involvement of senior staff and, in particular, anaesthetists and intensivists, once these or other warning symptoms of amniotic fluid embolism develop is important, as it is with any case of maternal collapse.

Pathology

Fetal elements should be searched for in the pulmonary vasculature at autopsy in any pregnant or recently delivered woman who dies following sudden collapse. If the diagnosis of amniotic fluid embolism is suspected clinically, all attempts should be made to confirm this at autopsy.

Amniotic fluid embolism should only be diagnosed on clinical grounds in the absence of an autopsy or an inadequately investigated autopsy.

50 years ago ...

Entry of amniotic fluid into the maternal circulation was first described in 1926¹ but it was not until 1941 that death following sudden collapse in late pregnancy was attributed to amniotic fluid embolism.² Amniotic fluid embolism was first recorded as a cause of death in the Report in England and Wales 1955–57, when there were 11 cases; only cases confirmed at autopsy were included. The authors suggested that previous deaths attributed to shock may have been caused by amniotic fluid embolism.

There has been a declining rate of death from amniotic fluid embolism over the last 40 years, as shown in Figure 5.1. It should be noted that, from 1991, clinical diagnoses were accepted as well as those confirmed at autopsy.

Summary of findings for 2000–02

There were five cases of amniotic fluid embolism in the United Kingdom reported during this triennium. This compares with eight in 1997–99 and 17 in 1994–95. The details of the five cases are described in this chapter, although there is little information in one case.

For four women, the diagnosis was confirmed at autopsy and one diagnosis made clinically as no autopsy was held. The youngest woman was in her mid-20s, two were nulliparous and all had reached term. Labour was spontaneous for two women, induced with prostaglandins for a further two, and the other received oxytocin augmentation. At the time of embolism, one woman still had her membranes intact, for two they had spontaneously ruptured (in one, a few minutes before collapse) and they were artificially ruptured for the other two women. All the women were delivered by caesarean section, four being perimortem during maternal resuscitation and one performed before the

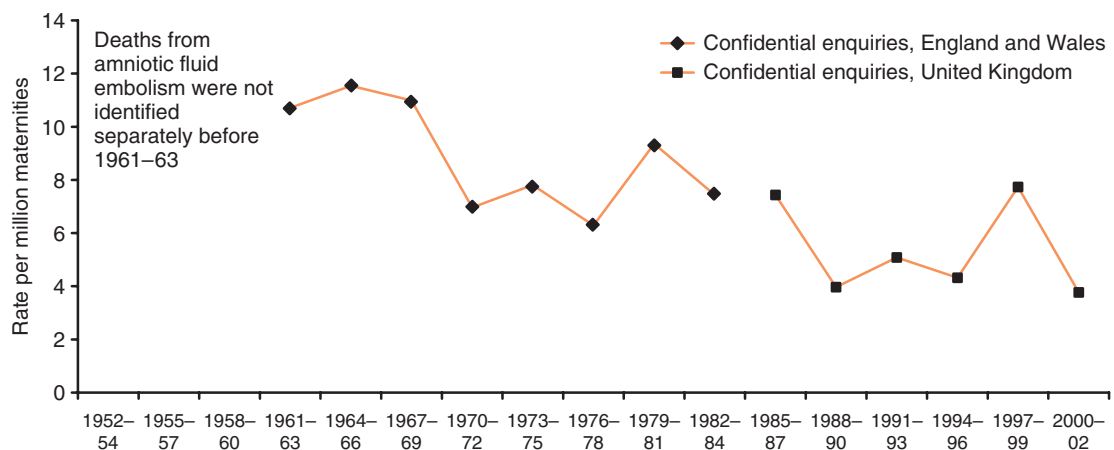


Figure 5.1 Maternal mortality from amniotic fluid embolism; England and Wales 1961–84, United Kingdom 1985–2002

woman collapsed. Four of the babies were born alive but two died in the early neonatal period. One was stillborn.

Three women died within 1 hour of collapse and two between 5 and 7 hours later. Two women required hysterectomies after caesarean section because of continued heavy bleeding, with one requiring a subsequent laparotomy. A third woman underwent a laparotomy without hysterectomy. A brief summary of these cases is given in Table 5.1.

