

CHAPTER 9

Anaesthesia

GRISELDA M COOPER and JOHN H McCLURE

on behalf of the Editorial Board

Anaesthesia: key recommendations

Service provision

Dedicated obstetric anaesthesia services should be available in all consultant obstetric units. These services should be capable of taking responsibility for epidural analgesia, anaesthesia, recovery from anaesthesia and management of mothers requiring high dependency care.

Isolated consultant obstetric units present major difficulties in terms of immediate availability of additional skilled anaesthetic backup and assistance from other specialties, including critical care. When presented with problem cases requiring special skills or investigations, obstetric anaesthetists should not hesitate to call on the assistance of anaesthetic colleagues in other subspecialties, as well as colleagues in other disciplines.

Anaesthesia training must ensure competence in airway management, especially the recognition and management of oesophageal intubation.

Obese pregnant women (body mass index, BMI, greater than 35) are at greater risk from anaesthesia and should be referred to the anaesthetist early.

Adequate advance notice of high-risk cases must be given to the obstetric anaesthetic service. The notice must be sufficient to allow consultation with the woman, specialist advice, investigation and assembly of resources needed for the safe management of high-risk women.

Women who are needle phobic are at greater risk from anaesthesia and an anaesthetic consultation in the antenatal period should be arranged to establish a management plan.

Supportive counselling of anaesthetic personnel involved in a maternal death is essential. It should be remembered that such an event represents a tragedy not only for the mother's family but also for the anaesthetist involved, who commonly assumes full responsibility for the death.

Individual practitioners

Invasive monitoring via appropriate routes should be used, particularly when the cardiovascular system is compromised by haemorrhage or disease. Invasive central venous and arterial pressure measurement can provide vital information about

the cardiovascular system. Samples for arterial blood gas estimation should be taken early and any metabolic acidosis should be taken seriously.

Care of women at high risk of, or with, major haemorrhage must involve a consultant obstetric anaesthetist at the earliest possible time.

Intensive care beds may not be available in an emergency. Early consultant to consultant referral is recommended to facilitate the creation of a bed and to help with the early institution of intensive therapy while awaiting bed availability.

Women with suspected raised intracranial pressure require a full neurological assessment to help determine the optimal mode of delivery and type of anaesthesia or analgesia if required.

Fifty years ago...

The preface of the first Report of the Confidential Enquiries 50 years ago drew attention to the fact that anaesthesia was a major primary or associated factor in maternal death. Anaesthetic deaths were not separately classified in the early Reports but 49 deaths were ascribed to anaesthesia in the first triennial Report (1952–54) and at least 20 more were identified where anaesthesia was contributory.

The dramatic reduction in the number of maternal deaths due to anaesthesia has been one of the notable success stories of these Reports. There were between 30 and 50 deaths in each triennium ascribed directly to anaesthesia until 1981. In the 1982–84 triennium, this figure was 19 deaths and the same total number of deaths due to anaesthesia was reported during the years 1985 to 1996 spanning four triennia or twelve years. Because of the small numbers of deaths now reported it is too early to say whether the increase in deaths due to anaesthesia in this triennium is real cause for concern.

The numbers of deaths due to anaesthesia should not be examined in isolation from the numbers of general and regional anaesthetic procedures given. Epidural analgesia services started in the late 1960s and 24% of women received epidural analgesia in labour in 2000. It is notable how few deaths have occurred as a result of regional anaesthesia since the late 1960s. There were no *Direct* deaths attributed to regional anaesthesia in this triennium.

The number of anaesthetics given during pregnancy and the postpartum period are not known with certainty, but the numbers for caesarean sections can be estimated from the caesarean section rate and the numbers of maternities. Although the Reports from 1955 until 1963 did not specify the numbers of deaths where anaesthesia was given for caesarean section, a large number of general anaesthetics were given for delivery by forceps during this time.

Caesarean section data for the triennia 1964–66, 1982–84 and this one, and the number of anaesthetic deaths for each, are summarised in Table 9.1. This shows that anaesthesia (spinal, epidural and general) for caesarean section is more than 30 times safer now than it was in the 1960s, when the majority of caesarean sections were performed under general anaesthesia.

