



MATERNAL MORTALITY IN BAGHDAD TEACHING HOSPITAL

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ABSTRACT

Background: Maternal deaths is the death of a women while pregnant or within 42days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental cause. **Objective:** To study causes of maternal mortality in Baghdad teaching hospital and the possible measures that may be taken to reduce mortality rate. **Study design:** A retrospective study. **Setting:** The study was carried out in the Department of Gynecology and Obstetrics at Baghdad teaching hospital for the period 1st of January to end of December 2013. **Method:** A retrospective study carried out on 8 died women, who referred to Baghdad teaching hospital with serious morbidity, 6 of them delivered by CS and 2 of them delivered vaginally, each case studied in depth to determine the most likely cause of death. **Result:** The total maternal deaths for Baghdad Teaching hospital in 2013 were 8 women and the live births were 10488; as a result, the maternal mortality ratio per 100000 live births was 76.3, many Factors analyzed included the sociodemographic characteristics of the women who died the main causes of death, pattern of health-seeking behavior for antenatal care / delivery, and place of labor and delivery. There is statistically significant difference for some of these factors as between employment and unemployment also there is significant difference between vaginal and cesarean delivery. **Conclusion:** Major causes of deaths in Baghdad teaching hospital was hemorrhage, as agreed by WHO estimates of causes of maternal death. This provide stimulus for health providers, hospital managers ,individuals and government to maintain downward trends in our maternal mortality ratios to meet the expectation of the millennium goal of reduction of 75% in maternal deaths in 2015.

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INTRODUCTION

The maternal mortality rate is an important indicator of standards of health care in different countries .pregnancy related deaths and disabilities result not only in human suffering but also in losses to social and economic development. Pregnancy is not a disease. These deaths and disabilities are preven Table through primary Health care, and with attainable simple and cost effective intervention.

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The aim, in any obstetric unit, should be to reduce the mortality from obstetrical cause to nil as there should be no wastage of maternal lives in a physiological process of reproduction. Maternal mortality is under estimated even in countries with vital registration system, official statistics from countries where maternal mortality is high seriously underestimate the true level (WHO, 1987). Population based studies provide the least biased estimates of maternal mortality. They allow nearly complete counts of live births and maternal deaths. Because of their prospective nature they include deaths that occur more than a week after delivery and probably include most of the deaths due to induced abortion. There are very few population based studies concerning maternal mortality, six from Bangladesh, one from Ethiopia, one from Egypt, one from Gambia, one from Jamaica.

Preliminary results from population based study in India are available. Although the Medical Research Council (MRC) project in the Gambia and the Machakos project are population laboratories that have yielded excellent information on a number of topics, maternal mortality in both areas has been almost completely eliminated because of care provided by the project (Iamb *et al.*, 1984; Voorhoeve *et al.*, 1979). Measuring maternal mortality accurately difficult, existing estimates of maternal mortality ratio are subject to wide margins of uncertainty and cannot be used to monitor trends in short term. As an alternative these are used to monitor interventions needed to reduce maternal mortality. They focus on professional care during pregnancy and child. (1) The most widely available process indicator is the proportion of women who deliver with the assistance of a skilled attendant, defined as a medically trained health care provider (doctor, nurse, or midwife). Use of a skilled attendant at delivery increased. The proportion of deliveries with a skilled attendant reflects coverage of care for women at the time of delivery. The focus on the period around child birth is appropriate because this is when obstetric complications are most likely to arise and when most maternal deaths occur. However, this indicator does not reflect care during pregnancy or post partum period. It is during these periods that significant proportion of maternal deaths occur, particularly in setting with high levels of unsafe abortion or where many maternal deaths are due to indirect causes, such as malaria.

In 1928 the British Government set up a committee on maternal mortality and morbidity. This Committee introduced the in its reports. In 1951 a more thorough system of reviewing cases was started. The enquiries are conducted by clinicians; doctors and now midwives. (4) Maternal mortality is much higher in developing than in the developed countries. This is clearly a function of a number of factors, including the greater risk inherent in pregnancy and delivery owing to lack of adequate medical care, the greater prevalence of infectious diseases which are cofactors in many deaths. And the higher incidence of pregnancy. Because high- mortality countries, are those with the least reliable vital statistics, little information is available about levels and risk factors. (15)

Definition: Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. To facilitate the identification of maternal deaths in circumstances in which cause of death attribution is inadequate, a new category has been introduced: pregnancy-related death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death. (5) Two periods are recognized in the 42-day interval: period one includes day 1–day 7; period two includes day 8–day 42. Maternal deaths are further classified as: direct maternal death, death resulting from obstetric complications of the gestation, labor, or puerperium, and from interventions, omissions, incorrect treatment, or a chain of events caused by any of the above; indirect maternal death, an obstetric death resulting from previously existing disease or from disease developing during pregnancy, labor, or the puerperium; it is not directly due to obstetric causes, but to conditions aggravated by the physiologic effects of pregnancy (6).