Diagnosis

The classical scenario of amniotic fluid embolism involves an older multiparous woman in advanced labour who suddenly collapses, although it can occur following termination of pregnancy, amniocentesis, placental abruption and trauma, during caesarean section and unexpectedly up to 30 minutes after delivery. There may be cardiotocographic abnormalities, uterine hypertonus and an obstetric intervention such as artificial rupture of the membranes. The initial pulmonary symptoms may be minor. Cardiovascular collapse follows due to acute left ventricular failure. Disseminated intravascular coagulation and haemorrhage rapidly follow. Most mortality occurs in the first few hours. Death rates from the major case series vary between 26.4%³ and 61%.⁴

Diagnosis may be clinical but should be confirmed by the presence of fetal squames and lanugo hair in the pulmonary vasculature at autopsy. Fetal elements have been found however, in pulmonary artery aspirate⁵ in living patients with and without the clinical syndrome of amniotic fluid embolism, as well as in maternal sputum.⁶ The Report only accepts amniotic fluid embolism as a cause of death if this is confirmed at autopsy or on clinical grounds in the absence of an autopsy or where the autopsy was inadequately performed or investigated.

All the cases described in the present triennium were in their late 20s or 30s and four were in advanced labour at term. Three had some form of uterine stimulation. The relationship between uterine stimulation and amniotic fluid embolism however, has been questioned;⁷ indeed, it has been suggested that hypertonus occurs as a result of amniotic fluid embolism.⁴

Speed of collapse

Three women experienced premonitory symptoms before their collapse. In one case, the woman complained of feeling cold and developed stertorous breathing and cyanosis for an unspecified time before collapse. Another woman developed respiratory distress, restlessness and cyanosis, and the third experienced extreme distress and was said to have behaved in an abnormal manner. These symptoms appeared to have developed within the half an hour preceding their collapse.

The time taken to deliver the baby from first symptoms ranged from 15 minutes to 45 minutes. The time from maternal collapse to death was less than 1 hour in three cases and between 5.5 and 7 hours in the other two. Previous Reports have suggested that improved treatment for women who survive long enough to be transferred to the intensive care unit offers hope for better survival. Only one case was admitted to intensive care but she died shortly after admission and the other four cases died rapidly where they had delivered or collapsed.

Table 5.1 Clinical features of amniotic fluid embolism cases; United Kingdom 2000–02

	Case 1	Case 2	Case 3	Case 4	Case 5
Parity	Nulliparous	Multiparous	Nulliparous	Multiparous	Multiparous
Gestation*	Term	Term+	Term	Term+	Term
Uterine stimulation	Induced with PG	Induced with PG	Nil	Oxytocin augmentation	Nil
State of membranes at maternal collapse	Intact	Spontaneous rupture	Artificial rupture	Artificial rupture	Spontaneous rupture
Type of caesarean	Perimortem	Perimortem	Emergency for fetal distress	Perimortem	Perimortem
Premonitory signs/symptoms	Felt cold, stertorous breathing, cyanosis	Respiratory distress, cyanosis, restlessness	Extreme distress, abnormal behaviour	Nil	N/K
Interval between symptoms and delivery	15–30 minutes	30–45 minutes	15–30 minutes	15–30 minutes	30–45 minutes
Time between collapse and death	30–45 minutes	30–45 minutes	5–7 hours	45–60 minutes	5–7 hours
Neonatal outcome	Early neonatal death	Early neonatal death	Survived	Survived	Stillborn

Term = within 7 days of due date; Term+ = later than 7 days of due date; N/K = information not available

Pathology

Postmortem diagnosis was made in four cases where there was evidence of amniotic fluid embolism in the pulmonary vasculature. One autopsy, however, was barely adequate. Details of these cases are discussed in Chapter 16 Pathology. One diagnosis was made on clinical grounds. The clinical criteria for diagnosis of amniotic fluid embolism, in the absence of autopsy findings, include:

- acute hypoxia (dyspnoea, cyanosis or respiratory arrest)
- acute hypotension or cardiac arrest
- coagulopathy
- no other clinical condition or potential explanation for the symptoms and signs.