Table 9.1 The estimated numbers of caesarean section (CS) operations performed, the caesarean section rate expressed as a percentage of maternities, the numbers of *Direct* anaesthetic maternal deaths and the rate of maternal deaths from anaesthesia given for caesarean section; England and Wales 1964–84, United Kingdom 1982–84 and 2000–02

Triennium	Maternities (n)	Caesarean section		Direct Deaths due to anaesthesia	Direct deaths due to anaesthesia for CS	Rate of Direct deaths due to anaesthesia per 100,000 CS*
		(n)	(%)			
1964–66	2,600,000	88,000	3.4	50	32	36
1982–84	1,884,000	190,000	10.1	19	11	6
2000–02**	1,997,000	425,000	21.0	7	4	1

* This figure excludes other causes of death at or after caesarean section
 ** Caesarean section data for the UK (2000–02) are grossed from Hospital Episode Statistics for England

The predominant cause of anaesthetic death used to be related to airway management, either through failure to oxygenate the mother while trying to achieve tracheal intubation or because of aspiration of gastric contents resulting in either immediate asphyxiation or later respiratory failure from adult respiratory distress syndrome. It is obvious from reading the older Reports that practice was very different from now. Examples that illustrate this include: “In five, and possibly six, cases the anaesthetic was administered by the single-handed obstetrician” (1955–57).² “Anaesthesia (spinal anaesthesia for caesarean section) initially appeared satisfactory but respiratory difficulties occurred before the operation was completed. By this time the anaesthetist was busy elsewhere and not immediately available.” (1961–63)³

These illustrations speak for themselves, although it is worth noting that abolishing operator-anaesthetists in dentistry did not occur until 1983. It is now unthinkable that the anaesthetist would not be present throughout the procedure.

The problem of acid aspiration was tackled by a series of changes. The technique of rapid-sequence induction involving preoxygenation, cricoid pressure, use of succinyl choline and avoidance of mask ventilation before tracheal intubation, was developed in a piecemeal fashion, as documented in the first five Reports.

The widely adopted policy of limiting oral intake during labour has ensured that relatively few women are anaesthetised with a genuinely full stomach. Perhaps the most effective measure has been the widespread administration of drugs to prevent acid secretion from the stomach to women anticipated to need anaesthesia. In the UK, in 98% of cases, this is achieved with H₂ blockers coupled with a drug such as sodium citrate to neutralise any gastric acid already present.¹

The requirement for tracheal intubation for caesarean section in order to reduce aspiration risk had become accepted by the 1960s. Unfortunately, this led to a marked increase in deaths from failed intubation and failed oxygenation and other airway problems; 16 deaths from these causes were recorded in the 1976–78 Report, eight in 1979–81 and ten in 1982–84. This had become unusual in recent Reports, presumably as a result of better training and assistance, use of failed intubation drills and monitoring such as capnography and oximetry throughout induction, maintenance and recovery from anaesthesia. It is a concern that unrecognised oesophageal intubation has re-emerged as a cause of death from anaesthesia in this Report.

One of the key ways of avoiding airway management problems has been the increased use of regional anaesthesia. In the year 2000, 91% of elective and 77% of emergency

caesarean sections were performed under regional block.¹ Assuming an 80% frequency of use of regional anaesthesia for caesarean section in the 2000–02 triennium, it is possible to estimate the risk of death due to general anaesthesia for caesarean section as one death per 20,000. Unfortunately, this estimated risk does not seem to have altered from the 1982–84 triennium. When general anaesthesia is required, there is some concern now over the lack of experience attained by some anaesthetists and their confidence in its delivery.

Successive Reports have highlighted the lack of consultant involvement. At a time when specialist input was sparse, the recommendation from the 1964–66 Report recognised that “patients with obstetric emergencies are gravely at risk and require knowledge and skill of an experienced anaesthetist who must be readily available”. Rationalisation of maternity services has reduced the frequency of trainees working in isolation and the training of anaesthetists new to the discipline of obstetric anaesthesia has improved considerably. There has been a concerted effort to improve consultant anaesthetist staffing of obstetric services but the trainee anaesthetist is still sometimes isolated from senior backup out of hours.