Causes of Maternal Death

There is general agreement to classify maternal death: Direct obstetric deaths resulting from obstetric complications of pregnancy, labour, or the puerperium and closely equated with "true maternal death" a term used in the British confidential enquiries. It include the following causes:

Hypertensive disease of pregnancy: The incidence of these conditions has been slowly falling during the last 30 year, but they are still one of the greatest single causes of maternal death. One of the major aim of antenatal care from the earliest days has been the prevention of eclampsia by early recognition and treatment of pre-eclampsia and proteinuria. Evidence from both developed and developing countries suggests that death associated with hypertension are the most difficult to prevent. The world health organization estimates that globally between 50 000 and 75 000 die of this condition each year. (11). In women with potentially severe pre-eclampsia (symptoms e.g. sudden heavy proteinuria, markedly disordered liver function and or hematological tests result) but with unexceptional blood pressure measurements, alarming rises in blood pressure should be anticipated. Considerations should be given to early administration of antihypertensive drugs. Magnesium sulphate is the anticonvulsant drug of choice in the treatment of eclampsia. To avoid the potentially serious consequences of fluid overload careful monitoring of fluid input and output, fluid restriction and central monitoring is essential. Some recommended that 160mmHg to be the systolic blood pressure at which or above it urgent and effective antihypertensive drug should start.

Eclampsia and pre-eclampsia cause death by: (4)

- Cerebral; intracranial hemorrhage, subarachnoid hemorrhage, infarct, edema.
- Pulmonary; ARDS, edema.
- Hepatic rupture; failure, necrosis, other.

Learning points:

- Early onset pre-eclampsia poses serious threat to the mother as well as the fetus.
- the danger of high systolic blood pressure leading to intracranial hemorrhage needs greater recognition by clinician and more ready response with antihypertensive treatment.(5)
- To avoid the potentially serious consequences of fluid overload careful monitoring of fluid input and output, fluid restriction and central monitoring is essential.
- Amniotic fluid embolism:

It is estimated to be the fifth most common cause of maternal mortality. The condition is so rare (between 1 in 8000 and 1 in 80,000 deliveries, although more recent studies show 1 in 20,464 deliveries for a more precise number) that most doctors will never encounter it in their professional careers, and as a result the exact process is poorly understood. It is still a significant cause of maternal mortality. It must be suspected in all cases of sudden maternal collapses (10) The pathogenic mechanism appears to be obstruction of pulmonary vascular tree by combination of amniotic fluid debris (squamous, vernix, lango and meconium), reflex vasospasm and particulate microclots resulting from the thromboplastin-like material contained in amniotic fluid. Patient at particular risk include: multi-paras, very rapid labour, augmentation with oxytocin, over distention of the uterus and operative

manipulation inside the uterus (10). There is some evidence that AFE may be associated with abdominal trauma or amniocentesis. A 2006 study showed that the use of drugs to induce labor, such as misoprostol, nearly doubled the risk of AFE. A maternal age of 35 years or older, caesarean or instrumental vaginal delivery, polyhydramnios, cervical laceration or uterine rupture, placenta previa or abruption, eclampsia, and fetal distress were also associated with an increased risk. Diagnosis ante-mortem by pulmonary arterial catheter and examined cytologically for evidence of fetal cells, however most cases are still confirmed by finding pulmonary vascular plugging with amniotic fluid debris at autopsy (10). Amniotic fluid embolism mostly occur in an advanced labour, although can occur following termination of pregnancy, amniocentesis, placenta abruption, trauma, during caesarian section, unexpectedly up to 30 minutes after delivery.

The time taken to deliver the baby from the first symptoms ranged from 15_45 minutes. The time from maternal collapse to death was less than one hour to 5.5_7.5 hours.

The clinical criteria 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.

The immediate treatment is to establish ventilation and provide adequate oxygenation with mechanical ventilation, replacement of blood, FFP and platelets transfusion and if no response use vasopressor or dopamine. Steroids may also be used, Heparin, aspirin and protease.

Learning points

- Amniotic fluid embolism is not universally fatal but despite improved resuscitation techniques, in some cases death is still inevitable.
- 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 behavior, may give the first clue to diagnosis before collapse and hemorrhage occur.
- C. abortion:
- Abortion was until recent years, one of the most important causes of maternal mortality. Many of deaths were associated with illegal abortion. The causes of death in abortion were sepsis, hemorrhage and complication of interference (e. g. over vigorous dilatation, perforation, damage to internal organs). Since 1967 abortion act, there was an acceleration in the decline in the maternal deaths despite an increased number of deaths following legal abortion (5).

Abortion occurs either spontaneous or induced, complications occur mostly with induced abortion especially illegal abortions.

Learning points

- Complications due to abortion should be prevented or recognized early and treated appropriately (3).
- Illegal abortion should be strongly prevented.
- Well preparing of patient who are going to undergo termination of pregnancy especially good estimation of gestational age to choose appropriate method of termination (medical or surgical).

Hemorrhage: Massive obstetric hemorrhage continues to be an important cause of maternal mortality, maternal deaths associated with ante-partum and postpartum hemorrhage have fallen steadily since 1950 in developed countries (8). Placental abruption remain one of the most serious complication of pregnancy. For these cases monitoring of the central venous pressure is essential, and large amounts of blood required to treat hypovolaemia. Coagulopathy commonly occurs and should be treated vigorously with FFP and platelet transfusions. Placenta praevia used to cause significant proportion of deaths, but increased diagnostic accuracy through the use of ultrasound scanning and Doppler ultrasound is probably a major factor in the improvement. the number of deaths from postpartum hemorrhage was sharply reduced by prophylactic use of ergometrine in the third stage of labour and by increased availability of blood transfusion (8). Management of hemorrhage is a shared responsibility of midwifery, obstetric, anesthetic and blood transfusion personnel. Anesthetist should ready to suggest that the obstetrician summons help in face of major hemorrhage regardless of the obstetrician grade or experience. Good communication is vital and regular practice of emergency drills is crucial, particularly in units with a high turnover of staff.

