

## CHAPTER 1

# Morbidity and mortality in the parturient

### Maternal mortality and CEMACH

The Confidential Enquiry into Maternal Deaths in England and Wales was launched in 1955. The report evolved into the Confidential Enquiry into Maternal and Child Health (CEMACH) which came into being on 1 April 2003. CEMACH, funded by the National Patient Safety Agency (NPSA), was an independent body with board members being made up of representatives from the Royal College of Obstetricians and Gynaecologists (RCOG), Midwives (RCM), Anaesthetists (RCA), Pathologists, Paediatrics and Child Health and the Faculty of Public Health Medicine of the Royal College of Physicians. The report is the longest running and most complete record of the causes of maternal death in the developed world. The reduction on maternal death rates not only in the UK but also throughout the world owes a huge debt to these triennial reports. On 1 July 2009, CEMACH became an independent charity with the new name 'Centre for Maternal and Child Enquiries' (CMACE).

The leading causes of maternal mortality are shown in Box 1.1.

The leading cause of direct maternal death in the UK is thrombosis and/or thromboembolic disease, and this has been the case for more than 20 years. However, within this group the pattern of disease has changed over this period. There has been a decrease in the number of deaths due to pulmonary embolism after caesarean section, almost certainly as a result of increased awareness in the obstetric team and meticulous use of thromboprophylaxis guidelines. This pattern has not been reflected in the number of antepartum deaths where there has been a slight increase since 1985.

**Box 1.1** Causes of maternal mortality in the UK  
(CEMACH 2003–2005)

**Direct**

- Thrombosis/thromboembolic disease (TED)
- Pre-eclampsia/eclampsia
- Amniotic fluid embolism
- Genital tract sepsis
- Haemorrhage

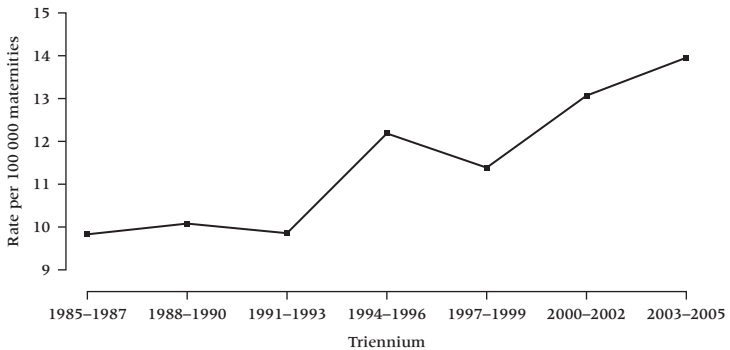
**Indirect**

- Cardiac disease
- Psychiatric disease

Genital tract sepsis has again become a leading cause of maternal death in the UK and this is of particular relevance to the maternity high dependency unit (MHDU) where it is likely that not only women with a diagnosis of sepsis may be cared for but also women who are at risk of maternal sepsis. It was commented upon in the last confidential enquiry that the advent of antibiotics and aseptic precautions had led to a dramatic reduction in the number of deaths from sepsis in the early years of the confidential enquiry and that this in turn had removed the anxiety of maternal sepsis from our 'collective memory'. The report recommended action to raise awareness of the recognition and management of maternal sepsis in all healthcare professionals who may care for the obstetric patient and also that maternal early warning scoring systems be implemented.

Cardiac disease is now the leading overall cause of maternal death in the UK. The principal causes of death in this group are aortic dissection and myocardial ischaemia. The changes over the last 50 years in the population of women of childbearing age in the UK (rising maternal age at childbirth, increasing levels of obesity) are likely to have had an impact in this area.

Despite the huge impact of the report, the UK maternal mortality rate has not fallen in recent years (Figure 1.1). A number of factors may have contributed to this lack of decline. One possible explanation for this is the increasing numbers of high risk patients becoming pregnant.



**Figure 1.1** Overall maternal mortality rate (deaths from direct and indirect causes combined) per 100 000 maternities, UK, CEMACH.

### Maternal morbidity

There is increasing recognition of the importance of the relationship between mortality and morbidity. Unlike maternal mortality, the full extent of maternal morbidity is not known. In a case control study published by Waterstone et al. (2001) estimated the incidence of severe obstetric morbidity at 12.0/100 deliveries. Another study from the USA estimated that 43% of women experienced some form of maternal morbidity.

