Maternal critical care: who cares?

With rising birth rates, and greater numbers of increasingly challenging mothers, the need for maternal critical care is rising. In the light of several major reports, this article looks at current provision, as well as areas for future development.

In 2011, 723 913 women gave birth in England and Wales (Office for National Statistics, 2012). While many of those required minimal medical intervention, some required high dependency or intensive care. Increasing numbers of sick mothers with more complex problems are being seen on isolated maternal critical care units. These units operate outside the standards and guidelines of the critical care environment. They manage a wide spectrum of critically ill obstetric patients, and mothers who may or may not have had a 'high risk pregnancy'. In-hospital management of parturients is primarily undertaken by obstetricians, midwives and obstetric anaesthetists. Optimal care of this challenging population requires extensive input from multiple specialities. This article highlights current deficiencies in providing this and gives suggestions for improvement.

Outlining the problem

Although the majority of pregnancies are medically uneventful, clinicians are facing greater numbers of increasingly complex medical and obstetric problems. There is a particular rise in obesity and increased maternal age. The number of deliveries is also rising – up by 21.7% from 2001 to 2011 (Office for National Statistics, 2012). While maternal mortality thankfully remains low, for every death there are at least nine women who develop severe maternal morbidity. Many of these patients require critical care. Maternal critical care includes both high dependency and intensive care for parturients. However, defining the level of care for a specific patient can be difficult.

Figures show that 11.4% (513) of all women aged from 16–50 years admitted to intensive care units in the UK were obstetric patients. Of these, around 80% were 'recently pregnant' rather than 'currently pregnant' (Intensive Care National Audit and Research Centre, 2009). The main obstetric cause of intensive care unit admission in recently pregnant patients was haemorrhage, while pneumonia was the major reason in those currently pregnant. The Intensive Care National Audit and Research Centre numbers translate to 2.4 intensive care unit admissions per 1000 deliveries. Moreover, up to 20 times more women will require level 2 care (Intensive Care Society classification) than require level 3 care (*Table 1*). Level 2 care is usually delivered within the maternity unit. The Scottish Confidential Audit on Severe Maternal Morbidity identified 1.4 intensive care unit admissions per 1000 live births and a rate of serious morbidity of 5.7 per 1000 deliveries (NHS Quality Improvement Scotland, 2010). This extrapolates to annual figures of around 1000 mothers requiring intensive care unit admission and up to 20 000 needing high dependency unit care.

Table 1. Levels of care most likely to be applicable to patients on a delivery suite

Level of care	Maternity example	
Level 0: normal ward care	Care of low risk mother	
Level 1: additional monitoring or intervention, or step down from higher level of care	Risk of haemorrhage	
	Syntocinon infusion	
	Neuraxial analgesia	
	Remifentanil analgesia	
	Mild pre-eclampsia on oral antihypertensives, fluid restriction	
Level 2: single organ support	Basic respiratory support	50% or more oxygen via face-mask to maintain oxygen saturation
	Basic cardiovascular support	Infusion of labetalol or hydralazine to control blood pressure in pre-eclampsia
		Arterial line used for pressure monitoring or sampling
		Central venous pressure line used for pressure monitoring or access
	Advanced cardiovascular support	Simultaneous infusions of labetalol and hydralazine to control blood pressure in pre-eclampsia
	Neurological support	Magnesium infusion to control seizures
	Hepatic support	Severe hepatic failure (e.g. from HELLP (haemolysis, elevated liver enzymes and low platelets) syndrome or acute fatty liver), such that transplantation is being considered
Level 3: advanced respiratory support alone, or support of two or more organ systems	Advanced respiratory support	Invasive mechanical ventilation via a tracheal tube

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Current management of critically ill mothers

A summary document, *Providing equity of critical and maternity care for the critically ill pregnant or recently pregnant woman* (Maternal Critical Care Working Group, 2011), examined existing standards across several models of care. This recognized local variation in training and facilities, but underlined the need to ensure that standards are being met. *Comprehensive Critical Care* (Department of Health, 2000) stated that care of the critically ill patient should be of a high standard irrespective of the location of the patient within the hospital; the so-called 'critical care without walls'. Unfortunately, the funding and initiatives for critical care teaching, training and audit were not taken up by obstetrics in many hospitals.