Learning points

- In young fit women the severity of hemorrhage may not be recognized until the cardiovascular system decompensate suddenly. Tachycardia indicates hypovolaemia, but blood pressure may not fall until the circulating blood volume is very low. However, some patients may not exhibit the normal tachycardia response to hemorrhage, such as women with pregnancy induced hypertension treated with Beta adrenergic blockers.
- Care of women who suffer a major hemorrhage or at high risk of major hemorrhage must involve consultant obstetric, anesthetist, at the earliest possible time.
- Blood and a device to rapidly infuse warmed blood must be immediately available. blood is regularly removed from the blood bank refrigerators by blood transfusion technician and therefore a check that the blood is actually available is essential.
- Maternity units should not be isolated and distant from blood transfusion services and the intensive care unit.
- Central venous and direct arterial pressure monitoring should be used when the cardiovascular system is compromised by hemorrhage, when difficulty encountered ultrasound guidance for insertion of central venous catheter is recommended.
- Surgical compression with packs, uterine or internal iliac ligation or hysterectomy to control bleeding should not be delayed.

- A plan of management for women at high risk of bleeding as placenta accrete, anterior placenta previa after previous caesarean section. These women require particular preparation, as they are at very high risk of major hemorrhage. The placement of bilateral iliac artery balloon catheters immediately prior to caesarean section should be considered in high risk elective cases.
- Is something that could be considered for a woman having a caesarean who decline homologous blood transfusion on religious ground.

Genital tract sepsis: Genital tract sepsis is one of the important avoidable cause of maternal mortality as estimated in the maternal mortality report which reviewed all deaths between 2003-2005 in UK and found that the incidence of maternal death due to genital tract sepsis to be 18 per 100 000. All units should have an antibiotic policy for cases of sepsis; the aim is to control infection without delay and prevent the development of disseminated intravascular coagulation (DIC) and organ failure. The most identifiable pathogen is the Beta hemolytic streptococcus:

Lancefield identified. Maternal deaths from genital tract sepsis due to unusual organism, (a fulminating and overwhelming genital tract sepsis) this is an anaerobic gram negative bacillus is usually sensitive to penicillin. When there is strong suspicion of sepsis doctors should commence parenteral broad spectrum antibiotics immediately, without waiting for microbiology results, even if the presence of diarrhea suggests gastroenteritis as a possible diagnosis. Fluid resuscitation and oxygen therapy are also important in the treatment of the compromised patient. The onset of life threatening sepsis in pregnancy or puerperium can be insidious, with rapid clinical deterioration, vomiting, diarrhea, abdominal pain, tachycardia, tachypnoea, and pyrexia greater than 38 degree centigrade may all be signs and symptoms of pelvic sepsis (1). Genital sepsis can occur before 24 weeks of gestation for example surgical termination of pregnancy, fulminating septicemia in a woman with pelvic sepsis or following amniocentesis. Streptococcal infection has deceptive and fulminating nature which the cause for the challenges facing staff presented with a pyrexial patient who deteriorates so rapidly that there is little time for investigations or treatment. (6) increasing shortness of breath may predict impending cardiac arrest. Sepsis should be considered in recently delivered woman who feel unwell and have pyrexia, it can be insidious in onset and have fulminating course. The risk of sepsis increased after prolonged rupture membranes, emergency caesarean section, and if product of conception retained, after miscarriage, termination of pregnancy. The severity of the illness should not be underestimated, starting intravenous antibiotics immediately, involving consultant sooner, continuity of care with intensive care unit admission earlier to avoid complications as coagulopathy.

Signs of critical illness

- Signs of sympathetic activation; tachycardia, pallor, clamminess and peripheral shutdown.
- Signs of systemic inflammation: fever or hypothermia, tachycardia and increased respiratory rate.
- Signs of hypoperfusion: cold peripheries, confusion, hypotension and oliguria.

- Biochemical: metabolic acidosis, high or low white cell count, low platelets count, raised urea and creatinine, raised C-reactive protein concentrations.

Learning points

- Genital tract sepsis and overwhelming sepsis remain the significant cause of maternal deaths in the developing world.
- If sepsis is suspected, vaginal swabs and urine culture, blood cultures should be taken, if appropriate and throat and rectal swabs considered. Blood should also be taken for hemoglobin, white cell count, platelets, C-reactive protein, coagulation screen, blood group and hold, renal and liver function test and electrolytes.
- Continuing close surveillance and assessment of antenatal patient at increased risk of infection as patients with prolonged rupture membranes for any signs and symptoms of sepsis, avoiding vaginal examination in these women unless essential, where careful aseptic techniques should be observed and the use of prophylactic antibiotics for caesarean section.
- In postpartum women with possible sepsis, any history of raged membranes or possibly incomplete delivery of the placenta should be sought and the woman examined for the presence of uterine tenderness or enlargement. If retained product of conception is suspected vaginal swabs and an ultrasound scan to confirm that the uterine cavity empty should be done before discharging the women from the hospital.
- Improved education - staff (The general practitioner, junior hospital doctors and nurses or midwives) emphasizing the importance of appropriate timely investigation, treatment and early communication with and involvement of consultant may help to avoid some future maternal deaths due to sepsis.
- Ideally there should be an operating theatre and intensive care facilities in the same building as the maternity unit. For example transfer to theatre delayed because it was on different floor, making a lift journey necessary or transfer to an intensive care unit on a different site making an ambulance journey necessary (3)