Women who have experienced and survived a severe health condition in the antepartum period, at delivery or in the postpartum period are considered as cases of 'near miss' or 'severe acute maternal morbidity' (SAMM). The terms 'near miss' and 'SAMM' have been used interchangeably but the World Health Organization (WHO) working group on maternal morbidity and mortality recommends the use of the term 'maternal near miss'. There are various definitions of maternal near miss and these have been amalgamated by the WHO to provide one clear definition (Box 1.2).

**Box 1.2** WHO International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD10) – Definition of maternal near miss

A woman who nearly died but survived a complication during pregnancy, childbirth or within 42 days of termination of the pregnancy

In the past, maternal mortality and morbidity have been studied in isolation from one another, but it is clear that if the two are treated as separate clinical entities and by only investigating mortality, the chance to detect other problems in maternity care is lost. The relationship between morbidity and mortality in pregnancy has been described as a 'continuum of adverse pregnancy events' (Box 1.3).

**Box 1.3** The continuum of adverse pregnancy events

Normal healthy pregnancy → Morbidity → Severe Morbidity  
→ Near miss → Death

*Source:* Stacie E Geller. Am J Obstet Gynecol 2004;191:939–944.

Studies into maternal near miss cases have shown that the predominant underlying obstetric causes of obstetric morbidity differ somewhat from the major causes of maternal mortality. In the most recent CEMACH report, haemorrhage was the fourth commonest cause of direct maternal death, but in the Scottish audit of obstetric morbidity it was by far the most common cause of obstetric morbidity. Therefore it has been suggested that while enquiries into maternal near misses cannot completely act as a surrogate for maternal mortality, they can deliver information that complements the findings of studies into maternal deaths. What is perhaps even more interesting is the fact that it has been shown that a woman's progression along the continuum is affected by medical decision-making. This would suggest that identification of the high risk parturient as early as possible should have a major role in the primary and secondary prevention of morbidity and mortality.

**Maternal mortality, morbidity and the MHDU**

The purpose of an MHDU is to provide care to women at risk of or experiencing morbidity at any stage during the antenatal or postnatal period. It is required to improve care and reduce maternal mortality and morbidity for the sick or high risk obstetric patient. There are two major components of MHDU care (Box 1.4).

**Box 1.4** Major components of maternity high dependency care

- Timely recognition of the sick or high risk obstetric patient
- Delivery of high quality, dedicated maternity high dependency care

## The high risk parturient

The term 'high risk' in association with pregnancy is often used interchangeably to refer to either the mother *or* the fetus being high risk. For the purposes of this discussion, the term 'high risk parturient' refers to a pregnant woman at risk of developing serious morbidity or mortality. Factors that may put a woman into the high risk parturient group may be divided into four categories (Box 1.5).

**Box 1.5** Factors that may predispose a parturient to becoming high risk

### Pre-existing disease

- Heart disease – congenital, ischaemic, valvular
- Respiratory disease – asthma, cystic fibrosis
- Renal – acute or chronic renal failure
- Neurological – e.g. multiple sclerosis, epilepsy, cerebrovascular disease
- Musculoskeletal – e.g. scoliosis ± surgery, connective tissue disorders
- Haematological – thrombocytopenia, thrombophilias

### Pregnancy-related disease

- Pre-eclampsia
- Haemorrhage
- Acute fatty liver
- Peri-partum cardiomyopathy

### Social factors

- Social disadvantage
- Poor communities
- Ethnic minorities
- Late bookers
- Obesity
- Domestic violence
- Substance abuse

### Miscellaneous factors

- Jehovah's witness
- Needle phobia
- Anaesthetic-related issues – e.g. allergy, suxamethonium apnoea

## Identification of the high risk parturient

Identification of the 'high risk' parturient is key to the prevention of obstetric morbidity and mortality. Early identification allows time to plan effective multidisciplinary management strategies for the high risk woman. It is the responsibility of all healthcare professionals who may be (but not necessarily routinely) involved in the care of the pregnant woman. A woman may be identified as being high risk at any stage from pre-conception through to the booking visit, antenatal appointments, labour and the puerperium. The assessment of risk should take place at every opportunity.

