Maternal collapse

Lisa Long

Leonie Penna

Abstract

Maternal collapse occurs in a range of circumstances from hypoglycaemia to cardiac arrest and death. There has been no statistically change in the maternal death rate in the UK between 2009-11 and 2012-14. The current maternal death rate is 8.54 per 100,000 maternities. Maternal deaths in the UK are, fortunately, rare. However, a much larger number of women, estimated to be up to 100 times as many as those who die, have severe pregnancy complications which can leave them with lifelong disability.

An appreciation of the wide range of pathologies, including some rarely encountered, that may cause collapse - is essential for all obstetricians.

Keywords cardiac arrest; maternal collapse; maternal mortality; pregnancy; resuscitation

Introduction

A maternal collapse has been defined by the Royal College of Obstetricians & Gynaecologists as an acute event involving the cardiorespiratory systems and/or brain, resulting in a reduced or absent conscious level, at any stage in pregnancy and up to six weeks postpartum. This is a rare occurrence with its incidence estimated to be between 0.14 and 6 per 1000 births and requires prompt and decisive management to mitigate the sequelae of maternal morbidity and potential mortality. It is therefore mandatory that all medical staffs are appropriately trained in initiating effective resuscitation techniques, and that they have the ability to investigate and diagnose the cause of the event. A large number of causes of maternal collapse exist and this article aims to address the main aetiological factors.

In the UK there is a comprehensive reporting system for maternal death, which can be a tragic consequence following maternal collapse. Until 2011, reporting was co-ordinated by CMACE (Centre for maternal and child enquiries), an independent organisation closely related to its predecessor CEMACH (Confidential enquiry into maternal and child health). Reporting is now under auspices of the National perinatal epidemiology institute in Oxford which has established a collaboration of a number of interested organisations to be known as MBRRACE-UK (Mother's and babies: Reducing risk through confidential enquiries across the UK). MBRRACE published their first report in December 2014; this gives valuable information in relation to the common causes of maternal collapse.

Lisa Long *MRCOG Consultant in Obstetrics at King's College Hospital, London, UK. Conflicts of interest: none declared.*

Leonie Penna *FRCOG Consultant in Obstetrics at King's College Hospital, London, UK. Conflicts of interest: none declared.*

Causes

Cardiovascular disease

Cardiac disease is the leading cause of indirect maternal mortality, and the leading overall cause of maternal mortality in the UK. The MBRRACE-UK - Saving Lives, Improving Mothers' Care 2016 showed between 2009 and 2014 there were 189 women who died from heart disease associated with or aggravated by pregnancy. Rising cardiac disease in the pregnant population has been attributed to increasing maternal age, increasing levels of obesity and increasing fertility in those with pre-existing cardiac conditions. Interestingly, in the MBRRACE-UK report, over three quarters of the women who died of cardiac conditions were not known to have pre-existing cardiac disease. Clinicians should have a low threshold for investigating symptoms of both cardiac and respiratory in origin, including the use of ECGs, echocardiogram, chest x-rays, cardiac enzymes and CTPA.

Valvular heart disease: with increasing immigration from countries where rheumatic fever remains prevalent, valvular heart disease has become a more commonly encountered co-morbidity and is often first recognized during pregnancy when the increased demands on the heart trigger symptoms. Rheumatic mitral stenosis is the most common clinically significant condition in pregnancy. The rise in heart rate and stroke volume increases the pressure gradient across the narrowed mitral valve. This leads to an increase in left atrial pressure and the development or worsening of symptoms. This diagnosis should be considered in women who present with dyspnoea, decreased exercise capacity, orthopnoea, paroxysmal nocturnal dyspnoea and pulmonary oedema. Increased left atrial pressure also increases the risk of atrial fibrillation, which can lead to an uncontrolled ventricular rate and heart failure. These women are at risk of pulmonary oedema and can deteriorate rapidly. Diagnosis and severity should be assessed by echocardiogram. Pulmonary oedema should be treated with oxygen, diamorphine and diuretics. Atrial fibrillation requires prompt treatment with cardioversion, beta-blockers or digoxin. Balloon mitral valvuloplasty is indicated with refractory symptoms despite optimal medical therapy and is safe and effective during pregnancy.

Pregnancy in women who have had mechanical valve replacement is associated with a 45% incidence of thrombotic episodes, with a maternal mortality rate of 1–4%. A national cohort study was undertaken through the UK Obstetric Surveillance System between February 2013 and January 2015, identifying all pregnant women with a prosthetic heart valve. The study identified 58 women giving an estimated 3.7 cases per 100,000 maternities incidence. Five of the 58 women died. The clinical presentation of pulmonary valve thrombosis (PVT) is highly variable. Severe obstructive PVT is typically associated with overt heart failure, whereas non-obstructive PVT is often an incidental finding or can present as an embolic episode. Partial obstruction (for example, obstruction of one leaflet) can manifest itself with abnormal dyspnoea, or systemic embolism and rarely fever. Effective anticoagulation is critical and the risks to the mother and fetus need to be carefully balanced; the option associated with the lowest thrombosis risk (4%) is for the mother is to take warfarin for the duration of the pregnancy, stopping at 38 weeks for elective caesarean delivery, with intravenous (IV)

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heparin peri-operatively however this is associated with a 6% risk of fetal abnormality. An alternative strategy of substituting low molecular weight heparin (LMWH) for warfarin during the period of organogenesis (6–12 weeks of gestation) abolishes the risk of warfarin embryopathy but doubles the maternal thromboembolism rate. These women are extremely high risk and need early expert obstetric, cardiology, haematology and anaesthetic input. Measures such as joint obstetric cardiac clinics with multidisciplinary care plans should be arranged.