Uterine rupture: Uterine rupture can occur in uterus scarred by surgery or spontaneously (but rarely) in an unscarred uterus. High incidence of morbidity and mortality are seen. Predisposing factors include uterine surgery, oxytocin hyperstimulation, obstructed labour and abdominal trauma (10). Before delivery watch for vaginal bleeding, abdominal tenderness, tachycardia, and cessation of uterine contraction and fetal heart tone. After delivery, unresponsive bleeding may lead to circulatory collapse (10). With persisting haemorrhage and shock the cervix and uterus should always be examined, if necessary under anaesthesia. If there is any possibility of uterine rupture laparotomy should not be delayed (9).

Anaesthesia: The great majority of direct anaesthetic related maternal deaths are associated with emergency general anaesthesia (5) Anaesthesia requirements are different for vaginal and caesarean section delivery in regard to type, depth or level and duration. General anaesthesia is preferable for emergencies unless a regional block has already been started. (10). The problems with anaesthesia were misplaced endotracheal intubation (difficulty with intubation in pregnant women remain a serious problem), neurological damage due to

anaesthetic complications and aspirating gastric content by inhalation (Mendelson's syndrome) (5). It is recommended that patients should remain in an adjacent well staffed recovery area until they reach consciousness and cardio-respiratory stability, or alternatively transferred to intensive care unit when severe complications arise (9).

Deaths due to anesthesia

Miss placed tracheal tubes: The Royal College of Anaesthetists issued in 1998 that no trainee anaesthetists should be in position of having to intubate the trachea without a capnograph. If capnograph is not available then either the patient or the equipment should be moved. In the year 2000 it is further clarified that no anaesthesia should be delivered without monitoring equipment available, and capnograph should be part of the monitoring procedures. Anaesthesia training must concentrate on airway management skills, especially esophageal intubation.

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

Anaphylaxis: Women may develop the classic signs of acute anaphylaxis and cardiac arrest rapidly after induction of anaesthesia with propofol and succinyl choline given to facilitate tracheal intubation.

Isolated sites: Where the delay in obtaining help was contributory factor in death such as inadequate management of patient suffering hypoventilation, or deficiency in equipment, or drugs important for resuscitation in cases of cardiac arrest until help arrived. It is important to note that in remote hospitals the career non-consultant staff should be working under the line responsibility of a named consultant anaesthetist, they should be proficient in advanced cardiac life support. Deaths to which anaesthesia contributed:

Direct

- Thromboembolism
- Eclampsia and pre-eclampsia c. Hemorrhage
- Amniotic fluid embolism
- Sepsis

Indirect

- Cardiac
- Other indirect causes.

There are maternal mortalities in which preoperative anaesthesia management contributed, falling into several categories:

Lack of multidisciplinary cooperation

Lack of appreciation of the severity of illness 3. Lack of preoperative care

Learning points

- It is recommended that only an anaesthetist holding a higher qualification should give anaesthesia for termination of

pregnancy.

- Good perioperative care and stabilization of any pre-existing medical illness which is part of multidisciplinary team planning.
- Consultant anaesthetic attendance must be forthcoming for sick women.
- Unexpected reading from a monitor should not be due to amniotic fluid embolism and end with cardiac arrest while the anaesthetist considers that it is due to a malfunctioning probe because of nail polish or poor peripheral circulation.
- Frequent checking and maintenance of equipment, their availability, good training of the staff on their use.

Caesarean section: Mortality after caesarean section is four times greater than that for vaginal delivery, and usually are related to the reasons for which caesarean section done (ante-partum haemorrhage like in placenta praevia or placenta accreta or placental abruption), or because of anaesthetic complications or haemorrhagic complications and is estimated to be less than 0.33 per 1000 (5) countries. (5). The condition under which emergency surgery is still performed carries greater risk and a shift from emergency to elective operations could reduce some of maternal deaths from caesarean section. (10)

Miscellaneous: Hydatidiform mole, hyperemesis gravidarum, water intoxication.

Indirect obstetric deaths: Resulting from either a previously existing disease or from disease developing during pregnancy, not as a result but aggravated by it, e. g. viral hepatitis.