Maternity units often function as a separate site within the hospital. They have their own guidelines, and manage the majority of maternal critical care cases. There are many models of care depending on the size of unit, numbers of high risk patients, facilities and staff training. Some units transfer all critically ill patients, whereas others manage certain cases, predominantly pre-eclampsia and massive haemorrhage. In larger centres (Liverpool, Birmingham, Leeds) the vast majority of cases requiring critical care (around 5% of deliveries) are managed within the obstetric unit. Many countries outside the UK practice different models of care, with maternal critical care staff trained in intensive care. Patients requiring a higher level of care go to the main high dependency unit or intensive care unit. UK culture is different with sicker patients being cared for on the delivery suite, and the advantages and disadvantages of this need to be recognized.

Staffing and training

Caring for critically ill parturients usually involves input from midwives, obstetricians and obstetric anaesthetists. Delivering top quality care requires specific training, but unfortunately this does not always occur. Midwives are no longer initially trained as nurses. Most midwives currently practicing come via a direct entry degree course of 3–4 years. There is a strong focus on studying 'normality' in pregnant women. The undergraduate curriculum does not provide the specialized training required for looking after critically ill parturients. This is compounded by a national shortage of midwives and a higher proportion of maternity support workers, resulting in over-stretched and under-staffed units.

Early specialization and 'streamlining' of obstetric training in the UK adds to the issue. Trainees apply for 7-year 'run-through' in obstetrics after 2 years of foundation training. The variability in foundation posts may result in trainees never having worked in a critical care environment. There is also minimal maternal critical care content in the obstetric core curriculum. This can lead to confusion between caring for high risk patients, and critical care. Patients who are high risk have identified pathology requiring more intensive obstetric input, which is extensively covered in obstetric training. However, any mother can develop problems requiring critical care, and management of this is not currently part of the obstetric curriculum.

Historically, obstetric anaesthetists have undergone a minimum of 6–9 months training in intensive care medicine as part of their core curriculum. This is comparable to colleagues taking up posts in smaller intensive care units. In August 2012 it became possible to train solely in intensive care medicine. As a result, the training scheme for intensive care medicine has undergone major changes. Although future consultant obstetric anaesthetists will still have received training in intensive care medicine, they will not be trained to the same level in critical care as the future generation of intensivists. Of note, approximately half of those appointed to the new intensive care medicine training posts in 2012 did not come from an anaesthetic background. They may therefore be unfamiliar with current obstetric anaesthetic practice.

The main threat is sepsis

National reviews of maternal deaths have been undertaken since 1952, identifying areas of concern and resulting in major changes in obstetric practice. The latest confidential enquiry (Cantwell et al, 2011) revealed a significant and number of deaths associated with suboptimal care of the critically ill mother. In particular, there was an increase in deaths from sepsis and genital tract infection. In the period 2006–8 there were 29 deaths from sepsis, including 13 direct deaths from *Streptococcus pyogenes* genital tract sepsis in pregnancy. Lack of recognition of the signs of sepsis and a lack of national guidelines on its management were both identified as problems in the report. Risk factors for sepsis include obesity, diabetes, anaemia, history of pelvic infection or group B streptococcal infection, and black or minority ethnic origin. In April 2012, national guidelines on managing bacterial sepsis during and following pregnancy were published (Royal College of Obstetricians and Gynaecologists, 2012). This was set against a background of increasing national and international awareness of the severity of the problem.