Summary of findings for 2000–02

The central assessors in anaesthesia reviewed the cases of all the women who died of either a *Direct* or *Indirect* cause and identified as having received an anaesthetic for this triennium, 120 of the 161 *Direct* and *Indirect* deaths.

In this triennium, six deaths are ascribed as being directly due to the conduct of anaesthesia. One other *Late* death is ascribed to anaesthesia, although death occurred several years after the anaesthetic event, which occurred in the previous triennium for 1997–99. Lessons from this death are included in this chapter, although it is not counted here for statistical purposes. The numbers of maternal deaths and death rates for this and the preceding triennia are shown in Table 9.1 and Figure 9.1.

In addition to these six *Direct* anaesthetic deaths, there were 20 deaths in which perioperative/anaesthesia management contributed to the death. These deaths have

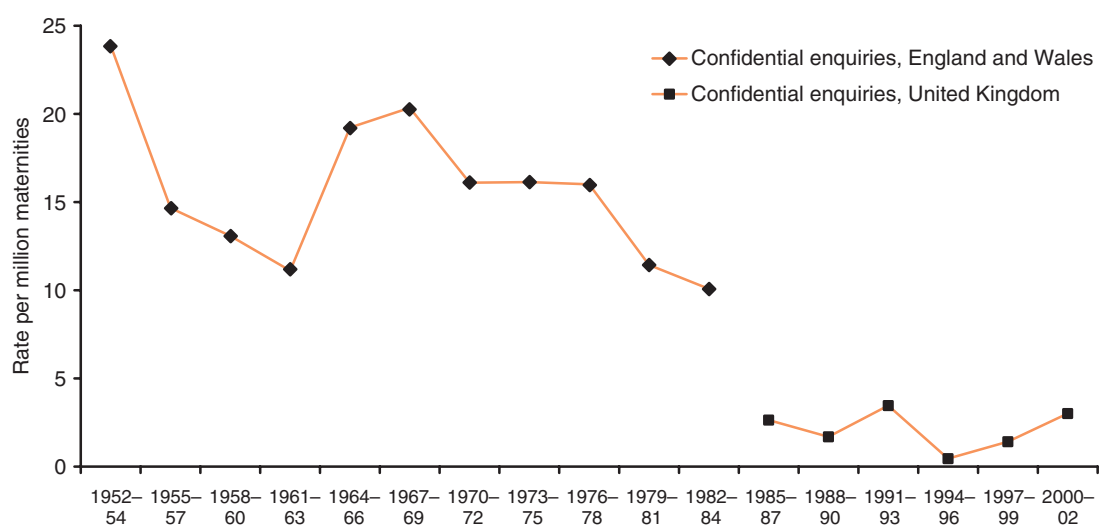


Figure 9.1 Maternal death rates from anaesthesia for all obstetric or maternity procedures; England and Wales 1952–1984, United Kingdom 1985–2002

been assigned to the core chapters but anaesthesia services were regarded as substandard.

In most cases the standard of record keeping was good but some records were very poor. Reviewing the records of some deaths showed that the anaesthesia service does not always meet the declared standards of the relevant Departments of Health and professional bodies. These units were often isolated from anaesthetic backup and other medical specialties and in particular critical care services. The workload and challenges presented to the obstetric anaesthetist are increasing in number, complexity and severity. In several of the cases, including those where anaesthesia was contributory, earlier consultant anaesthetic involvement was warranted and was either not sought or was not as prompt as was indicated.

It was a matter of consensus judgment assigning a death as being a direct result of anaesthesia and whether substandard care contributed to the mother's death. Key points of the cases illustrated here result from the central assessors' judgment.

In reviewing the cases, especially where anaesthesia was the cause of death, the profound effect of the maternal death on the anaesthetist was clear. Good record keeping is crucial in these situations. The need for proper support for the anaesthetist(s) involved in a maternal death is vital although the best source of support will vary between individuals. The Joint Committee on Good Practice is setting up a counselling service and can be contacted through the Royal College of Anaesthetists or the Association of Anaesthetists of Great Britain and Ireland.