Pulmonary embolism: This is sudden and dramatic cause of maternal death. Thrombosis is consistently the most common cause of maternal deaths in UK and the UK Confidential Enquiry 2003-5 reported 33 deaths caused by pulmonary embolism. The most recent data suggest an incidence between 10.6 and 16.1 per 100 000 maternities in the UK. (9). Vaginal delivery and higher in women aged over 34 years, in those who have an operative delivery of any kind. Other risk factors for pulmonary embolism include a history of DVT, mechanical heart valve, atrial fibrillation, trauma, prolonged immobilization, major surgery, antiphospholipid antibody syndrome, and several hereditary thrombophilias (6). Clinical warning signs of pulmonary embolism (chest pain, dyspnoea, hyper-ventilation and cyanosis). Deaths due to pulmonary embolism can be reduced by high index of suspicion and early initiation of anticoagulant therapy, arterial blood gas confirms hypoxemia and hypocapnia, electrocardiogram shows tachycardia with right heart strain, and the chest radiograph reveals subsegmental atelectasis, if there is high suspicion of pulmonary embolism then intravenous heparin therapy should be initiated immediately (5). Over the last 20 years the relative safety of prophylaxis with subcutaneous low molecular weight heparin has become firmly established, and there is clear guidelines to use anti-coagulant prophylaxis to more women in intermediate and high risk categories (9). Treatment of pulmonary thromboembolism by unfractionated heparin consists of intravenous administration for 5-10 days, followed by subcutaneous heparin every 12 hours or three times daily for the remainder of the pregnancy. Heparin is a large molecule that does not cross the placenta and has few reported side effects, the dose should be titrated to achieve a mid-interval activated partial thromboplastin time (aPTT), 1.5-2.5 times the normal or a Unfractionated heparin also can be

administered by continuous subcutaneous pump. Heparin should be resumed 6_12 hours postpartum depending on the mode of delivery and the occurrence of any complications. The recurrence of pulmonary embolism in a subsequent pregnancy is 4%_15%; the risk is higher in patient has predisposing risk factors as thrombophilias.

Cardiac disease: The maternal mortality rate from cardiac disease has continued to rise since 1980s. there were indirect deaths attributed to cardiac disease in 2006-2008, giving a death rate of 2.3 per 100 000 maternities (5) The major causes of cardiac deaths over the last 10 years are cardiomyopathy (predominantly peri-partum), myocardial infarction and ischemic heart disease, congestive heart failure and pulmonary oedema, dissection of the aorta and sudden adult death syndrome. Rheumatic heart disease is now extremely rare in childbearing age in UK. patient at increase syndrome, mitral stenosis, mechanical heart valves, pulmonary hypertension and infective endocarditis (5).

Fortuitous deaths: From causes not related to or influenced by pregnancy, this category excluded from internationally defined maternal mortality. e.g. suicide, road traffic accident. Other Factors Contributed To Maternal Death Include: 1. Health service factors: Deficient medical treatment of complications, lack of essential supplies and trained personal in medical facilities and lack of ante-natal care.

Reproductive Factors: Include maternal age, parity and unwanted pregnancy. 3. Socio Economic Factor:

Poverty is a high risk factor poor women, less likely to be in a good health and less likely to seek medical care.

Avoidable causes for maternal mortality:

Many of the factors for maternal deaths may be avoided 1. Hemorrhage

- Eclampsia and Pre-Eclampsia
- Anesthetic causes
- Genital tract sepsis
- Pulmonary thromboembolism 6. Amniotic fluid embolism
- Caesarean section

Aim of the Study

- To study the incidence of the maternal deaths in Baghdad teaching hospital for the year 2013.
- Identification of the main causes of maternal deaths.
- Study the risk factors for maternal deaths in Baghdad teaching hospital.
- Provide information in order to reduce maternal mortality and provide a stimulus for improvement of maternal health care.

METHODOLOGY

A retrospective review of maternity and live birth records of Baghdad Teaching hospital was carried out for period from 1st of January to end of December, 2013. Baghdad Teaching hospital is a tertiary center for gynecology and obstetrics in Baghdad the capital.

Study population: All the pregnant women who attended and/or referred to Baghdad Teaching hospital.

Inclusion criteria: All the pregnant women who were died in obstetrics department of Baghdad Teaching hospital regardless the cause and gestational age.

Exclusion criteria:

- A dead pregnant woman at admission.
- Under or mal-reporting of patient record.
- Accidental and incidental causes.

Data collection: All the medical records of women who died in the obstetrics department of Baghdad Teaching hospital were retrieved by the researcher from the hospital medical records and reviewed for immediate and remote causes of death, identified and subjected to in-depth analysis. This study was done under the approval of department of gynecology and obstetrics/Baghdad medical college. Factors analyzed included the sociodemographic characteristics of the women who died the main causes of death, pattern of health-seeking behavior for antenatal care / delivery, and place of labor and delivery. Also assessed were the types of delays leading to maternal death, causes of maternal death in hospital, as well as duration of hospital stay before death.

Operational definitions: Maternal death: is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. To facilitate the identification of maternal deaths in circumstances in which cause of death attribution is inadequate, a new category has been introduced: Pregnancy-related death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death. ☐ Maternal mortality rate (MM rate): is the number of maternal deaths in a population divided by the number of women of reproductive age, usually expressed per 1,000 women. ☐ Maternal mortality ratio (MMR): is the number of women who die during pregnancy and childbirth, per 100,000 live births. Complications during pregnancy and childbirth are a leading cause of death and disability among women of reproductive age in developing countries. The maternal mortality ratio represents the risk associated with each pregnancy, i.e. the obstetric risk. ☐ Live birth: refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life - e.g. beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles - whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born.

Statistical Analysis

The retrospective review, which covered year 2013, provided descriptive information on mothers and babies. This was determined by data available at the time the study was undertaken. The annual incidence estimates were augmented by data provided by the records department at the labor room, giving total numbers of live births and maternal and early neonatal deaths per year between 1st January and 31 December

2013. These data were used to calculate the annual maternal mortality ratios SPSS version 17 was used for all statistical analysis. The results were presented in tables and graphs. A t-test and chi-square test were used to identify the factors that were highly associated with maternal death with significance level less than 0.05.