International work by the Surviving Sepsis Campaign (2013) has identified sepsis in the general population as more common than acute coronary syndrome and more deadly than stroke. However, it is often under-recognized and inadequately managed. The Sepsis Group and the Surviving Sepsis Campaign are leading the drive to meet the challenges of sepsis, and to improve its management, diagnosis and treatment in all patients. While obstetric causes are by no means the largest cause of sepsis, they still result in the potentially avoidable deaths of mothers. Proper management requires cooperation between the obstetric team, who will see these patients,

and critical care, with their expertise in managing severe sepsis and identifying clinical deterioration. The 2006–8 Confidential Enquiry highlighted the involvement of specialist critical care for very sick women as one of its 'top ten' recommendations. Explicit reference was made to severe sepsis, along with severe pre-eclampsia and major haemorrhage. It also acknowledged the expertise of the Surviving Sepsis Campaign in managing severe sepsis, and highlighted the need for formal national guidelines. This preceded the publication of the green top guidelines (Royal College of Obstetricians and Gynaecologists, 2012).

Planning for the future

A safe environment is fundamental to optimal patient care. In the case of patients requiring a high level of organ support, level 3 care should be provided in a general intensive care unit; however, it is preferable to manage most patients within the maternity environment. This has traditionally been achieved within the maternity unit, but there are centres that have modified traditional critical care units to accommodate sick mothers. Women who become critically ill should receive the same high standards of care for both their pregnancy-related and critical care needs. It is important to promote links with critical care and outreach services to help ensure staff are adequately trained in early recognition of a critically ill parturient and to optimize the use of physiological early warning systems to increase safety on the delivery suite. However, only a few units around the country have high dependency unit trained staff available to care for sick mothers, and this is a concern.

Multidisciplinary work ethic

Cooperation between obstetricians, obstetric anaesthetists, intensivists with an obstetric interest, midwifery and critical care staff is vital. A trust maternal critical care forum should be established in the delivery suite, including clinical and managerial leads. There should be clear links with intensive care and outreach, including common documentation. Patient numbers and outcomes should be monitored, and critical incidents analysed with regular multidisciplinary meetings to review severe maternal morbidity cases and ensure that resources, such as high dependency unit equipment, are in place. Identifying a lead obstetrician for maternal critical care is vital, with combined ward rounds or clinics for high-risk patients and those returning after critical illness in pregnancy or childbirth. Adequate time and resources for this should be identified and assigned in job plans.

Recognizing the sick patient

At least one member of the nursing/midwifery staff per shift should be available and free to focus complete attention on a sick mother. Often this senior member of staff is of equal experience to a team leader and under pressure to perform a dual role. This should be actively discouraged. All midwives should be competent in recording early warning scores, and escalating care using the track and trigger system as recommended by National Institute for Health and Clinical Excellence (2007) and the Centre for Maternal and Child Enquiries (CMACE) (Cantwell et al, 2011). Obstetricians should be encouraged to develop a maternal critical care subspecialty interest, possibly including rotation to the intensive care unit during their training period. Obstetric anaesthetists should have sessions for organizing maternal critical care and consider rotating to the intensive care unit to keep their knowledge of critical care updated. With all parties able to recognize the sick parturient, prompt and appropriate escalation of care can be initiated.

Courses and training

Postgraduate education should include training in early recognition of acutely ill and deteriorating patients and their initial resuscitation. However, this can be very variable between regions. The Scottish Multi-disciplinary Maternity Group has been developed to coordinate training for all health-care professionals caring for pregnant women, but no such body yet exists in England or Wales.