Deaths due to anaesthesia

There were six *Direct* deaths (plus one *Late Direct* death) due to anaesthesia, representing a regrettable increase from the three deaths directly attributable to anaesthesia in the 1997–99 Report. All the deaths in this triennium were associated with general anaesthesia.

Misplaced tracheal tubes

In this triennium, there were two deaths and one *Direct Late* death that resulted from oesophageal intubation during anaesthesia. In two of the cases, anaesthesia was being given for urgent caesarean section and in one it was for a presumed ruptured ectopic pregnancy. In all cases, SHO-grade trainees, without immediate senior backup, administered the anaesthetics.

The need for proper checking of anaesthetic machines before use is highlighted, as it transpired in one of these cases that the fresh gas flow from the common gas outlet had been disconnected during a previous case. It is recommended that a separate oxygen supply is used when patients receiving regional anaesthesia are given oxygen supplementation and that the anaesthetic breathing system is not disconnected. One of the reasons for caesarean section being performed under general anaesthesia is because of urgency of delivery but guidelines published in 2004 and not available during this triennium suggest that the monitoring equipment, breathing system and ventilator should be checked before each new patient.⁴ There also needs to be comprehensive check of equipment and emergency drugs at each change of shift.

In one case, a death from anaesthesia occurred due to inadequate supervision. The anaesthetist, who was new to the country and the hospital, had not undergone any assessment of competence and gave general anaesthesia without direct supervision or immediate backup being available. The woman sustained irreversible brain damage.

At the time of this anaesthetic being given it was not common practice for anaesthetists new to a hospital to have to perform basic competency tests formally.⁵ The need for a formal test of competency of all new anaesthetic trainees is emphasised by this case.

It is noteworthy that, in all the cases, auscultation of the lung fields gave false reassurance that the tracheal tube was correctly placed. Only in one of the cases was capnography used, and in that case the tubing to the capnograph became blocked with gastric contents. The Royal College of Anaesthetists issued a statement in 1998 that “No trainee anaesthetist should be put into the position of having to intubate the trachea without a capnograph being available. If a capnograph is not available, either the patient or the equipment should be moved”.⁶ In the year 2000, it was further clarified that anaesthetists should not be required to deliver anaesthesia without using monitoring equipment which complies with the recommended minimum monitoring standard current at that time. When intubating the trachea during induction of anaesthesia or managing an intubated patient during anaesthesia, a capnograph must be used as part of the monitoring procedure.⁷

The isolation of relatively inexperienced trainee anaesthetists (SHO grade) was considered to be a factor in all of these cases. It was not possible to receive urgent experienced help that might have been able to recognise and correct the misplaced tracheal tubes. Even with experienced anaesthetists, when unexpected difficulties occur the ready availability of a second pair of hands may be life saving. It is clear that previous recommendations of “a failed intubation drill” were not implemented and each patient’s oxygenation was not maintained while allowing spontaneous respiration to return and awaiting more senior help. In all these cases, there appeared to be a major reluctance on behalf of the anaesthetist to consider the possibility that the oesophagus had been intubated in error. Anaesthesia training must concentrate on airway management skills, especially the recognition and management of oesophageal intubation. The small numbers of general anaesthetics given in obstetrics mean that some of this training will have to be delivered in other clinical areas; the use of simulators may be explored usefully.

In those having caesarean section, general anaesthesia was the patient’s choice. One of these women did not speak English. It may have been possible to explain the option of regional anaesthesia through a translator.

In addition to the cases above, where the relative isolation of the trainees was a relevant factor, there are two further cases where the proximity of additional early help may have averted maternal death.

Isolated sites

Two women had general anaesthetics in isolated sites where the delay in being able to obtain help was a contributory factor in the death. Both women suffered hypoventilation which was inadequately managed. One woman was undergoing caesarean section and the other mid trimester termination of pregnancy. One of the women was obese (BMI 40) and one of the women was needle phobic. In one of the cases, a capnograph was not

used, contrary to recommendations.⁸ In one of the cases the cardiac arrest was inadequately managed, the administration of any drugs being delayed until help arrived. In another case, amniotic fluid embolism was thought to be a possible cause of death on clinical grounds but this was specifically excluded by autopsy including detailed histology.