RESULTS

A review of maternity and live birth records for Baghdad Teaching hospital, 2013, revealed that total admission of pregnant women was 11577 pregnant women, 4934 women delivered vaginally, 5863 women delivered by cesarean section and 780 women had abortions. The higher admission number was at November (1215 women) and the lowest admission number was at April (775 women). The highest number of vaginal deliveries was during December (550 women) and the lowest number of vaginal deliveries was during February (305 women), Table 1. Cesarean sections carried out in Baghdad Teaching hospital in 2013 reached a peak with highest number at November (620 women) and lowest number of cesarean sections was at April (344 women). Regarding abortions occurred throughout 2013 in Baghdad Teaching hospital, the highest number of abortions presented at March (79 women) and the lowest number of abortions presented at June (47 women), Table 1.

Table 1. Total number of admission of the pregnant women and their outcome in 2013

Month	Admission	Vaginal delivery	Caesarian	Abortion
January	949	412	485	52
February	819	305	450	64
March	795	337	379	79
April	775	367	344	64
May	821	360	400	61
June	876	369	460	47
July	1081	403	600	78
August	1075	400	600	75
September	1103	448	595	60
October	1037	466	500	71
November	1215	517	620	78
December	1031	550	430	51
Total	11577	4934	5863	780

Maternal deaths in Baghdad Teaching hospital were 1 woman in February, 2 women in March, 2 women in July, 2 women in October and 1 woman in December. No woman died occurred during January, April, May, June, August, September and November. The total maternal deaths for Baghdad Teaching hospital in 2013 were 8 women and the live births were 10488; as a result, the maternal mortality ratio per 100000 live births was 76.3, Table 2. Socio demographic characteristics of the eight women who died during 2013 in Baghdad Teaching hospital revealed that half of them (50%) were equal and less than twenty years of age, one woman (12.5%) in age period 21-30 years, 3 women (37.5%) were in age period 31-40 years, Table 3. More than half of dead women (62.5%) were living in rural areas and 3 (37.5%) women were living in urban areas. Half of the dead women (50%) were illiterate, 3 (37.5%) completed primary level of education, one woman (12.5%) completed secondary level of education, Table 3.

Regarding employment of dead women, there was significant difference between employed and unemployed women ($p=0.01$). Only one employed woman and 7 unemployed women, Table 3.

Table 2. Live births, maternal deaths and MMR, 2013

Total	Live births	Maternal deaths	MMR /100000 live births
	10488	8	76.3

Table 3. Socio demographic characteristics of maternal deaths, 2013

Variable	No	%	P
Age (years)			0.8
≤ 20	4	50.0	
21-30	1	12.5	
31-40	3	37.5	
Total	8	100.0	
Residence			0.6
Urban	3	37.5	
Rural	5	62.5	
Total	8	100.0	
Educational level			0.8
Illiterate	4	50.0	
Primary	3	37.5	
Secondary	1	12.5	
Total	8	100.0	
Employment			0.01
Employed	1	12.5	
Unemployed	7	87.5	
Total	8	100.0	

Table 4. Obstetric & medical history of maternal deaths

Variable	No	%	P
Gravidity			0.6
Prim	3	37.5	
Multi	5	62.5	
Total	8	100.0	
Parity			0.5
No	4	50.0	
Yes	4	50.0	
Total	8	100.0	
Previous abortion			0.5
Yes	4	50.0	
No	4	50.0	
Total	8	100.0	
Past medical history			0.2
HT	5	62.5	
DM	2	25.0	
Heart diseases	1	12.5	
Total		100.0	
Past surgical history			0.03
Previous cesarean section	4		
No previous cesarean section	4		
Total	8	100.0	
Type of intervention			0.03
Vaginal	2	25.0	
Caesarian	6	75.0	
Total	8	100.0	
ANC			
+ve	2		
-ve	6		
Total	8	100.0	

Table 5. Possible causes of maternal deaths

Variable	No	%	P
Possible Causes			0.01
Hemorrhage	4	50.0	
Antepartum			
postpartum	1		
Anesthesia	1	12.5	
Cardiac	1	12.5	
Pulmonary embolism	1	12.5	
HELLp syndrome	1	12.5	
Total	8	100.0	

Review of obstetrical and medical history of the eight dead women showed that 3 women (37.5%) were primigravida and 5 women (62.5%) were multigravida, 4 (50%) were without

previous parity and 4 (50%) were with previous parity, 4 (50%) had previous abortion and 4 (50%) did not have previous abortion, Table 4. Only two women (25%) were delivered by vaginal delivery and 6 women (75%) were delivered by cesarean section, Table 4 and figure 5. As we have no feedback from forensic medicine department to determine causes of deaths occurred, So Possible causes of maternal deaths in Baghdad Teaching hospital during 2013 were hemorrhage (50.0%), anesthesia (12.5%), cardiac (12.5%), pulmonary (12.5%) and HELLP syndrome (12.5%), Table 5.