There are a number of national, certified courses covering initial recognition and resuscitation of critically ill patients. These include AIM (Acute Illness Management) and ALERT (Acute Life-threatening Events: Recognition and Treatment). There are also specific obstetric resuscitation courses, such as MOET, MOSES and PROMPT. The Obstetric Anaesthetists Association, the Royal College of Obstetricians and Gynaecologists, and the Royal College of Anaesthetists run regular study days on maternal critical care. Simulator-based courses are useful for team training and learning in the management of critical scenarios, and allow assessment of competencies. A wide variety of such courses are available across the UK. In addition, local training days and e-learning packages are useful modes of instruction. Introducing a maternal critical care module into the postgraduate midwifery and obstetric curricula should also be considered to assist those interested in pursuing this sub-speciality. The CMACE report recommended that all clinical staff undertake regular training in the recognition and initial treatment of severe maternal disease (Cantwell et al, 2011). This should certainly be achievable with the wealth of courses available. With the onset of revalidation for doctors, evidence of ongoing continuing professional development in maternal critical care may be required, especially in large tertiary centres.

Higher level training

The Care of the Critically Ill Childbearing Mother at Leeds University is a unique postgraduate course in the UK specifically for midwives interested in maternal critical care. The PGCert comprises pre-course on-line preparation, followed by a training day with simulated scenarios, case discussions and resuscitation training. Faculty

include obstetricians, midwives and anaesthetists. Funding for midwives comes from the strategic health authority. The same course material is mandatory training for trainee obstetricians in the Yorkshire obstetric postgraduate training scheme. The course provides a theoretical basis for clinical skills training without too much initial study leave, but requires continued commitment and investment by all concerned.

Critical care funding

Each designated critical care unit within a trust records the level of care for a given patient using the critical care minimal dataset. This is subsequently analysed to generate payment by results. Payments in obstetrics are different and are in broad groups: for vaginal delivery, caesarean section and high risk pregnancy, but there is no breakdown for the level or intensity of nursing care in a severely ill patient. Imminent changes to NHS funding may provide an opportunity to identify a revenue stream to establish and support high quality maternal critical care teaching and training. Maternity services constitute one of the four new NHS Senates and the maternity pathway tariff for mothers requiring 'intensive postnatal care' has been highlighted by the Department of Health. The new tariff aims to encourage normal births but in recognition of the high-risk patients, an extra £825 is available if they require intensive postnatal care.

Current projects

Since October 2010 the West Yorkshire Critical Care Network has supported a maternal critical care group that meets four times a year, chaired by an obstetric anaesthetist (AQ). After a benchmarking audit based on the recommendations of the Maternal Critical Care Working Group (2011), the following action plans and recommendations were developed:

- Improved education around sepsis
- Ensuring early warning scores and protocols for escalation are in place, with regular audit of obstetric areas to encourage compliance
- Encouraging obstetric staff to attend a course with ABCDE approach to recognizing acutely ill patients, e.g. ALERT, AIM, PROMPT, REACTS
- Promoting links between obstetric departments and critical care or outreach.

The group has also recognized the general lack of staff with high dependency unit competency training throughout the region. As a result, regional maternal critical care competency teaching based on the new national high dependency unit competencies is being developed. This will include training and audit.

KEY POINTS

- Good quality maternal critical care requires cooperation between all involved parties, including intensivists and outreach.
- Delivery of maternal critical care requires dedicated lead clinicians, regular sessional commitments and time for continuing professional development.
- Training in maternal critical care is often poorly covered during traditional training across all disciplines, so ongoing education and courses are essential.
- Early warning scores aid timely recognition of problems, and abnormalities should result prompt escalation of care using standardized protocols.
- Poor recognition and treatment of sepsis remains a problem.

Conclusions

Participating in a quality maternal critical care service should be an overall rewarding experience, with motivated staff and facilities similar to those in units for non-pregnant patients. This should be the aim of all obstetric units managing increasingly complex cases needing higher levels of care. Links with critical care and outreach services should be promoted to ensure that staff are adequately trained in early recognition of a critically ill parturient, particularly those admitted as 'low risk' but who subsequently deteriorate on a postnatal ward. The incidence may be small but a sick mother and her newborn deserve the best care in UK hospitals. **BJHM**

Table 1 *is reprinted from Wheatly (2010) by kind permission of Elsevier.*
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