It is relevant to note that on sites remote from general hospitals, the Department of Health standard⁹ is that non-consultant career grade staff with NHS appointments should be working under the line responsibility of a named consultant anaesthetist. They should also be proficient in advanced cardiac life support. It also recommends that only anaesthetists holding a higher qualification should give general anaesthetics for terminations of pregnancy.

Aspiration of gastric contents

An obese woman (BMI greater than 35) died after aspiration of gastric contents following failure to intubate the trachea after induction of general anaesthesia for caesarean section, having declined a regional block because of needle phobia. The assessors were unable to determine whether the woman had received antacid prophylaxis.

Aspiration of gastric contents remains a clear risk during induction of general anaesthesia and this risk is higher when there is difficulty experienced intubating the trachea. Obesity is a major factor in causing difficulty with tracheal intubation and obesity and late pregnancy predispose to hiatus hernia, which make regurgitation of gastric contents more likely to occur.

Anaphylaxis

A woman presented with bleeding due to an incomplete miscarriage. An SHO induced anaesthesia with propofol and succinyl choline was given to facilitate tracheal intubation. She developed the classic signs of acute anaphylaxis and cardiac arrest rapidly ensued

The diagnosis was confirmed by a raised mast cell tryptase in a sample of blood taken shortly after the collapse. This is a helpful investigation in a case of suspected anaphylaxis.

Deaths to which anaesthesia contributed

In addition to the six *Direct* anaesthetic deaths detailed above, there were 20 deaths in which perioperative anaesthesia management contributed. These deaths are counted in the relevant chapters, as shown in Table 9.2, and are discussed here in the broad categories of perioperative care where anaesthesia services were regarded as substandard or where there are lessons for anaesthesia services.

These deaths highlight examples of the following aspects of care with some deaths falling into several categories:

- lack of multidisciplinary cooperation
- lack of appreciation of the severity of the illness
- lack of perioperative care
- the management of haemorrhage.

Table 9.2 *Direct and Indirect causes of death in which perioperative anaesthetic management contributed counted in other chapters; United Kingdom 2000–02*

Chapter	Cause of death	Deaths associated with anaesthesia (n)
2	Thromboembolism	1
3	Eclampsia and pre-eclampsia	2
4	Haemorrhage	5
5	Amniotic fluid embolism	2
7	Sepsis	1
8	<i>Other Direct</i>	2
10	Cardiac	3
12	<i>Other Indirect</i>	4
Total		20

Lack of multidisciplinary cooperation

There were three deaths in which there were failings in multidisciplinary working. In two women, cardiac arrest occurred but the resuscitation teams failed to find the patients in good time. In another case resuscitation was confused and ineffective. This failure and inability to provide basic and advanced life support on hospital wards is substandard. It is recommended that cardiac arrest drills are practised routinely in all maternity units and all medical and midwifery staff maintain their resuscitation skills.

All team members need to be aware of the vital contributions that can be made by anaesthetists and intensive care specialists when adequate warning of women with serious illness is given and the harm that can result when it is not. Obstetric anaesthetists must also remember that they have colleagues with different, but invaluable, skills provided that the anaesthetist calls on their help in good time. It is evident that intensive care consultants should be part of the multidisciplinary team planning the care of those pregnant women with serious co-existing disease. Beds in an intensive care unit are always at a premium but consultant to consultant referral can facilitate the creation of a bed in an emergency in a seriously ill woman.

Lack of appreciation of the severity of illness

There were nine deaths in which a common theme emerged where trainee obstetric and anaesthetic staff sought help from a senior anaesthetist or other senior specialist too late, owing to failure to realise the severity of illness. The major learning points from these cases are:

- Not all headaches are due to spinal anaesthesia
A postdural puncture headache is not associated with severe difficulty with communication. Neurological symptoms and signs may indicate serious intracranial or spinal pathology and a neurological opinion needs to be sought urgently.
- Pre-eclampsia with haemolysis, elevated liver enzymes and low platelets (HELLP syndrome) accompanied by intrauterine death from placental abruption can be anticipated to result in severe haemorrhage.

When this occurs further assistance should be sought early, invasive monitoring used and arterial blood gases measured.