DISCUSSION

It is well known that the main indicator of a society's level of development is its state of maternal health, which also serves as an indicator of health care delivery system performance (10). Maternal mortality remains a major public health issue, especially in the developing countries (12). Total admission of pregnant women in Baghdad Teaching hospital throughout 2013 was 11577 women; approximately half of them (51%) were delivered by cesarean section. This rate is higher than that reported in Iran (41.9%) and Egypt (27.6%) in 2010 (13). Several studies have shown an inverse association between CS rates with maternal and infant mortality at population level in low income countries where large sectors of the population lack access to basic obstetric care (14, 15). On the other hand, CS rates above a certain limit have not shown additional benefit for the mother or the baby, and some studies have even shown that high CS rates could be linked to negative consequences in maternal and child health (14-17).

The maternal mortality ratio in 2013 at Baghdad Teaching Hospital of 76.3 per 100,000 live births during the study period is relatively good. However, this is in agreement with similar studies from other parts of the country. In study carried out in Southern Iraq Marshes (2009) by Jebra AQ and Habib OS resulted that the MMR was 92/100000 live births which is within national context (18). In another previous study that was carried out in Iraq (2007) by Yassin BA and Al-Saneed EH, the MMR in Iraq ranged 168-214/100000 live births (19). With improvement in infrastructures at the hospital, improved public confidence, resulting in increased delivery rates and a fall in maternal mortality figures. This implies that socioeconomic determinants have a strong influence on maternal morbidity and mortality (20). Teaching hospitals in developing countries deal with high-risk obstetric cases, and so more maternal deaths will be recorded (20). Baghdad Teaching hospital is a referral center that receives all cases, including moribund ones, from within and outside the Capital. With the exception of this teaching hospital, accurate data collection on maternal deaths is lacking throughout Baghdad governorate in particular and in the country as a whole. Where available, the data are not comprehensive. It is therefore expected that the outlying mortality data will underestimate true maternal mortality. The MMR resulted by this study is close to that reported (2010) in Cuba (73/100000) and Argentina (77/100000) (21).

This MMR of 76.3 per 100,000 live births in 2013 is higher than that reported for national board in Iraq 2010 (63/100000) and higher than the MMR reported in 2010 for UK (12/100000), USA (21/100000), Iran (22/100000), Jordan (63/100000), Saudi Arabia (24/100000), Kuwait (14/100000), on other hand, this MMR is lower than that reported in 2010 for Morocco (100/100000), Southern Korea (81/100000) and

India (200/100000) (21). The global MMR decreased from 422 (358–505) in 1980 to 320 (272–388) in 1990, and was 251 (221–289) per 100 000 live births in 2008. The yearly rate of decline of the global MMR since 1990 was 1.3% (1.0–1.5). (21) As mentioned above 3 of cases were primigravida, one of them presented with full term pregnancy and heavy vaginal bleeding, chest pain and dyspnoea, ECG done which shows tachycardia, had ultrasound documentation of placenta previa, decision for CS made, during operation she developed arrhythmia and cardiac stand still, resuscitation done and she referred to RCU after completion of surgery but unfortunately died after few hours. Second one referred from hospital in Al-Hilla with preterm pregnancy, history of preeclampsia, disturbed level of consciousness and jaundice, vomiting, epigastric pain, medical consultation stated that she was in hepatic encephalopathy and or septic shock., acceleration of labor done and the patient delivered vaginally but she continued to have vaginal bleeding in spite of resuscitation efforts so laparotomy done and hysterectomy but the patient still in shock state and died at RCU after several days. Third one were referred from IBN_ albalady hospital with preterm pregnancy and severe preeclampsia, elevated blood pressure not responding to treatment, medical consultation done who stated the she also had pulmonary oedema and admit the patient to the cardiac care unit, where their she developed cardiac standstill, decision for cesarean section done, during operation she had another attack of cardiac arrest and passed.

For the other 5 cases who were multiparaus, 4 of them had repeated cesarean section, 3 of them had presented with vaginal bleeding, diagnosed to have placenta previa by emergency ultrasound, the 3rd one who had previous 4 cesarean section presented with labor pain and full dilatation of cervix, all of these cases admitted to emergency C/ S, all of them had emergency hysterectomy, and complicated with bleeding and admitted to the RCU all of them died there. The fourth case who had previous C/ S, presented with full term pregnancy intrauterine fetal death, with history of pregnancy induced hypertension and diabetes mellitus with uterine contractions, in the operating theatre decision for spinal anesthesia done, during which the patient collapsed and passed. The last case was multiparaus women referred from AL- Zahraa hospital as a case of primary postpartum hemorrhage, after delivery at midwife home, the patient arrived in a shock state, resuscitation started hand by hand with examination to detect the possible cause of hemorrhage, as the bleeding continued decision for emergency life saving hysterectomy done, during which she developed ventricular fibrillation as stated by the anesthetist and cardiac physician called to assist in her resuscitation but, unfortunately the patient passed. Unfortunately, in this study half of the died women were less and equal to 20 years of age that represented a disastrous event for them and their families and this proportion is higher than that reported in other developing countries as in Nigeria (2010) study by Agan TU, *et al.* the proportion of younger age was approximately 20%. The residence of died women was 62% rural and this might be attributed to difference in socioeconomic conditions (22).