Substandard care

It appears that maternal death was inevitable in all of these cases. There was no substandard care in two cases and, although there are some more general lessons around the provision of anaesthesia in the other cases, these would not, in all probability, have affected the outcome. These issues are discussed in Chapter 9 Anaesthesia. However, it is disconcerting that, in one case, the arrival of the cardiac arrest team was delayed because they apparently did not know where the obstetric theatre was.

Comment

The number of maternal deaths due to amniotic fluid embolism has fallen significantly over the last three triennia. Amniotic fluid embolism is rare. It remains unpredictable, unpreventable and is rapidly progressive. Management is supportive (oxygenation, correction of cardiovascular collapse, blood transfusion and replacement of clotting factors) and maternal outcome is improved if she has rapid access to an intensive care unit.

Premonitory signs and symptoms (restlessness, abnormal behaviour, respiratory distress and cyanosis) may occur before collapse. There may be associated hypertonic contractions and fetal distress. Early recognition of the possibility of amniotic fluid embolism could lead to earlier involvement of the resuscitation team, as well as consultant input in obstetrics, anaesthetics, intensive care and haematology.

All the cases described here involved resuscitation and advanced life support. All relevant staff should keep up to date their basic and advanced life support skills and be encouraged to attend appropriate courses, such as Advanced Life Support in Obstetrics (ALSO) and Managing Obstetric Emergencies and Trauma (MOET). Resuscitation protocols should be kept up to date. MOET recommends caesarean section delivery of the infant within five minutes of cardiac arrest.⁸

Amniotic fluid register

All cases of suspected or proven amniotic fluid embolism, be they fatal or not, should be reported to the National Amniotic Fluid Embolism Register. Contact details are given in

the recommendations at the start of this Chapter. Comparison of fatalities and survivors may help to identify treatment strategies that improve survival.

In 2000–02, 19 cases were reported to the Register, including four of the five deaths discussed here. This gives a 21% case mortality rate in cases reported to the Register. If the unreported case were included, mortality would be around 25%. This confirms that the condition should not be thought of as universally fatal and that early recognition should be encouraged. Early consideration of the diagnosis seems more common in survivors than in deaths. The early involvement of anaesthetists once symptoms develop is also be important.⁹

Amniotic fluid embolism: learning points

- Amniotic fluid embolism is not universally fatal but, despite improved resuscitation techniques, in some cases death is still inevitable.
- Only 25% of the known or suspected cases reported to the Amniotic Fluid Embolism Register died.
- Women with symptoms suspicious of amniotic fluid embolism should be transferred to intensive care as soon as possible, as these women may have a better chance of survival.
- Significant premonitory signs and symptoms, i.e. respiratory distress, cyanosis, restlessness and altered behaviour, may give the first clue to diagnosis before collapse and haemorrhage occur.

Acknowledgements

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References

1. Meyer JR. Embolis pulmonar-caseosa. *Bras Med* 1926;2:301–3.
2. Steiner PE, Lushbaugh CC. Maternal pulmonary embolism by amniotic fluid as a cause of obstetric shock and unexpected deaths in obstetrics. *JAMA* 1941;117:1245–54, 1340–5.
3. Gilbert WM, Danielsen B. Amniotic fluid embolism: decreased mortality in a population-based study. *Obstet Gynecol* 1999;93:973–7.
4. Clarke SL, Hankins GD, Dudley DA, Dildy GA, Porter TF. Amniotic fluid embolism: analysis of the national registry. *Am J Obstet Gynecol* 1995;172:1158–69.
5. Clark SL, Pavlova Z, Greenspoon J, Horenstein J, Phelan JP. Squamous cells in the maternal pulmonary circulation. *Am J Obstet Gynecol* 1986;154:104–6.
6. Zipser G. Amniotic fluid embolism. *Med J Aust* 1971;2:953–6.
7. Morgan M. Amniotic fluid embolism. *Anaesthesia* 1979;34:20–32.
8. Grady K, Prasad BGR, Howell C. Cardiopulmonary resuscitation in the non-pregnant and pregnant patient. In: Johanson R, Cox C, Grady K, Howell C, editors. *Managing Obstetric Emergencies and Trauma*. London: RCOG Press; 2003. p. 24.
9. Tuffnell DJ. Amniotic fluid embolism. In: MacLean AB, Neilson JP, editors. *Maternal Mortality and Morbidity*. London: RCOG Press; 2002. p. 190–200.