- Overwhelming sepsis can be rapidly fatal and requires urgent intensive therapy, which may be started in the maternity unit while waiting for an intensive care unit bed to become available.

For example, in one case, the attention of the obstetric staff was directed towards the management of an intrauterine death without fully appreciating the serious condition of the mother, who was systemically unwell but afebrile. She died shortly after admission from disseminated streptococcal sepsis, although this outcome could probably have not been prevented.

- Fetal compromise may be due to severe maternal disease.
 - An underweight woman with an undelivered premature baby was referred from another hospital because of the need for neonatal intensive care for her baby. A consultant anaesthetist commendably noticed cyanosis and delayed caesarean section. A cardiologist diagnosed Eisenmenger's syndrome and she died 1 week after delivery.
- Coexisting disease should be properly assessed in good time and managed by a multidisciplinary team.

There were several cases where the woman could have been anticipated to have needed preoperative anaesthetic assessment and management. Clinical records should be clearly flagged to alert staff of women with serious medical conditions.

Perioperative care

There were five deaths in which poor perioperative care was a contributing factor and the lessons to be learned from these can be summarised as:

- Good blood pressure control in proteinuric hypertension is required to avoid cerebral haemorrhage.
 - Inadequate treatment of blood pressure was evident in one case while awaiting the availability of a neonatal cot. Liaison with neonatologists needs to stress where delivery is urgent for the mother's health.
- Unexpected readings from a monitor should not be dismissed.
 - In one case, a woman said to be behaving strangely had a general anaesthetic for an urgent caesarean section. A locum anaesthetist considered that the woman's low oxygen saturation was due to a malfunctioning probe because of nail polish or poor peripheral circulation. She suffered a cardiac arrest after surgery and amniotic fluid embolus was confirmed at autopsy.
- Proper monitoring should alert staff to the existence of concealed haemorrhage
 - An anaesthetist was called to see a woman as it was thought that she had a retained placenta. The anaesthetist found the woman bleeding heavily from the vagina and laparotomy later revealed a uterine tear. There appeared to be some reluctance on the part of the obstetric staff to consider the possibility that she was also bleeding intra-abdominally. Ultrasound guidance for the placement of a central venous line may have helped with her resuscitation.¹⁰
- Consultant anaesthetic attendance must be forthcoming for sick women.

In several cases the consultant anaesthetist, although aware of major problems in the anaesthetic management or high-dependency care of acutely ill women, did not attend.

The management of haemorrhage

Major haemorrhage is still one of the most common causes of *Direct* maternal death. In looking at the deaths due to haemorrhage, multifactorial causation is clear. Pathological process, poor obstetric management and care, poor inter-specialty communication and inadequate anaesthetic response all appear in various combinations. Anaesthetists are trained to recognise and treat major haemorrhage that they encounter in many areas of their professional practice. Obstetric haemorrhage is often sudden and massive and accompanied by a coagulopathy, which is sometimes difficult to manage. Excellent anaesthetic care was provided in many of the cases, sometimes involving large volumes of blood replacement. However, responsibility for substandard care in five of the 17 deaths from haemorrhage, described in Chapter 4 Haemorrhage, rests in part with the anaesthetic services. In addition, there were two deaths in women who declined to receive blood products and lessons may also be learned from their anaesthetic management. From these deaths the following factors were relevant:

- In young fit women the severity of haemorrhage may not be recognized until the cardiovascular system decompensates suddenly.

Tachycardia will usually indicate hypovolaemia and blood pressure may not fall until the circulating blood volume is very low. However, some patients may not exhibit the normal tachycardic response to haemorrhage, such as women with pregnancy-induced hypertension treated with beta-adrenergic blockers.

- Care of women who suffer a major haemorrhage or are at high risk of major haemorrhage must involve consultant obstetric anaesthetists at the earliest possible time.

Help from several anaesthetists may be required for optimal management of massive blood loss.

- Blood and a device to rapidly infuse warmed blood must be immediately available in all cases at high risk of major haemorrhage.

Blood is regularly removed from blood bank refrigerators by blood transfusion technicians and therefore a check that the blood is actually available is essential.

- Isolated maternity units distant from blood transfusion services and the intensive care unit present a particular risk when major haemorrhage occurs.