Half of those who died had been illiterate, three women completed primary school and one woman completed secondary school. Education usually affords the woman the opportunity to make her own decision to save herself, especially during an emergency health situation (24). It is

generally known that education has a positive impact on reproductive behavior and maternal health standards (25). However, it can be deduced that factors other than educational level contributed to maternal mortality in this review. Maternal mortality is multifaceted in Iraq, arising from a chaotic social, political, and economic situation leading to poor primary obstetric care (25). The majority of those who died (87.5%) were unemployed. A significant difference in employment was observed ($p = 0.01$). The employment is an index for socioeconomic conditions, educational background, physical activity in addition to cultural background that play major roles in maternal deaths in these parts of the world (25, 26). Review of obstetric and medical history of maternal deaths revealed that more than half of them were with multi-gravidity, equal proportions of parity and abortions (50%), all of them had past medical history that might play a major role in increase the chance of death. Three quarters of the died women (75%) were delivered by cesarean section ($p = 0.03$), the cause of death in these cases were primarily necessitate doing CS. This might be attributed to high rates of cases with mandatory indication for cesarean section in Baghdad Teaching hospital (tertiary center) led to high rate of CS (51%), the recommended minimum necessary CS rate at population level to avoid death and severe morbidity in the mother lays between 1-5%, according to WHO and others (27, 29). Hemorrhage was significantly the cause for half of the mortality cases in Baghdad Teaching hospital through 2013 ($p=0.01$).

This finding is consistent with WHO estimates of maternal death causes (30). Severe bleeding after birth can kill a healthy woman within 7 hours if she is unattended. In our study about half of the women died because of antepartum hemorrhage due to placenta previa, and were delivered by lower segment transverse CS through abdominal transverse (Pfannenstiel) incision, use of classical incision during CS in dealing with these cases associated with lower risk of hemorrhage. These results are agreed with results of Al-Dhhan FH, *et al.* study (2006) in Basrah in which the hemorrhage, was the major cause of maternal deaths in hospitals of Basrah for period (1983-2002) (18). In study carried out over European countries on reproductive women (2003-2004) concluded that the main cause of maternal mortality was hemorrhage (31). Obstetrical hemorrhage refers to heavy bleeding during pregnancy, labor, or the puerperium. Bleeding may be vaginal and external, or, less commonly but more dangerously, internal, into the abdominal cavity. Typically bleeding is related to the pregnancy itself, but some forms of bleeding are caused by other events. Obstetrical hemorrhage is a major cause of maternal mortality (32). The World Health Organization (WHO) estimates that, in 1995, nearly 515,000 women died from complications of pregnancy and childbirth. Most of these deaths occur in developing countries, because women often lack access to life-saving care (33).

A woman living in a developing country is much more likely to receive antenatal care than she is to have skilled care during labor, childbirth, or the postpartum period. Yet more than half of all maternal deaths occur within 24 hours of delivery, mostly due to excessive bleeding (34). Severe bleeding, or hemorrhage, is the single most important cause of maternal death worldwide. At least one-quarter of all maternal deaths are due to hemorrhage; the proportions range from less than 10 percent to nearly 60 percent in various countries (35). There are an estimated 14 million cases of pregnancy-related

hemorrhage every year; at least 128,000 of these women bleed to death. (16) Anesthesia, cardiac, pulmonary and HELLP syndrome were the causes for death of other half of dead women in this study. It is important to state that some of these deaths may be due to multiple factors, because a ruptured uterus can be complicated by hemorrhage and sepsis, and delay in intervention may worsen the outcome. Efforts must therefore be made on the part of health care providers, hospital managers, individuals, and government to maintain the current downward trend in our maternal mortality ratio to meet the expectation of the millennium development goal of reduction in maternal deaths by 75% in 2015. (36) Hospital policies must be revised such that senior residents and consultants on call are contacted as soon as a life-threatening emergency arrives in a health care facility, also emphasis on early referral of critical cases to the centers specialist in dealing with them, surely after insertion of at least an intra venous to reduce the delays which frequently occur. We believe that reduction of maternal deaths due to delay can be achieved with the provision of quality of primary obstetric care services in the developing countries (37, 39).

Limitations of study

- This study is a review of data of hospital that might be affected by under or missed data recording.
- Like any observational study, the temporal relationship cannot be estimated.
- Low number of died cases (8) might affect the results of significance (P value) for this study.
- This is a hospital based study and cannot generalized on Iraqi population.

Conclusion

- The maternal mortality ratio in Baghdad Teaching hospital is relatively good in comparing it to previous studies and within the national context.
- High rates of cesarean sections implemented in Baghdad Teaching hospital as it is a tertiary referral center for repeated cesarean sections.
- Some of the maternal death risk factors may prevented like illiteracy, unemployment, surgical intervention, increased interval between symptoms and intervention, early referral, lack of health awareness in most social aspects, medical diseases complicating pregnancy .

Recommendations

- Improving the antenatal care program will certainly decrease the effect of preventable risk factors of maternal death.
- Urgent need to increase public awareness of maternal health issues through the media, community associations, mosques, and community leaders.
- Early referral of serious cases tertiary obstetric center to deal with these cases and saving lives.
- Encouraging health education of pregnant women on labor complications through lectures and group classes.
- Promotion of compulsory education for all Iraqis, including girls till completion of secondary school.
- Supervision and continuous education of resident doctors, nurses and midwives working in labor room about labor complications especially hemorrhage.

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