### Points of referral

#### Multidisciplinary antenatal clinics and the obstetric anaesthesia antenatal clinic

The schedule for antenatal care in the UK has been clearly laid out by National Institute for Clinical Excellence (NICE). The guideline refers to care of the healthy pregnant woman but within the algorithm it does highlight woman who may need additional care (Box 1.6).

**Box 1.6** Women needing additional care as specified by NICE guideline

- Cardiac disease, including hypertension
- Renal disease
- Endocrine disorders or diabetes requiring insulin
- Psychiatric disorders (being treated with medication)
- Haematological disorders
- Autoimmune disorders
- Epilepsy requiring anticonvulsant drugs
- Malignant disease
- Severe asthma
- Use of recreational drugs
- Human immunodeficiency virus (HIV) or Hepatitis B virus (HBV) infection
- Obesity (body mass index, BMI, 30 kg/m<sup>2</sup> or above)
- Underweight (BMI below 18 kg/m<sup>2</sup>)
- Higher risk of developing complications, e.g. women aged 40 and older
- Women who smoke
- Women who are particularly vulnerable (such as teenagers) or who lack social support

Women who need additional care should be seen in multidisciplinary antenatal clinics. Multidisciplinary clinics ideally use a list of named physicians representing all specialities so that the obstetrician in charge of the case can contact the physician to review the case together and develop a management plan. The value of multidisciplinary antenatal clinics to allow forward planning for patients who may be high risk has long been recognised. For example, National guidelines (Obstetric Anaesthetists Association/Association of Anaesthetists Guidelines for Obstetric Anaesthetic Services, Revised Edition, 2005) have stressed the importance of timely anaesthetic involvement in the management of high risk pregnancies. Increasingly, referral to these clinics has become an essential step in the care pathway of the high risk parturient. Early attendance of a high risk parturient at the multidisciplinary antenatal clinic confers a number of advantages (Box 1.7).

**Box 1.7** Rationale for high risk parturient attendance at multidisciplinary antenatal clinic

- Assessment of patient and potential to deteriorate; optimisation if required
- Consideration of possible peri-partum complications
- Allows for adequate time to obtain necessary investigations
- Improved patient/healthcare professional partnership; communication, informed decision-making
- Allows time for referral and advice from other disciplines, e.g. cardiologists
- Starting point for *written* management strategy for elective and emergency situations
- Good environment for teaching and training.

Development of these clinics requires significant input from trusts. Financial constraints are clearly one of the major factors that may limit the extension of this service in hospitals. It has been estimated that only 30% of units in the UK have a dedicated anaesthetic antenatal clinic. Many units still rely on *ad hoc* referrals between obstetricians and anaesthetists. When this is the case, it is essential that there are clear lines of communication between all specialist teams and the maternity unit.

**Labour ward**

It has been suggested that up to 90% of non-elective caesarean sections could be predicted. Furthermore from critical care outreach

work in the general population, we know that cardiorespiratory arrest is almost always preceded by a period of physiological instability. Therefore in a labour ward setting, multidisciplinary ward rounds (obstetric, anaesthetic and midwifery) play an essential role in identifying the at-risk parturient.

### **Ward referrals and maternal early warning scores (MEWS)**

High risk clinics will not detect healthy pregnant women who develop unexpected complications of pregnancy. Early warning scores have been used in the general hospital population for several years. In the 2003–2005 CEMACH report, a key recommendation was that a national obstetric early warning chart, similar to those in use in other areas of clinical practice be developed for use in all obstetric women. More recently the Clinical Negligence Scheme for Trusts (CNSTs) revised standards for Maternity Clinical Risk Management (2009) has, as a level 1 requirement that a 'maternity service has an approved guideline/documentation which describes the process for ensuring the early recognition of severely ill pregnant women and prompt access to either a high dependency unit (HDU) or intensive care unit (ICU)'.

The confidential enquiry report suggested that in the absence of a national chart, hospitals should adopt one of the existing early warning scoring systems currently available. Currently there is no universally validated scoring system available for obstetrics.

An early warning system is essentially a track and trigger system. It uses data derived from different physiological readings (e.g. systolic blood pressure (BP), heart rate (HR), respiratory rate, body temperature, conscious level, urine output) to generate a score which above a certain level triggers a 'response'. Alternately, data is recorded on a chart that is 'colour coded to red, yellow or green'. The trigger would occur if one parameter fell into the red zone or two parameters fell into the yellow zone.