Acute coronary syndrome (ACS)/Myocardial infarction: acute coronary syndrome is an uncommon event in women of child-bearing age with an approximate incidence of 1 in 25,000 pregnancies and a subsequent maternal mortality rate of 5–7%. However, it was the second most common cause of death in those women that died of cardiac conditions in the most recent MBRACE-UK study (34 women, 22% of women who died from cardiac causes). As women are delaying childbirth into their late 30s and 40s, coronary artery disease and myocardial infarction have increased 3–4 fold in pregnancy. The risk factors for ACS are age $\geq$35 years, multiparous, obesity, smoking, hypertension, type 2 diabetes, positive family history, Asian ethnicity, and poor attendance for antenatal care. Acute myocardial infarction most commonly occurs in the third trimester, peri-partum, and post delivery. Crushing central chest pain or heaviness with or without radiation to the jaw or left arm will alert any clinician to this diagnosis. However, in many cases, there is no history of angina and atypical cases may present with just epigastric pain and/or nausea. In all circumstances an ECG should be performed and a cardiologist's opinion should be obtained if there is any possibility of the diagnosis. The ECG in an ST elevation myocardial infarction (STEMI) is not subtle and this is a medical emergency. Treatment of myocardial infarction during pregnancy is the same as that outside pregnancy, with heparin, beta-blockers and nitrates. Coronary angiography is safe in pregnancy and percutaneous catheter intervention is used as the first-line treatment. Thrombolysis can cause bleeding from the placental site but is still indicated in the management of acute myocardial infarction.

Congenital Heart disease: in the developed world, congenital heart disease (CHD) is more common in pregnant women than acquired heart disease. Among pregnant women with heart disease, the proportion with heart disease of congenital origin has risen in two decades from 5% to almost 80%. This reflects advances in cardiac surgery and medication, meaning that 85% of girls born with congenital heart disease now survive to reproductive maturity. Approximately 60% of the CHDs in pregnancy are patent ductus arteriosus (PDA), atrial septal defects (ASD), and ventricular septal defects (VSD). The risk of decompensation is reduced by antenatal diagnosis with subsequent multidisciplinary optimization and planning. Pregnancy increases the risk of primary cardiac events in these women. Pulmonary oedema and/or cardiac arrhythmia account for the majority of events, with thromboembolism, angina, hypoxaemia and infective endocarditis also reported. Pre-pregnancy counselling should be available both within the paediatric cardiology transition service and to women of child-bearing age with known cardiac disease.

Peri-partum cardiomyopathy (PPCM): peri-partum cardiomyopathy is a disorder in which left ventricular systolic dysfunction and heart failure present in the last month of pregnancy and the first 5 months post-delivery. It is a rare condition, with an estimated incidence of 1 per 2289 live births. Maternal mortality rates are between 9 and 15%. The main risk factors are advanced maternal age, multiparity, multiple pregnancy, Afro-American ethnicity, pre-eclampsia, hypertension, diabetes, and obesity. Women present with signs and symptoms of left ventricular failure. Clinical signs include tachycardia and tachypnoea. A raised JVP, bibasal crepitation and hepatomegaly are indicative of heart failure and a chest X-ray will confirm the presence of pulmonary oedema. Peri-partum cardiomyopathy is a diagnosis of exclusion. Therefore, all other causes of dilated cardiomyopathy with heart failure must be excluded. Adequate treatment with beta-blockers, diuretics, hydralazine and digoxin reduce mortality rates and improve overall prognosis. ACE inhibitors replace hydralazine postpartum. Subsequent pregnancy after a diagnosis of peripartum cardiomyopathy carries a higher risk of relapse if left ventricular systolic function is not fully recovered first and, even with full recovery, some additional risk of relapse remains. Women should be counselled against future pregnancies if the left ventricular size or function does not return to normal.

Aortic dissection: dissection of the aorta is rare, but frequently catastrophic. It accounted for 21 deaths in the most recent MBRACE-UK report. Approximately 50% of aortic dissections that occur in women less than 40 years of age are pregnancy related. Aortic dissection is associated with hypertension and especially with specific connective tissue disorders such as Marfan's, Loeys Dietz, and Ehlers Danlos type IV. Turner syndrome, coarctation of the aorta, and bicuspid aortopathy are also associated with the condition. In some cases, women have no risk factors and it is just the haemodynamic and hormonal changes of pregnancy that precipitate this event.

This diagnosis should be considered in any pregnant women who presents with acute severe chest pain. The classic presentation prior to collapse is a constant retrosternal 'tearing' type chest pain that can radiate between the scapulae and is associated with dyspnoea and jaw pain. They are often misdiagnosed as a PE. Collapse may occur due to blood loss or secondary to a cardiac event related to the dissection reducing coronary blood flow. A chest X-ray is mandatory and may show mediastinal widening, although its absence does not rule out the diagnosis. There is often systolic hypertension and/or different blood pressures in each arm. The dissection may be confirmed by trans-thoracic or trans-oesophageal echocardiography, CT, or MRI imaging. Management is surgical, with emergency transfer to cardiac theatres.

Eclampsia: this is a life threatening complication of pregnancy characterized by tonic-clonic seizures. Maternal deaths from hypertensive disorders are at the lowest ever rate in the UK, with fewer than one death for every million women giving birth from the UKOSS study 2012–2014. A third of women had established hypertension and proteinuria in the week before their first fit. Seizures occurring in the antenatal, intrapartum, and postnatal period are suggested to be 38%, 18%, and 44% respectively. In

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