- Central venous and direct arterial pressure monitoring should be used when the cardiovascular system is compromised by haemorrhage or disease.

When difficulty is encountered, ultrasound guidance for the insertion of a central venous catheter is recommended.¹⁰

- Surgical compression with packs and aortic compression may allow time to restore the circulating volume while waiting for more senior surgical and anaesthetic help.

The anaesthetist may need to request this from the obstetrician. The anaesthetist should be aware that surgical manoeuvres that may be considered include the B-Lynch suture, uterine or internal iliac artery ligation, or hysterectomy.¹¹

The placement of bilateral iliac artery balloon catheters under portable image intensifier control may also help to control haemorrhage in an emergency. Arterial embolisation is also an option but may be more difficult to deliver where haemorrhage has occurred without warning or if the woman's condition does not permit safe transfer to the radiology department.¹¹

- Postoperative care frequently needs to be provided in an intensive care or high-dependency unit.

Stabilisation of cardiovascular parameters prior to transfer is necessary and improvement of a metabolic acidosis can be a helpful indication of success. Hands-on help from an intensivist, such as providing appropriate inotropic support, in theatre before transferring the patient may be life saving.

- A plan of management for women at high risk of placenta accreta, such as those with an anterior placenta praevia after a previous caesarean section, should be evident.

These women require particular preparation, as they are at very high risk of major haemorrhage.¹² The placement of bilateral iliac artery balloon catheters immediately prior to caesarean section should be considered in high-risk elective cases.

- The use of a 'cell saver' is something that could be considered for a woman having a caesarean section who declines homologous blood transfusion on religious grounds.¹³

The management of haemorrhage is a shared responsibility of midwifery, obstetric, anaesthetic and blood transfusion personnel. Anaesthetists should be ready to suggest that the obstetrician summons help in the face of major haemorrhage regardless of the obstetrician's grade or experience. Good communication is vital and regular practice of emergency drills is crucial, particularly in units with a high turnover of staff.

Acknowledgements

This chapter has been seen and discussed with the National and Regional Assessors in Anaesthesia.

References

1. Royal College of Obstetricians and Gynaecologists. Clinical Effectiveness Support Unit. *The National Sentinel Caesarean Section Audit Report*. London: RCOG Press; 2001.
2. Ministry of Health. *Report on Confidential Enquiries into Maternal Deaths in England and Wales 1955–1957*. London: HMSO; 1960.
3. Ministry of Health. *Report on Confidential Enquiries into Maternal Deaths in England and Wales 1961–1963*. London: HMSO; 1966.
4. Association of Anaesthetists of Great Britain and Ireland. *Checking Anaesthetic Equipment 3*. London: Association of Anaesthetists; 2004.
5. Royal College of Anaesthetists. *The CCST in Anaesthesia*. 2nd ed. London: RCA; 2003.
6. Royal College of Anaesthetists. *Guidance for Trainers*. London: RCA; 1999. p. 8.
7. Royal College of Anaesthetists. *Guidance for Trainers*. London; RCA; 2000. p. 13.

8. Association of Anaesthetists of Great Britain and Ireland. *Recommendations for Standards of Monitoring During Anaesthesia and Recovery*. London: Association of Anaesthetists; 2000.
9. Department of Health. *Procedures for the Approval of Independent Sector Places for the Termination of Pregnancy*. London: Department of Health; 1999.
10. National Institute for Clinical Excellence. *Ultrasound Locating Devices for Placing Central Venous Catheters*. Guideline number 49. London: NICE; 2002.
11. Hong T-M, Tseng H-S, Lee R-C, Wang J-H, Chang C-Y. Uterine artery embolisation: an effective treatment for intractable obstetric haemorrhage. *Clin Radiol* 2004;59:96–101
12. Royal College of Obstetricians and Gynaecologists. *Placenta Praevia: Diagnosis and Management*. Guideline No. 27. London: RCOG; 2001.
13. Catling SJ, Freitas O, Krishnan S, Gibbs R. Clinical experience with cell salvage in obstetrics; 4 cases from one UK centre. *Int J Obstet Anesth* 2002;11:128–34.