There are various potential difficulties associated with the development of a MEWS system. The first and most obvious is that the physiological changes of pregnancy mean that the charts in use for the general population would not be directly applicable to the pregnant woman. There are also concerns that by using a MEWS system for all pregnant women, there may be further overmedicalisation of the birthing process. Furthermore implementing a MEWS system



for all women on the maternity unit would undoubtedly significantly increase workload in an area which is often already stretched to capacity. For example, the majority of suggested MEWS systems have respiratory rate as one of the measured variables. Respiratory rate cannot be measured with an automated system and therefore would undoubtedly impact on the nursing/midwifery workload on a ward. How then should one target an early warning system in the obstetric population? It does not seem logical to limit it to women who have already been identified as being high risk or who have suffered a complication of pregnancy (e.g. post-partum haemorrhage) alone as these individuals have already been 'flagged-up'. Therefore it would seem sensible to extend its use to a subgroup of women who may be at risk of becoming 'high risk.' In addition the CEMACH report has suggested that these systems be used for pregnant women being cared for outside the obstetric setting, e.g. in gynaecology wards and accident and emergency departments. A list of suggested at-risk groups to include for MEWS monitoring are shown in Box 1.8.

**Box 1.8** Suggested at-risk groups suitable for MEWS monitoring

- Post-operatively, e.g. lower segment caesarean section (LSCS)
- Any woman who has had a spinal/epidural/patient-controlled analgesia (PCA)
- Post-partum haemorrhage
- Antepartum haemorrhage
- Women with raised BP
- Severe pre-eclampsia/eclampsia
- Women with diabetes
- Women with pre-labour rupture of membranes >24h
- Any suspected or diagnosed infection
- Women receiving oxygen or with an oxygen saturation (SaO<sub>2</sub>) of <94%
- Women undergoing blood transfusion
- Post-intensive treatment unit (ITU)/HDU patients
- Any woman who is readmitted after discharge from post-natal wards
- Any pregnant woman admitted via the accident and emergency department
- Any midwifery or medical concern

Of equal importance to the early recognition of patients with potential or established critical illness is the timely attendance to all such patients by those who possess appropriate skills, knowledge and experience. The CEMACH report has stated that ‘detection of life-threatening illness alone is of little value; it is the subsequent management that will alter the outcome’. If these systems are to be adopted it is essential that enough resources are available, particularly with regard to staff training, in the places where they are to be used (including non-obstetric settings such as accident and emergency departments).

Other questions that remain to be answered and should be considered in the development of a MEWS system include how frequently should a patient undergo MEWS scoring and also for what time period MEWS scoring should be continued in any one patient?

The use of MEWS is not a substitute for sound clinical judgement nor do they mandate immediate HDU/ICU admission for the patient whose score has ‘triggered’ the second part of the system. Evidence from work in the non-obstetric population has not demonstrated that they act as either predictors of the development of critical illness or overall outcome from critical illness. What MEWS almost certainly do offer is an aid to effective communication between all members of the clinical team by acting as a common language.

The basic requirements for development of a MEWS system are shown in Box 1.9.

**Box 1.9** MEWS systems – basic requirements for development

Parameters – systolic blood pressure (SBP), HR, respiratory rate, body temperature, conscious level, urine output

Trigger – numerical or colour coded

Response to trigger – develop local algorithm encompassing

- immediate treatment measures
- investigations required
- escalation procedure – who to call

Further monitoring and review

**Post-natal care on the wards and in the community**

Identification of the high risk parturient does not end when the woman has delivered and been discharged from hospital. This is particularly important for those women who have normal deliveries

and are rapidly discharged (6 h) from hospital. This also applies to women who deliver at home. In the 2000–2002 Confidential Enquiry, two women who had delivered at home died from puerperal sepsis.

The importance of good communication between the hospital, GP and community midwives has been highlighted, particularly if there have been any problems preceding/during the delivery. Although the use of MEWS may not be applicable in this setting, the importance of recording and acting upon any abnormality of basic observations (HR, BP and respiratory rate) cannot be underestimated. Care of the post-natal patient must also include an assessment of the lochia. Lastly it cannot be emphasised enough that any patient with a temperature or who is unwell must be rapidly referred to hospital.

